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Evaluation of Truck and Bus Automation Scenarios: Operations Cost Analysis

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Final Report

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ABSTRACT

Automated bus and truck systems hold the potential to improve road safety by eliminating some human error, increase the vehicle throughput by allowing vehicle convoying to shorten headways, and reduce costs associated with infrastructure, user time, and drivers. In this study, an automated bus system (ABUS) was compared with more-conventional light rail and bus-on-dedicated-lane (BDL) alternatives. A cost comparison (excluding accident costs) was also made among an automated freight trucking system (AHS-Truck), a no-build base condition, and configurations involving the addition of a conventional lane or a dedicated truck lane to the existing roadway. In both the ABUS and the Truck-AHS cases, the buses and trucks were assumed to operate in convoys. The benefits and costs were assessed from a societal perspective. Another comparison, based on shipping rates, was made among the AHS-truck, conventional trucking, and intermodal rail. The study concludes that the proposed bus alternatives could have substantially-lower costs than a functionally-equivalent light rail system for relatively low passenger volumes, but that there is no significant difference between the ABUS and BDL options at these volumes. At intermediate and high passenger volumes, ABUS and light rail may be the preferred alternatives, respectively. With regards to the freight systems, the analysis presented here indicates that the AHS lane performed better than the other two alternatives, primarily because of the lower vehicle operating and user costs. Additional research is recommended that addresses safety, demand change, and other impacts of the systems considered in this study.

KEYWORDS

Automated Highway Systems (AHS)
Automated transit
Automated trucking
Benefit cost analysis

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EXECUTIVE SUMMARY

Vehicle automation has the potential to aid in improving road safety by eliminating some human error, increasing the vehicle throughput by shortening headways and decreasing vehicle operating costs. Automated vehicles that convoy (i.e. – operate in electronically-linked “trains”) could require less and less-costly infrastructure and fewer driver-related and fuel-related operating costs. For instance, a “truck train” would possibly require only one driver for multiple vehicles, and a decrease in fuel costs could be attained if vehicles were to convoy closely at relatively high speeds.

The primary goal of the study detailed in this report was to evaluate and compare the costs of some configurations of automated bus and truck systems. The costs of an automated bus transit system (ABUS) were compared with the costs of conventional transit alternatives: a light rail system and a non-automated bus-on-dedicated-lane (BDL) system. The costs of an automated freight transportation system (Truck-AHS), wherein automated trucks operate on a dedicated lane, were compared with the costs of some conventional freight transportation alternatives. A direct comparison was made between the existing condition and an alternative where a conventional lane was added, as well as between the existing configuration and an alternative comprised of adding a conventional dedicated truck lane. In both the ABUS and the Truck-AHS cases, the buses and trucks were assumed to operate in convoys. Another comparison, based on shipping rates, was made among AHS-truck, conventional trucking and intermodal rail.

The study reported here is in partial fulfillment if Task Order TO 4236 funded by the Partners for Advanced Transit and Highways (PATH). This study utilized funding of $80,517.97 out of a total amount of $124,897.00 allocated to San Jose State University for the project. Contributions by Professor Randolph Hall of the University of Southern California are also included in this report.

The basic approach followed in the study was to base the comparisons on existing systems so as to make the comparisons as realistic as possible. The transit systems were based on the route and passenger characteristics of a portion of the light rail system of the Santa Clara Valley Transportation Authority (VTA) in California, while the freight systems were based on portions of route and traffic characteristics of Interstate Route 5 (I-5) and State Route 710 (SR-710) in California.

The comparisons were carried out for alternative systems that were functionally comparable, i.e. the same volume of passengers or freight between two end points was transferred. Both agency and user costs were considered. It should be noted that the objective of the evaluation was not to determine if the systems are worthwhile to implement – it was to compare the costs for functionally comparable systems. However, the way in which the analysis was conducted for the freight systems did enable making conclusions of this nature.

The benefits and costs were assessed from a societal perspective, i.e. no differentiation was made as to whom the benefits and costs accrue to. However, individual stakeholders often view benefits and costs differently from the societal viewpoint. This could mean that a

project is worthwhile from a societal point of view but not necessarily from, say, a group of users of the facility. Some aspects of stakeholders' perspectives were discussed but not analyzed.

Ideally, a comparison should be made among optimally-configured systems that are functionally the same at a specified traffic volume level. Determining the optimal configuration for each alternative was outside the scope of this project. The configurations that were used were considered to be reasonable and were related to the existing systems. It is also conceivable that the demand for the different systems would be different, but considering this effect would entail extensive analysis that was considered outside the scope of this project.

Costs for transportation systems generally fall into the following categories:

- System planning and design costs
- Construction, rehabilitation and other infrastructure capital costs
- System maintenance costs
- Administration and system operating costs
- Vehicle operating costs
- Travel time costs
- Accident costs

All of the above costs, with the exception of accident costs, were considered in this study. As stated before, external costs such as environmental costs were not considered. The approach utilized in this report was to discuss them where appropriate, but not quantify them.

A summary of the major conclusions and recommendations follows:

Transit Conclusions

i. Based on the findings of this study, the Automated Busway System (ABUS) and Bus-on-Dedicated-Lane (BDL) system have been found to have substantially lower costs than a functionally-equivalent light rail system for relatively low passenger volumes. The primary source of the difference comes from the relatively-high costs for planning, designing, and constructing the light rail system. It should be noted that the results of the analysis do not indicate that any of the systems studied are economically feasible, or that there would be obvious promise in creating an ABUS system.

ii. For the base configuration at the relatively-low base volume levels, the overall costs of the ABUS scenarios are comparable to those of the non-automated BDL system. ABUS is the favored alternative in terms of infrastructure (due to narrower lanes) and driver-related costs (due to bus convoying). The advantage of the BDL system was primarily related to the shorter headways, and thus less wait time-related costs for passengers. Given that individual cost items may vary from place to place, some or all of the cost differences between these two systems may be insignificant.

iii. The analysis did not attempt to quantify safety considerations as part of the evaluation of the systems. Due to the different natures of the ABUS, BDL, and light rail systems, it is possible that costs associated with safety could vary considerably among the alternatives. Such costs could include those related to accidents, infrastructure, and others. This study also did not attempt to quantify the differences in costs among the systems resulting from environmental factors, ridership and user diversion, or impact on the surrounding transportation systems. These types of costs could be substantial, and could alter the outcomes of the analysis and, consequently, the conclusions presented here.

iv. At relatively-small increases in passenger volumes, the BDL system would likely be the best-performing system, since it would still have the advantage over the other systems with regard to passenger wait time. At significantly-large volumes, the light rail system could be the preferred system. It would be capable of offering a larger capacity than the other systems, and probably at greater safety standards.

v. At moderate volume increases, when decreasing headways becomes a safety problem for the BDL system, the ABUS would have an advantage over the BDL system – largely due to proportionally-smaller driver-related vehicle-operating costs for the ABUS. Also, at moderate volumes, the ABUS would have the advantage over the light rail system, with fewer costs in most cost categories.

vi. One advantage for bus systems, versus light rail, was that buses could enter a dedicated lane from a feeder route and thereby eliminate the need for passengers to transfer from a feeder bus line. This could reduce costs associated with wait time and potentially induce an increase in demand resulting from eliminating the need to transfer for some passengers.

vii. On-board travel time hours account for substantially more of the total user travel time than do wait time for all of the transit systems, so finding ways to decrease on-board travel time may be a more effective way to reduce travel-time costs. That could entail increasing the speed of operations on the system, which could require a better-protected right-of-way, and consequently, increased construction, rehabilitation, and maintenance costs. Also, at higher speeds, the issue of safety for the ABUS could become an issue of greater concern. This might not be favorable when comparing and ABUS versus a light rail or BDL system.

Transit Recommendations

i. It could be beneficial to investigate, more rigorously, the effect of increased passenger volumes, combined with different convey lengths, on the rail and bus systems presented here. It is highly recommended that this analysis be conducted before additional funds are spent on further research or implementation of strategies involving automated buses in convoys.

ii. The extent to which bus convoys could be expanded would be a safety issue, whereas in the case of rail systems, it has been proven that long trains can be safely operated. The passenger volume at which light rail could become the favored option could then depend upon the safety issue, and not necessarily the economic criteria examined in this study. Further research into the level of safety that can be attained, as well as the economic operations thereof, should be conducted.

iii. The additional impacts of implementing the alternative systems should be further evaluated. Impacts such as noise and air pollution are hard to quantify, but some of the impacts of the implementation of the alternative systems on the surrounding street system could be quantified. The delay imparted to other vehicle traffic could be quantified and included in the economic analysis. The impacts on bicyclists and pedestrians are also important, but may be difficult to quantify.

iv. Changes in demand due to the attributes of each system were not addressed in this study, and could significantly alter the outcomes of the analysis, and the extent to which each system would attract users should be examined in future research.

v. Since the impact of rehabilitation and periodic maintenance of light rail systems beyond the 30-year assumed useful life of the systems was not investigated, definitive conclusions cannot be made regarding this issue. The issue of differing useful lives of the projects was identified early in this report, and should be addressed further in subsequent research.

Freight Conclusions

i. The analysis presented here for road-based freight indicates that, based on current vehicle volumes, the reduction in user costs would not offset the increase in agency costs for any of the options (addition of a conventional lane, addition of an AHS lane, and addition of a dedicated truck lane). The AHS lane performed better than the other two alternatives, primarily because of the lower vehicle operating and user costs. It should be noted that different assumptions regarding truck speeds, diversion to a dedicated lane, and unit costs could influence the results significantly, although the advantage of the AHS over the other alternatives should remain. Construction costs had a large influence on the outcome. Dealing more specifically with the physical environment and the effects thereof on the construction costs, as well as developing more accurate unit costs and considering real estate costs for local circumstances, could also influence the results in a meaningful way. Additionally, accident costs were considered to be outside the scope of this study, and could affect the results significantly.

ii. An analysis based on a segmentation of the study section into low-, medium-, and high-volume sections indicates that, for a low-volume road, the agency costs are lower than the savings from user costs associated with the addition of an AHS at low volumes. This may appear to be counter-intuitive, but this result is a consequence of, among other factors, significantly-lower construction costs in rural areas, where passenger volumes are lower. Again, it should be noted that assumptions, especially regarding truck speeds and diversion, and the exclusion of accident and real estate costs, influenced those results significantly.

iii. Based on the analysis related to shipping rates, it was found that the unit costs for intermodal rail are the highest for the three study systems for short-haul shipping distances (shorter than 800 miles), and the lowest for long-haul shipping distances (greater than 800 miles). The results of this analysis show that, for distances shorter than 800 miles, the cost of conventional trucking was very similar to that of AHS-truck. It could be surmised that AHS-truck may become less costly than conventional trucking at longer distances because the cost of freight transfer would be spread over a longer travel distance. It should be noted, however, that the analysis conducted does not indicate at which distances one mode may become more advantageous than another.

Freight Recommendations

i. The results of this analysis were based on a number of assumptions, calculations, and unit costs that can all be varied with good reason. In order to evaluate the effects of those assumptions, a sensitivity analysis should be undertaken. This would be especially important for the AHS options, since their b/c ratios are not that far removed from a value of one, and could possibly change to values exceeding one with changes in the assumptions and values of the parameters used in the analysis presented in this report. Based on such a sensitivity analysis, a decision could be made to refine those costs or other aspects of the analysis that would influence the outcome most significantly. Additionally, future research should address the use of unit costs that vary with speed and their effects on vehicle operating costs, as well as accident costs.

ii. It is recommended that an in-depth study be undertaken based on real costs to compare AHS-truck and intermodal rail; however, such a study should only be undertaken once a sensitivity analysis for the road-based freight alternatives has been undertaken. This should be done to ensure that AHS-truck is a viable option and that the envelope of constraints within which this would be true is established.

Overall Conclusions and Recommendations

It appears that there is some promise for automation of vehicles, as it was discussed in this report. For both transit and freight automation, however, accidents costs could affect the economic feasibility significantly.

It is recommended that this evaluation be continued and refined. Refining the costs and some other aspects of the analysis would make the analysis more definitive, and could also indicate where the most gains could be made through further development of automation. Investing more resources in the study of the feasibility of the overall design and operation, both in concept and in the economic feasibility thereof, could lead to better decisions regarding how to spend finite funds for specific research and development of automation.

1 INTRODUCTION

1.1 Background and Study Goals

Vehicle automation has the potential to aid in improving road safety, by eliminating some human error, increasing the vehicle throughput by shortening headways and decreasing vehicle operating costs. Vehicle operating costs could be reduced by having vehicles convoy (tying them together electronically) and removing drivers (or all except the driver of the lead vehicle). A decrease in fuel costs could be attained if vehicles were to convoy closely at relatively high speeds.

The primary goal of the study detailed in this report was to evaluate and compare the costs of some configurations of automated bus and truck systems. The costs of an automated bus transit system (ABUS) were compared with the costs of conventional transit alternatives (i.e. – a light rail system and a bus system operating on a dedicated right-of-way). Additionally, the costs of an automated freight transportation system (Truck-AHS) were compared with the costs of some conventional freight transportation alternatives: adding a conventional lane to the existing configuration, adding a dedicated lane for use by conventional trucks to the existing system, and intermodal rail. The study reported here is in partial fulfillment if Task Order TO 4236 funded by the Partners for Advanced Transit and Highways (PATH). This study utilized funding of $80,517.97 out of a total amount of $124,897.00 allocated to San Jose State University for the project. Contributions by Professor Randolph Hall of the University of Southern California are also included in this report.

The basic approach followed in the study was to base the comparisons on existing systems so as to make the comparisons as realistic as possible. The transit systems were based on the route and passenger characteristics of a portion of the light rail system of the Santa Clara Valley Transportation Authority (VTA) in California, while the freight systems were based on portions of route and traffic characteristics of Interstate Route 5 (I-5) and State Route 710 (SR-710) in California.

The comparisons were carried out for alternative systems that were functionally comparable, i.e. the same volume of passengers or freight between two end points were transferred. Both agency and user costs were considered. It should be noted that the objective of the evaluation was not to determine if the systems are worthwhile to implement – it was to compare the costs for functionally comparable systems. However, the way in which the analysis was conducted for the freight systems did enable making conclusions of this nature. This issue will be more fully articulated later in the following section of the report as well as in later sections of the report when discussing the results of the analyses.

1.2 Report Outline

Some of the salient broad issues related to the cost analysis are discussed in the next section. The comparison of the transit alternatives are discussed in Chapters 3 through 8. The comparison of the freight systems follows in Chapters 9 through 14. Additional impacts are discussed in Chapter 15 and some aspects of stakeholder concerns in Chapter 16. Finally, conclusions and recommendations are presented in Chapter 17. References are provided at the end of each chapter. Details of some parts of the calculations are presented in Appendices A through J for the transit component of the research, and in Appendices K through Y for the freight component. It should be noted that a broad literature review is not provided here, since this was included in a previous report (1). Also, the material included in the appendices is extensive, which was done to enable the reader to evaluate the basis of the evaluation. Given all the variables and parameters considered in the benefit-cost analysis, a considerable amount of variation can be experienced in the final outcome, depending upon the variations inherent in the parameters and variables. Ideally, this variation should be contained in the analyses, but resources in addition to the amount expended for this study would be required to carry out such an extensive study.

1.3 Reference

1. Tsao, H.-S.J., Botha, J.L., Zabyshny, A.A., Day, J.E. Definition and Evaluation of Bus and Truck Automation Operations Concepts: Final Report. California PATH Research Report UCB-ITS-PRR-2003-19. May 2003.

2 SOME SALIENT ASPECTS OF THE COST COMPARISON

The overall goal of this section is to discuss some of the broad aspects of the analysis in order to lay a foundation for putting the results of the study in perspective. Specifically, the following will be discussed:

- Objectives of the analysis.
- Basic approach to the benefit-cost analysis.
- Proposed options for analysis.
- Some complicating factors and potential pitfalls.
- Economic feasibility.
- Major cost categories.

2.1 Objectives of the Analysis

As stated before, the ultimate goal of the benefit-cost analysis was to compare the costs of alternative systems which are (as far as possible) functionally the same, i.e. they convey a specified volume of traffic between two specific points. The effect of different levels of traffic volume is discussed in the case of the transit systems, and in the case of the freight systems, an analysis was performed to assess the effects of varying volumes.

The benefits and costs were assessed from a societal perspective, i.e. no differentiation was made as to whom the benefits and costs accrue to. However, individual stakeholders often view benefits and costs differently from the societal viewpoint. This could mean that a project may be worthwhile from a societal point of view but not necessarily from, say, a group of users of the facility. Some aspects of stakeholders' perspectives are discussed but not analyzed.

2.2 Basic Approach to the Benefit-Cost Analysis

It is worthwhile to review some aspects of benefit-cost analysis to enable some perspective on the possible shortcomings of and some of the practical issues involved in such an analysis, as they may pertain to this study.

The term "benefit-cost analysis" is used in a generic sense here. The term encompasses the whole family of benefit-cost analyses and not just the benefit-cost ratio. When evaluating transportation systems, the term "benefits" often means a reduction in user costs while the term "costs" indicates an increase in the system costs which accrue to the agency, e.g. construction costs. When the benefits exceed the costs, a project is generally considered worthwhile. These definitions are consistent with conducting the analysis from the societal viewpoint and are used in this report. However, instead of using benefits and costs, it is often convenient to use "total cost" (the sum of user and system costs) when analyzing the performance of systems. When using total costs for a comparison, the best alternative is the one with the lowest costs. In the event of comparing the incremental total costs of an alternative to the base case, a negative value for the incremental costs would signify an improvement. When using a total-cost analysis correctly, it will be precisely equivalent to using a comparison of benefits and costs correctly.

When conducting a benefit-cost analysis, all values have to be brought to a common basis. Because of the large number of cost items that were recurring costs, the comparisons were based on equivalent uniform annual amounts. The discount rate used was six percent, which is a discount rate used by the California Department of Transportation (Caltrans) (1). The base year for the evaluation was chosen to be 2001, and all costs were inflated or deflated to this base year. It is worth noting that the results of this study are a function of the basis on which the calculations were carried out. Vehicle-hours and vehicle-miles of travel were used as a basis in many of the calculations, and a different basis could produce different results.

Since the resources available for this study did not allow for an estimation of the total cost of all alternatives, only differences in cost among the alternatives were considered where this was suitable.

Ideally, the comparison should be made among optimally-configured systems that are functionally the same at a specified traffic volume level. Determining the optimal configuration for each alternative was outside the scope of this project. The configurations that were used were considered to be reasonable and were related to the existing systems, which were the VTA light rail system for the transit component and Interstate 5 (I-5) and California State Route 710 (SR-710) for the freight comparison. Related assumptions will be discussed in more detail later in the report. The analyses for both transit and freight were undertaken using the existing traffic volumes as a starting point. A zero growth rate was assumed for the vehicular traffic and passenger volumes because assuming a greater-than-zero growth rate would have added complexity to the analysis, would have made the understanding of the effect of different volumes on the different systems less transparent, and would not have added more insight or clarity to the study. It is also conceivable that the demand for the different systems would be different, but considering this effect would entail extensive analysis that is considered outside the scope of this project.

2.3 Options Analyzed

The options analyzed are as follows:

Transit:

- Conventional light-rail system
- Automated Bus System (ABUS)
- Bus-on-Dedicated-Lane (BDL) System

Freight Transportation:

- Added conventional lane
- Automated truck system operating on a dedicated lane (Truck-AHS)
- Dedicated truck lane

- Intermodal rail

Details of these alternatives are discussed in a previous report (2). However, it should be noted that the emphasis here is on the benefits that convoying automated vehicles (with, consequently, fewer drivers required overall) can effect, and not so much on the other benefits that could result from automation.

2.4 Some Complicating Factors and Potential Pitfalls

It should be noted that the comparison conducted for the transit systems consisted of a least-cost analysis for all three systems. Because a comparison was not made with an automobile-only or conventional bus system, it cannot be concluded that any of these systems are economically feasible. For the road-based freight alternatives, most of the incremental costs over the existing system were calculated for each of the alternatives. Therefore, conclusions about the economic feasibility of each alternative over the base system can be inferred in the latter case.

When doing a comparison, it would be desirable to hold all variables, related to the quality of service and that cannot be quantified, constant for all alternatives and to make the two systems functionally the same i.e. to transport the same traffic volume (passengers or freight) over the same distance. For instance, in the case of the transit systems, the system that would transport a specified volume of passengers within assumed standards such as travel comfort, reliability etc., with the least cost for a specified distance, should then be selected as the appropriate system for that volume.

A comparison between ABUS and the BDL system would be relatively “pure” in the sense that almost everything will be the same except for the cost. A relatively “pure” comparison between a truck-AHS and conventional truck operations on a dedicated lane could also be accomplished. A comparison between the ABUS system and a light-rail system is not as “pure”. There are aspects, such as the quality of ride, seating comfort etc., that would most likely differ between the two alternatives. Similar issues could arise in the comparison of AHS-truck versus the inter-modal rail alternative. The inter-modal rail option could be very different in terms of the quality of service that is experienced by a shipper.

Some costs were not readily quantifiable because it is impossible to do so or beyond the scope of the next phase of the project. They will only be discussed and not quantified. For example, in the case of the light rail system, it should offer the benefit (or lower cost) of generating less air pollution in the immediate area (it is possible that more air pollution could be generated at the source of power generation) than conventionally powered buses. However, it is beyond the scope of the project to estimate the costs of air pollution. The light rail system may also offer a more comfortable ride than buses, but this is difficult to quantify in terms of reduced costs, and is also considered to be outside the scope of this project.

The comparison of costs for the intermodal rail to trucking in a specific corridor would be a significant and potentially-difficult undertaking. Costs data for the rail are, in many cases, proprietary, and it is difficult to make a realistic direct comparison in a specific corridor. As stated in the project proposal, a different approach was followed for this comparison. The comparison is discussed in Chapter 16 of this report.

As stated before, the viewpoint taken for the comparison of alternatives is the societal viewpoint. Ideally, projects that employ public funds should all be evaluated from this point of view before other viewpoints are considered. This does not take into account to whom the costs accrue. A project could be economically feasible from the societal point of view, but may not be economically or financially feasible from a specific stakeholder's (or group's) vantage point. For instance, if an AHS lane were added, user costs on all lanes could be reduced. It is conceivable that the user cost savings for the AHS lane users may not offset the cost of outfitting the vehicles. Furthermore, the use of the lane may not be beneficial if tolls were levied for use of the AHS lane. It should be noted that issues related to financing, revenue generation, and pricing were not part of this benefit-cost analysis except as the flow rates and, consequently, user costs would be affected.

When considering another vantage point, such as the view of a freight shipping company, the issue of cost allocation becomes pertinent. Trucks are often not allocated the full cost burden of providing the road, and their shipping rates would include only the direct costs that they will incur. In the case of a rail system, it is more likely that the rates will include the full cost of the track. The way in which the respective two shipping companies will view the costs will not only depend on which costs they have to bear, but also how they finance their operations and how costs are accounted for. In U.S. accounting practice, costs are accounted for according to accounting rules, which consider costs differently from the way a conventional benefit-cost analysis would account for costs.

A shipping company would also consider an increase in net revenues or profits as the major reason for investing in new technology. Since the benefits, from a societal point of view, are not necessarily proportional to net revenues or profits, there would not necessarily be a one-to-one correspondence between the investment decisions from the societal point of view and the business point of view.

Because of the basic approach proposed, i.e., to consider real costs, this requires eliminating taxes, financing cost etc. from the amounts. This was accomplished where there was evidence of the presence of such items in any of the data used; however, it is possible that some of these costs could have been present in some of the data but not explicitly itemized, especially where borrowing was used to finance the systems. Given the available time and the anticipated difficulty of obtaining information on the internal business practices of shipping companies, a full-blown analysis of the benefits and costs accruing to different stakeholders was not conducted (as stated in the project proposal). A discussion of some issues related to the various stakeholders is presented in Chapter 16.

When conducting a benefit-cost or cost analysis, the focus is naturally on the benefits and costs, and on the final outcome. It should be kept in mind, however, that the benefit and cost calculations are dependent on the accuracy of a large number of parameters. These parameters were not only related to the benefit and cost calculations themselves (such as unit costs, interest rates), but also to the operating concepts and the associated conditions, such as traffic volumes, etc. For this reason, the interpretation of the results should be viewed from a holistic perspective, with understanding of all elements of the analysis. This makes the analysis and understanding thereof very difficult because it requires knowledge of all of these elements.

2.5 Economic Feasibility

Economic feasibility refers to a determination of whether a project is favorable as compared to the no-build alternative, and to other available alternatives. It should be noted that the results of the transit portion of this analysis did not indicate that any of the transit systems that were studied are economically feasible. To determine feasibility, the transit alternatives should also be compared to a no-build condition, and an incremental analysis should be undertaken to determine the best transit alternative. Note also that the base condition could be a condition without a transit alternative. In regards to the freight system, the nature of this analysis provides a basis for a feasibility argument, since the proposed alternatives are compared to a no-build base case.

2.6 Cost Items

Costs for transportation systems generally fall into the following categories:

- System planning and design costs
- Construction, rehabilitation and other infrastructure capital costs
- System maintenance costs
- Administration and system operating costs
- Vehicle operating costs
- Travel time costs
- Accident costs

All of the above costs, with the exception of accident costs, were considered in this study. The operating concepts are not adequately understood to enable reliable prediction of the frequency and severity of accidents. As stated before, external costs such as environmental costs will not be considered. The approach utilized in this report is to discuss them where appropriate, but not quantify them.

2.7 References

1. Booz: Allen and Hamilton Inc. *California Life-Cycle Benefit/Cost Analysis Model* (Cal-B/C). California Department of Transportation. September 1999.
2. Tsao, H.-S.J., Botha, J.L., Zabyshny, A.A., Day, J.E. Definition and Evaluation of Bus and Truck Automation Operations Concepts: Final Report. California PATH Research Report UCB-ITS-PRR-2003-19. May 2003.

3 GENERAL ISSUES RELATED TO THE TRANSIT SYSTEMS EVALUATION

3.1 Route Location

The route location chosen as a basis for the analysis is the part of the Santa Clara Valley Transportation Authority (VTA) light rail system route north of the downtown area. A part of this system is located in the median of a freeway, another on city streets and also a part in the downtown area of the City of San Jose. A portion of the route located on city streets was chosen as a basis for the analysis, because the authors of this report consider this part to have the character of light rail systems most likely to be found elsewhere and also the most representative of the characteristics of a main transit route.

The current and planned route of the light rail system is shown in Figure 3.1. The portion used as a basis for this analysis is boxed in the figure. The study section is a 5.19-mile section extending from the Japantown/Ayer station in the south to the Baypointe station in the north.

3.2 System Design and Operating Concepts

The alternative transit systems that were considered consisted of a light rail system, a bus system on a dedicated lane and an automated bus system on a dedicated lane. Some aspects of these systems were discussed in a report by Tsao, Botha, Zabyshny, and Day (1). It should be noted that these systems could operate at different speeds and at different levels of safety standards. The speed of operation was assumed to be equivalent to the current speed of existing light rail operations on the study section. Barriers to divide traffic flowing in opposite directions and to separate vehicles using the dedicated lanes from the regular traffic stream were not considered in the cost estimates, but should be considered in future studies, depending on the physical conditions and desired safety standards of the implementation location.

3.2.1 Light Rail

The portion of the light rail system chosen for analysis consists of an at-grade track system operating on a dedicated right-of-way. Dimensions for the minimum width of a typical light rail section in Santa Clara County are shown in Figure 3.2. Currently, the system is operated with minimum headways of 15 minutes, which, according to VTA staff, can be shortened to a minimum of 10 minutes, although 5-minute headways have been used in the past. Three-car, two-car and one-car trains are currently used, depending upon demand. The limitation of three cars per train results from available length of platforms.

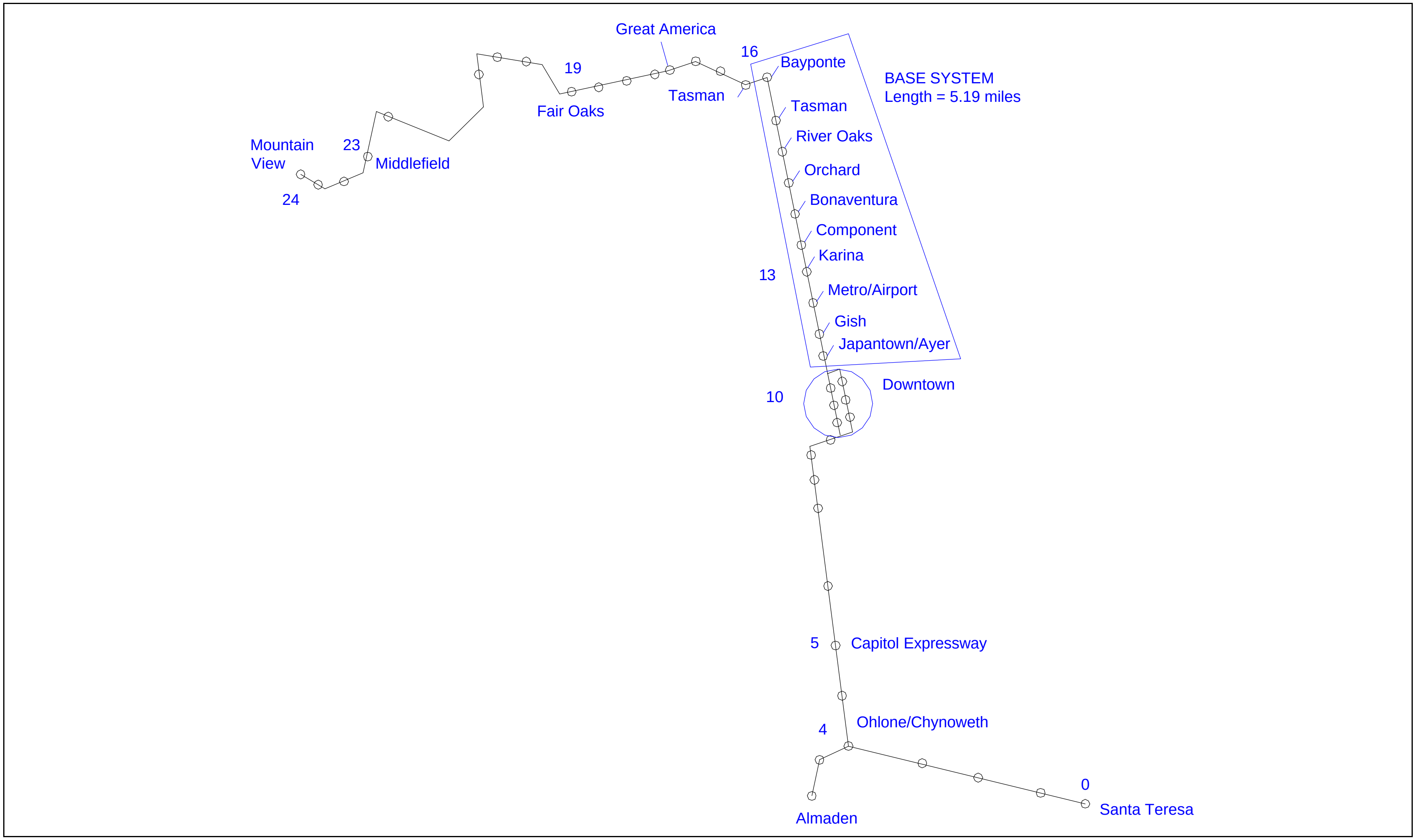

FIGURE 3.1 SANTA CLARA VALLEY TRANSPORTATION AUTHORITY (VTA) LIGHT RAIL SYSTEM

3.2.2 ABUS

Like a conventional light rail system, ABUS vehicles would convoy in "bus convoys." The buses would be electronically linked together using automation technology. For the purpose of this study, it was assumed that the maximum length of a train will be no more than five vehicles and that a train of five buses would be technologically feasible and safe. The length of five vehicles is somewhat arbitrary, but was selected so that the capacity of a five-bus train would be approximately the same as that of a three-car light-rail train.

Like a conventional light rail system, the ABUS design includes a traveled way for vehicles in each direction, without a breakdown lane. This means that it would be functionally equivalent to the light rail system and that stalled vehicles would have to be removed from the operational lane before operation could proceed. The system could be placed in the median of the roadway. It would have at-grade intersection crossings with regular traffic, and signal priority would be given to ABUS vehicles in a similar fashion as is given to the light rail system in Santa Clara County. A barrier between the ABUS and regular traffic would probably be desirable, but, again, to maintain functional equivalence with the light rail system, it was not included.

Two possible design scenarios are given in this report. In the first, the dimensions of the cross section were based on principles for road widening in the *Policy on Geometric Design of Highways and Streets, 2001,* published by the American Association of Highway and Transportation Officials (AASHTO) (2). In the second, dimensions of the cross-sectional design are based on the principle that travel lanes for trucks and buses using automated technologies need be only 30 cm (0.98 feet) wider than the vehicles using them (suggested by Dr. Steven Shladover of PATH). Further discussion of the required space is presented in Section 5.2. A schematic representation of the two designs are presented in Figures 3.3 and 3.4.

3.2.3 Bus-On-Dedicated-Lane

The Bus-On-Dedicated-Lane (BDL) system design is similar to that of the ABUS except, that the buses do not convoy and operate at equal headways. A schematic representation of this design is presented in Figure 3.5. The design follows AASHTO standards.

3.3 Some Issues Related to the Evaluation

3.3.1 The Approach to the Economic Evaluation

The basic premise of the economic analysis was to compare the alternative systems which would, as much as possible, be functionally the same. This would mean that they would convey the same number of passengers between the same origins and destinations with the same service standards. It is assumed that the safety standards would be comparable, although they probably would not be. The quality of service for passengers is also assumed to be the same. Because all the systems operate on the same right of way under the same traffic control systems, the speeds are assumed to be similar. This

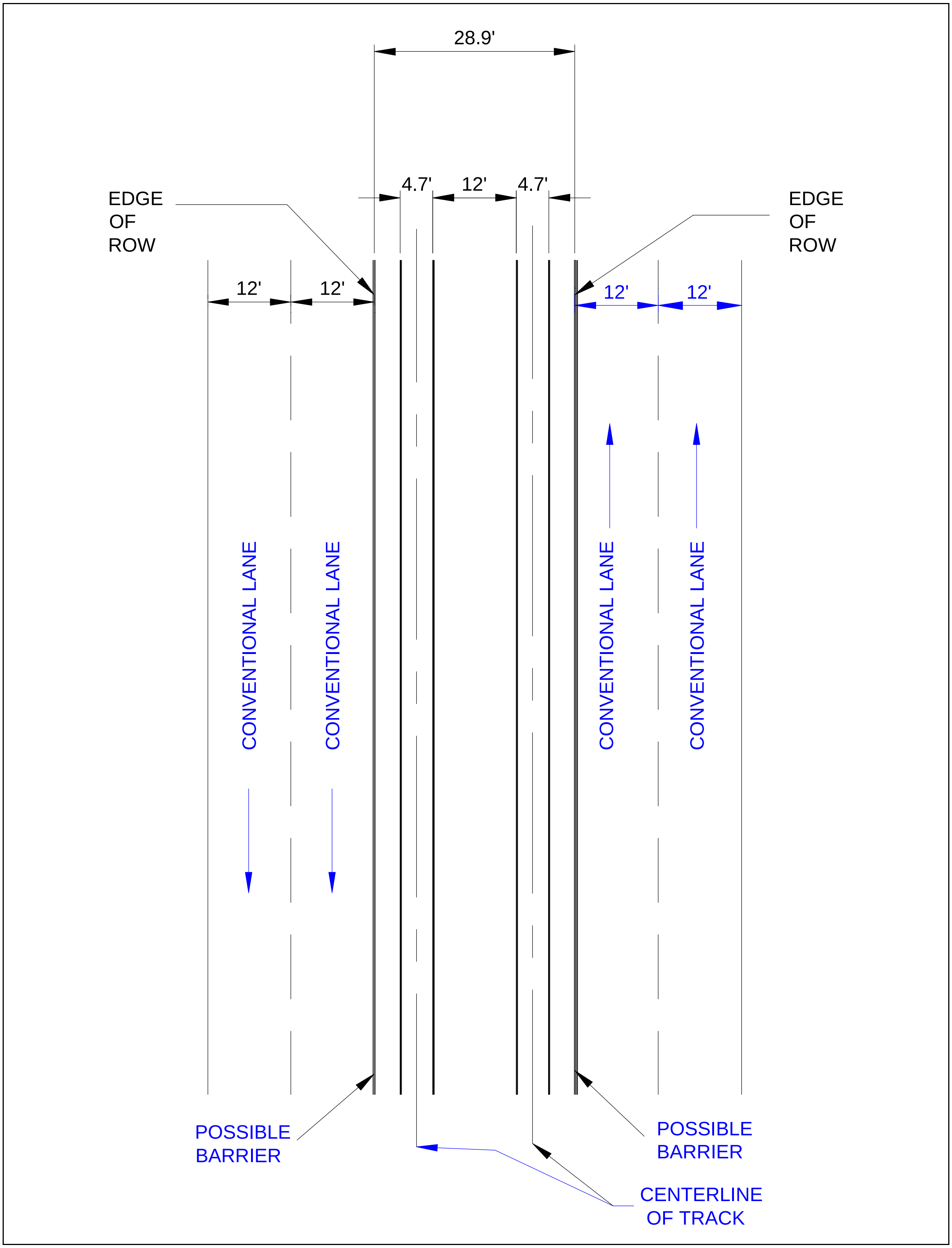

FIGURE 3.2 BASIC GEOMETRY FOR LIGHT RAIL

assumption may not hold entirely for the BDL system because the buses are more dispersed than the vehicles of the other two alternatives and consequently the traffic control system may have to be different and could possibly affect the travel time of the buses. Without investigation of the control system, this possible effect cannot be quantified. Such an investigation falls outside the scope of this project.

Equivalent uniform annual costs (EUACs) were calculated for all cost categories. The project life assumed for the analysis was 30 years, with a 6 percent discount rate, and 2001 was used as the base year. The choice of the analysis period of 30 years was deemed reasonable, although longer projects lives could certainly be considered appropriate for fixed projects such as the light rail. Ideally, the project life should be such that it would be a multiple of individual project lives, which would include rehabilitation, etc. Alternatively, the issue could have been dealt with through salvage values, though this would have added complexity to the analysis which would probably not have been worthwhile, given the level of aggregation used in the study. Since Caltrans uses a 6 percent discount rate for its economic analyses, this rate was deemed appropriate for this project.

The costs that were assumed to differ for the different systems were calculated. Those costs that were common were not considered. It should again be noted that a comparison of these costs does not indicate that the system with the least cost would be economically feasible, or necessarily the best system to implement, because a comparison would have to be made with an automobile-only option or an automobile-plus-bus option – a base system that is not one of the considered alternatives.

3.3.2 Cost Categories

The following costs categories were identified for the analysis. All costs apply to all proposed systems, and were calculated for both design scenarios:

- System Planning and Design Costs
- Construction, Rehabilitation, and Other Infrastructure Costs
- Vehicle Operations Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs
- User Costs

Some general comments regarding these cost categories will be provided in the following sections.

System Planning and Design Costs

System planning and design costs for the light rail and ABUS systems would generally be expected to be higher than the corresponding costs for the BDL system because of the greater complexity associated with the light rail and ABUS systems. The costs could be relatively

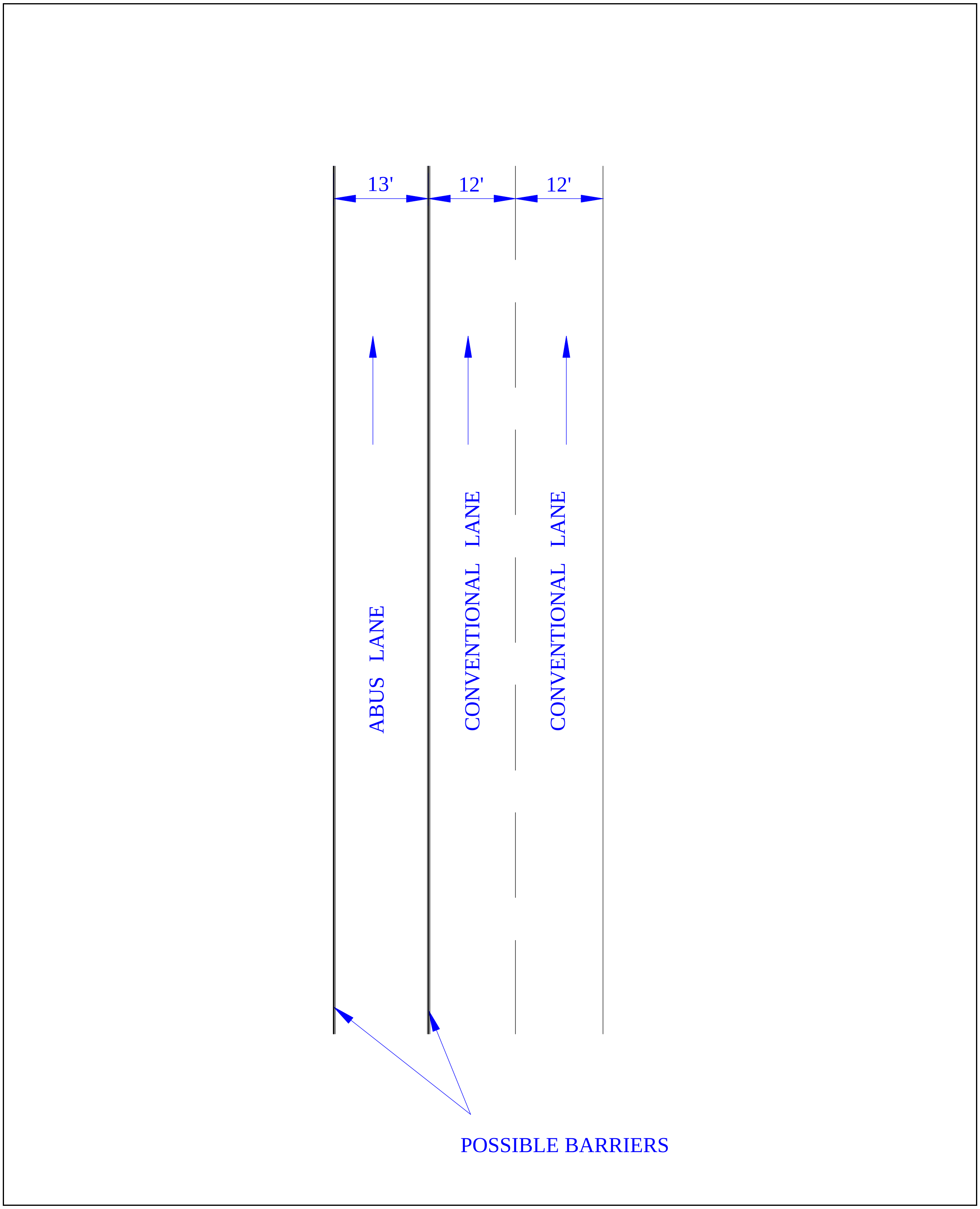

FIGURE 3.3 BASIC GEOMETRY FOR ABUS-ON-DEDICATED-LANE CONFIGURATION – SCENARIO 1: DESIGN BASED ON AASHTO STANDARDS

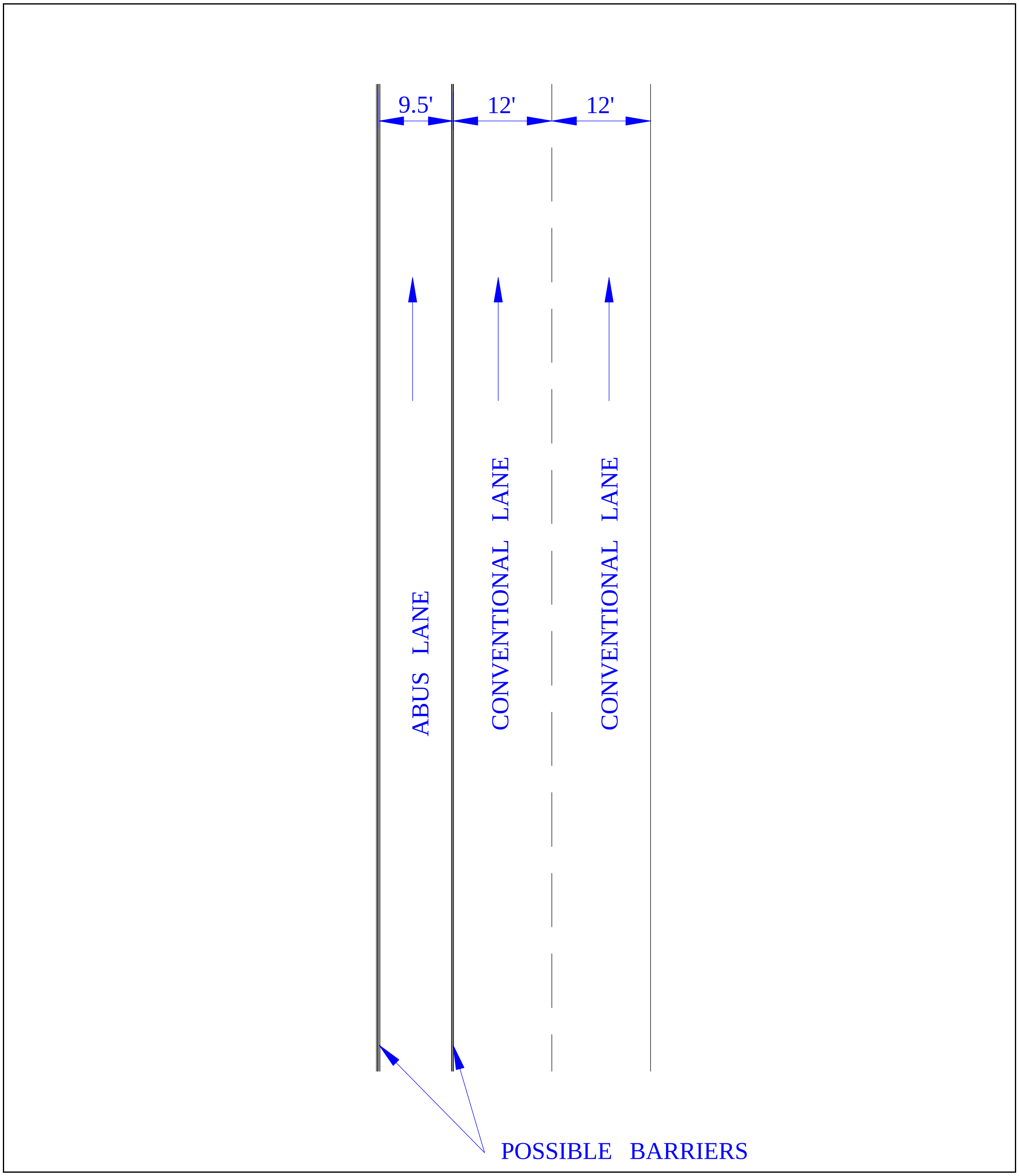

FIGURE 3.4 BASIC GEOMETRY FOR ABUS-ON-DEDICATED-LANE CONFIGURATION – SCENARIO 2: REDUCED WIDTH

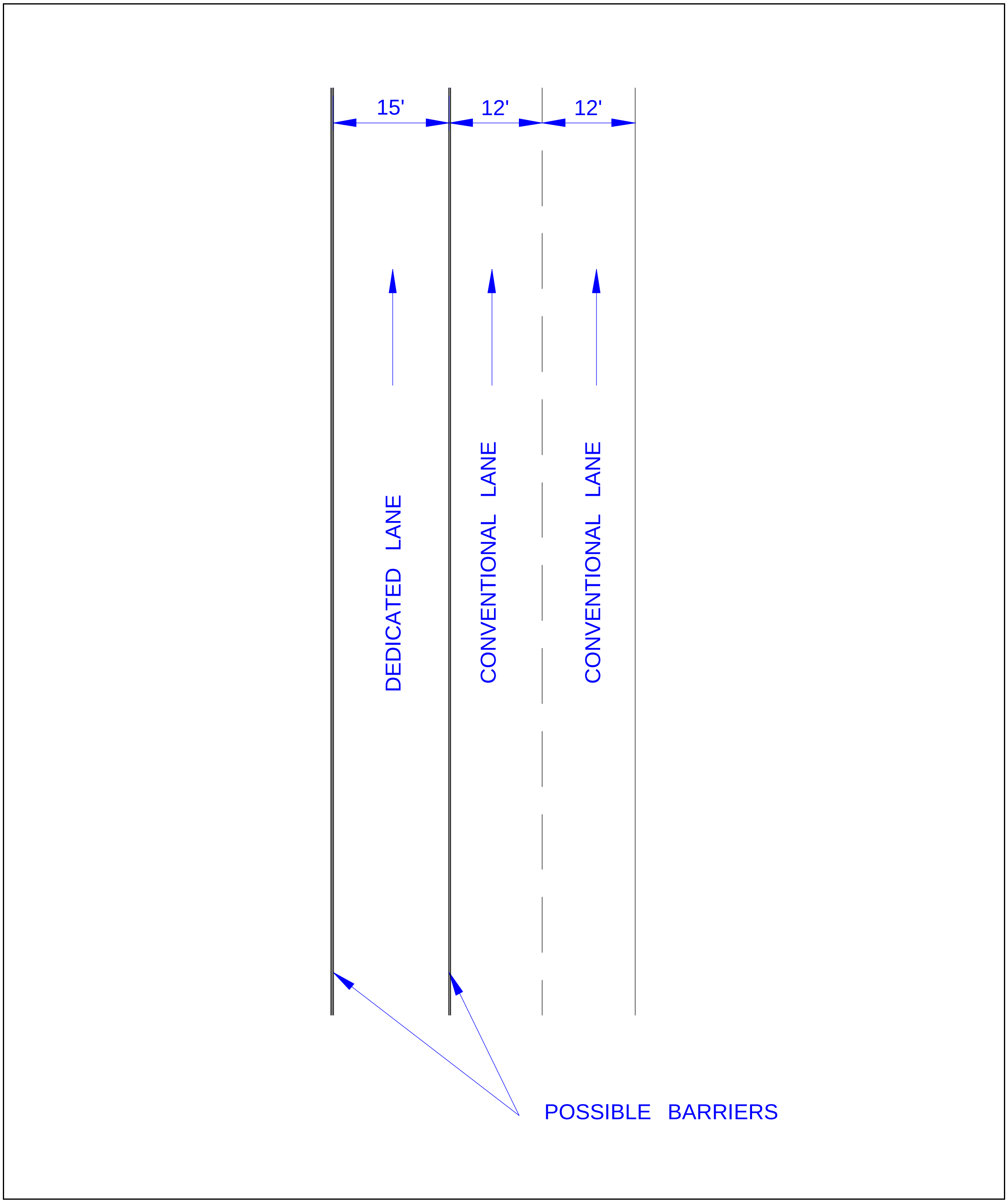

FIGURE 3.5 BASIC GEOMETRY FOR BUS-ON-DEDICATED-LANE CONFIGURATION

higher for the ABUS as compared to the BDL system, depending on the components of design and possible increased safety appurtenances.

Construction, Rehabilitation, and Other Infrastructure Costs

There will be a difference in the costs associated with providing the track or way for the systems. This cost will include the construction and rehabilitation of the systems. For the ABUS system, costs for magnetic strips used in automation – both for the initial construction and rehabilitation -- are also included as part of this cost category. Rehabilitation costs are included in this category, since these costs are more akin to construction costs than to maintenance costs that are incurred on a more routine basis. In addition, costs associated with fleet purchase and renewal are included in this category, since they are capital costs. Right-of-way costs are also considered here. It is noteworthy that right-of-way costs for stations and system-supporting infrastructure (such as overhead electrical) were included for the light rail system, but were not included for the ABUS and BDL systems. Depending on the type of bus stations provided, these could be minimal or significant.

Because of the differences in the traveled way provided for the different options, there will be differences in costs. It should be noted that the roadway for the ABUS may be narrower and related costs will be lower than the corresponding costs for the dedicated bus lanes because of more accurate lane-keeping by AHS vehicles. The structural cost of the pavement may also be lower, because of more efficient construction resulting from less "wander" of the vehicles, but that is difficult to quantify without extensive study.

Vehicle Operations Costs

Vehicle operations costs include costs associated with driver wages and fringe benefits, fuel, tires, and other materials, supplies, wages, fringe benefits, and miscellaneous expenses.

Vehicle operating costs will be fundamentally different for all of the systems because of the difference in the vehicle types and capacity, the number of vehicle-miles traveled, the number of vehicle-hours operated, and the number of operators needed. There may also be reduced fuel consumption for the ABUS because of reduced wind drag resulting from close following, although this may not be significant at low operating speeds, and were not considered in this analysis. There will be additional costs related to vehicle operations to automate the ABUS.

To estimate the vehicle operations costs, operational revenue-miles and revenue-hours for four different time regimes were calculated for each of the three systems being compared. These periods were the same as the periods used by the VTA in its data collection. They are: AM Peak (5:30 – 8:30), Midday (8:30 to 14:30), PM Peak (14:30 to 17:30), and Off-Peak (17:30 to 5:30) periods. Also, a differentiation was made between weekday, Saturday, and Sunday traffic volumes for calculation purposes for each system.

In order to assure functional equivalence of the three systems being compared, the revenue-miles and –hours used for calculation of costs of the light rail system were based on the existing VTA schedule, and user volumes were considered to be constant for all three systems. The revenue-miles and –hours associated with the ABUS were found by creating an ABUS system that is functionally-equivalent to the light rail. This was done by assuming that the ABUS convoys operate with the same frequencies as the light rail trains in the VTA system and that a three-car light rail train is equivalent to (i.e. - carries the same number of passengers as) a five-car ABUS convoy, a two-car train is equivalent to a three-car ABUS convoy, and a one-car train is equivalent to a one-bus convoy.

The BDL system was assumed to operate the same number of buses as the ABUS system, though those buses are each operated by a driver and do not convoy. Rather than convoying, BDL buses were assumed to operate under shorter headways, though hourly passenger throughput remained the same as for the ABUS. Also with regards to functional equivalence, the service lengths for all systems were considered to be identical.

Vehicle Maintenance Costs

Annual costs for vehicle maintenance include vehicle upkeep, and are a function of the number of operating hours and operating miles each system uses annually, and of the unit cost for each expense incurred in terms of operating hours and operating miles. The procedures used to calculate these costs were similar to those used for calculation of vehicle operating costs.

System (Non-Vehicle) Maintenance Costs

Annual costs for system (non-vehicle) maintenance include routine system upkeep, and are a function of the number of operating hours and operating miles each system uses annually, and of the unit cost for each expense incurred in terms of operating hours and operating miles. The procedures used to calculate these costs were similar to those used for calculation of vehicle operating costs.

System Administration Costs

Annual general administration costs include those costs related to coordination and other office functions necessary for the operation of the system, and are a function of the number of operating hours and operating miles each system uses annually, and of the unit cost for each expense incurred in terms of operating hours and operating miles. The procedures used to calculate these costs were similar to those used for calculation of vehicle operating costs.

Administration costs and system operating costs have some fixed elements and some elements are a function of the size of the system. These costs are related to the management and offices, salaries and benefits, transportation supervision (dispatchers, inspectors etc.), office expenditures (heat, light, telephone, rentals etc.), building and fixed plant expenditures, support services (promotion, legal, audit, purchasing and taxes). Since only a part of the complete transit system functioning concurrently with the study section was considered (the remainder of the bus service and purchased transportation operating off the main trunkline was not considered), it would be difficult to separate out the differences in these costs that could be attributed to using the light rail versus the ABUS. These costs were therefore considered to be common to both systems.

User Costs

The only user costs considered here were those associated with travel time. It should be noted that counting the fare as a cost would actually amount to double-counting.

Travel time consists of user on-board travel time, access time, and egress time. The system boundaries were chosen such that only users and vehicles operating along the specified trunkline are considered to be within the project domain. Consequently, the feeder and distribution system, which in this case would be buses or automobiles, will be excluded. When a bus, for instance, exits the dedicated bus lane onto another city street, that vehicle has effectively exited the domain of the project.

The on-board travel times for all systems were the same, since it was assumed that the vehicle travel times would be equivalent. The access time was assumed to consist only of the wait time, which was equivalent for the ABUS and light rail systems, and considerably less for the BDL system. Egress time was, in general, not considered in this study because it was assumed to be equal for all systems. Some issues related to transfer time for the AHS and BDL systems will be discussed in a later section.

The passenger volumes for all systems were assumed to be the same, although it is possible that the demand could change depending on the type of system and the access to the system. For instance, on the BDL system, if buses were to access the dedicated lane from an origin some distance from the dedicated lane and there were no transfer time involved, this could reduce user transfer time, making the system more attractive. A similar situation could arise for the ABUS system, although in this case additional travel time could result from the time taken by the convoys to "form up."

3.4 References

1. Tsao, H.-S.J., Botha, J.L., Zabyshny, A.A., Day, J.E. Definition and Evaluation of Bus and Truck Automation Operations Concepts: Final Report. California PATH Research Report UCB-ITS-PRR-2003-19. May 2003.
2. *A Policy on the Geometric Design of Highways and Streets.* American Association of State Highway and Transportation Officials (AASHTO). 2001.

4 LIGHT-RAIL COSTS

4.1 Light Rail Study Section Specifications

As stated before, the study section consists of a 5.19-mile segment of the VTA light rail system extending from Japantown/Ayer Station north to Baypointe Station. The 5.19-mile section (10.38 track-miles in both directions) does not include mileage necessary for crossovers and yard tracks. An estimate of this effective mileage is required for the calculation of some of the costs – specifically, those costs associated with traveled-way construction. In order to estimate the total effective system mileage it was assumed that the percentage of crossover and yard track miles for the study section is the same as for the overall-light rail system operated by VTA.

The VTA system consists of roughly 60 miles of track dedicated to route miles, and 2 additional miles dedicated to crossovers and yard miles. This means that the total effective mileage is equal to the total route mileage increased by roughly 2/60, or 3.33%. The effective track mileage for the study section is therefore 5.36. Station and link data for the light rail system, supplied by the VTA, are presented in Appendix A. Appendix A also shows system length calculations and supporting tables. Figure 3.2 shows a schematic description of the light rail track layout.

For the base system, existing passenger volumes, as reported by the VTA, were assumed to apply to the light rail system. These are the passenger volumes which are used in all applicable calculations.

4.2 Light-Rail Costs – Base Volume

4.2.1 Light-Rail System Planning and Design Costs

The costs for the VTA Tasman West light-rail project was used as a basis for estimating planning and design costs for the study section. Planning and design costs include VTA labor, consulting and legal costs. The 7.6-mile double-track (which includes crossover and yard-track miles) Tasman West line was completed in 1999, and information on system planning and design was provided by the VTA in the form of a summary of construction costs.

The 1999 costs were converted to 1999-equivalent unit costs by dividing the total cost of construction by 15.2 miles (twice 7.6 miles) to calculate a cost per track-mile. Then, the unit costs were converted to 2001-equivalent costs by accounting for inflation. The unit costs were multiplied by 10.73, the total number of track-miles in the study section (5.36 miles in each direction) to obtain the total 2001-equivalent costs for the proposed light rail study section. It is noteworthy that rounding error was the cause of the two-directional study section length to be approximated at 10.73 miles, instead of the 10.72 miles expected when 5.36 is doubled. Because of the magnitude of the costs reported here, and also because of the approximate nature of the cost calculations, this rounding error only negligibly affects the

TABLE 4.1. LIGHT RAIL SYSTEM PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS

Cost Element	Item	Year	VTA Total Cost ($)	Unit Cost ($)[a]	Unit	Unit Cost (2001-Equiv. $)	Unit	# of Units in Study Section	Unit	One-Time Cost ($)	EUAC (2001-Equiv. $)
System Planning and Design Costs	Design Consultants	1999	60,266,983	3,964,933	track mile	4,104,895	track mile	10.73	track miles	44,027,686	3,198,563
	Professional Consultants	1999	49,651,941	3,266,575	track mile	3,381,885	track mile	10.73	track miles	36,272,930	2,635,189
	VTA Labor	1999	25,086,106	1,650,402	track mile	1,708,661	track mile	10.73	track miles	18,326,506	1,331,401
	Non-Technical Services	1999	3,453,199	227,184	track mile	235,204	track mile	10.73	track miles	2,522,714	183,272
	TOTAL										7,348,425
Infrastructure Costs	Property Costs/ ROW Acquistion	1999	34,166,626	23.65	sq. foot	24.49	sq. foot	791,952	sq. feet	19,391,768	1,408,791
	Utility Relocations	1999	9,015,859	593,149	track mile	614,087	track mile	10.73	track miles	6,586,482	478,501
	Material and Equipment	1999	12,619,406	830,224	track mile	859,531	track mile	10.73	track miles	9,219,032	669,753
	Civil/Structural Construction	1999	113,150,901	7,444,138	track mile	7,706,916	track mile	10.73	track miles	82,661,718	6,005,284
	Systems	1999	19,547,712	1,286,034	track mile	1,331,431	track mile	10.73	track miles	14,280,465	1,037,460
	TOTAL										9,599,788
Non-Infrastructure Capital Costs	Fleet Purchase (Vehicle Purchase)	2001	N/A	3,000,000	vehicle	3,000,000	USD per veh	6.288	vehicles	18,863,654	1,370,424
Periodic Capital Costs	Major Rehabilitation (Tangent Track Sections)[b]	2002	N/A	0	year	0	per year per veh	N/A	N/A	0	0
	Major Rehabilitation (Curved Track Sections)	2002	N/A	134,228	per 10 years per track mile	8,319	per year per track mile	4.037	track miles	N/A	33,586
	Major Rehabilitation (System/ Wayside Maintenance)	2002	N/A	50,000	per year per double-track mile	49,020	per year per double-track mile	5.19	double-track miles	N/A	254,414
	TOTAL										287,999
Fleet Renewal	Vehicle Replacement Costs			0	per year per veh.	0	per year per veh.	0	veh.	0	0
TOTAL CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS											11,258,212
TOTAL SYSTEM PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS											18,606,637

[a] *Based on 7.6-mile line length, double-track system, for a total of 15.2 trackway miles.*

[b] *Rehabilitation of tangent track sections is estimated by VTA personnel to occur every 75 to 100 years. This time period is beyond the scope of this study, and tangent section rehabilition is thus considered to be negligable.*

results of the study. Using a 30-year useful life, an Equivalent Uniform Annual Cost (EUAC) was calculated using 2001 as the base year**.** The costs for the study section are shown in Table 4.1. Methodologies and sample calculations are available in Appendix C.

4.2.2 Light Rail Infrastructure Costs

Construction costs for the light-rail system were also estimated using the completed VTA Tasman West light rail project as a basis. Information on construction costs was provided by VTA in the form of a summary of construction contract costs. The same procedure used to determine light rail system planning and design costs was used to determine the construction costs. Construction costs include those expenses associated with civil infrastructure, electrical systems, right-of-way acquisition, utilities, materials and equipment, and non-technical services. This cost category does not include vehicle procurement. The resulting costs are shown in Table 4.1.

4.2.3 Light-Rail Fleet Purchase

Initial fleet purchase costs for the light-rail system for the study section depend on the cost per vehicle and the number of vehicles purchased. VTA personnel estimate that an average light rail vehicle purchased in 2001 costs in the range of $2.5 - $3 million, depending on traction, drive, integration, and other factors. A cost of $3 million per light-rail vehicle was assumed for the purposes of this project.

To determine the costs of the light rail vehicles allocated to the study section, it was assumed that the number of vehicles would be proportional to the length of the study section for the base volume condition. Appendix C shows calculations for the number of light rail cars needed to service the proposed light rail line for this project (see Table C4) and discusses annual cost calculation methodologies. Table 4.1 shows the costs.

4.2.4 Light-Rail Rehabilitation Costs

Rehabilitation costs associated with a light-rail system can be subdivided into three categories:

- Tangent track section rehabilitation
- Curved track section rehabilitation
- Wayside Rehabilitation

Wayside rehabilitation refers to the costs for repairing and upgrading non-track elements of the light rail system (e.g. – shelters at passenger stations, electrical lines, etc.). These costs reflect as-needed improvements, which is why they are classified as rehabilitation expenses and not included in the “System Maintenance Costs” described in a later section.

The costs of the various categories of rehabilitation for the study section were based on data provided by the VTA.

Tangent and Curved Track Mileages

For the entire VTA system, the 60 miles of single track is comprised of 22.35 miles of curved track and 39.65 miles of tangent sections (this figure does not include approximately 2 miles of track dedicated to crossovers and yard tracks). Assuming crossover mileage fits into the curved track category, and yard tracks are tangent sections, and assuming that one mile of the aforementioned two miles is used for crossovers, this implies that roughly 37.66% (23.35/62) of the VTA rail system is made up of curved track. Applying this percentage to the 10.72-effective track-miles (5.36 miles in each direction) study section this would result in the following lengths of curved and tangent tracks:

- Curved track: 4.037 miles
- Tangent track: 6.683 miles

Curved Track Section Rehabilitation

VTA personnel estimate that $3,000,000 (in 2002 dollars) is required every ten years to rehabilitate the curved sections of the existing Guadalupe light rail line. For the estimated 4.037 miles of curved sections of the study section, the rehabilitation cost would amount to $33,586 per year per one-directional track mile after converting the cost to 2001 dollars. Methodologies used to arrive at this figure can be viewed in Appendix C.

Tangent Track Section Rehabilitation

For tangent track sections, VTA personnel estimate that rehabilitation occurs at a 75 to 100-year frequency. Because the rehabilitation cycle is longer than the 30-year assumed life of this project, costs associated with tangent track rehabilitation are considered to be negligible for the purpose of this analysis.

Wayside Rehabilitation

VTA personnel estimate system and wayside rehabilitation costs at approximately $50,000 per year per double-track mile (2002 dollars) for the existing Guadalupe line, which is 20.8 miles long. For the 5.19 track-mile study section, this results in system and wayside rehabilitation costs of $254,414 per year per double-track mile after conversion to 2001 dollars. It is noteworthy that the effective track length is not used here because there would be little, if any, wayside rehabilitation associated with crossover tracks and yard tracks. Table 4.1 shows tabulated costs for wayside rehabilitation. Methodologies and sample calculations for determination of costs can be found in Appendix C.

4.2.5 Light Rail Fleet Renewal Costs

According to VTA personnel, modern light rail vehicles are built to have a useful life of 30 years, to comply with the 25-year amortization period required by the federal government. Since the assumed life of this project is also 30 years, fleet renewal is of zero cost in the domain of this project. It is noteworthy that VTA is currently replacing its 15-year-old fleet

– not due to vehicle wear, but because the vehicles are being upgraded with low-floor light rail cars.

4.2.6 Light Rail Vehicle Operations Costs

Costs associated with vehicle operations include daily costs necessary to run the system, including operators' salaries, wages and benefits, fuel and oil, utilities, and other expenses. Vehicle operating costs do not include costs for routine vehicle maintenance, such as tire replacement and labor costs for workers performing the maintenance.

The calculation of the light rail study system vehicle operating costs was carried out in the following phases:

- Determination of individual cost elements that comprise costs in this category (discussed in Appendix C).
- Determination of unit costs for those cost elements in terms of vehicle-revenue-miles and vehicle-revenue-hours (discussed in Appendix C).
- Determination of annual train-revenue-miles and –hours for the study section (discussed in Appendix D).
- Determination of unit costs for each cost element, based on the VTA light rail system, in terms of vehicle-revenue-miles and vehicle-revenue-hours, or train-revenue-miles and –hours.
- Calculation of light rail study system annual costs based on unit costs and calculated vehicle-revenue-miles and –hours, or train-revenue-miles and –hours.

Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours (which are the same for all cost categories), and overall annual costs are shown in Table 4.2. Methodologies and sample calculations for operating cost calculations are shown in Appendix C.

4.2.7 Light Rail Vehicle Maintenance Costs

Costs associated with vehicle maintenance include materials, supplies, fuels, lubricants, utilities, and labor used to keep the system in good working order, and are not included in vehicle operating costs. Cost calculations for vehicle maintenance follow identical methodologies for those in the "Vehicle Operating Costs" category. Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours, and overall annual costs are shown in Table 4.3. Methodologies and sample calculations for operating cost calculations are shown in Appendix C.

4.2.8 Light Rail System (Non-Vehicle) Maintenance Costs

Costs associated with system maintenance include maintenance expenses for stations and trackways. Cost calculations for system maintenance follow identical methodologies for those in the previous "Vehicle Operating Costs" category. Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours (which are the same for all cost categories),

TABLE 4.2. LIGHT RAIL VEHICLE OPERATIONS COSTS

Cost Element	Item	Revenue-Miles				Revenue-Hours			
		Unit Cost (2001-Equiv. $)	Annual Units in LR System	Unit	EUAC (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in LR System	Unit	EUAC (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages	2.27	276,035	Train-Rev-Mi	625,840	33.55	15,439	Train-Rev-Hr	517,923
	Other Salaries and Wages	0.48	448,068	Veh-Rev-Mi	213,235	7.06	25,061	Veh-Rev-Hr	176,823
Fringe Benefits	Operators' Fringe Benefits	1.86	276,035	Train-Rev-Mi	514,622	27.59	15,439	Train-Rev-Hr	425,883
	Other Fringe Benefits	0.39	448,068	Veh-Rev-Mi	175,341	5.80	25,061	Veh-Rev-Mi	145,400
Services	Services	0.30	448,068	Veh-Rev-Mi	136,416	4.51	25,061	Veh-Rev-Mi	113,122
Materials and Supplies	Fuel and Lubricants								
	Tires and Lubes								
	Other Materials and Supplies	0.01	448,068	Veh-Rev-Mi	3,589	0.12	25,061	Veh-Rev-Mi	2,976
Utilities	Utilities	0.82	448,068	Veh-Rev-Mi	366,665	12.13	25,061	Veh-Rev-Mi	304,054
Taxes	Taxes								
Misc.	Miscellaneous Expenses	-0.01	448,068	Veh-Rev-Mi	-6,555	-0.22	25,061	Veh-Rev-Mi	-5,435
Expense Transfers	Expense Transfers								
TOTAL LIGHT RAIL VEHICLE OPERATIONS COSTS					2,029,153				1,680,746

TABLE 4.3. LIGHT RAIL VEHICLE MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in LR System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in LR System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	1.36	448,068	609,023	20.15	25,061	505,027
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.95	448,068	426,521	14.11	25,061	353,690
Services	Services	0.22	448,068	98,617	3.26	25,061	81,778
Materials and Supplies	Fuel and Lubricants	0.03	448,068	12,147	0.40	25,061	10,073
	Tires and Lubes						
	Other Materials and Supplies	0.49	448,068	221,011	7.31	25,061	183,272
Utilities	Utilities	0.00	448,068	928	0.03	25,061	770
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	448,068	2,960	0.10	25,061	2,454
Expense Transfers	Expense Transfers						
TOTAL LIGHT RAIL VEHICLE MAINTENANCE COSTS		3.06		1,371,208	45.37		1,137,063

and overall annual costs are shown in Table 4.4. Methodologies and sample calculations for operating cost calculations are shown in Appendix C.

4.2.9 Light Rail System Administration Costs

Costs associated with system administration include expenses incurred for system support personnel in VTAs offices. Cost calculations for system administration follow identical methodologies for those in the previous "Vehicle Operating Costs" category. Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours (which are the same for all cost categories), and overall annual costs are shown in Table 4.5. Methodologies and sample calculations for operating cost calculations are shown in Appendix C.

4.2.10 Light Rail User Costs

For the purposes of this study, user costs are assumed to be costs associated with rider wait and on-board travel time, and do not include fares. Table 4.6 shows a summary of calculated user costs for the study segment. Tables containing user time calculations can be found in Appendix E**,** along with methodologies and sample calculations.

User costs were based on on-off ridership data for the VTA light rail system. The data were obtained from VTA, and are given for weekday, Saturday, and Sunday ridership in both the northbound and southbound directions. Additionally, data for each day are divided into four periods: AM Peak (5:30-8:30 am), Midday (8:30 am – 2:30 pm), PM Peak (2:30 pm – 5:30 pm), and Off-Peak (5:30 pm – 5:30 am). Appendix F shows the on-off data.

Cost calculations for overall user costs were completed in the following sequence:

- Determination of user wait- and travel-time unit values (in $).
- Calculation of daily passenger wait time for weekdays and weekends.
- Calculation of daily passenger on-board travel time for weekdays and weekends.
- Summation of daily wait time and travel time, and of annual wait and travel time.
- Calculation of wait- and travel-time costs.

The unit value of user wait and travel time was found to be equal to $8.32 in 2001-dollars. This value was based on a value of $8.16 (in 1999 dollars) used by Caltrans (1), which was adjusted for inflation to 2001 dollars using a factor of 1.0353 (2).

Methodologies, sample calculations, and supporting tables for the user cost calculations can be found in Appendix E.

4.3 Light-Rail Cost Summaries

Table 4.7 shows a summary of all calculated costs associated with the rail system.

4.4 References

1. Booz: Allen and Hamilton Inc. *California Life-Cycle Benefit/Cost Analysis Model* (Cal-B/C). California Department of Transportation. September 1999.
2. GDP Deflator Inflation Calculator. Online. <http://www.jsc.nasa.gov/bu2/inflate.html>

TABLE 4.4. LIGHT RAIL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	# Units in LR System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	# Units in LR System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	1.05	448,068	468,739	15.51	25,061	388,698
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.65	448,068	293,388	9.71	25,061	243,289
Services	Services	0.37	448,068	166,745	5.52	25,061	138,272
Materials and Supplies	Fuel and Lubricants	0.00	448,068	2,029	0.07	25,061	1,682
	Tires and Lubes						
	Other Materials and Supplies	0.04	448,068	17,726	0.59	25,061	14,699
Utilities	Utilities	0.20	448,068	87,721	2.90	25,061	72,742
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	448,068	4,666	0.15	25,061	3,869
Expense Transfers	Expense Transfers						
TOTAL LIGHT RAIL VEHICLE MAINTENANCE COSTS		2.32		1,041,014	34.45		863,252

TABLE 4.5. LIGHT RAIL SYSTEM ADMINISTRATION COSTS

Cost Category	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	# Units in LR System	EUAC (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	# Units in LR System	EUAC (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	2.50	448,068	1,119,918	37.06	25,061	928,683
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	2.26	448,068	1,013,297	33.53	25,061	840,268
Services	Services	0.70	448,068	312,903	10.35	25,061	259,472
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.12	448,068	55,810	1.85	25,061	46,280
Utilities	Utilities	0.02	448,068	8,819	0.29	25,061	7,313
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.18	448,068	81,613	2.70	25,061	67,677
Expense Transfers	Expense Transfers						
TOTAL LIGHT RAIL SYSTEM ADMINISTRATION COSTS		5.79		2,592,359	85.78		2,149,693

TABLE 4.6. LIGHT RAIL TOTAL USER COSTS

Day	Element	Daily User-Hours	Cost/User-Hour ($)	Daily Cost ($)	Annual Cost ($)
Weekday	Wait Time	733	8.32	6099	1,591,724
	On-Board Travel Time	1126	8.32	9366	2,444,462
Saturday	Wait Time	408	8.32	3395	176,532
	On-Board Travel Time	601	8.32	4999	259,952
Sunday	Wait Time	346	8.32	2877	149,625
	On-Board Travel Time	511	8.32	4252	221,084
TOTAL WAIT TIME					1,917,881
TOTAL ON-BOARD TRAVEL TIME					2,925,498
TOTAL				30,987	4,843,378

TABLE 4.7. LIGHT RAIL COST SUMMARY ($)

Cost Category	Vehicle-Revenue-Miles	Vehicle-Revenue-Hours	Average
	EUAC (30 yrs)	EUAC (30 yrs)	EUAC (30 yrs)
System Planning and Design	7,348,425	7,348,425	
Construction, Rehabilitation, and Other Infrastructure	11,258,212	11,258,212	
Vehicle Operations	2,029,153	1,680,746	
Vehicle Maintenance	1,371,208	1,137,063	
System (Non-Vehicle) Maintenance	1,041,014	863,252	
System Administration	2,592,359	2,149,693	
User	4,843,378	4,843,378	
TOTAL COST	30,483,749	29,280,770	29,882,259

5 ABUS COSTS

5.1 System Characteristics

The ABUS study system is assumed to be functionally equivalent to the light rail study section discussed in Chapter 4 of this report. In order to achieve functional similarity, the following light rail system characteristics have also been applied to the ABUS system:

- Study system length and location
- Study system passenger stations
- Study system passenger volume data

5.2 ABUS Study Section Specifications

Two separate design scenarios were developed for the ABUS system. Design Scenario 1 reflects standards set forth by the American Association of State Highway and Transportation Officials (AASHTO), which provides geometric design standards for non-automated streets and highways in its *A Policy on Geometric Design of Highways and Streets* (1). Design Scenario 2 reflects a principle suggested by Steven Shladover of The California Partners for Advanced Transit and Highways (PATH) project, which asserts that travel lanes for trucks and buses using automated technologies need be only 30 cm (0.98 feet) wider than the vehicles using them.

The following dimensions, which include travel lanes in both directions, were determined to be the minimum required right-of-way width for the ABUS system:

Design Scenario 1: 26 feet
Design Scenario 2: 19 feet.

The ABUS system operates on a dedicated right-of-way in the median of a regular roadway. As with the light rail system, the ABUS lanes operate at-grade, without physical barriers to separate the ABUS lanes from each other, or from the regular traffic. AASHTO (1) requires a 15-foot pavement width be used in this case to accommodate any design bus; however, included in this 15 feet is a two-foot width which accounts for wandering of the vehicle within the lane. Because it is assumed that automated technology will guide these buses without the wavering associated with manual steering, it is assumed that this two feet can be subtracted from the lane width. The resulting requirement is a 13-foot pavement width for each direction of travel. AASHTO standards for tangent sections of ramps were used to determine required widths. Additional widths may be required for horizontal curves.

The width of 19 feet associated with Design Scenario 2 was determined based on the principle that the width required for the roadway must be 30 cm (0.98 feet) wider than the design vehicle. The chosen design vehicle, the City Bus, is 8.5 feet wide. This implies a 9.5-foot traveled way in each direction, or 19 feet in total. Appendix G discusses width calculations for Design Scenarios 1 and 2 in more detail. Figures 3.3 and 3.4 show design concepts for Design Scenarios 1 and 2, respectively.

5.3 ABUS Cost Calculations

5.3.1 ABUS Infrastructure Costs

The ABUS is a theoretical system, and therefore costs related to infrastructure and other capital expenditures are not available in literature or other research reports. Costs associated with construction, rehabilitation, and other capital expenses were estimated based on data obtained from the VTA and the City of San Jose (CSJ).

Costs associated with constructing the ABUS system were calculated based on a recent City of San Jose roadway improvement project – the Hope Street project – where the roadway was widened but some existing pavement was salvaged for the new design. Discussion of the Hope Street project as the base project is available in Appendix G.

The ABUS study system construction cost calculations are based on the assumption that the aforementioned Hope Street project is scalable to ABUS system dimensions. For all costs except those associated with right-of-way acquisition, the following general procedure was followed to calculate construction costs for the ABUS system:

- The cost items were divided into two categories: those which would be applicable to any ABUS section, and those which were site-specific, meaning that they are dependent on the location of the project.
- Unit costs for work items were identified from the Hope Street project contract documents.
- Unit costs were converted to 2001-equivalent costs by adjusting for inflation
- The unit costs were applied to corresponding quantities for the ABUS section to calculate the construction costs.
- Construction costs were calculated based on adjusted unit costs and unit quantities for the ABUS system.
- Costs were converted to Equivalent Uniform Annual Costs (EUAC) with 2001 as the base year.

Tables 5.1a and 5.1b give tabulated annual costs for the ABUS Design Scenarios 1 and 2, respectively. Methodologies, sample calculations, and supporting tables for derivation of these costs are given in Appendix G. Costs associated with right-of-way acquisition are also discussed in Appendix G.

5.3.2 ABUS System Planning and Design Costs

Project engineers for the City of San Jose estimated the planning and design costs for the Hope Street project to be roughly $96,000. Since the Hope Street project is much smaller than the proposed ABUS system, the system planning and design costs were scaled up using the same approach as was used for the construction costs to obtain ABUS system planning and design costs. Methodologies, sample calculations, and supporting tables for derivation of these costs are given in Appendix G. Tables 5.1a and 5.1b show the tabulated estimated system planning and design costs for Design Scenarios 1 and 2, respectively.

5.3.3 ABUS Non-Infrastructure Capital Costs

Costs for non-infrastructure capital expenses include bus fleet purchase and purchase of automation technology for outfitting the vehicles to operate in an automated mode.

<u>ABUS Fleet Purchase Costs</u>

The following assumptions were used in determining fleet size:

- Fleet requirements were determined by the number of buses needed during the weekday period with the highest-volume and the lowest average headways (this is the PM peak northbound direction).
- In order to make the ABUS system compatible to the light rail system, bus-convoy sizes were calculated that would provide a capacity approximately equal to that of the corresponding light rail train sizes. It is assumed that bus-convoy sizes of these magnitudes would be possible and safe. The following equivalencies represent light-rail-train and equivalent bus-convoy sizes:

    - 3 light rail vehicles = 5 buses
    - 2 light rail vehicles = 3 buses
    - 1 light rail vehicle = 1 bus

- The number of buses allocated to the cost of the 5.19-mile proposed ABUS system length is proportional to the length of the line. This assumption is appropriate because it is assumed that the proposed project system is a portion of the regular system, and not a stand-alone system in itself.
- Approximately 20 percent of vehicles are not in service at any given time – for maintenance and contingency purposes.

Three significant figures have been retained in the calculation of ABUS-system fleet requirements to distinguish this number as being a derived quantity, and a portion of a whole, rather than representative of a self-contained system.

It was determined that 10.180 buses are required to operate an ABUS system equivalent to the VTA light rail operations on the study segment. This number appears in the "# Units in ABUS System" column in Tables 5.1a and 5.1b for Design Scenarios 1 and 2, respectively.

Table G10 in Appendix G shows the applicable calculations for arriving at this figure. Appendix G also discusses methodologies and sample calculations for fleet size calculations.

TABLE 5.1a. ABUS SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS - DESIGN SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

	Item	Year	Unit Cost ($)	Unit	Unit Cost (2001-Equiv.	Unit	# of Units in ABUS System	One-Time Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
System Planning and Design Costs									
	VTA Personnel Labor Costs and Design Expenses	2002	2,077,842	One-Time	2,037,115.83	One-Time	1	2,037,116	147,994
Construction, Rehabilitation, and Other Infrastructure Capital Costs									
Infrastructure Costs	Right-of-Way Acquisition	1999	23.65	Sq. Foot	24.49	Sq. Foot	712,483	17,445,882	1,267,424
	Street Clean-Up	2002	150.00	Day	147.06	Day	433	63,660	4,625
	Mobilization	2002	10,000.00	Lump Sum	9,804.00	Lump Sum	21.64	212,200	15,416
	Traffic Control	2002	2,000.00	Lump Sum	1,960.80	Lump Sum	21.64	42,440	3,083
	Clearing, Grubbing, and Removal of Obstructions	2002	2,500.00	Lump Sum	2,451.00	Lump Sum	21.64	53,050	3,854
	Roadway Excavation	2002	30.00	Cu. Yard	29.41	Cu. Yard	7,359	216,444	15,724
	Subgrade Preparation-Class A	2002	1.00	Sq. Foot	0.98	Sq. Foot	467,514	458,351	33,299
	Imported Fill Materials	2002	30.00	Cu. Yard	29.41	Cu. Yard	7,359	216,444	15,724
	Deeplift/Base AC (8" max.)	2002	70.00	Ton	68.63	Ton	13,203	906,092	65,827
	AC Surface Course	2002	80.00	Ton	78.43	Ton	5,757	451,561	32,805
	AC Base Course	2002	80.00	Ton	78.43	Ton	9,091	712,991	51,798
	Cold Planing	2002	1.50	Sq. Foot	1.47	Sq. Foot	21,644	31,830	2,312
	Pavement Reinforcing Fabric	2002	1.00	Sq. Yard	0.98	Sq. Yard	75,755	74,270	5,396
	Gravel Conform	2002	50.00	Ton	49.02	Ton	433	21,220	1,542
	Traffic Stripes and Pavement Markings	2002	800.00	Lump Sum	784.32	Lump Sum	21.64	16,976	1,233
	Street Lighting System	2002	60,000.00	Lump Sum	58,824.00	Lump Sum	21.64	1,273,197	92,496
	Geotextile	2002	3.00	Linear Foot	2.94	Linear Foot	23,809	70,026	5,087
	Site-SpecificWork Items	2002	9,828,623.28	Lump Sum	9,635,982.26	Lump Sum	1.00	9,635,982	700,044
	Magnetic Reference Markers - Includes Installation	2001	5,000.00	Lane Mile	5,000.00	Lane Mile	10.38	51,900	3,770
	TOTAL INFRASTRUCTURE COST								2,321,461
Non-Infrastructure Capital Costs	Fleet Purchase	2002	293,000.00	Bus	287,257.20	Bus	10.180	2,924,389	212,454
	Automation Technology Outfitting for Vehicle	2001	25,000.00	Bus	25,000.00	Bus	10.180	254,510	18,490
Periodic Capital Costs	Minor Rehabilitation - Seals	2002	See Table G11	N/A	N/A	N/A	N/A	N/A	30,732
	Major Rehabilitation - Resurfacing	2002	See Table G11	N/A	N/A	N/A	N/A	N/A	84,443
	Magnetic Reference Markers - Includes Installation	2001	See Table G11	N/A	N/A	N/A	N/A	N/A	8,550
Fleet Renewal	Bus Replacement Costs	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
	Vehicle Automation Technology Replacement Costs	2001	25,000.00	Bus	25,000.00	Bus	10.180	N/A	16,967
TOTAL CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									2,888,056
TOTAL DESIGN, PLANNING, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									3,036,050

TABLE 5.1b. ABUS SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS - SCENARIO 2: DESIGN FOLLOWS 30-CM PRINCIPLE

	Item	Year	Unit Cost ($)	Unit	Unit Cost (2001-Equiv. $)	Unit	# of Units in ABUS System	One-Time Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
System Planning and Design Costs									
	VTA Personnel Labor Costs and Design Expenses	2002	1,518,422.65	One-Time	1,488,661.57	One-Time	1	1,488,662	108,150
Construction, Rehabilitation, and Other Infrastructure Capital Costs									
Infrastructure Costs	Right-of-Way Acquisition	1999	23.65	Sq. Foot	24.49	Sq. Foot	520,661	12,748,913	926,195
	Street Clean-Up	2002	150.00	Day	147.06	Day	316	46,521	3,380
	Mobilization	2002	10,000.00	Lump Sum	9,804.00	Lump Sum	15.82	155,069	11,266
	Traffic Control	2002	2,000.00	Lump Sum	1,960.80	Lump Sum	15.82	31,014	2,253
	Clearing, Grubbing, and Removal of Obstructions	2002	2,500.00	Lump Sum	2,451.00	Lump Sum	15.82	38,767	2,816
	Roadway Excavation	2002	30.00	Cu. Yard	29.41	Cu. Yard	5,378	158,170	11,491
	Subgrade Preparation-Class A	2002	1.00	Sq. Foot	0.98	Sq. Foot	341,645	334,949	24,334
	Imported Fill Materials	2002	30.00	Cu. Yard	29.41	Cu. Yard	5,378	158,170	11,491
	Deeplift/Base AC (8" max.)	2002	70.00	Ton	68.63	Ton	9,648	662,144	48,104
	AC Surface Course	2002	80.00	Ton	78.43	Ton	4,207	329,987	23,973
	AC Base Course	2002	80.00	Ton	78.43	Ton	6,643	521,032	37,852
	Cold Planing	2002	1.50	Sq. Foot	1.47	Sq. Foot	15,817	23,260	1,690
	Pavement Reinforcing Fabric	2002	1.00	Sq. Yard	0.98	Sq. Yard	55,359	54,274	3,943
	Gravel Conform	2002	50.00	Ton	49.02	Ton	316	15,507	1,127
	Traffic Stripes and Pavement Markings	2002	800.00	Lump Sum	784.32	Lump Sum	15.82	12,406	901
	Street Lighting System	2002	60,000.00	Lump Sum	58,824.00	Lump Sum	15.82	930,413	67,594
	Geotextile	2002	3.00	Linear Foot	2.94	Linear Foot	17,399	51,173	3,718
	Site-SpecificWork Items	2002	7,182,455.47	Lump Sum	7,041,679.35	Lump Sum	1.00	7,041,679	511,570
	Magnetic Reference Markers - Includes Installation	2001	5,000.00	Lane Mile	5,000.00	Lane Mile	10.38	51,900	3,770
	TOTAL INFRASTRUCTURE COST								1,697,467
Non-Infrastructure Capital Costs	Fleet Purchase	2002	293,000.00	Bus	287,257.20	Bus	10.180	2,924,389	212,454
	Automation Technology Outfitting for Vehicle	2001	25,000.00	Bus	25,000.00	Bus	10.180	254,510	18,490
Periodic Capital Costs	Minor Rehabilitation - Seals	2002	See Table G12	N/A	N/A	N/A	N/A	N/A	22,458
	Major Rehabilitation - Resurfacing	2002	See Table G12	N/A	N/A	N/A	N/A	N/A	61,708
	Magnetic Reference Markers - Includes Installation	2001	See Table G12	N/A	N/A	N/A	N/A	N/A	8,550
Fleet Renewal	Vehicle Replacement Costs	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
	Vehicle Automation Technology Replacement Costs	2001	25,000.00	Bus	25,000.00	Bus	10.180	N/A	16,967
TOTAL CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									2,233,054
TOTAL SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									2,341,204

<u>ABUS Automation Technology Outfitting for Vehicles</u>

Costs in this category are calculated using an identical methodology as for fleet purchase in the previous section. Automation technology would purchased for every vehicle at a cost of roughly $25,000 per bus. PATH personnel, who supplied this figure, believe that technology costs could be reduced to as low as $5,000 per vehicle if large numbers of vehicles are outfitted. The $25,000 per-bus cost used in this study, then, is a conservative estimate of technology costs. Tables 5.1a and 5.1b show results for Design Scenarios 1 and 2, respectively.

5.3.4 ABUS Periodic Capital Costs

Rehabilitation costs for the ABUS system include routine pavement sealing and resurfacing costs, replacement of automated technology on vehicles, and replacement of magnetic reference markers when the roadway is rehabilitated. In this report, they are referred to as follows:

- Major Rehabilitation – Pavement Resurfacing
- Minor Rehabilitation –Seals
- Magnetic Reference Marker Replacement

None of these types of maintenance are included in the VTA "System Maintenance" cost category because VTA does not maintain the roads on which its buses operate. Costs and other information pertaining to rehabilitation were obtained from engineers in the City of San Jose, and are historic costs based on previous projects. They are considered to be accurate for the years 2002 and 2003. The unit costs are all-inclusive, meaning that all costs associated with the given type of work are included in the figure. This includes overhead, internal costs, engineering, contract costs, etc.

<u>Minor Rehabilitation – Seals</u>

For minor rehabilitation, a seal is applied to the surface of a typical asphalt concrete roadway with a frequency of 5 to 7 years. A unit cost of $3.90 per square yard (in 2002 dollars) was cited by City of San Jose engineers as representative of the cost of preventative seals. This cost is all-inclusive, as described above, and also includes the repair of localized failures, such as potholes, before the seal is applied. Assuming a 5-year seal frequency, the annual costs for this type of minor rehabilitation to the roadway surface were calculated. The applicable values are shown in Tables 5.1a and 5.1b.

<u>Major Rehabilitation - Pavement Resurfacing</u>

In a major rehabilitation, roadway resurfacing – typically with an asphaltic concrete overlay – occurs. According to City of San Jose engineers, a typical resurfacing of an asphaltic concrete roadway occurs every 2-to-3 seal cycles. For this study, a conservative 10-year resurfacing cycle was assumed. A unit cost of $17.21 per square yard (in 2002 dollars) was given by City of San Jose personnel. Like costs for preventative seals, this cost is all-inclusive, as described above, and also includes the repair of localized failures, such as potholes, before resurfacing. Based on these unit costs, costs for the rehabilitation of the ABUS system were calculated and are shown in Tables 5.1a and 5.1b for the two design scenarios. Appendix G details calculation methodologies, and gives calculation tables and sample calculations.

Magnetic Reference Marker Replacement

Magnetic reference markers are mounted on the pavement to guide automated vehicles, and must be replaced every time the roadway is sealed or resurfaced. In this study, the replacement frequency for magnetic reference markers is five years at a cost of $5000 per mile. Tables 5.1a and 5.1b show results for Design Scenarios 1 and 2, respectively. Methodologies appear in Appendix G.

5.3.5 ABUS Fleet Renewal

Fleet renewal includes:

- Vehicle Replacement Costs – Fleet Renewal
- Vehicle Automation Technology Replacement Costs

Bus Replacement

VTA personnel were consulted, and it was determined that the organization typically replaces an operating bus after 14 years of service. The buses used for this project cost $287,257 in 2001-equivalent dollars. This figure is adjusted for inflation and does not include taxes, as discussed in Appendix G.

For compatibility with the ABUS study system 30-year life cycle, a 15-year fleet replacement cycle was assumed. Thus, 1/15th of the fleet will be assumed to be replaced each year, at a per-bus cost of $287,257 (in 2001-equivalent dollars).

It was previously calculated that 10.180 buses are required to service the study segment. If 1/15th of these are replaced each year, then the annual cost, in 2001-equivalent dollars, is calculated as follows:

EUAC (2001-Equiv.) = [10.180/15] x $287,257 = $194,959

Fleet renewal calculations are identical for Design Scenarios 1 and 2. Tables 5.1a and 5.1b show the tabulated values. Tables 5.1a and 5.1b show the calculated costs for Design Scenarios 1 and 2, respectively. EUAC (2001-Equiv.) calculations are presented in Appendix G.

ABUS Vehicle Automation Technology Replacement Costs

Vehicle automation is assumed to be replaced as the bus housing it is replaced. Thus, costs in this category are calculated using an identical methodology as for fleet renewal in the previous section. Automation technology is purchased for every vehicle at a cost of roughly $25,000 per bus. Tables 5.1a and 5.1b show results for Design Scenarios 1 and 2, respectively.

5.3.6 ABUS Vehicle Operating Costs

Costs associated with vehicle operations include daily costs necessary to run the system, including operators' salaries, wages, and benefits, utilities, and other expenses. Vehicle operating costs do not include costs for routine vehicle maintenance, such as tire replacement and labor costs for workers performing the maintenance.

Determination of the ABUS study system vehicle operating costs was performed in several major phases:

- Determination of individual cost elements that comprise costs in that category (discussed in Appendix G).
- Determination of unit costs for those cost elements in terms of vehicle-revenue-miles and vehicle-revenue-hours (discussed in Appendix G).
- Determination of annual convoy-revenue-miles and –hours for the study section (discussed in Appendix H).
- Determination of unit costs for each cost element, based on the VTA bus system, in terms of vehicle-revenue-miles and vehicle-revenue-hours, or convoy-revenue-miles and –hours.
- Calculation of ABUS study system annual costs based on unit costs and calculated vehicle-revenue-miles and –hours, or convoy-revenue-miles and –hours.

Unit costs were calculated in terms of revenue-miles and revenue-hours because both data were given by VTA in the source data used, and calculation according to unit costs derived from both data, though relatively similar, do not yield the same costs. Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours, and overall annual costs are shown in Table 5.2. Methodologies and sample calculations for operating cost calculations are shown in Appendix G.

5.3.7 ABUS Vehicle Maintenance Costs

Cost calculations for vehicle maintenance follow identical methodologies for those in the previous "Vehicle Operating Costs" category. All unit costs are calculated in terms of vehicle-revenue-miles and –hours. Costs are shown in Table 5.3.

5.3.8 ABUS System (Non-Vehicle) Maintenance Costs

Costs associated with system maintenance include maintenance expenses for bus stops and other infrastructure, and also for minor roadway maintenance activities such as street sweeping, cleaning of storm sewers, landscaping, streetlights, traffic signals, signs, and

TABLE 5.2. ABUS VEHICLE OPERATING COSTS

Cost Element	ITEM	Revenue-Miles				Revenue-Hours			
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Unit	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Unit	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages	2.27	276,035	convoy-revenue-hour	625,840	33.55	15,439	convoy-revenue-hour	517,923
	Other Salaries and Wages	0.48	620,101	bus-revenue-hour	300,469	6.30	34,683	bus-revenue-hour	218,577
Fringe Benefits	Operators' Fringe Benefits	1.86	276,035	convoy-revenue-hour	514,622	27.59	15,439	convoy-revenue-hour	425,883
	Other Fringe Benefits	0.28	620,101	bus-revenue-hour	173,790	3.65	34,683	bus-revenue-hour	126,424
Services	Services	0.19	620,101	bus-revenue-hour	114,794	2.41	34,683	bus-revenue-hour	83,507
Materials and Supplies	Fuel and Lubricants	0.30	620,101	bus-revenue-hour	187,306	3.93	34,683	bus-revenue-hour	136,256
	Tires and Lubes	0.07	620,101	bus-revenue-hour	41,765	0.88	34,683	bus-revenue-hour	30,382
	Other Materials and Supplies	0.01	620,101	bus-revenue-hour	4,912	0.10	34,683	bus-revenue-hour	3,573
Utilities	Utilities	0.12	620,101	bus-revenue-hour	74,441	1.56	34,683	bus-revenue-hour	54,152
Taxes	Taxes								
Misc.	Miscellaneous Expenses	0.03	620,101	bus-revenue-hour	19,373	0.41	34,683	bus-revenue-hour	14,093
Expense Transfers	Expense Transfers								
TOTAL OPERATING COSTS					2,057,312				1,610,770

TABLE 5.3. ABUS VEHICLE MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001 Equiv. $)	Annual Units in ABUS System	Annual Cost (2001 Equiv. $)	Unit Cost (2001 Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.91	620,101	564,772	11.85	34,683	410,845
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.54	620,101	336,119	7.05	34,683	244,510
Services	Services	0.17	620,101	107,631	2.26	34,683	78,297
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.28	620,101	176,453	3.70	34,683	128,361
Utilities	Utilities	0.00	620,101	89	0.00	34,683	65
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	620,101	5,562	0.12	34,683	4,046
Expense Transfers	Expense Transfers						
TOTAL ABUS VEHICLE MAINTENANCE COSTS		1.92		1,190,627	24.97		866,123

markings. System maintenance does not include resurfacing or rehabilitation (i.e. – resurfacing and preventative seals) for the roadways on which the buses travel. Roadway rehabilitation of this sort is included in infrastructure and capital costs, under the heading of "Rehabilitation." Cost calculations for system maintenance follow identical methodologies for those in the previous "Vehicle Operating Costs" category. Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours (which are the same for all cost categories), and overall annual costs are shown in Table 5.4. Methodologies and sample calculations for operating cost calculations are shown in Appendix G.

5.3.9 ABUS System Administration Costs

Costs associated with system administration include expenses incurred for system support personnel in VTA's offices. Costs for system administration are assumed to be more compatible with the administration costs for a light rail system than with the VTA bus system. Since the ABUS system shares train-based operating principles with a light rail system, and since scheduling and other administrative tasks are likely to be reliant on the type of operation, this assumption is reasonable. For this reason, unit costs for ABUS system administration are extracted directly from the light rail section of the report (see Table 4.5). To calculate annual ABUS system administration costs, annual vehicle-revenue-miles and –hours for the ABUS system are used, and the calculation methodology is identical to that used to calculate vehicle operations costs. Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours, and overall annual costs are shown in Table 5.5. Methodologies and sample calculations for operating cost calculations are shown in Appendix G.

5.3.10 ABUS User Costs

User costs for the ABUS study system, like the light rail study system, are based on user on-board travel time and wait time. Because the ABUS system is assumed to run with the same headways and at the same speed as the light rail system, and to carry the same passenger volumes, there is no variation in cost between ABUS user costs and light rail user costs.

Table 5.6 shows a summary of calculated user costs for the ABUS system. These costs are identical; to the light rail system Table 4.6. Refer to the Appendix E for procedures and methodologies.

5.4 ABUS Cost Summaries

Tables 5.7a and 5.7b show a summary of all calculated costs associated with the ABUS systems for Design Scenarios 1 and 2, respectively.

5.5 Reference

1. *A Policy on the Geometric Design of Highways and Streets.* American Association of State Highway and Transportation Officials (AASHTO). 2001.

TABLE 5.4. ABUS SYSTEM (NON-VEHICLE) MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.15	620,101	91,718	1.92	34,683	66,721
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.08	620,101	47,139	0.99	34,683	34,291
Services	Services	0.13	620,101	80,152	1.68	34,683	58,307
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.01	620,101	9,038	0.19	34,683	6,575
Utilities	Utilities	0.02	620,101	11,363	0.24	34,683	8,266
Taxes	Taxes						
Street Maintenance*	Street Sweeping	N/A	N/A	6,988	N/A	N/A	6,988
	Storm Sewers (Includes Inlet Cleaning)	N/A	N/A	3,669	N/A	N/A	3,669
	Landscaping (Includes Median Islands)	N/A	N/A	7,903	N/A	N/A	7,903
	Streetlights	N/A	N/A	4,517	N/A	N/A	4,517
	Traffic Signals	N/A	N/A	3,910	N/A	N/A	3,910
	Signs	N/A	N/A	1,681	N/A	N/A	1,681
	Markings	N/A	N/A	2,684	N/A	N/A	2,684
Misc	Miscellaneous Expenses	0.00	620,101	1,847	0.04	34,683	1,344
Expense Transfers	Expense Transfers						
TOTAL ABUS SYSTEM (NON-VEHICLE) MAINTENANCE COSTS				272,609			206,855

*See Table G17 for street maintenance cost calculations.

TABLE 5.5. ABUS SYSTEM ADMINISTRATION COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	2.50	620,101	1,549,903	37.06	34,683	1,285,245
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	2.26	620,101	1,402,346	33.53	34,683	1,162,884
Services	Services	0.70	620,101	433,040	10.35	34,683	359,095
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.12	620,101	77,238	1.85	34,683	64,049
Utilities	Utilities	0.02	620,101	12,204	0.29	34,683	10,120
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.18	620,101	112,948	2.70	34,683	93,661
Expense Transfers	Expense Transfers						
TOTAL ABUS SYSTEM ADMINISTRATION COSTS		5.79		3,587,679	85.78		2,975,054

TABLE 5.6. ABUS TOTAL USER COSTS

Day	Element	Daily User-Hours	Cost/User-Hour ($)	Daily Cost ($)	Annual Cost
Weekday	Wait Time	733	8.32	6,099	1,591,724
	On-Board Travel Time	1,126	8.32	9,366	2,444,462
Saturday	Wait Time	408	8.32	3,395	176,532
	On-Board Travel Time	601	8.32	4,999	259,952
Sunday	Wait Time	346	8.32	2,877	149,625
	On-Board Travel Time	511	8.32	4,252	221,084
TOTAL WAIT TIME					1,917,881
TOTAL ON-BOARD TRAVEL TIME					2,925,498
TOTAL				30,987	4,843,378

TABLE 5.7a. ABUS SYSTEM COST SUMMARY ($) - DESIGN SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

Cost Category	Calculations Based on Vehicle-Revenue-Miles	Calculations Based on Vehicle-Revenue-Hours	Average EUAC (30 yrs)
System Planning and Design	147,994	147,994	
Construction, Rehabilitation, and Other Capital Costs	2,888,056	2,888,056	
Vehicle Operations	2,057,312	1,610,770	
Vehicle Maintenance	1,190,627	866,123	
System (Non-Vehicle) Maintenance	272,609	206,855	
System Administration	3,587,679	2,975,054	
User	4,843,378	4,843,378	
TOTAL COST	14,987,655	13,538,231	14,262,943

TABLE 5.7b. ABUS SYSTEM COST SUMMARY ($) - DESIGN SCENARIO 2: REDUCED-WIDTH DESIGN

Cost Category	Calculations Based on Vehicle-Revenue-Miles	Calculations Based on Vehicle-Revenue-Hours	Average EUAC (30 yrs)
System Planning and Design	108,150	108,150	
Construction, Rehabilitation, and Other Capital Costs	2,233,054	2,233,054	
Vehicle Operations	2,057,312	1,610,770	
Vehicle Maintenance	1,190,627	866,123	
System (Non-Vehicle) Maintenance	272,609	206,855	
System Administration	3,587,679	2,975,054	
User	4,843,378	4,843,378	
TOTAL COST	14,292,808	12,843,384	13,568,096

6 BUS-ON-DEDICATED-LANE (BDL) COSTS

6.1 System Characteristics

The BDL system is assumed to be functionally equivalent to the light rail study section discussed in Chapter 4 of this report and the ABUS study section discussed in Chapter 5. In order to achieve functional similarity, the following light rail/ABUS system characteristics have also been applied to the BDL system:

- Study system length and location
- Study system passenger stations
- Study system passenger volume data

6.2 BDL Study Section Specifications

6.2.1 BDL Cross-Sectional Geometry (Width Requirements)

The BDL system, like the ABUS and light rail systems, will operate on a dedicated right-of-way in the median of a regular roadway, without physical barriers that separate the dedicated lanes from each other or well as from the regular traffic. According to AASHTO (1), a 15-foot pavement width is necessary to accommodate any design bus. As was the case for ABUS, the roadway width was based on design standards for tangent sections of turning roadways, with no provision for passing a stalled vehicle. Thus, for dedicated bus lanes running in both directions, a total width of 30 feet is required to accommodate two 15-foot pavement widths. Figure 3.5 shows a schematic depiction of the BDL concept.

6.3 BDL Cost Calculations – Base VTA System

6.3.1 BDL System Planning, Design, Construction, Rehabilitation, and Other Infrastructure Costs

The BDL system planning, design, construction, and other infrastructure costs were calculated in the same manner, and using the same methodologies, as the corresponding costs for the ABUS. The results are shown in Table 6.1 and Appendix I. Rehabilitation cost calculations appear in Table 6.2. It is noteworthy that the BDL system does not require construction, rehabilitation, and maintenance of automation technologies, so these do not appear as costs in the tables or appendices.

TABLE 6.1. BUS-ON-DEDICATED LANE CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS										
	Item	Year	Unit Cost ($)	Unit	Unit Cost (2001-Equiv. $)	Unit	# of Units in ABUS System	One-Time Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
System Planning and Design Costs									
	VTA Personnel Labor Costs and Design Expenses	2002	2,398,266	One-Time	2,351,260.29	One-Time	1	2,351,260	170,817
Construction, Rehabilitation, and Other Infrastructure Capital Costs									
Infrastructure Costs	Property Costs/ ROW Acquistion	1999	23.65	Sq. Foot	24.49	Sq. Foot	826,848	20,246,221	1,470,866
	Street Clean-Up	2002	150.00	Day	147.06	Day	500	73,477	5,338
	Mobilization	2002	10,000.00	Lump Sum	9,804.00	Lump Sum	25	244,923	17,793
	Traffic Control	2002	2,000.00	Lump Sum	1,960.80	Lump Sum	25	48,985	3,559
	Clearing, Grubbing, and Removal of Obstructions	2002	2,500.00	Lump Sum	2,451.00	Lump Sum	25	61,231	4,448
	Roadway Excavation	2002	30.00	Cu. Yard	29.41	Cu. Yard	8,494	249,821	18,149
	Subgrade Preparation-Class A	2002	1.00	Sq. Foot	0.98	Sq. Foot	539,610	529,034	38,434
	Imported Fill Materials	2002	30.00	Cu. Yard	29.41	Cu. Yard	8,494	249,821	18,149
	Deeplift/Base AC (8" max.)	2002	70.00	Ton	68.63	Ton	15,239	1,045,821	75,978
	AC Surface Course	2002	80.00	Ton	78.43	Ton	9,993	783,753	56,939
	AC Base Course	2002	80.00	Ton	78.43	Ton	10,492	822,941	59,786
	Cold Planing	2002	1.50	Sq. Foot	1.47	Sq. Foot	24,982	36,738	2,669
	Pavement Reinforcing Fabric	2002	1.00	Sq. Yard	0.98	Sq. Yard	87,437	85,723	6,228
	Gravel Conform	2002	50.00	Ton	49.02	Ton	500	24,492	1,779
	Traffic Stripes and Pavement Markings	2002	800.00	Lump Sum	784.32	Lump Sum	25	19,594	1,423
	Street Lighting System	2002	60,000.00	Lump Sum	58,824.00	Lump Sum	25	1,469,538	106,760
	Geotextile	2002	3.00	Linear Foot	2.94	Linear Foot	27,480	80,825	5,872
	Site-SpecificWork Items	2002	9,828,623.28	Lump Sum	9,635,982.26	Lump Sum	1	9,635,982	700,044
	TOTAL INFRASTRUCTURE COST								2,594,214
Non-Infrastructure Capital Costs	Vehicle Purchase*	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
Periodic Capital Costs	Minor - Seals	2002	See Table I3	N/A	See Table I3	N/A	See Table I3	N/A	35,460
	Major - Resurfacing	2002	See Table I3	N/A	See Table I3	N/A	See Table I3	N/A	97,434
Fleet Renewal	Vehicle Replacement Costs	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
TOTAL CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS									3,117,027
TOTAL SYSTEM PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS									3,287,843

*Required number of vehicles is considered to be the same for the ABUS and BDL systems.

TABLE 6.2. BDL ROADWAY REHABILITATION COSTS

Type	Unit Cost (2002 $)		Unit Cost (2001-Equiv. $)		Project Surface Area				Total Cost per Rehab. Cycle (2001-Equiv. $)	Frequency		Annual Cost (2001-Equiv. $)
	Cost	Unit	Cost	Unit	Area	Unit	Area	Unit				
Minor - Seals	3.90	SY	3.82	SY	822,096	Sq. Feet	91,344	Sq. Yards	349,259	5	years	35,460
Major - Resurfacing	17.21	SY	16.87	SY	822,096	Sq. Feet	91,344	Sq. Yards	1,541,218	10	years	97,434

6.3.2 BDL Vehicle Operating Costs

BDL study system vehicle operating costs were determined using a similar methodology as was used for the ABUS study system vehicle operating costs, with the exception of driver-related costs (i.e. – salaries and wages, and fringe benefits). All costs, including driver-related costs, for the BDL system were based upon vehicle-revenue-miles and –hours. This is a departure from the ABUS methodology, where driver-related costs were calculated based on convoy-revenue-miles and –hours.

Annual vehicle-revenue-miles and –hours used in the calculations for the BDL system were identical to those used in the ABUS calculations, and are shown in Table 6.3. The rationale for this equivalence is discussed in the following paragraphs.

In order to have a valid cost comparison, functional equivalency among the three study systems must be maintained. This implies that each system must transport the same number of passengers in the same time period. Since the same type of bus was assumed to operate on both bus systems, the same number of buses would be required to transport a given volume of passengers in a given time period for the ABUS and the BDL systems. For this reason, identical vehicle-miles and –hours were used for the two systems. It is noteworthy that, under the assumptions made here, the BDL and light rail system are also functionally equivalent, since the ABUS and light rail systems are functionally equivalent. .

It is also noteworthy that, although the BDL and ABUS systems operate with the same number of vehicle-revenue-hours and –miles, the assumed bus headways are not the same for the two systems. This difference is due to the convoying capacity of the ABUS, and is discussed in Section 6.3.6, on DBL user costs.

Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours (which are the same for all cost categories), and overall annual costs are also shown in Table 6.3. Methodologies for operating cost calculations are identical to those for the ABUS system, which are shown in Appendix G. Appendix I gives general explanations of the procedure and references Appendix G.

6.3.3 BDL Vehicle Maintenance Costs, System (Non-Vehicle) Maintenance, and System Administration Costs

Cost calculations for vehicle maintenance, system maintenance, and system administration follow identical methodologies for those in the previous “Vehicle Operating Costs” category. Category descriptions are identical to those in the ABUS section of the report, excluding those items that support automation (such as maintenance and replacement of magnetic reference markers and vehicle automating technology). Individual cost elements, unit costs, annual vehicle-revenue-miles and –hours (which are the same for all cost categories), and overall annual costs are shown in Tables 6.4, 6.5, and 6.6, respectively.

TABLE 6.3. BUS-ON-DEDICATED-LANE VEHICLE OPERATIONS COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in BDL System*	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in BDL System*	Unit Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time	1.81	620,101	1,124,106	23.58	34,683	817,733
	Paid Non-Operating Work Time	0.14	620,101	88,470	1.86	34,683	64,358
	Other Salaries and Wages	0.48	620,101	300,469	6.30	34,683	218,577
Fringe Benefits	Operators' Fringe Benefits						
	Operating Time	1.05	620,101	650,178	13.64	34,683	472,973
	Paid Non-Operating Work Time	0.08	620,101	51,171	1.07	34,683	37,224
	Other Fringe Benefits	0.28	620,101	173,790	3.65	34,683	126,424
Services	Services	0.19	620,101	114,794	2.41	34,683	83,507
Materials and Supplies	Fuel and Lubricants	0.30	620,101	187,306	3.93	34,683	136,256
	Tires and Lubes	0.07	620,101	41,765	0.88	34,683	30,382
	Other Materials and Supplies	0.01	620,101	4,912	0.10	34,683	3,573
Utilities	Utilities	0.12	620,101	74,441	1.56	34,683	54,152
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.03	620,101	19,373	0.41	34,683	14,093
Expense Transfers	Expense Transfers						
TOTAL OPERATING COSTS				2,830,775	59.37		2,059,252

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

TABLE 6.4. BUS-ON-DEDICATED-LANE VEHICLE MAINTENANCE COSTS

Cost Elements	Item	Vehicle-Revenue-Miles: Unit Cost (2001 Equiv. $)	Vehicle-Revenue-Miles: Annual Units in System*	Vehicle-Revenue-Miles: Annual Cost (2001 Equiv. $)	Vehicle-Revenue-Hours: Annual Cost (2001 Equiv. $)	Vehicle-Revenue-Hours: Annual Units in System*	Vehicle-Revenue-Hours: Annual Cost (2001 Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.91	620,101	564,772	11.85	34,683	410,845
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.54	620,101	336,119	7.05	34,683	244,510
Services	Services	0.17	620,101	107,631	2.26	34,683	78,297
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.28	620,101	176,453	3.70	34,683	128,361
Utilities	Utilities	0.00	620,101	89	0.00	34,683	65
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	620,101	5,562	0.12	34,683	4,046
Expense Transfers	Expense Transfers						
TOTAL BDL VEHICLE MAINTENANCE COSTS		1.92		1,190,627	24.97		866,123

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

TABLE 6.5. BUS-ON-DEDICATED-LANE SYSTEM (NON-VEHICLE) MAINTENANCE COSTS

Cost Elements	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System*	Annual Cost (2001-Equiv. $)	Annual Cost (2001-Equiv. $)	Annual Units in ABUS System*	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.15	620,101	91,718	1.92	34,683	66,721
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.08	620,101	47,139	0.99	34,683	34,291
Services	Services	0.13	620,101	80,152	1.68	34,683	58,307
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.01	620,101	9,038	0.19	34,683	6,575
Utilities	Utilities	0.02	620,101	11,363	0.24	34,683	8,266
Taxes	Taxes						
Street Maintenance	Street Sweeping	N/A	N/A	6,988	N/A	N/A	6,988
	Storm Sewers (Includes Inlet Cleaning)	N/A	N/A	3,669	N/A	N/A	3,669
	Landscaping (Includes Median Islands)	N/A	N/A	7,903	N/A	N/A	7,903
	Streetlights	N/A	N/A	4,517	N/A	N/A	4,517
	Traffic Signals	N/A	N/A	3,910	N/A	N/A	3,910
	Signs	N/A	N/A	1,681	N/A	N/A	1,681
	Markings	N/A	N/A	2,684	N/A	N/A	2,684
Misc	Miscellaneous Expenses	0.00	620,101	1,847	0.04	34,683	1,344
Expense Transfers	Expense Transfers						
TOTAL BDL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS				272,609			206,855

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

TABLE 6.6. BUS-ON-DEDICATED-LANE SYSTEM ADMINISTRATION COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in System*	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in System*	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.86	620,101	530,314	11.12	34,683	385,778
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	1.28	620,101	791,109	16.59	34,683	575,494
Services	Services	0.45	620,101	278,770	5.85	34,683	202,792
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.06	620,101	39,354	0.83	34,683	28,628
Utilities	Utilities	0.01	620,101	3,579	0.08	34,683	2,603
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.08	620,101	51,897	1.09	34,683	37,752
Expense Transfers	Expense Transfers						
TOTAL BDL SYSTEM ADMINISTRATION COSTS		2.73		1,695,023	35.55		1,233,048

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

6.3.6 BDL User Costs

User costs for the BDL study system, like the light rail and ABUS study systems, were based on user on-board travel time and wait time. Because the BDL study system is assumed to run at the same speed as the light rail and ABUS study systems, and to carry the same passenger volumes, there is no variation in cost between ABUS user costs, light rail user costs, and BDL user costs for the on-board travel time. However, because the BDL study system is assumed to run the same number of buses as the ABUS system, but without convoying, the total passenger wait time will be different for the BDL and ABUS/light rail systems.

For this study, in order to maintain functional equivalence between the BDL and other systems, it is assumed that the BDL system requires the same number of buses per daily period as the ABUS system, but without convoying. This means that headways could be dispersed throughout the time period. For ease of computation, it is assumed here that headways are evenly distributed.

Cost calculations for overall user costs were completed in the following sequence:

- Calculation of BDL headways for each daily period, both on weekdays and weekends.
- Calculation of daily passenger wait time for weekdays and weekends.
- Determination of daily passenger on-board travel time for weekdays and weekends (this is identical, both numerically and in methodology, to that for the ABUS system).
- Summation of daily wait time and travel time, and of annual wait time and travel time.
- Calculation of wait- and travel-time costs.

Table 6.7 shows a summary of calculated user costs for the BDL system. Appendix J shows procedures, methodologies, and sample calculations for user costs.

TABLE 6.7. BDL TOTAL USER COSTS ($)

Day	Element	Daily User-Hours	Cost/User-Hour	Daily Cost	Annual Cost
Weekday	Wait Time	397	8.32	3307	863,107
	On-Board Travel Time	1126	8.32	9366	2,444,462
Saturday	Wait Time	426	8.32	3545	184,359
	On-Board Travel Time	601	8.32	4999	259,952
Sunday	Wait Time	363	8.32	3022	157,156
	On-Board Travel Time	511	8.32	4252	221,084
TOTAL WAIT TIME					1,204,622
TOTAL ON-BOARD TRAVEL TIME					2,925,498
TOTAL				28,491	4,130,120

6.4 BDL Cost Summaries

Table 6.8 shows a summary of all calculated costs associated with the BDL system.

TABLE 6.8. BUS-ON-DEDICATED LANE SYSTEM COST SUMMARY - EUAC ($)

Cost Category	Vehicle-Revenue-Miles	Vehicle-Revenue-Hours	Average
System Planning and Design	170,817	170,817	
Construction, Rehabilitation, and Other Infrastructure	3,117,027	3,117,027	
Vehicle Operations	2,830,775	2,059,252	
Vehicle Maintenance	1,190,627	866,123	
System (Non-Vehicle) Maintenance	272,609	206,855	
System Administration	1,695,023	1,233,048	
User	4,130,120	4,130,120	
TOTAL COST	13,406,997	11,783,241	12,595,119

6.5 Reference

1. *A Policy on the Geometric Design of Highways and Streets.* American Association of State Highway and Transportation Officials (AASHTO). 2001.

7 COST COMPARISON OF LIGHT RAIL, ABUS, AND BDL SYSTEMS

7.1 Comparison for Systems Operating at Base Volumes and Base Conditions

A summary of cost calculations for the three study systems is shown in Table 7.1. The calculations were carried out according to both vehicle-revenue-miles and vehicle-revenue-hours. Both calculation procedures yielded slightly different results for individual cost items, but cost trends are generally consistent for costs based on vehicle-miles and vehicle-hours.

In general, the results show that the bus alternatives have the lowest costs for existing passenger volumes on a section of the light rail base system in Santa Clara County. Light rail is shown to be the least cost-efficient design for these volumes, with costs of more than twice the alternative systems. The remainder of the alternatives are comparable in cost. The differences could be accounted for by certain assumptions made, and also variations in elements of the analysis. The variations could arise from such sources as the origin of unit costs and the base system chosen.

The largest cost differentials between the light rail and other systems occur in the category of construction, rehabilitation, and other capital costs, with costs for infrastructure accounting for the largest single portion of the differential. Even considering the substantially-lower fleet renewal costs associated with a light rail system, the light rail system cannot compete with the ABUS and BDL systems at this passenger volume. This is reasonable considering that light rail systems require more infrastructure, and this cost is more significant at lower volume levels.

In the case of design and planning, the high cost differentials could be partially explained by the fact that the cost data were obtained from different sources for the light rail and ABUS/BDL systems. For the light rail system, costs for design, planning, construction, and infrastructure were based largely on the recently-completed Tasman West light rail project in the Santa Clara Valley Transit Authority (VTA), while costs for the ABUS and BDL systems were extrapolated from data based on a recent roadway improvement project in the City of San Jose. It is noteworthy that the total design and planning costs for the Tasman West project constituted a large portion of the total infrastructure costs – a characteristic that is reflected in the light rail study system costs – while system planning and design for the ABUS and BDL systems are a smaller fraction of the construction costs. Especially in the case of design costs, differences in practices among these two agencies could account for some of the difference: for the Tasman West light rail project, planning and design was largely contracted to private agencies, while the City of San Jose did most of the design for the Hope Street project in-house. It should be noted that the system planning and design costs for the ABUS system may be higher than shown here because differences in design complexity between a conventional bus system and an automated one were not accounted for in this analysis.

Construction and rehabilitation costs for the ABUS are different from corresponding costs for the BDL due to roadway design widths and costs for magnetic strips, and non-infrastructure

Table 7.1. LIGHT RAIL, ABUS, AND BDL COST COMPARISON

Cost Category	Costs ($) Based on Revenue-Miles				Costs ($) Based on Revenue-Hours			
	Light Rail	ABUS		Bus-On-Dedicated-Lane	Light Rail	ABUS		Bus-On-Dedicated-Lane
		Scenario 1	Scenario 2			Scenario 1	Scenario 2	
System Planning and Design	7,348,425	147,994	108,150	170,817	7,348,425	147,994	108,150	170,817
Construction, Rehabilitation, and Other Capital Costs	11,258,212	2,888,056	2,233,054	3,117,027	11,258,212	2,888,056	2,233,054	3,117,027
Infrastructure Costs[a]	9,599,788	2,321,461	1,697,467	2,594,214	9,599,788	2,321,461	1,697,467	2,594,214
Non-Infrastructure Capital Costs[a]	1,370,424	230,944	230,944	194,959	1,370,424	230,944	230,944	194,959
Periodic Capital Costs[a]	287,999	123,725	92,717	132,894	287,999	123,725	92,717	132,894
Fleet Renewal[a]	0	211,927	211,927	194,959	0	211,927	211,927	194,959
Vehicle Operations	2,029,153	2,057,312	2,057,312	2,830,775	1,680,746	1,610,770	1,610,770	2,059,252
Vehicle Maintenance	1,371,208	1,190,627	1,190,627	1,190,627	1,137,063	866,123	866,123	866,123
System (Non-Vehicle) Maintenance	1,041,014	272,609	272,609	272,609	863,252	206,855	206,855	206,855
System Administration	2,592,359	3,587,679	3,587,679	1,695,023	2,149,693	2,975,054	2,975,054	1,233,048
User	4,843,378	4,843,378	4,843,378	4,130,120	4,843,378	4,843,378	4,843,378	4,130,120
TOTAL COST	30,483,749	14,987,655	14,292,808	13,406,997	29,280,770	13,538,231	12,843,384	11,783,241

[a] *This is a subheading of Construction, Rehabilitation, Infrastructure, and Other Capital Costs*

capital costs differ due to the costs associated with automating technologies for the ABUS buses. Table 7.1 indicates that the infrastructure and periodic capital costs (including pavement rehabilitation and, for the ABUS, magnetic reference marker replacement) for the ABUS are lower than those for the BDL system. It is noteworthy, in the case of both infrastructure costs and periodic capital costs, that decreases in pavement width have a more substantial effect on the cost decreases for the ABUS than do savings resulting from not placing magnetic strips on the roadway in the case of the BDL system. This can be seen in Tables 5.1a, 5.1b, and 6.1. In the case of non-infrastructure capital costs, the additional costs for installing the automating technology on each bus in the ABUS is the only factor resulting in cost differences between the ABUS and the BDL, with the BDL favored slightly. This can also be seen in Tables 5.1a, 5.1b, and 6.1. With regards to fleet renewal, Table 7.1 indicates that the BDL scenario is less expensive than the ABUS configurations. This is due to the costs associated with automating technologies that are assumed to be replaced when each ABUS bus is replaced.

The calculated costs for vehicle operations indicate that the BDL system is the most expensive in this category, and the ABUS system the least expensive. The difference in cost between the BDL and ABUS/light rail systems is not insignificant (about $800,000 per year), which constitutes about 5 to 7 percent of the total bus-system costs, depending on the system and whether vehicle-miles or vehicle-hours are used for the calculations. This result is reasonable because vehicle operating costs are dominated by driver costs, which comprise approximately 67 percent to 80 percent of the total costs in the category (see Tables 4.2, 5.2, and 6.3) depending on the system. Because of the fact that light rail and ABUS options can have trains and convoys, it could be expected that the costs for drivers could be reduced for these options relative to the associated cost for the BDL system because each bus in the BDL system requires a driver. Light rail costs in this category are not significantly different from corresponding ABUS costs because higher costs for light rail utilities, other wages, and services offset the additional costs incurred from having more ABUS vehicles in operation than light rail vehicles. Notably, it was assumed that ABUS trains would require drivers of similar training and, consequently, salary level, as drivers for light rail, and driver wages for ABUS were assumed to be the same per unit as driver wages for those of light rail operators.

Costs for vehicle maintenance appear to be comparable for all systems, with light rail maintenance slightly higher than the other alternatives.

The costs for system (non-vehicle) maintenance are lower for the bus systems than for the light rail. This could be attributed to the fact that the light rail infrastructure is more extensive and costs more to maintain. However, this comparison is complex because the VTA does not maintain the roads upon which its buses operate (VTA does maintain the light-rail right-of-way), and a separate source of costs was utilized to estimate the maintenance costs for the roadway. In order to make the comparison as realistic as possible, costs for traveled-way and wayside rehabilitation were added to the system (non-vehicle) costs for bus operations reported by VTA in order to arrive at a total system maintenance figure for both bus systems. It is possible that, because of the record-keeping and the fact that different sources were utilized to find maintenance costs for light rail and the two bus systems, not all cost items were included for the system maintenance of the bus systems. Further investigation of this issue was not pursued for the purposes of this study since this is not a major cost item.

System administration costs are highest for the ABUS system, and lowest for the BDL system. Costs in this category are a product of vehicle-revenue-hours and –miles, and unit costs for system administration, as given in VTA source data. Since the ABUS study system operates more vehicles than the functionally-equivalent light-rail system, it is expected that costs for the ABUS system would be higher than the corresponding costs for the light rail. It should be noted that the ABUS administrative costs were calculated using the same unit costs as the light rail system because of the expected similarity in administration.

The significant differences in system administration costs come not between the ABUS and light rail, but between BDL and the other study systems. The cost differentials between the ABUS/light rail and BDL systems arise primarily from the difference in unit costs, based on either revenue-miles or revenue-hours. Care should be taken when interpreting these results (pertaining to system administration costs) because of the way in which the costs were estimated. The assumption in this study was that these costs could be estimated on the basis of vehicle-revenue-miles and –hours for all systems, as opposed to other possible methods of factoring these costs. Using this way of factoring may contribute to this larger-than-expected difference in costs. This difference in costs between the BDL and ABUS scenarios is significant in this comparison and could unfairly favor the BDL over the ABUS.

The results in Table 7.1 indicate that the user costs, which are comprised only of travel-time costs, are not largely different among the three systems compared in this report. There are several reasons for this. First, in the analysis presented here, there are two components of travel time and the resultant costs: wait time and on-board travel time. In order to maintain functional equivalence, the vehicles in all systems were assumed to travel at the same speed, and the same number of passengers were assumed to be transported on all systems. For these reasons, the total on-board travel time is identical for the light rail, ABUS, and BDL options. The only differences in travel time costs resulted from differentials in passenger wait time. It should be noted that transfer time from the study system to other modes was not included in this part of the analysis and was assumed to be comparable for all systems. The latter assumption would, of course, not hold true if passenger volumes were a function of the demand for a particular system. This study assumed the same passenger volumes for all systems compared, and did not attempt to determine whether the demand for one system alternative would be different from another.

Costs associated with wait time for ABUS and light rail are identical, since the systems are assumed to operate functionally-equivalent vehicle trains, and it is assumed that every passenger transfers from another mode to the mainline system. Wait-time (in terms of user-hours) for the BDL system, as it is proposed in this study, is substantially less than that for the ABUS and light rail systems. When represented as an annual cost, this difference in cost amounts to roughly $715,000 – a significant percentage of the ABUS and light rail wait-time costs (more than 37 percent, as per Table 5.6 and 4.6), though a relatively-small fraction of the total user costs, which are approximately $4,900,000 for the ABUS and light rail systems, and an even smaller fraction (roughly 2 to 6 percent) of the total system costs for any of the three systems.

It is also noteworthy that the wait-time cost calculations performed in this report assumed a uniform passenger arrival rate, implying that the average passenger waits for half of the bus headway. For smaller headways, this assumption could be expected to yield more accurate cost savings than for larger headways. This is because, with larger headways, passengers might be more inclined to coordinate their arrival at the station to be close to the train arrival time. Assumption of non-uniform arrival rates could significantly reduce passenger wait-time, and consequently diminish the significance of wait-time costs.

A change in the cost of user time could affect the comparative cost of the systems. The cost per hour of user time of $8.32 was used, based on a value used by Caltrans (1). The significance of the difference in travel time costs is undercut by the relative smallness of the value of user travel time. The annual cost for light rail and ABUS wait time amounts to roughly $1.9 million, and $1.2 million for BDL. If user travel-time unit costs were doubled, this would produce approximately $3.8 million annually for user wait-time costs associated with the ABUS and light rail systems, and roughly $2.4 million for the BDL system. This roughly $1.4 million difference in cost of the BDL system over the two other systems would mean that the total cost for the BDL system would still favor the BDL over the lower-cost ABUS alternative.

Changes in costs related to safety (i.e. – reduction or increase in accidents) were not addressed in this report because safety was not an element of the proposed research. It is noteworthy that the calculations and conclusions presented here with respect to transit are largely dependent upon safe operation of up to five automated buses formed into a convoy; however, the extent to which bus convoys could be formed and expanded would be a safety issue (it has been proven that light rail trains can safely operate with multiple cars). It is also worth noting that, because of the high costs associated with accidents, quantification of safety factors could significantly affect the conclusions presented here. Future research should address the feasibility of the five-bus convoy assumption, and of other related safety issues.

7.2 Effects of Changes in System Configurations at Base Passenger Volumes

The comparative costs could change as a result of changes in passenger volumes, system configuration, or a combination of both. The effect of changes in system configuration of ABUS will be discussed in this section.

There are several potential system configurations for the ABUS that were not considered as part of the analysis, but which could impact the cost comparison. These alternative systems could have fewer or more buses in a convoy, or automated buses operating on a dedicated lane without convoying. In addition, a system wherein a bus entering the automated lane attaches itself to a convoy, and then disengages from the convoy when exiting the system, could be imagined. In a previous report (2), an ABUS configuration was proposed wherein buses would enter the ABUS system, drop off drivers, and assemble in convoys. Then, individual buses would pick up drivers at the exits to the system and continue to service bus routes outside the automated system. This operational scheme could result in a reduction of driver-related costs. It is assumed that one driver would remain in the lead bus of the convoy.

Another potential configuration for an ABUS, rather than the system proposed in this report, is one that involves formation of convoys at intermediate points, rather than at the beginning of the main line. The cost of drivers would increase because of the time that drivers would spend transferring in and out of buses, and the time that drivers would be idle between driving assignments. The waiting time of passengers could potentially be reduced as compared to a light rail system because of the elimination of transfer time of bus passengers to the main-line service. A BDL system operating in a similar manner could have similar wait-time reductions to the ABUS. A discussion of wait-time-related cost savings appears in the following paragraphs.

As can be seen from Table 7.2, which is based on data received from the VTA, approximately 33.9 percent of light rail riders transferred from a bus in the northbound direction (the southbound data supplied by the VTA were incomplete, and therefore not used in the analysis). Assuming that their wait time would be half of the average headway (7.5 minutes per passenger), and that weekday passenger volumes (5076 passengers boarding per day for northbound and southbound combined) and bus-transfer percentages (33.9 percent) are representative of volumes for all days in the year, the value of the wait time for these passengers would constitute roughly $650,000 per year (refer to Tables E1 and E2 in Appendix E for the relevant passenger volumes). Moreover, if it were assumed that the same costs could be allocated to the transfer time when exiting from the light rail system, and that the configuration of the system off the main line was such that no passengers commuting to the main line by bus would have to transfer once reaching the line, then the total value of entrance and egress transfer time for passengers transferring from buses to the light rail would be $1,300,000 per year.

TABLE 7.2. PERCENTAGE OF LIGHT RAIL RIDERS TRANSFERRING FROM BUS - WEEKDAY NORTHBOUND CONDITION

Station	Total Passengers Using Station	Passengers Transferring from Bus	
		Number	% of Total Station Users
Japantown/Ayer	190	34	17.9
Civic Center	1051	416	39.6
Gish	491	0	0.0
Metro/Airport	548	154	28.1
Karina Court	435	104	23.9
Component	382	63	16.5
Bonaventura	503	41	8.2
Orchard	365	66	18.1
River Oaks	639	54	8.5
Tasman	635	95	15.0
Baypointe	1415	319	22.5
TOTAL	6654	N/A	N/A
WEIGHTED AVERAGE	N/A	N/A	33.9

Assuming that this cost would be the same for the ABUS system, some speculation about the magnitude of savings in transfer and wait-time costs, as well as the increased cost for drivers due to the change in configuration, could be undertaken. For instance, if driver costs increased by, say, 20 percent, due to the implementation of this type of configuration, the increase in driver-related costs would be approximately $200,000. In this situation, the passenger wait time would also increase due to the time taken to form convoys. Hypothetically, if the passenger wait time were assumed to increase by that same 20 percent, this would amount to roughly $400,000 per year. The total increased costs, then, would be roughly $600,000. Compared to the $1,300,000 potential savings of transfer time, this implies an annual savings of $700,000 for the implementation of the aforementioned ABUS configuration change. It is noteworthy that this $700,000 savings is the maximum potential savings under this configuration, and is based on the assumption that all passengers currently commuting to the light rail study system by bus would be served (in the proposed bus systems) by buses that collect all passenger at their points of origin and then access the main line. Also, savings could also be reduced by the need for passengers to transfer from one bus to another on the main line if the bus on which they enter the system does not go to their destinations. It is possible, due to resource limitations, that some passengers would still have to transfer once reaching the main line, or while on the main line. As a result, the actual magnitude of the savings may be much less than the annual $700,000 aforementioned.

Even more significant savings (relative to the ABUS savings over light rail) could be expected for the BDL system, were it operating with the seamless configuration discussed in the immediately-preceding paragraph. For the BDL, the additional savings over ABUS would arise from the elimination of delay related to convoy formation. Though driver cost increases could be higher, the non-automated configuration would eliminate the added delay resulting from buses waiting for others to join a convoy, resulting in similar cost savings. Assuming the same conditions as assumed for the ABUS configuration in the previous paragraph, the wait-time cost increases (at 20 percent of the total wait-time costs) would be $240,000. Since no cost increases would be incurred from convoy-formation-related delay, the total BDL savings would be over $1 million. Of course, the same limitations of the ABUS, in terms of transfer-time savings reductions, would apply to the BDL system. It is also worth noting that this savings could be even higher if passenger demand were evaluated and it were found that more of the passengers who formerly commuted to the light rail station via other means (e.g. – by car) chose to access the system on one of the feeder routes, rather than at the main line. Cost differentials due to demand for each system could be impacted by such factors as decreased congestion on streets in the corridor where the system operates. Demand analysis was considered to be beyond the scope of this study, but could be addressed in future research.

Furthermore, any route system design that could utilize the benefit of eliminating transfer costs could be different from the one currently employed by the VTA, e.g. – the structure of north/south versus east/west routes may have to be modified. It is therefore questionable whether a configuration based on the formation of convoys at intermediate points would be beneficial at these passenger volumes. At an increased frequency of service, the transfer time plays less of a role, and any benefits arising from elimination of transfer time decreases. It is important to note that the benefits of bus-based configurations that eliminate the transfer time associated with light rail is not tied to automation per se, but is more directly related to using buses operating on a dedicated lane instead of a multimodal system where transfer is necessary. The elimination of transfer time would probably not impact the total overall cost differential between the light rail and the bus options significantly; however, the magnitude of the savings associated with transfer time and driver idle time could be significant enough to make BDL more cost-effective relative to the ABUS.

Another potential configuration would involve automated buses operating on an ABUS lane, but without the capacity for convoying. In this case, the system would operate similarly to the BDL system, and offer the increased user wait-time savings that the BDL provides. Also, were the automated buses to operate without drivers, driver-related vehicle-operating costs would be eliminated on the system. Moreover, with the reduced headways, transfer-time costs (if applicable) would be reduced. In this scenario, the ABUS system would likely be the preferred scenario, outscoring both the light rail and the BDL in terms of cost savings.

Unless changes were made to the number of vehicles in a convoy/train or the headways, there would be no potential for cost savings for the ABUS over the light rail, given the assumptions that were made regarding the constitution of trains for the ABUS. If ABUS trains were comprised of fewer individual vehicles running at smaller convoy headways, the travel-time costs would decrease, principally because of the reduction in wait time, but driver operating costs would increase. However, because wait-time costs are approximately double the costs associated with operators' wages and fringe benefits (see Tables 5.6 and 5.2), there is some potential for reduction in cost by operating smaller bus convoys at more frequent headways.

As it stands now, user wait-time costs account for roughly 6 percent of total light rail costs, 13 percent of the ABUS costs, and 9 percent of BDL costs (calculated Using Table 7.1 and Tables 4.6, 5.6, and 6.7 for the light rail, ABUS, and BDL study systems, respectively). If wait-time costs were a more significant portion of the total system costs, it could be argued that any option that would result in wait-time reductions would be the more attractive alternative. Using fewer buses in a convoy would essentially mean that the ABUS system costs would become more similar to the BDL costs, and the characteristics of the system would more closely resemble those of the BDL.

It is noteworthy that on-board travel time hours account for substantially more of the total user travel time than do wait time, so finding ways to decrease on-board travel time may be a more effective way to reduce travel-time costs. That could entail increasing the speed of operations on the system, which could require a better-protected right-of-way, and consequently, increased construction, rehabilitation, and maintenance costs. Also, at higher speeds, the issue of safety for the ABUS could become an issue of greater concern because of short headways and few physical restraints, unless inexpensive technological advances could mitigate this potential problem. This might not be favorable when comparing ABUS versus a light rail or BDL system, and it may be construed that, for longer-distance commuting with greater distances between stations and increased cruising speeds, safety conditions may relatively favor the rail and BDL systems. Thus, increasing speed to reduce on-board travel time may favor the BDL system and the light rail system over the ABUS. Since the additional infrastructure necessary to accommodate safety concerns for each system was not determined as part of this study, the cost differentials with respect to infrastructure construction, rehabilitation, and maintenance cannot be ascertained from this study. This would be a critical element of future research that deals with safety considerations.

It should also be noted that individual buses could also be outfitted with some automated features that would add to the quality of service and safety. Such additions could be added to buses on the dedicated lane, and could be beneficial without calling into question the safety issues related to a convoy of buses.

It is also noteworthy that, rail systems have, in the past, been associated with a better level of service related to comfort than buses. When comparing a light rail system to the ABUS at higher speeds, it is difficult to imagine that ABUS could operate with the same quality of service as a light rail system. Quality-of-service issues are related to demand, and could be quantified as such in future research.

In summary, it would appear that changes in configuration at base volume could possibly favor the BDL system over the other alternatives.

7.3 Effects of Changes in Passenger Volumes

Increases in passenger volumes over the base volumes could affect multiple aspects of the costs. User costs could change. However, increased passenger volumes can imply a necessary increase in service, which could affect such items as rehabilitation frequency, maintenance activities, vehicle replacement frequency, and user costs.

For the purposes of this research, the effects of changes in passenger volumes are discussed in terms of increases in passenger volumes from the base volume. Although it is possible that changes in service characteristics (e.g. – decreased headways, increased convoy sizes, etc.) would be implemented by the operating agency to increase the efficiency of the system for significantly increased passenger volumes on the transit systems studied in this report, performing this type of analysis in a precise fashion is beyond the scope of this study. For the purposes of this study, the increased volumes are assumed to be accommodated by the existing system or, where changes in service are required, some reasoned (but not necessarily optimal) changes in configuration are assumed.

Analyses regarding the relative cost-effectiveness of the three systems are presented in the following passages for individual cost elements (e.g. – infrastructure) as passenger volumes increase, and projections about overall relative cost-effectiveness of the systems are made thereafter.

For small volume increases (i.e. - increases in volume not accompanied by changes in service such as increased frequency of trains, convoys, or buses), increases in costs would be primarily the result of user-cost increases. Other system costs, such as those associated with vehicle operations, maintenance, etc., would not change. As discussed in previous sections of this report, user costs for this study are quantified in terms of passenger wait-time costs and passenger on-board travel-time costs. All transit vehicles are assumed to operate at the same speed, and speed increases/decreases are not considered. Under this assumption, changes in travel-time costs for increased passenger volumes increase proportionally to the increases in user volumes (i.e. – a doubling of passenger volumes would imply a doubling of user on-board travel-time and wait-time costs). Based on the results shown in Table 7.1, the BDL system would be favorable over the ABUS at increased passenger volumes. This would be due to the smaller cost increases associated with wait time for the BDL, since per-passenger wait time is less for the BDL than for the ABUS (resulting from the shorter headways associated with the BDL), and the on-board travel time is equivalent for all systems. The BDL would also be favored over light rail, for the same reason. Overall, then, for small volume increases, the BDL would likely be the favored system.

Increases in passenger volumes can only be accommodated, without changes in service frequency or other capacity expansions, up to the capacity of the base system, whereupon changes must be made to increase the system capacity. The increased service frequencies resulting from the volume increases and associated change in system capacity would also result in an increase in system (i.e. - agency) costs, as well as user costs. These concepts are discussed in the following paragraphs.

An increase in system capacity could mean an increase in vehicle capacity, increasing the number of vehicles (or trains or convoys) or increasing the capacity of the traveled way (such as adding lanes). For the sake of simplifying the discussion below, it was assumed that vehicle and traveled-way capacities would be held constant.

At moderate passenger volume increases, the bus systems would still be more cost-effective alternatives with respect to system planning, design, some initial capital costs, and periodic capital costs. If more than one lane were to be constructed, ABUS would have an advantage over BDL due to its narrower lane-width requirements. Also, as passenger volumes increase, there is a possibility that ABUS could have an additional competitive advantage over BDL because the ABUS allows for greater capacity than the BDL alternative.

It is worth noting that, since the impact of rehabilitation and periodic maintenance of light rail systems beyond the 30-year assumed useful life of the systems was not investigated, definitive conclusions cannot be made regarding the issue of savings in the category of periodic capital costs. The issue of differing useful lives of the projects was identified early in this report, and should be addressed further in subsequent research.

It is noteworthy that, at very high volumes, the capacity of the bus systems may not be adequate to accommodate the demand without adding additional lanes (for which there may not be adequate space). Also, ABUS should have an advantage over BDL regarding capacity expansion. The capacity advantages for the light rail and ABUS arise because, in a train or convoy, the vehicles are linked together and, on the average, it should be theoretically possible for the ABUS vehicles and practically possible for the light rail vehicles to operate at average vehicle headways that are shorter than for BDL. The extent to which bus convoys could be expanded would be a safety issue, whereas in the case of rail systems, it has been proven that long trains can be safely operated. The passenger volumes at which ABUS and light rail would become the respective favored option could then depend upon the safety issue, and not necessarily an economic criterion.

Increased vehicle volumes could impact system-rehabilitation and fleet-replacement costs for all systems. Considering additional wear-and-tear of vehicles and the infrastructure, rehabilitation needs could increase in frequency, as could vehicle replacement needs, and a resultant increase in cost could occur. Again, since the impact of rehabilitation and periodic maintenance of light rail systems beyond the 30-year assumed useful life of the systems was not investigated, definitive conclusions cannot be made regarding this issue.

Even if fleet replacement cost differences could favor the light rail system as volumes increase and vehicle frequency is increased, this might not be significantly meaningful unless volumes increase substantially. Based on the findings of this study, costs associated with light rail fleet renewal are negligible for the assumed 30-year project life, while ABUS and BDL fleet renewal costs sum to approximately $212,000 and $195,000 (EUAC), respectively. Given this disparity, it is likely that increases in volume would incur larger increases in the bus-based options' costs. However, given the large initial capital cost of the light rail system, drastically increased volumes might be necessary for savings related to periodic capital costs to overcome the initial cost differential. The difference in costs between the ABUS and BDL systems are not significant given the assumptions regarding the rehabilitation of the magnetic strips.

An increase in the number of vehicles, convoys, or trains would increase the number of vehicle-miles and vehicle-hours and, consequently, those costs that depend on the number of vehicle-miles and vehicle-hours of service. These costs include vehicle operations, vehicle maintenance, system (non-vehicle) maintenance, system administration, and user costs, and are discussed in the following passages. Because the vehicle operations, vehicle maintenance, system (non-vehicle) maintenance, and system administration costs are directly related to vehicle-miles and –hours, it is expected that the trends forecast here would hold for small, moderate, and significant passenger volume increases, with the numeric quantity of any cost differences proportional to the increase in passenger volumes (e.g. – higher passenger volumes imply a higher cost difference than moderate passenger volumes, etc.).

Increased passenger volumes could result in relatively greater total vehicle operations cost increases for the light rail system as compared to the ABUS, assuming the train/convoy configuration as used in the analysis described previously, i.e. – the number of ABUS trains and light rail convoys held to be the same as service is expanded to accommodate higher passenger volumes. Non-driver-related operating unit costs for the ABUS amount to about two-thirds of the non-driver operating unit costs for the light rail (in terms of vehicle-revenue-hours, approximately $19.24 for ABUS versus $29.40 for light rail, as per Tables C7b and G13b). Vehicle-hours and –miles for the light rail are roughly 72 percent those of the ABUS (as per Tables C7b and G13b). Since the costs are the products of unit costs and vehicle-revenue-miles/hours, non-driver-related operating costs would therefore be approximately the same for light rail and ABUS, with perhaps a slight inclination toward favoring the ABUS. Since driver unit costs are equal for the ABUS and light rail systems, and the number of train/convoy miles/hours are the same, the net increase in driver-related costs resulting from the addition of vehicle-miles or –hours in reaction to increased passenger volume levels, would be the same for the ABUS and the light rail. However, if the number of buses in a convoy would be restricted for safety reasons, then the driver costs for the ABUS would increase relatively faster than the corresponding light rail costs.

When increasing the number of vehicles to account for passenger volume increases, the increase in vehicle operating costs would be proportionally less for ABUS than for the BDL system. The difference in vehicle operating costs arises only from the difference in driver costs between the two systems and constitutes a smaller proportion of total costs for ABUS than for the BDL system, while the two systems function with identical revenue-miles and revenue-hours (see Tables G13b and I7b).

Non-driver operating costs for the BDL are the same as those for the ABUS and, therefore, as concluded in the comparison of the light rail system and the ABUS non-driver operating costs above, the non-driver operating costs for the BDL would be about the same as those for the light rail, with perhaps a slight advantage for the BDL. However, since there is a difference in the number of drivers and the driver unit costs, this would imply a probable driver-related operations cost difference and, thus, an overall vehicle-operating-cost difference. This difference is discussed in the following paragraph.

In terms of costs associated with drivers' wages and fringe benefits, the differences are not easy to see because of the differing base units (i.e.- vehicle-revenue-hours versus train-hours) used in Tables C7b and I7b (corresponding to light-rail and BDL costs, respectively), so some attempt will be made here to simplify the analysis. For the BDL, the driver-related unit costs for operations amount to about $40.15 per vehicle-hour, and there are roughly 34,700 annual vehicle-revenue-hours used by the system. For the light rail system, driver-related unit costs amount to $61.14 per train-revenue-hour of operation, and there are roughly 15,000 annual train-revenue-hours used by the system. This would result in a unit cost of roughly $38.00 per vehicle-revenue-hour for the roughly 24,000 annual vehicle-revenue-hours. Based on these estimates, and given that the unit costs for the two systems are approximately the same (roughly $40 for the light rail, and roughly $38 for the BDL), differences in costs would arise because of the differences in annual vehicle-revenue-hours for the two systems. Since the light rail uses roughly two-thirds of the BDL annual vehicle-revenue-hours, the total driver-related costs for the light rail should increase at a lower rate than the BDL driver-related costs as vehicle-hours increase to accommodate increases in passenger volumes.

For the light rail system, unit costs for vehicle maintenance are about 188 percent those of the ABUS (based on the calculations for vehicle-revenue-miles, with an approximate unit cost of $45 for light rail and $24 for ABUS - see Tables 5.3 and 4.3), yet annual vehicle-miles for the light rail are about 72 percent of those for the light rail (refer, again, to Tables 5.3 and 4.3). This implies that the total vehicle-maintenance costs for the light rail system would be about one-third higher than for the ABUS with a specified volume of passengers. Therefore, as volume increases, the costs for light rail would increase relatively faster than the corresponding ABUS costs.

For the ABUS versus the BDL system, the costs associated with vehicle maintenance would be expected to be comparable as volumes increase, since the two systems operate the same number of vehicle-revenue-miles and –hours and have the same unit costs. This would imply that the BDL system would perform relatively better than the light rail system as volumes increase.

The costs associated with system (non-vehicle) maintenance would be expected to increase at a higher rate for the light rail than for the ABUS and BDL options, as volumes increase. Table 4.4 gives unit costs for the light rail system maintenance to be roughly $45 per vehicle-hour. Table 5.4 does not give a unit cost for ABUS system maintenance, but one can be derived: the cost per vehicle-revenue-hour for the ABUS system is approximately $206,855/34,683 annual vehicle-revenue-hours, or $6 per vehicle-revenue-hour. Although the light rail operates about two-thirds of the total annual vehicle-revenue-hours as the ABUS, the light rail unit cost is roughly 7.5 times that of the ABUS. This implies that, as volumes increase, the light rail costs would increase significantly faster than those for the ABUS, so the ABUS system would be favored. As per Table 6.5, the BDL unit costs, and annual vehicle-revenue-miles and hours, are the same as those for ABUS. This implies that, based on the model presented in this report, the system (non-vehicle) maintenance costs for the ABUS and BDL systems would increase at the same rate with volume increases.

For the purposes of this analysis, system administration costs are assumed to increase as a function of annual vehicle-revenue-miles and –hours, and also as a function of the base condition unit costs. Costs associated with system administration could increase due to increased need for coordination of the system and its employees, and it is noteworthy that the extent to which system administration costs would increase with increased service might not be proportional to vehicle-mile and vehicle-hour increases. However, determination of cost-increase patterns beyond this assumed proportionality are beyond the scope of this study.

In comparing the light rail system to the ABUS in terms of system administration costs, unit costs are the same for both systems (this was assumed for the purposes of the study), at approximately $86 per vehicle-revenue-hour (as per Tables 4.5 and 5.5). However, the light rail annual vehicle-revenue-hours and –miles are roughly 72 percent of those for the ABUS. This implies that increasing volumes would favor the light rail. For the comparison of the BDL administrative costs versus the ABUS administrative costs, a unit cost of roughly $36 per vehicle-revenue-hour (see Table 6.6) was applied to the BDL system. Since the ABUS and BDL systems are assumed to operate the same number of vehicle-revenue-hours annually, this implies that the BDL would be the favored configuration in reference to system administration. Also, the BDL option would likely be favored over the light rail option. This is because the unit costs per vehicle-revenue-hour for the BDL system administration are roughly 42 percent of the unit cost for the light rail ($36 as opposed to $86, respectively), while the light rail uses 72 percent of the annual vehicle-revenue-hours that the BDL uses. In sum, then, since the BDL would be favored over the light rail at increased volumes, and since the light rail would be favored over the ABUS, the BDL is the favored system in regards to system administration. It should be noted, however, that the connection between administration costs and vehicle-hours/miles could be considered very tenuous, given that administration could also be a function of the difficulty involved in operational coordination, which could vary considerably among the three options explored in this report. As volumes increase, there may or may not be a linear relationship (as was assumed here) between administration costs and vehicle-hours/miles for all systems.

As passenger volumes increase, costs associated with user travel time could increase as a result of increases in user on-board travel time and wait time. Since, according to the parameters of this study, on-board travel time is the same for all alternatives, the relative increases in travel-time costs would be related to wait-time costs for each of the systems. If passenger volumes were increased by 50 percent without a concomitant decrease in vehicle or convoy headways, it would be expected that passenger wait-time total costs would increase by 50 percent. However, such an increase in passenger volumes could imply a proportional decrease in headways (i.e. – a 33 percent decrease over the headways associated with the base volume). Similarly, a 200 percent volume increase would imply a 67 percent decrease in headways, and a 300 percent volume increase would imply a 75 percent decrease in headways. When passenger volumes are multiplied by the per-passenger wait-time, the total wait times are the same for each alternative, regardless of the passenger volume. Under these assumptions, for all of the systems examined in this study, user time costs would then still favor the BDL system over the light rail and ABUS.

However, some additional factors could be taken into consideration. Previously in this report, an equivalence (i.e – 3 light rail cars equals 5 buses, etc.) was assumed for buses and light rail vehicles. With larger passenger volume increases, the need to add vehicles to a light rail train would occur at a slower rate than the addition of vehicles to a bus convoy or to the BDL system, since light rail vehicles carry more passengers per vehicle. This would imply that, as passenger volumes increase, headways would not necessarily decrease at the same rate for the bus and non-bus systems. It is likely that the ABUS and BDL headways would decrease at a faster rate. This configuration would favor the ABUS, and especially the BDL, systems over the light rail because user wait time would decrease with the decreasing headways. However, there would be a limit to the decrease in headways: at some headway, safety would become an issue, and the favorability of the BDL system would yield to that of the light rail or ABUS.

Passenger transfer time was discussed in the previous section. At increased volumes, it is expected, based on the study systems presented in this report, that the net change in transfer-time costs would be negligible as passenger volumes increase. The reasoning for this is similar to the argument for wait-time-related costs: as passenger volumes increase, costs related to wait-time increase. The average wait time, however, would decrease as a result of decreased train, convoy, or bus headways.

In summary, then, at relatively-small increases in passenger volumes, the BDL system would likely be the best-performing system, since it would still have the advantage over the other systems with regard to passenger wait time. At significantly-large volumes, the light rail system could be the preferred system. It would be capable of offering a larger capacity than the other systems, and probably at greater safety standards.

At moderate volume increases, when decreasing headways becomes a safety problem for the BDL system, the ABUS would have an advantage over the BDL system – largely due to proportionally-smaller driver-related vehicle-operating costs for the ABUS. It should again be noted that a major cost difference between the ABUS and BDL system is related to the system administration costs and, as noted previously, this difference could be smaller, and could result in the ABUS system being the preferred system at lower volumes (such as those volumes used as a basis for this report). At very low volumes and large headways, the advantage that the ABUS offers, i.e. – of not requiring drivers in all buses, would not be reasonable, since convoys would not be justified based on passenger volumes. Also, at the intermediate volumes, the ABUS would have the advantage over the light rail system because it would have a cost advantage in all categories except for user costs (where they have equal costs) and fleet renewal, which was not included in this comparison because it was outside the comparison period. Inclusion of this cost would still favor the ABUS.

In Section 7.1, the issue of safety was broached in the context of operations at base volumes. At increased volumes, system safety would likely be of increasingly-significant concern for the ABUS and BDL systems. The extent to which bus convoys could be expanded would be more of an issue than light-rail train expandability to accommodate increased passenger volumes, while with light rail, it has been proven that expanded trains can be safely operated. The passenger volumes at which the light rail could become the favored option would depend on safety issues surrounding convoy formation and expansion, the quantification of which is beyond the scope of this study.

Technological improvements addressed in this study include those associated with ABUS automated operations. It is notable that, although technological advances could reduce ABUS-associated costs, technological advances could also result in reduction of costs for the other systems (i.e. – more efficient engines, fuel cell-powered vehicles, etc.), which were not considered as part of this study. However, the major reduction in costs for the ABUS as a result of technological improvements, and as compared to the other two modes considered, was the reduction in driver costs. The cost of outfitting the buses and the road for ABUS operation was a relatively-small proportion of the total cost, and any reduction in this cost would not amount to a significant change in the comparative costs. In contrast, technological improvements, such as ABUS, that reduce labor costs have the potential to decrease operations costs substantially.

7.4 References

1. Booz: Allen and Hamilton Inc. *California Life-Cycle Benefit/Cost Analysis Model* (Cal-B/C). California Department of Transportation. September 1999.
2. Tsao, H.-S.J., Botha, J.L., Zabyshny, A.A., Day, J.E. Definition and Evaluation of Bus and Truck Automation Operations Concepts: Final Report. California PATH Research Report UCB-ITS-PRR-2003-19. May 2003.

8 GENERAL ISSUES RELATED TO THE FREIGHT SYSTEMS EVALUATION

8.1 Study Section Location

The choice of an existing route as a basis for the analysis was done for two reasons. It allowed for some understanding of the feasibility of placing an additional lane in the median of an existing freeway (placement of an additional lane anywhere but in the median could be more costly than median placement). Also, this approach allowed for using a realistic range and mix of traffic volumes in time and space (location along the route).

The ideal candidate route for analysis should allow for a "fair" comparison of alternatives. Historically, rail systems have been more competitive relative to truck transportation, over longer distances, i.e. in excess of 500 miles (1). The AHS-truck is also intended for longer distances, but without analysis it is unclear at what trip distance it becomes competitive relative to intermodal rail or to conventional truck transportation. To gain insight into this issue, it would be useful to define a system with a length of more than 500 miles. Moreover, the comparison should be made in a corridor where intermodal rail is already in operation. This would make cost comparisons more realistic. However, there are some major complicating factors that force a simplification of this comparison, given the resources available for this study.

Finding rail routes and truck routes that are comparable is difficult. The rail systems are generally old systems with terminals in central urban areas, and it would be difficult and very artificial to conceive a truck terminal at the same location. If the truck terminal were placed elsewhere, differences is costs related to access would be difficult to attribute to differences inherent in the systems, rather than difference in access locations. This could be partially overcome by defining a rail system and a road system with the same lengths, but different terminal locations. One problem with this approach is that the terminal access costs would not be exactly the same and the costs would be less for the AHS-truck option, because access outside Central Business District (CBD) areas would generally be less costly. It is conceivably possible to substitute a highway on a rail route, but estimating costs for this comparison would also be outside the scope of this project. As will be discussed subsequently, an ideal corridor, for which data were readily available, could not be found.

The route chosen as a basis of analysis was Interstate 5 (I-5) in California because this provided a relatively long (418-mile) section of road for analysis. Although the section was less than the 500-mile minimum ideal length, the route was used because data were readily available. In addition, a segment of California State Route 710 (SR 710) was added to the I-5 study section to connect it to the port at Long Beach Harbor, thus providing a more realistic simulation of a trucking route. Long Beach was chosen as the southern boundary for the study section, and Sacramento as the northern boundary. Although this route is only 418 miles in length, which is less than the length that would have been ideal for this study, it does provide a relatively suitable basis for comparison. The issue of distance in the comparison of trucking options to the intermodal rail option will be addressed in subsequent sections of this report.

This study section allowed for varied traffic volumes, truck percentages, and geometric configurations in several urban and non-urban areas to be included in the analysis, and provided for the inclusion of long-distance service providers from Southern California traveling to the San Francisco Bay Area. Figure 8.1 shows the study section.

It would have been advantageous to have a rail section between Sacramento and Long Beach as a base rail system for this study; however, information provided by J.B. Hunt Transport, Inc. indicated that intermodal rail was not being operated on this route at the time that this study was undertaken. To make a comparison between rail and trucking for this study, per-mile freight shipping rates were obtained for the same product between two points where intermodal rail and trucking services exist. This issue will be further discussed in a later section of the report.

8.2 Some Issues Related to System Design and Operating Concepts

8.2.1 Introduction

All of the road-based alternative developments consisted of adding a lane to the existing configuration (one added lane for each direction). For the different alternatives, the added lane would be:

- A conventional lane
- A dedicated AHS lane
- A dedicated truck lane

An added lane can be provided in several different ways:

- The least expensive way to add lanes is usually to add them in the median of the freeway, should there be adequate space. That would usually entail provision of a separator between opposing traffic streams should the distance between them become too narrow for safe operation. In the case of an exclusive AHS or a dedicated truck lane, a separator would also be desirable between the exclusive lane and conventional lanes. However, this could require substantial infrastructure for access to the median because it would not be good operation to have trucks weave through traffic to get through to the center lane.
- If space were not available to add the extra lanes in the median, then one of the existing lanes could be dedicated as an AHS-truck lane or for conventional trucks. This option may be politically infeasible because of the difficulty presented by taking away space from existing users.
- Adding space on the outside of the roadway is generally very costly, because it involves major redesign and construction of interchanges. Acquisition of additional right-of-way may also be required in this case, and may be politically infeasible in urban areas.
- Constructing a completely new roadway, which is a very expensive alternative.

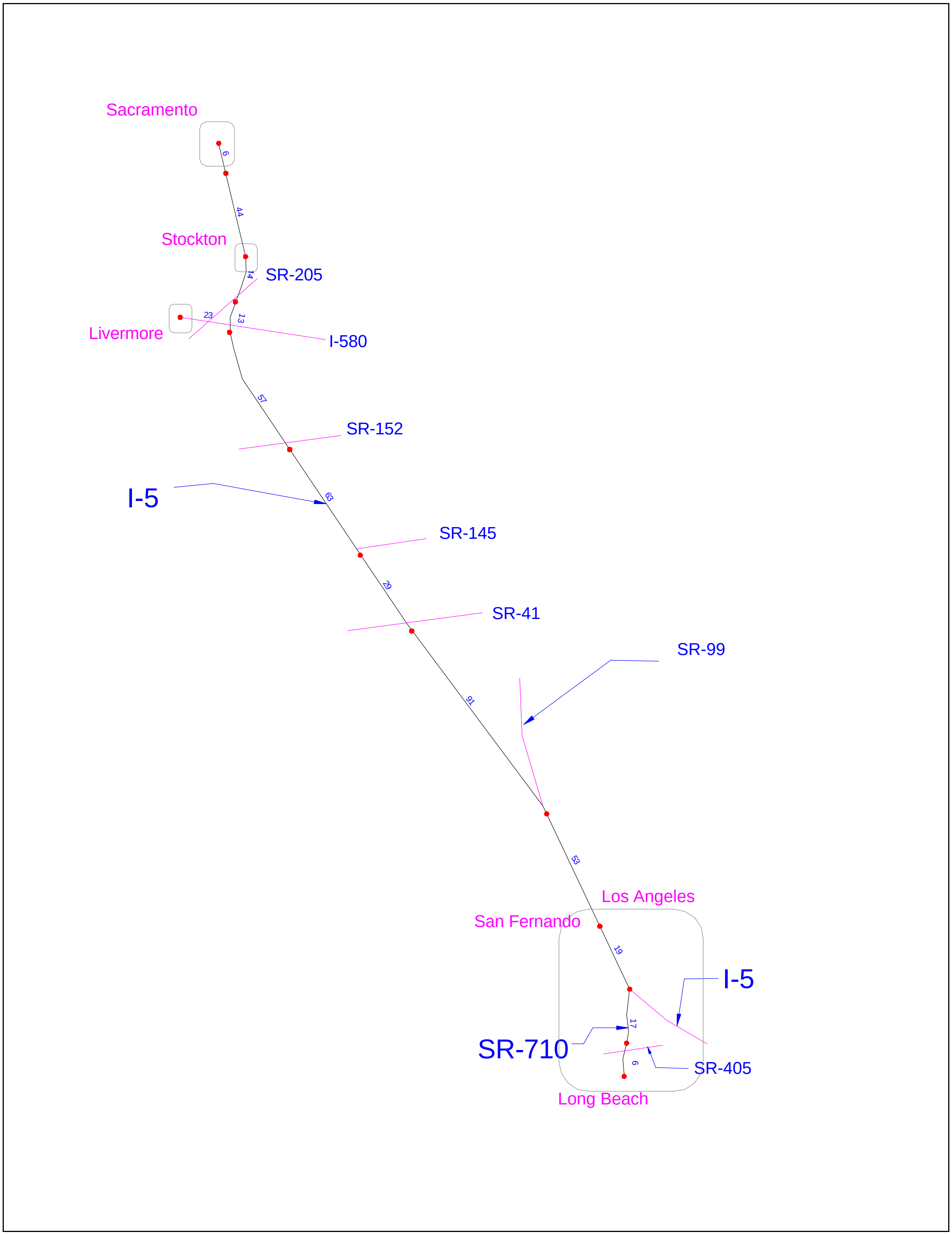

FIGURE 8.1 FREIGHT STUDY SECTION

- Another option to provide the requisite space would be to double-deck the existing roadway. Double-decking the freeway may be costly and may be unacceptable to the public because of the fear of failure during earthquakes. However, in future, this option may become acceptable, especially if rising congestion levels would become unacceptable, leading to a change in the public's priorities.

In the remainder of the report, the distinction was only made between providing lanes in the median and placement elsewhere but the median (non-median). No distinction was made among the non-median alternatives because this would have involved very specific analysis of road sections, which is considered outside the scope of this report.

8.2.2 Added Conventional Freeway Lanes
Adding a conventional lane would not change the operation of the road, except that it would have the benefit of reduced traffic density in the other lanes. No special access would be required.

8.2.3 AHS
The concept used in this study for AHS-truck consisted of truck convoys of three trucks operating on a dedicated lane, with a driver in the front vehicle only. This configuration was assumed to be reasonable for study purposes, though research could be conducted in the future to ascertain safe, feasible, and optimal convoy lengths. Also, for the purposes of this study, the AHS has major access points at relatively large spatial intervals. At each one of these access points, a transfer terminal (which serves as an assembly/disassembly area) would have to be constructed to transfer freight from conventional trucks to AHS-outfitted trucks that operate on the AHS. The operating concept is discussed in Appendix N, which was authored by Professor Randolph Hall of the University of Southern California. In addition, infrastructure (interchanges, etc.) would have to be provided to allow trucks access to the AHS lanes.

8.2.4 Dedicated Truck Lane

The alternative ways to place the dedicated lane would be similar to those for the AHS, as discussed above. The access points could be closer together than those for AHS because no transfer terminals are required. The spacing of these access points would affect the number of trucks using the truck lane, and it would have been necessary to consider different alternatives to examine this effect. For the purpose of this study, however, the only alternative considered was one where the access spacing was equivalent to that of the AHS. This would give some insight into the incremental cost differences between the AHS system and functionally-equivalent truck operation on a dedicated lane.

8.3 Some Issues Related to the Evaluation

8.3.1 Functional Equivalence of All Systems

For the purposes of this study, two systems were considered to be functionally equivalent if they transported the same number of vehicles in the same time period. Because vehicles do not access the added conventional freeway lanes in the same manner as they access the AHS and dedicated truck lanes, the systems are not truly equivalent. Because the added lanes would improve traffic flow in different ways for each alternative system, traffic demand would be affected differently for each alternative. For this reason, it was assumed, for this study, that the addition of AHS, dedicated-truck, or conventional freeway lanes would not affect demand on the system. This allowed for a more "clear" comparison for research purposes. Additionally, zero traffic growth was assumed. Analysis conducted to evaluate the effects of volume levels using a traffic growth rate would have added complexity to the analysis without being meaningful for the evaluation. Applying traffic growth rates would have resulted in higher equivalent uniform annual costs (EUACs) for all alternatives, but was unnecessary for purposes of this evaluation. Of course, if a benefit/cost analysis were to be conducted to determine whether an additional lane should actually be constructed over a real-life specific section of roadway, then exact traffic volumes (as opposed to the approximate traffic volumes used in this study) and growth rates should be used.

Additionally, only one direction of travel –in the South-to-North direction – was considered for all systems. It was assumed that traffic volumes in both directions would be comparable, since volumes that span the entire day are used.

8.3.2 The Approach to the Economic Evaluation

The costs to construct a new section of freeway, or to add a lane to an existing freeway, vary widely. For the purposes of this study, costs per unit length and unit area (e.g. – linear and square feet) are influenced by geography (i.e. – whether the area is urban or rural) and alignment (i.e. – median or non-median placement). Costs associated with rural median-placed segments are the least expensive to construct; costs associated with urban non-median alignment are the most expensive.

Since it was impossible, given resource constraints, to conduct a detailed cost analysis for the whole road, a simplified approach was followed. This consisted of partitioning the roadway into sections that were relatively homogeneous with respect to the average daily traffic (AADT), the number of existing travel lanes in each direction, and the availability of space in the median. The following procedure was used:

1. The route was first characterized and segmented according to the location of the truck lane, i.e. whether the lane was placed inside or outside of the median.
2. Each route segment was further partitioned into sections according to the volume, the number of lanes, and type of development (i.e. – urban, suburban, or rural).
3. The costs associated with each of the sections were calculated.
4. The total costs for all sections for each alternative design were calculated and compared.

The accuracy of the comparison was therefore dependent not only upon the accuracy and detail of the analysis, but also on the degree of idealization and approximation of the actual conditions in steps 1, 2 and 3. This approach allowed for the best allocation of the available resources to obtain the best result, while still maintaining the realism of using an existing section of roadway. This procedure is discussed in Chapters 9, 10, and 11 for the three system options.

A major barrier to an accurate comparison of costs is that cost data for inter-modal rail in a specific corridor are proprietary and it is therefore very difficult to estimate the real cost of intermodal rail in a specific corridor. In order to arrive at a tractable comparison between the intermodal rail and trucking options, an approximate approach to the comparison was undertaken.

First, it was assumed that the two industries share a common ratio between the actual costs of transportation versus the actual shipping rate. Since shipping rates for both industries are in the public domain and the actual cost of trucking was assumed to have been calculated with reasonable accuracy in this study, this assumption enables a very rough estimation of the actual cost of the rail industry. In this study, the costs of intermodal rail were estimated by multiplying the shipping rate for intermodal rail by the ratio of the shipping cost for the truck alternative to the shipping rate for trucks. In this study, the aforementioned estimate is based on the rates per mile for an existing intermodal rail section elsewhere and applying it to the corridor selected for comparison. When interpreting the results, allowance should be made for the fact that distortions will be present because of accounting and business practices as well as the allocation of fixed costs. This ratio-based estimate is not expected to be very accurate, but this approach does offer a solution to estimating intermodal rail costs, given the limitations of available resources and the unavailability of certain data. It is noteworthy that this comparison would be more realistic, were the corridor used for comparison one where competition between trucking and intermodal rail does take place.

8.3.3 Cost Categories

The cost elements are:

- System planning and design costs
- Construction, rehabilitation and other infrastructure capital costs
- System maintenance costs
- Administration and system operating costs
- Vehicle operating costs
- Travel time costs

An overview of these elements will be discussed in the following paragraphs. The details of each cost category will be discussed in Sections 9, 10, and 11.

<u>System Planning and Design Costs</u>

System planning and design costs consist of all costs incurred before and during the design phase of the project. These costs include engineering, environmental review, etc. As will be seen below, the system planning and design costs were included in the construction costs.

Construction, Rehabilitation and Other Infrastructure Capital Costs

Construction costs consist of those costs incurred for the construction of the additional lanes and other system infrastructure. As stated above, system planning and design costs were included in construction costs for the purposes of this study. Rehabilitation costs include those costs associated with periodic reconstruction and major maintenance activities for the infrastructure. It is noteworthy that costs for acquisition of right-of-way were not considered as part of this study, except for the land costs related to the AHS transfer terminals. Consideration of land costs would have required a very detailed study. Such a study would have entailed determination of whether sufficient right-of-way existed outside the median to place those segments where median alignment of the added lane was not possible. For those segments of the study section where the added lane could not be located in the median, differentiation was not made among non-median placements (e.g. – elevated structures, at-grade placement, etc.). Since the costs associated with alternative placements could vary considerably depending on both availability of right-of-way and infrastructure needs, the costs associated with the additional right-of-way could not be ascertained.

Both the AHS-truck option and the dedicated-truck-lane option require infrastructure to provide access to the dedicated and AHS lanes (i.e. – interchanges). In addition, the AHS also requires assembly and disassembly areas (called “transfer terminals” and “staging areas” in this report).

System Maintenance Costs

Generally, system maintenance costs consist of routine roadway maintenance, including pavement patching, culvert cleaning, etc. There would also be additional maintenance costs for the interchanges associated with the AHS and dedicated lane systems. Costs for maintenance of assembly areas and associated buildings would also be incurred; however, these costs for maintenance of assembly-area infrastructure were considered to be relatively insignificant and were not included in this analysis.

Administration and System Operating Costs

Costs for administration and system operation include all functions for which costs would be incurred by an operating agency such as Caltrans, excluding the planning, design, construction, rehabilitation, and maintenance costs. The basic administration and system operating costs should be different for the three proposed systems. For instance, possibly levying tolls for the AHS lane would result in additional administration costs. Also, operating the AHS staging areas would result in extra costs. However, since it is not clear how the AHS lane would be operated and how overall administration costs would be allocated, estimation of these types of costs was considered to be outside the scope of this study. Operating costs for the AHS-truck staging areas were included in the cost estimates of this study.

<u>Vehicle Operating Costs</u>

The vehicle operating costs are those expenses necessary to operate a vehicle on the freeway lane. Typically, costs for vehicle operations include driver wages and fringe benefits, other wages and fringe benefits, equipment rents and purchased transportation, insurance, depreciation, tires, outside maintenance, fuel, tax, licensing, and other miscellaneous items. For the purposes of this study, taxes and licensing fees were not included in vehicle operations costs because they are considered transferred costs. This exclusion is proper because this analysis was performed from a societal perspective.

The driver-related costs associated with the AHS-truck system would be less than for the other options, because of using fewer drivers to drive the trucks over the line-haul sections. The trip lengths for the trucks using the AHS and dedicated truck lane could be longer than for conventional systems because there are fewer access points to the freeway, and the access and egress trips may therefore be more circuitous than for the conventional freeway. Because the trucks using the AHS system will be traveling longer distances to the access points, vehicle-related costs would increase. The extra cost of access was not included in this analysis because this would have entailed establishing an origin and destination for each truck, and then to estimate the extra distance traveled. This was considered outside the scope of this project.

There is evidence that fuel use for the AHS-truck would be less because of the decrease of wind resistance when the trucks are in a train with short headways between the individual trucks (2). The added cost for outfitting the trucks to enable them to be a part of a convoy could offset some of these savings; however, these costs were not included because it was outside the scope of this project to estimate how many individual trucks would be outfitted for this purpose, how many of these trucks would repeatedly use this particular lane, and how many of these trucks would be using other automated lanes. It was therefore impossible to determine, without a significant study, which proportion of these costs would be allocated to this particular route.

<u>Travel Time Costs</u>

Travel-time costs would be reduced by implementation of any of the alternatives because the added lanes should lead to increases in vehicle speeds, resulting in fewer expended user hours on the system. Compared to conventional traffic, it was assumed that truck speeds on the AHS would be higher than on the other alternatives, because of improved control provided by the automation technology, and also because of the separation of AHS traffic from regular traffic. With the removal of trucks from the regular traffic stream (in the case of the AHS and dedicated systems) or the dispersal of vehicles into an extra lane (as with the added-conventional-lane scenario), in some cases, speeds for the vehicles remaining on the conventional lanes increased. This could reduce user travel time costs for the line haul more significantly for the AHS than for the other systems. Also, since fewer drivers are necessary, this, conceivably, would further reduce travel-time costs for the AHS-truck system.

Compared to conventional traffic, additional time is taken by the AHS-lane traffic for formation and disassembly of convoys. Drivers may have to wait at the assembly areas for a truck to drive after disassembly, which will be an added cost for the AHS-truck. Also, it is anticipated that there will be additional travel time for the AHS-truck and dedicated lane because of the longer distances traveled from access points to destinations that are not near system access/egress locations. The costs discussed in this paragraph were not explicitly calculated because it was considered outside the scope of this study.

8.4 References

1. McKenzie, D.R., North, Mark C., and Smith, D.S. *Intermodal Transportation: The Whole Story*. Simmons-Boardman Books, Inc. Omaha, Nebraska. August, 1989.
2. Bonnet, C., Fritz, H. "Fuel Consumption Reduction Experienced by Two Promote-Chauffeur Trucks in Electronic Towbar Operation." ITS World Congress 2000. Torino, Italy.

9 CONVENTIONAL FREEWAY LANE COSTS

9.1 Cross-Section

For this alternative, a standard 12-ft. lane was added in each direction. It was assumed that a barrier would be necessary to divide the two directions. This implies a total added width of 26 feet, including two travel lanes and one two-foot Caltrans standard barrier (1). Although this barrier might not be necessary in some instances, it is outside the scope of this project to determine where such a barrier may be needed. For uniformity across the analysis of the different alternatives, it was assumed that a center barrier was always necessary when the added lanes were placed in the median. The minimum space requirements for placing a lane in the median is shown in the layout presented in Figure 9.1. The non-median space requirements are not shown here because there are multiple possibilities that would depend on specific section constraints.

9.2 Section Characterization

The segmentation of the road, based on availability of space in the median, AADT, number of existing lanes, and type of development was carried out using data for the northbound direction. Using only one direction for the analysis, it was assumed that the northbound traffic volumes are representative of traffic volumes in northbound and southbound directions, and that the roadway is generally symmetric, so roadway characteristics (i.e. – number of lanes, traveled way width) in the north- and southbound directions are generally the same.

The procedure developed to partition the study section into these homogeneous segments is discussed in detail in Appendix K. The partitions are shown in Table 9.1.

9.3 Conventional Freeway Cost Calculations - Base Volume

9.3.1 Conventional Freeway Planning, Design and Construction Costs

Some freeway-related unit costs (in 1999 dollars), obtained from Caltrans, were used to calculate costs related to traveled way and shoulder planning, design, and construction. A range of values for 8-lane urban and 4-lane rural freeways were provided by Caltrans, and appear in Table 9.2. The procedure for assigning a unit cost to the roadway is explained in the following passages.

According to Caltrans, the related planning and design costs are included in each of the cost items shown. Based on these costs, a cost per mile per one foot width was obtained assuming a 78-foot total pavement width for the rural four-lane freeway and a 136-foot total pavement width for the eight-lane urban freeway. These widths were based on cross-section information obtained from the *California Highway Design Manual* (1). An inflator of 1.0353 (using the same base as was used for the transit systems) was then applied to each value to find the unit costs shown in Table 9.3.

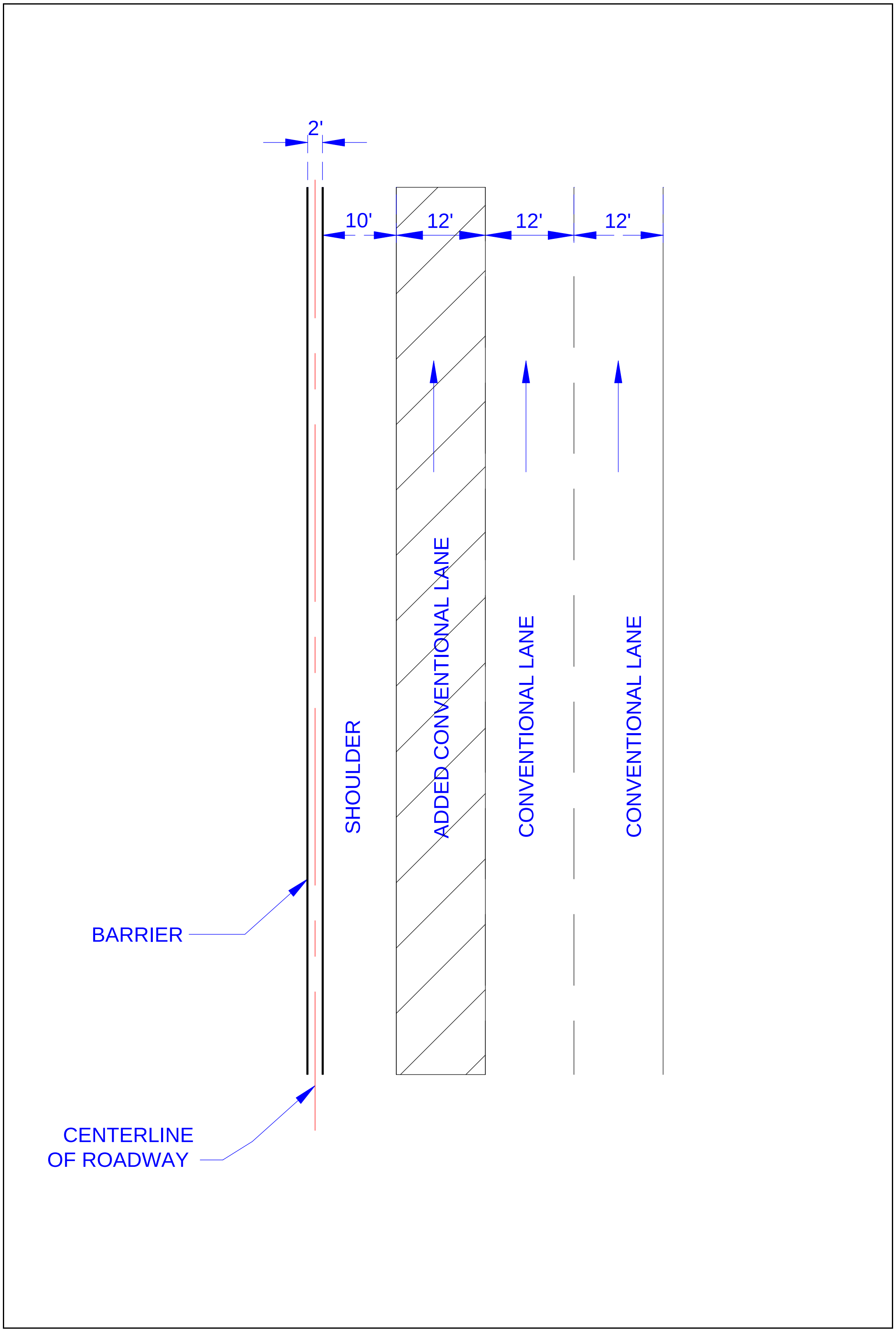

FIGURE 9.1 BASIC GEOMETRY FOR ADDED-CONVENTIONAL-FREEWAY-LANE CONFIGURATION

TABLE 9.1 SECTION PARTITIONING AND TRAFFIC VOLUME DATA (ADDED CONVENTIONAL LANE)

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AHS Lane Placement	Base AADT (One Direction)	Truck %	Truck AADT (One Direction)	Peak Period Duration (hours)	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration (hours)	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)															
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	40,000	16.0%	6,400	6	3,500	21,000	5	4.81%	1,923	385	13	17,077	1,314
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	49,000	11.0%	5,390	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Median	49,000	9.0%	4,410	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Median	67,000	13.0%	8,710	3	6,500	19,500	6	4.76%	3,189	532	15	44,311	2,954
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Median	73,000	9.0%	6,570	3	7,300	21,900	6	4.76%	3,475	579	15	47,625	3,175
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	80,000	10.0%	8,000	3	7,100	21,300	6	4.76%	3,808	635	15	54,892	3,659
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	75,000	11.0%	8,250	3	7,000	21,000	6	4.76%	3,570	595	15	50,430	3,362
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	65,000	14.0%	9,100	3	6,000	18,000	6	4.76%	3,094	516	15	43,906	2,927
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	63,000	14.0%	8,820	3	5,400	16,200	6	4.76%	2,999	500	15	43,801	2,920
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Median	50,000	14.0%	7,000	3	5,000	15,000	6	4.76%	2,380	397	15	32,620	2,175
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	40,000	14.0%	5,600	3	4,000	12,000	6	4.76%	1,904	317	15	26,096	1,740
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	30,000	25.0%	7,500	3	3,000	9,000	11	19.13%	5,738	522	10	15,262	1,526
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	25,000	24.0%	6,000	4	2,300	9,200	8	11.58%	2,895	362	12	12,905	1,075
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	40,000	23.0%	9,200	5	4,000	20,000	5	4.03%	1,613	323	14	18,387	1,313
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Median	45,000	24.0%	10,800	5	4,500	22,500	5	4.03%	1,814	363	14	20,686	1,478
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Median	50,000	24.0%	12,000	5	5,000	25,000	5	5.58%	2,791	558	14	22,209	1,586
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	40,000	26.0%	10,400	5	4,000	20,000	5	5.58%	2,233	447	14	17,767	1,269
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	63,000	26.0%	16,380	5	5,000	25,000	5	5.58%	3,517	703	14	34,483	2,463
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	42,000	26.0%	10,920	5	4,200	21,000	6	8.17%	3,430	572	13	17,570	1,352
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	10,000	26.0%	2,600	3	1,000	3,000	5	8.03%	803	161	16	6,197	387
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	10,000	28.0%	2,800	4	1,000	4,000	6	15.57%	1,557	259	14	4,443	317
I-5: Merced	Rural	0	32.45	32.45	2	Median	15,000	29.0%	4,350	4	1,500	6,000	6	15.57%	2,335	389	14	6,665	476
I-5: Fresno	Rural	0	66.16	66.16	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	18.05%	2,708	387	12	4,792	399
I-5: Kings	Rural	0	26.72	26.72	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	17.32%	2,597	371	12	4,903	409
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	17,000	29.0%	4,930	5	1,700	8,500	5	10.17%	1,728	346	14	6,772	484
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	30,000	28.0%	8,400	5	3,000	15,000	6	10.95%	3,284	547	13	11,716	901
I-5: Kern	Rural	10.35	15.08	4.73	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	7.04	9.28	2.24	4	Median	30,000	30.0%	9,000	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	5.36	6.41	1.05	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0.58	5.36	4.78	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0	0.58	0.58	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Los Angeles	Rural	84.76	88.61	3.85	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	35,000	19.0%	6,650	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Median	40,000	16.0%	6,400	5	4,000	20,000	5	6.08%	2,433	487	14	17,567	1,255
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Median	65,000	10.0%	6,500	5	6,500	32,500	5	6.08%	3,953	791	14	28,547	2,039
I-5: Los Angeles	Urban	46.9	52.33	5.43	4	Median	90,000	10.0%	9,000	6	8,600	51,600	5	5.89%	5,305	1,061	13	33,095	2,546
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Median	92,000	9.0%	8,280	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Median	92,000	10.0%	9,200	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Median	100,000	9.0%	9,000	6	8,900	53,400	5	5.89%	5,895	1,179	13	40,705	3,131
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Median	115,000	10.0%	11,500	6	9,100	54,600	5	5.89%	6,779	1,356	13	53,621	4,125
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Median	115,000	8.0%	9,200	6	8,500	51,000	5	6.62%	7,618	1,524	13	56,382	4,337
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	120,000	8.0%	9,600	6	9,500	57,000	5	6.62%	7,949	1,590	13	55,051	4,235
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	117,000	9.0%	10,530	4	4,600	18,400	5	4.88%	5,710	1,142	15	92,890	6,193
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	65,000	9.0%	5,850	4	4,800	19,200	5	4.88%	3,172	634	15	42,628	2,842
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	70,000	8.0%	5,600	4	5,000	20,000	5	4.88%	3,416	683	15	46,584	3,106
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	135,000	8.0%	10,800	5	10,200	51,000	5	4.20%	5,675	1,135	14	78,325	5,595
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	140,000	8.0%	11,200	5	10,000	50,000	5	4.20%	5,885	1,177	14	84,115	6,008
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	140,000	8.0%	11,200	5	9,600	48,000	5	4.20%	5,885	1,177	14	86,115	6,151
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	90,000	8.0%	7,200	5	6,800	34,000	5	4.20%	3,783	757	14	52,217	3,730
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	90,000	8.0%	7,200	5	7,200	36,000	5	4.20%	3,783	757	14	50,217	3,587
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	102,000	8.0%	8,160	5	8,200	41,000	5	4.20%	4,288	858	14	56,712	4,051
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	138,000	8.0%	11,040	8	9,900	79,200	5	4.48%	6,184	1,237	11	52,616	4,783
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	140,000	8.0%	11,200	8	9,600	76,800	5	4.48%	6,273	1,255	11	56,927	5,175
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	120,000	8.0%	9,600	8	8,000	64,000	5	4.48%	5,377	1,075	11	50,623	4,602
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	120,000	8.0%	9,600	6	7,900	47,400	5	2.79%	3,350	670	13	69,250	5,327
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	130,000	8.0%	10,400	6	8,000	48,000	5	2.79%	3,629	726	13	78,371	6,029
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	128,000	8.0%	10,240	6	8,400	50,400	5	2.79%	3,574	715	13	74,026	5,694
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	110,000	15.0%	16,500	8	8,000	64,000	5	4.48%	4,929	986	11	41,071	3,734
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	88,000	14.0%	12,320	8	7,500	60,000	5	4.48%	3,943	789	11	24,057	2,187
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	70,000	15.0%	10,500	8	6,000	48,000	5	4.48%	3,137	627	11	18,863	1,715

TABLE 9.2 FREEWAY CONSTRUCTION AND REHABILITATION UNIT COST DATA (IN MILLIONS OF DOLLARS) - CALTRANS 1999

Project Type	Freeway Type			
	8-Lane Urban		4-Lane Rural	
	Low	High	Low	High
1 Mile New Freeway	40	150	15	25
New Interchange - Arterial	20	50	10	20
1 Mile Pavement Rehab.	2.5	8	0.65	6

Table 9.3 shows unit costs for urban and rural sections of roadway (cost per mile per 12-foot width, which accounts for one direction of travel), for "low" and "high" cost scenarios. Low and high values were used to provide a range of costs because roadway construction costs vary considerably from project to project, and using only one number to represent these various cost scenarios would be misleading.

TABLE 9.3. NEW FREEWAY UNIT CONSTRUCTION COSTS FOR ADDED-CONVENTIONAL-LANE CONFIGURATION

Type of Area	Year	Cost per Mile per Foot Width ($)		Cost per Mile of 26 ft Cross-Section - per 12 ft ($)	
		Low	High	Low	High
Rural	1999	192,308	320,513	2,307,692	3,846,154
Urban	1999	294,118	1,102,941	3,529,412	13,235,294
Rural	2001	199,096	331,827	2,389,154	3,981,923
Urban	2001	304,500	1,141,875	3,654,000	13,702,500

Roadway segments were classified as urban, suburban, or rural based on proximity to a metropolitan area. A segment was classified as urban if it was within the boundaries of the city, as outlined in the *California Highway Log* (2). Segments were classified as suburban or rural if outside these boundaries. Suburban status was applied if the segments were considered to fall within the greater metropolitan area of the nearest major city. Where those boundaries were questionable (for instance, in Los Angeles), traffic volumes were analyzed. If the traffic volumes in the segment were comparable to those of an adjacent urban area, that segment was classified as suburban. Otherwise, it was classified as rural.

The unit costs in Table 9.3 were used to calculate the cost for each section of the road for the added lane, as described in Appendix L. The unit costs were applied as follows:

Urban Median Lane – low urban unit costs
Urban Non-Median Lane – high urban unit costs
Suburban Median Lane – average of low urban and rural unit costs
Suburban Non-Median Lane – average of high urban and rural unit costs
Rural Median Lane – low rural unit costs
Rural Non-Median Lane – high rural unit costs

Costs associated with barriers, like those associated with the roadway, are dependent upon segment classification. For the added conventional freeway lane option, a median barrier was assumed to be necessary to separate opposing travel directions on those partitions where the lanes are placed in the roadway median. If the added lanes were placed outside the median on a given partition, it was assumed that no barriers are necessary. On those segments where barrier costs are applicable, then, one-half of the barrier costs were assigned to each travel direction. For segments where no barrier is necessary, the barrier costs are listed as zero. Costs per mile for a barrier are equal to $94,776, as shown in Table L1 in Appendix L (this cost is based on barrier costs of $17.95 per linear foot, as provided by Caltrans (3)).

The total cost for barriers amounted to $17,114,176. An equivalent uniform annual cost of $1,243,326 was then found (using the same methodologies discussed in the transit sections – with an assumed project life of 30 years and a discount rate of 6 percent). Refer to Appendix L for costs itemized by segment.

It should be noted that right-of-way (ROW) costs were not considered because it was considered outside the scope of this study to determine whether space was available in the existing ROW. Total planning, design, and construction costs for the added conventional freeway lane amount to $1,561,745,939**,** which has an EUAC value of $113,459,142 in 2001-dollars.

9.3.2 Conventional Freeway Rehabilitation Costs

The rehabilitation costs were based on data obtained from Caltrans. The data from Caltrans are shown in Table 9.2. A unit cost was developed in the same way that a unit cost was developed for the construction costs and applied to the identified sections of the road. Those unit costs are shown in Table 9.4. An equivalent uniform annual cost of $5,357,421 was calculated assuming rehabilitation was carried out in years 10 and 20 and using a discount rate of 6 percent. Procedures used for inflation adjustments and discounting are identical to those used in the transit component of the report. Calculation tables appear in Appendix L.

TABLE 9.4. FREEWAY REHABILITATION UNIT COSTS FOR ADDED-CONVENTIONAL-LANE CONFIGURATION

Type of Area	Year	Cost per Mile per Foot ($)		Cost per Mile of 26 ft Cross-Section - per 12 ft ($)	
		Low	High	Low	High
Rural	1999	8,333	76,923	100,000	923,077
Urban	1999	18,382	58,824	220,588	705,882
Rural	2001	8,628	79,638	103,530	955,662

9.3.3 Conventional Freeway Maintenance Costs

According to data provided in “Economic Analysis of Transportation Investments and Economic Development” (4), the routine annual maintenance costs for a 4-lane (48-foot-width) road was $528 per mile in 1983 dollars – a figure which is based on historical Federal Department of Transportation figures. This translates to roughly $11 per mile per foot width in 1983 dollars, and $17.24 in 2001-equivalent dollars per foot width ($0.003 in 2001-equivalent dollars per square foot). This resulted in a total maintenance cost of $86,479 per year. This number was obtained by multiplying the 2001-equivalent EUAC per foot width by the system length of 418.01 miles.

9.3.4 Conventional Freeway System Administration and Operating Costs

As discussed in Chapter 8, the administration and operating costs associated with an added conventional lane were not considered in this study.

9.3.5 Conventional Freeway Vehicle Operating Costs

Vehicle operating costs were also determined on a per-section basis for the same sections as used for determining construction costs. The vehicle operating costs were determined for the categories of trucks and other vehicles and for three periods of the day: peak, off-peak and nighttime off-peak.

The duration and traffic volumes during the periods of the day were based on a sample of selected 24-hour traffic flow profiles obtained from Caltrans. Estimates were made of the peak and nighttime period durations and volumes. The duration of the daytime off-peak period was then found by subtracting the durations of the peak and nighttime periods from 24 hours. The traffic volume for the daytime off-peak period was found in a similar fashion. Traffic flow data were taken from the Caltrans website (5), as were truck data (6).

The vehicle operating costs were found by multiplying the annual vehicle-miles of travel with the unit cost per mile of travel for the categories of trucks and other vehicles. Unit costs per mile of travel for trucks were obtained from *American Trucking Trends* (7). For trucks, the total cost per mile of travel amounted to $1.68 in 1998 dollars, or $1.77 in 2001-equivalent dollars. (For the 2001-equivalent costs, the figure includes $0.41 per mile in costs for driver salaries and wages.) These values were then multiplied by an inflator of 1.0487 to bring the values to the year 2001. Appendix M shows vehicle operating costs itemized according to the cost categories discussed in Section 8.3.3.

For all other vehicles (assumed in this study to be passenger cars or the equivalent), the cost per mile of operations was assumed to be $0.325 per mile, which was the reimbursement for vehicle use at San Jose State University in the year 2001. The vehicle-miles of travel are the product of the section length and the volume of traffic in the section during the specific period.

These calculations were first carried out for the base condition (i.e. – the current configuration of the road) with the existing flow rates (i.e. – base volume). The same process was completed for the configuration wherein a lane is added and with the base volume. The incremental operating costs are equal to the difference between the operating costs for the base system and the operating costs for the base system plus the added lane. Since the unit cost in this case does not vary with speed, the addition of the lane does not yield a difference in vehicle operating costs. In future research, the use of unit costs that vary with speed could be used to quantify the effect of varying speed on vehicle operating costs. However, as will be seen later, the addition of an AHS lane will affect vehicle operating costs. The tables showing the calculations for the vehicle operating costs for the added lane are shown in Appendix M. A summary of vehicle-miles of travel for each daily period is shown in Table 9.5. A cost summary is provided in Table 9.6.

TABLE 9.5. SUMMARY OF DAILY VEHICLE MILES FOR ADDED-CONVENTIONAL-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	1,281,653	5,586,341
	Nighttime Off-Peak	263,550	912,542
	Daytime Off-Peak	1,088,269	5,221,226
TOTAL		2,633,471	11,720,109
Conventional Lanes including added lane	Peak Period	1,281,653	5,586,341
	Nighttime Off-Peak	263,550	912,542
	Daytime Off-Peak	1,088,269	5,221,226
TOTAL		2,633,471	11,720,109

9.3.6 Conventional Freeway User Costs

User costs are costs incurred for user travel time. Freeway user costs were found by multiplying vehicle-hours of travel by the unit cost per hour. This task was carried out in a similar fashion as was outlined in the foregoing section. The same traffic volumes as used in the previous section were utilized here. The travel time for each section was calculated by dividing the section length by travel speed during the period. The travel speed was found by calculating the passenger car equivalent flow rates for the section and period, according to the methodology contained in the Highway Capacity Manual (HCM) (8), and the speeds then read from the curve of freeway speeds versus flow rates. Truck speeds were assumed to be 50 mph on the average.

The unit time cost values used for automobile and truck passengers were obtained from the *California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C)* (9). These values are $8.16 and $27.72 per user hour, respectively, for the year 2000. Inflating these values to 2001 values yielded $8.32 and $28.27. An automobile occupancy value of 1.1 (10) was applied.

The tables showing the calculations for the user costs for the added lane are presented in Appendix M. A summary of vehicle-hours for each daily period appears in Table 9.7. A cost summary is provided in Table 9.8. From Table 9.8, it can be seen that the travel time costs were reduced by an EUAC of roughly $11.5 million when an additional conventional lane is added.

TABLE 9.6. VEHICLE OPERATING COSTS AND COST DIFFERENCES (ADDED-CONVENTIONAL-LANE CONFIGURATION VERSUS BASE VOLUME/CONDITION CONFIGURATION

Condition	Daily Vehicle-Miles		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	2,633,471	11,720,109	1.77	0.325	4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488
Conventional Lanes including added lane	2,633,471	11,720,109	1.77	0.325	4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488
Cost Difference	0	0			0	0	0	0	0

TABLE 9.7. SUMMARY OF DAILY VEHICLE HOURS FOR ADDED-CONVENTIONAL-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	25,633	95,243
	Nighttime Off-Peak	5,271	14,675
	Daytime Off-Peak	21,765	87,711
TOTAL		52,669	197,630
Conventional Lanes including added lane	Peak Period	25,633	91,721
	Nighttime Off-Peak	5,271	14,862
	Daytime Off-Peak	21,765	87,634
TOTAL		52,669	194,217

TABLE 9.8. TRAVEL TIME COSTS AND COST DIFFERENCES (ADDED-CONVENTIONAL-LANE CONFIGURATION VERSUS BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Hours		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	52,669	197,630	28.27	9.16	1,489,196	1,809,401	543,556,672	660,431,429	1,203,988,101
Conventional Lanes including added lane	52,669	194,217	28.27	9.16	1,489,196	1,778,154	543,556,672	649,026,049	1,192,582,721
Cost Difference					0	-31,248	0	-11,405,380	-11,405,380

9.4 Conventional Lane Cost Summaries

A summary of the cost calculations for the conventional freeway lanes is shown in Table 9.9. From the table it can be seen that the travel-time savings do not offset the costs for adding the lane. It should be kept in mind that the vehicle operating costs that may be time-related were not included.

TABLE 9.9. INCREMENTAL COST SUMMARY FOR ADDED-CONVENTIONAL-FREEWAY-LANE CONFIGURATION AT BASE VOLUMES

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	113,459,142
Rehabilitation	5,357,421
System Maintenance	86,479
Vehicle Operating Cost	0
Travel Time	-11,405,380
Total Incremental Cost	107,497,663

9.5 References

1. *California Highway Design Manual.* Online. 2003. <http://www.dot.ca.gov>
2. *1997 California State Highway Log.* Caltrans. 1997.
3. Caltrans Cost Data Information. Online. 2001. <http://www.dot.ca.gov/hq/esc/oe/awards/>
4. "Economic Analysis of Transportation Investments and Economic Development." Transportation Research Record 984. Transportation Research Board, National Research Council. 1984.
5. Caltrans Traffic Volumes. Online. 2001. <http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm>
6. Caltrans Truck Traffic. Online. 2001. <http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm>
7. *American Trucking Trends*. American Trucking Associations' Economics and Statistics Group. 2000.
8. *Highway Capacity Manual.* Transportation Research Board. 2001.
9. Booz: Allen and Hamilton Inc. *California Life-Cycle Benefit/Cost Analysis Model* (Cal-B/C). California Department of Transportation. September 1999.
10. National Transportation Demand Management and Telework Clearinghouse. *http://www.nctr.usf.edu/clearinghouse/censusavo.htm.*

10 AHS LANE COSTS

10.1 AHS-Lane Operating Concept

An overview of the basic operating concept was provided in Section 8.2.3. Details of the operating concept for the transfer points are provided in Appendix N, which was authored by Professor Randolph Hall of the University of Southern California. Key points of the AHS lane operating concepts are as follows:

- The AHS system provides one lane in each direction, with provision for passing a stalled vehicle at reduced speeds.
- The AHS lanes provide exclusive right-of-way to trucks with automation technology, and are separated from regular traffic lanes and opposing AHS lanes by physical barriers.
- Vehicles outfitted with AHS technology convoy in "truck convoys," with convoy assembly occurring at staging areas. These staging areas, which occur at access/egress points, provide space for convoy assembly, disassembly, and trailer storage.

Figure 10.1 shows basic operating concepts for the AHS system in the median. Figure 10.2 shows proposed access/egress locations along the proposed route. These access and egress points were suggested by Professor Randolph Hall of the University of Southern California. The volumes of trucks using AHS lanes at the various access points are shown in Table 10.1.

10.2 AHS-Lane Cross Section

Although California law does not currently allow all vehicles used in some other states, one potential benefit of AHS lanes is the ability of such vehicles to operate safely in California, thus increasing freight throughput. For this reason, the cross section used for the purpose of calculating costs made provision for all vehicles currently specified in the *A Policy on the Geometric Design of Highways and Streets* (1) published by AASHTO.

To determine the required width of the AHS-Lane cross section, the required width for tangent sections as specified for turning roadways was used as a starting point. The reason for using this approach as opposed to the section on open highways, was that it was assumed that the operation of the system would be tightly controlled and that vehicles would be slowed down to pass any stalled vehicle. Consequently the values specified for one-lane, one-way operation with provision for passing a stalled vehicle was used. The minimum width required under this provision was 21 feet. Another option would be to make the system such that the stalled vehicle could be passed at speed, but this could be undertaken in future research. Physical barriers will separate the AHS lanes from each other, as well as from the regular traffic. These physical barriers will be two feet wide (2). Figure 10.3 shows the space required for the AHS system when it is placed in the median. The non-median placement is not shown here because there are multiple possibilities for placement that would depend

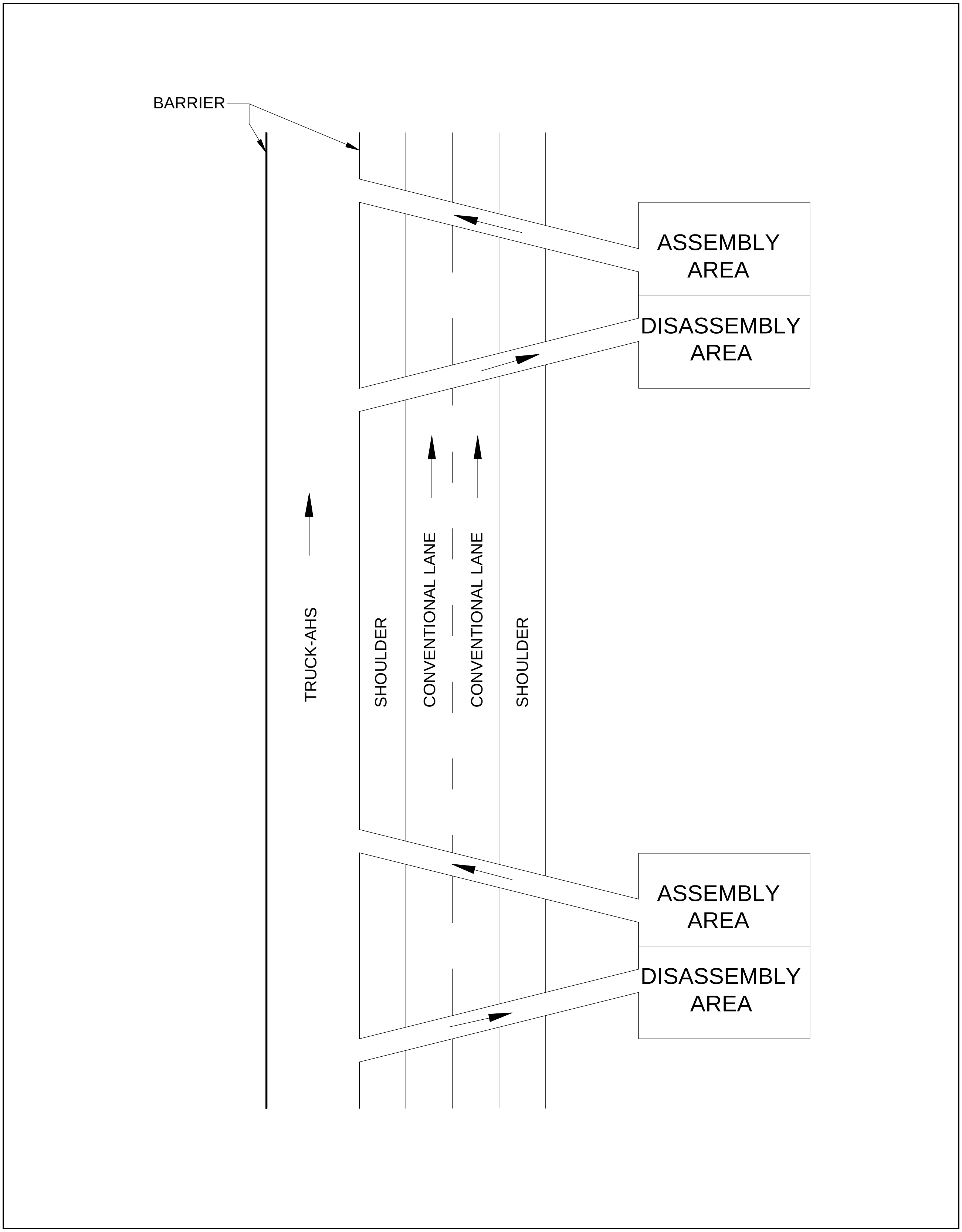

FIGURE 10.1 BASIC CONCEPT FOR TRUCK-AHS

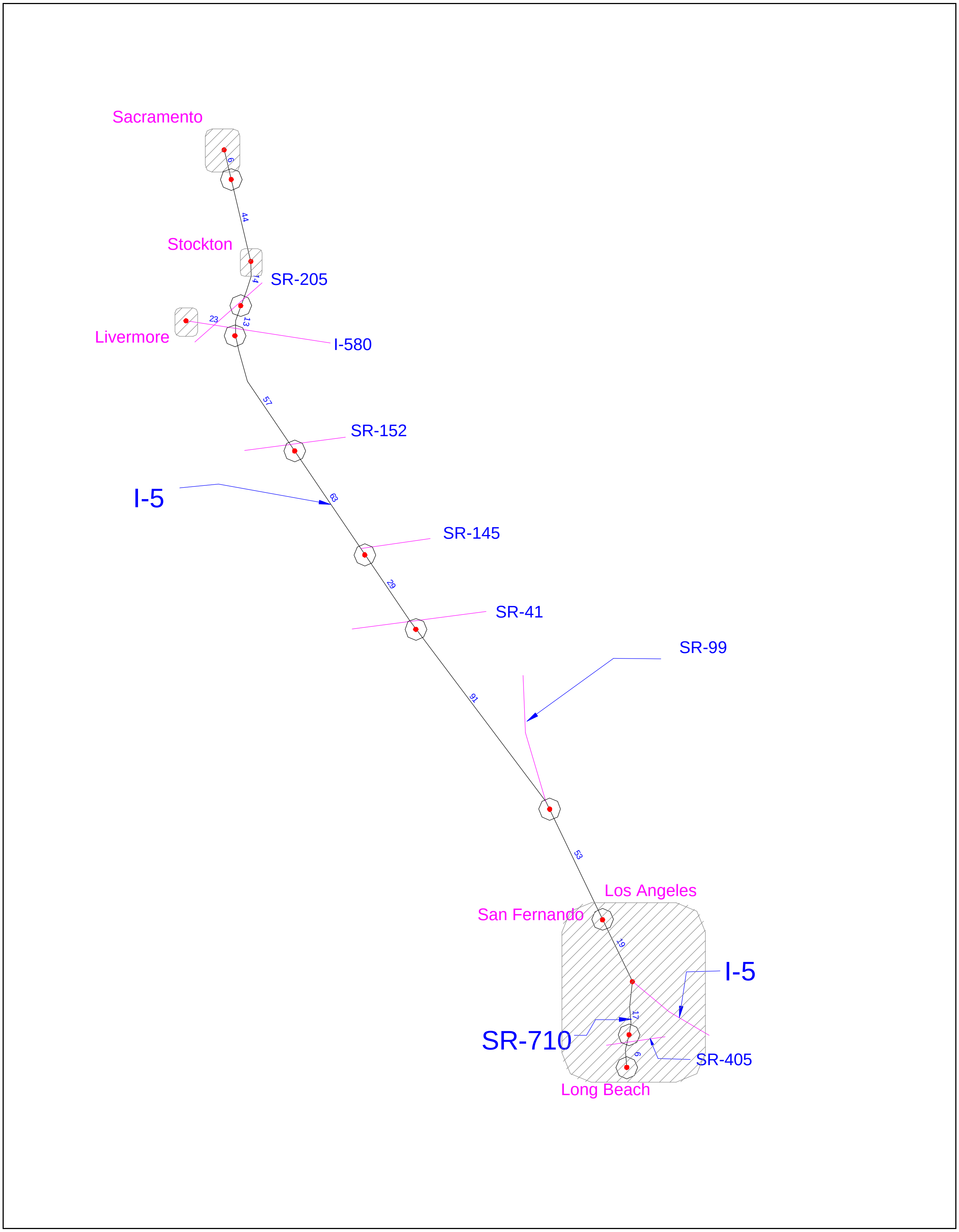

FIGURE 10.2 I-5, SR-710, AND ACCESS/EGRESS LOCATIONS

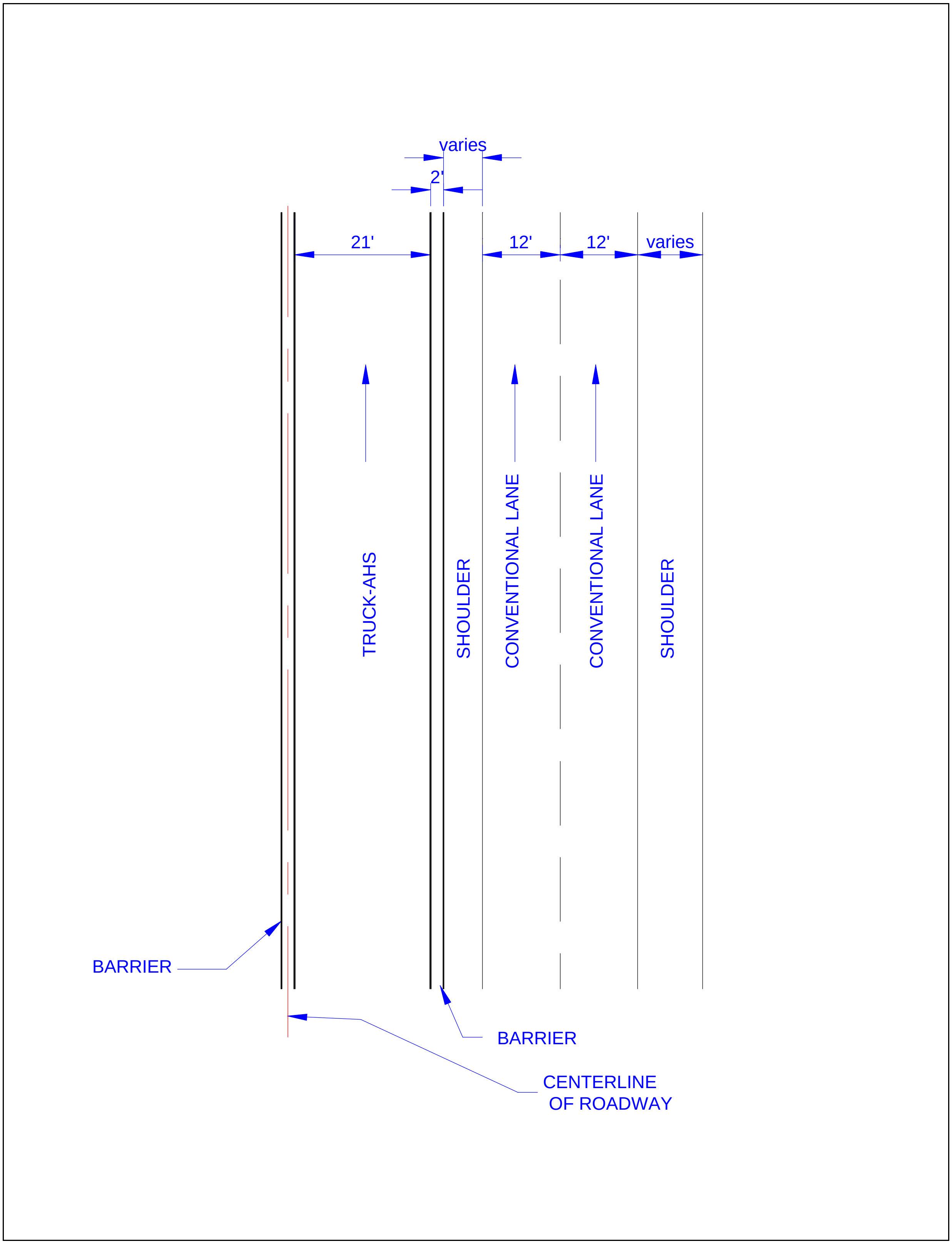

FIGURE 10.3 BASIC GEOMETRY FOR TRUCK-AHS CONFIGURATION

TABLE 10.1. TRAFFIC VOLUME ENTERING AHS

Terminal	Freeway	Interchange	Milepost	Daily Traffic				Terminal	Land
				Terminal	AHS Seg	Tot Trk	Tot Lrg Trk	Sq Ft	Cost
Long Beach	710	Del Almo	0	2000	2000	25490	16135	500,000	12,500,000
Commerce	710	5	11	2000	4000	20192	7924	500,000	12,500,000
Sylmar	5	Roxford	41	2000	6000	21551	16124	500,000	7,500,000
Wheeler Ridge	5	184	101.5	2000	4000	8120	6415	500,000	5,000,000
Lost Hills	5	46	159.6	500	4000	8990	6922	150,000	750,000
Coalinga	5	198	202.1	500	4000	8550	6669	150,000	750,000
Los Banos	5	152	269.8	1000	3500	9013	7490	275,000	1,375,000
Vernalis	5	580	313	2000	1500	3961	3204	500,000	2,500,000
Lathrop	5	Lathrop Rd.	331	500	1000	18130	14468	150,000	2,250,000
Sacramento	5	Freeport Blvd.	376	1000				275,000	4,125,000
		Total Terminal Traffic/day		13,500.00					
		Total Truck Trips/day		6,750.00					
		Total Truck Miles/day		1,401,400.00					
		Average Trip Length		208					

upon specific constraints in the area where the segment is located.

It should be noted that although it should be possible for automated vehicles to travel in lanes that are narrower than normally required because the tracking of the vehicle can be more tightly controlled using automating technology. However, when one vehicle must pass another, it would probably be accomplished manually (because magnetic strips will possible not allow for passing maneuvers). The 21-foot lane width used in this analysis only allows the sum of all clearances to be a maximum of four feet. This could be construed to allow for a clearance of one foot on the outside of the vehicles and two feet between them. It is not known at this time whether this allowance would be adequate for steering a truck-convoy consisting of three vehicles around a stalled truck-convoy; however, this could be investigated in future research.

10.3 AHS-Lane Section Characterization

The lane section characterization was carried out in the same manner as outlined in Section 9.2 except that the limitation on placing the extra road space in the center was more restrictive because of the greater space requirements. Consequently the road was divided into more sections. Appendix O shows the AHS segment characterization.

10.4 AHS-Lane Cost Calculations – Base Volume

10.4.1 AHS-Lane Planning, Design and Construction Costs

The planning, design and construction costs related to the AHS travel lane were generally determined in identical fashion to the methods used to calculate the corresponding costs for the added conventional freeway lane, except for the addition of some cost items. These additional cost items consist of the barriers to separate the AHS lanes from regular traffic, the magnetic strips necessary for guiding the automated vehicles, the interchanges required to access the road from the transfer terminals, and the construction of the transfer terminals themselves. Additional roadway surface is also necessary for the AHS option to account for the wider lane width (the AHS lane has a 48-foot cross section).

For sections where the AHS lane is placed within the median, it was assumed that a barrier would be placed on each side of the AHS lane. The total barrier-related costs amounted to $64,451,471. This is equivalent to an EUAC of $4,682,329 in 2001-dollars.

The cost of constructing the magnetic strips necessary for operating the automated vehicles were taken into account. According to Steven Shladover of PATH, the cost of these strips could amount to $5,000 per lane-mile. The EUAC for the construction of the magnetic strips, pavement, and barriers was found to be $228,896,732.

The cost of the interchanges were based on an estimate of the cost, provided by Caltrans and shown in Table 9.2, of an interchange for an arterial. For the purposes of this study, interchange costs were assumed to fall at the high end of each cost range shown in Table 9.2. The suburban interchange costs was assumed to be the average of the values for urban and rural interchanges. The appropriate inflator was applied to convert the cost to 2001 dollars. Table 10.2 shows interchange costs.

TABLE 10.2. INTERCHANGE CONSTRUCTION COSTS ($) - AHS AND DEDICATED LANE

Interchange	Interchange Type (Urban/Rural)	Unit Cost (1999)	Unit Cost (2001)	EUAC
		High	High	High
Long Beach	Suburban**	35,000,000	36,235,500	2,632,470
Commerce	Suburban**	35,000,000	36,235,500	2,632,470
Sylmar	Urban	50,000,000	51,765,000	3,760,671
Wheeler Ridge	Rural	20,000,000	20,706,000	1,504,268
Lost Hills	Rural	20,000,000	20,706,000	1,504,268
Coalinga	Rural	20,000,000	20,706,000	1,504,268
Los Banos	Rural	20,000,000	20,706,000	1,504,268
Vernalis	Rural	20,000,000	20,706,000	1,504,268
Lathrop	Rural	20,000,000	20,706,000	1,504,268
Sacramento	Rural	20,000,000	20,706,000	1,504,268
TOTAL			269,178,000	19,555,489

* Freeway costs in this study are assumed to correspond to the highest values in each range.

**Suburban values are an average of the rural and urban high values.

The cost of the transfer terminals, including terminal area requirements and costs for land and operational labor, were based on information provided by Professor Randolph Hall of the University of Southern California**.** The cost of providing the terminal surface was based on the same unit costs as used for the calculation of the road surface costs. Determining the cost of a terminal building was considered outside the scope of this project and a cost of $500,000 was assumed based on an assumption that the building would cost as much as a large house. The costs for individual terminals are shown in Table 10.3.

The incremental AHS lane planning, design, and construction costs amount to $228,896,732. Appendix O shows planning, design, and construction cost calculation tables.

10.4.2 AHS Rehabilitation Costs

The cost of rehabilitation for the AHS travel lane was calculated in the same way as presented for the addition of the conventional lane except that the surface is larger, and additional rehabilitation cost was incurred due to replacement of magnetic strips each time the roadway is rehabilitated. Additionally, the AHS system requires rehabilitation of the AHS interchanges and transfer terminals (staging areas).

It may be surmised that there should be a difference between the unit rehabilitation costs for the conventional lanes and the AHS lane because of the greater average per-axle weight of the vehicles in the AHS lane versus the conventional lanes. However, at the level of detail that this evaluation is being conducted, performing an analysis that would underscore the difference in cost was considered to be outside the scope of this study. For the additional cost of rehabilitation due to the presence of the magnetic strips, it is assumed that this would

TABLE 10.3. AHS TRANSFER TERMINAL CONSTRUCTION COSTS

Interchange	Freeway	Interchange Type (Urban/Rural)	Terminal Square Footage	Land Cost (2001 $)	Pavement Unit Cost* (2001 $ per Sq. Ft)	Pavement Cost ($)	Building Cost ($)	Total One-Time Cost ($)	EUATC ($)
Long Beach	SR-710	Suburban	500,000	12,500,000	48	23,844,515	500,000	36,844,515	2,674,912
Commerce	SR-710	Suburban	500,000	12,500,000	48	23,844,515	500,000	36,844,515	2,674,912
Sylmar	I-5	Urban	500,000	7,500,000	58	28,835,227	500,000	36,835,227	2,674,238
Wheeler Ridge	I-5	Rural	500,000	5,000,000	38	18,853,802	500,000	24,353,802	1,768,086
Lost Hills	I-5	Rural	150,000	750,000	38	5,656,141	500,000	6,906,141	501,386
Coalinga	I-5	Rural	150,000	750,000	38	5,656,141	500,000	6,906,141	501,386
Los Banos	I-5	Rural	275,000	1,375,000	38	10,369,591	500,000	12,244,591	888,957
Vernalis	I-5	Rural	500,000	2,500,000	38	18,853,802	500,000	21,853,802	1,586,586
Lathrop	I-5	Rural	150,000	2,250,000	38	5,656,141	500,000	8,406,141	610,286
Sacramento	I-5	Rural	275,000	4,125,000	38	10,369,591	500,000	14,994,591	1,088,607
TOTAL			3,500,000	49,250,000		151,939,467	5,000,000	206,189,467	14,969,355

*Pavement Unit Cost is the low value for rural or urban interchange construction unit cost depending upon where the interchange is located.

require full installation of new strips at each rehabilitation cycle. This would amount to an additional $5000 per lane mile in years 10 and 20 (as described in Section 9.3.2), at an equivalent uniform cost of $132,131.

For the additional costs of rehabilitating the interchanges, it was assumed that the ramp of each interchange is one mile in length (implying a two-mile interchange length that accounts for interchange lengths for both travel directions) and as wide as the AHS travel lane (21 feet). Costs were then calculated in the same fashion as for the added conventional lane. Table 10.4 shows interchange rehabilitation costs totaling $2,314,061 (EUAC).

TABLE 10.4. INTERCHANGE REHABILITATION COSTS - AHS AND DEDICATED LANE

Interchange	Interchange Type (Urban/Rural)	Unit Cost (2001-Equiv. $)	Length (mi)	Total Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
Long Beach	Suburban**	1,475,654	2	2,951,308	214,265
Commerce	Suburban**	1,475,654	2	2,951,308	214,265
Sylmar	Urban	1,278,900	2	2,557,800	185,696
Wheeler Ridge	Rural	1,672,408	2	3,344,815	242,834
Lost Hills	Rural	1,672,408	2	3,344,815	242,834
Coalinga	Rural	1,672,408	2	3,344,815	242,834
Los Banos	Rural	1,672,408	2	3,344,815	242,834
Vernalis	Rural	1,672,408	2	3,344,815	242,834
Lathrop	Rural	1,672,408	2	3,344,815	242,834
Sacramento	Rural	1,672,408	2	3,344,815	242,834
Total			20	31,874,123	2,314,061

For the additional costs associated with transfer terminal rehabilitation, a unit cost per square foot was calculated. This unit cost, shown in Table 10.5, was derived by dividing the rehabilitation costs per mile per foot width (shown in Table 9.4) by 5280 (the number of feet in a mile). This unit cost was then multiplied by the square footage of each terminal for a total cost, and an EUAC of $3,574,947 was obtained.

TABLE 10.5. AHS TERMINAL REHABILITATION COSTS

Interchange	Interchange Type (Urban/Rural)	Pavement Unit Cost* (2001-Equiv. $ per Sq. Ft)	Terminal Square Footage	Total Cost (2001-Equiv. $)	EUAC
Long Beach	Suburban	13	500,000	6,654,283	483,101
Commerce	Suburban	13	500,000	6,654,283	483,101
Sylmar	Urban	12	500,000	5,767,045	418,688
Wheeler Ridge	Rural	15	500,000	7,541,521	547,514
Lost Hills	Rural	15	150,000	2,262,456	164,254
Coalinga	Rural	15	150,000	2,262,456	164,254
Los Banos	Rural	15	275,000	4,147,837	301,133
Vernalis	Rural	15	500,000	7,541,521	547,514
Lathrop	Rural	15	150,000	2,262,456	164,254
Sacramento	Rural	15	275,000	4,147,837	301,133
Total			3,500,000	49,241,696	3,574,947

Appendix O shows rehabilitation cost-calculation tables.

10.4.3 AHS Maintenance Costs

Maintenance costs for the AHS lanes were calculated in the same way as they were for the added conventional lane, based on square footage. This resulted in a total lane maintenance cost of $102,045 in 2001-equivalent EUAC.

Interchange and staging area maintenance costs for the AHS system were also calculated based on square footage. An interchange was assumed to be 2 miles long and have the same width as the AHS roadway**.** Square footages for the transfer terminals (staging areas) in the study system were given by Professor Randolph Hall of the University of Southern California, and appear in Table 10.5. A unit cost of $0.003 per square foot was applied, to yield a total 2001-equivalent EUAC of $11,428 for staging-area maintenance.

Table 10.6 summarizes maintenance costs for the AHS system.

TABLE 10.6. SUMMARY OF AHS MAINTENANCE COSTS

Cost Category	EUAC (2001-Equiv. $)
Travel Lane	86,479
Interchange	4,138
Staging Area	11,428
TOTAL	102,045

10.4.4 AHS-System Administration and Operating Costs

As discussed in Section 8.3.3, the only administrative and system-related operating costs considered were the costs for transfer-terminal operations. Table 10.7 shows AHS transfer terminal operating costs, which were provided by Professor Randolph Hall of the University of Southern California. Appendix N, also authored by Professor Hall, shows supporting tables and discusses calculation procedures.

10.4.5 AHS Vehicle Operating Costs

For the purpose of calculating vehicle operating costs, the same general procedure as used for the adding of the conventional lane was used with some exceptions.

The calculations were conducted separately for the AHS lane and the remaining lanes. As stated in Section 9.3.5, the 2001-equivalent per-mile unit cost for truck operation was $1.77 (including $0.41 for driver wages and benefits and $0.11 for fuel). However, it was assumed for the AHS that a convoy of three trucks would be used and only one driver per convoy was necessary. Thus, the driver cost would amount to one-third of that of trucks not operating on the automated configuration. In addition, it has been estimated that the fuel cost

TABLE 10.7. AHS TRANSFER TERMINAL OPERATIONS COSTS

Interchange	Freeway	Interchange Type (Urban/Rural)	Required Daily Staff	Labor Cost ($/day)	EUAC (2001-Equiv. $)
Long Beach	SR-710	Suburban	50	10,000	726
Commerce	SR-710	Suburban	50	10,000	726
Sylmar	I-5	Urban	50	10,000	726
Wheeler Ridge	I-5	Rural	50	10,000	726
Lost Hills	I-5	Rural	15	3,000	218
Coalinga	I-5	Rural	15	3,000	218
Los Banos	I-5	Rural	25	5,000	363
Vernalis	I-5	Rural	50	10,000	726
Lathrop	I-5	Rural	15	3,000	218
Sacramento	I-5	Rural	25	5,000	363
TOTAL					5,013

would decrease because of convoy-related decreases in wind drag. The reduction that was used for this report amounts to 15 percent. This percentage is based upon research conducted within the PROMOTE-CHAUFFER project (5). The fuel-consumption reduction of two heavy-duty trucks driving at close spacing amounted to 6 percent for the lead truck and 17 to 21 percent for the trailing truck. Given the assumption that three-truck convoys would be used, a weighted average of these values resulted in a fuel reduction of about 15 percent – the value used for this evaluation. The cost for truck operation on the AHS lane, then, amounted to $1.48 after reductions in costs to account for fewer drivers and fuel savings. Appendix P shows itemization of vehicle operating cost elements for the AHS.

Also, each vehicle using the AHS system must be outfitted with automating technology. These costs were not identified in this study because of the high degree of uncertainty involved in the cost calculations. The cost-per-truck for technology outfitting is currently estimated to range from $5,000 to $25,000 per vehicle, depending on the novelty of the technology and the number of vehicles outfitted. At the present time, it would be difficult to estimate the number of individual trucks that would be using the system (one outfitted truck could potentially use the system several times), including the number of trucks outfitted by each trucking company – a factor which could cause considerable variation in automating technology costs (as bulk-buying might bring costs down). For future study, it should be assumed that the automating technology is purchased initially, and replaced when the host truck is replaced. Costs for technology, then, would be dependent on fleet size and replacement frequency.

The tables showing the calculations for the vehicle operating costs for the added lane are presented in Appendix P. A summary of vehicle-miles of travel for each daily period is shown in Table 10.8. A cost summary is provided in Table 10.9. It should be noted that the additional distance added for trucks to access the AHS lane at the specified points, as opposed to at every existing interchange on the study segment, and related transfer costs were not considered in the cost calculations.

TABLE 10.8. SUMMARY OF DAILY VEHICLE MILES FOR AHS-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	1,281,866	5,588,784
	Nighttime Off-Peak	263,637	913,331
	Daytime Off-Peak	1,087,968	5,217,993
TOTAL		2,633,471	11,720,109
AHS Lane - Base Volume	Peak Period	372,928	0
	Nighttime Off-Peak	88,740	0
	Daytime Off-Peak	290,720	0
TOTAL		752,388	0
Remaining Conventional Lanes	Peak Period	908,725	5,586,341
	Nighttime Off-Peak	174,898	913,331
	Daytime Off-Peak	797,461	5,220,436
TOTAL		1,881,084	11,720,109

10.4.6 AHS-User Costs

The AHS user costs were calculated in a similar fashion as was done for the addition of the conventional lane. Table 10.10 shows a summary of daily vehicle-hours, and Table 10.11 shows AHS user costs. The exceptions were that the speed for trucks was assumed to be 70 mph for the AHS lane, and that time costs were only considered for one-third of the drivers in the AHS lane. This figure is arbitrary, but the assumption was made that these trucks would be capable of this speed, and that the operating companies would desire them to travel at high speeds. It should be noted that applying the full time cost for a truck passenger of $28.27 probably would involve some double-counting, considering that the driver cost has already been applied in the previous section; however, it would involve a major effort to be able to find the incremental time-related costs, and this is considered outside the scope of this project. Therefore, the time cost of $28.27 was applied to get some estimate of what any time-related benefits might be. It should be also kept in mind that time-related costs for the vehicles are not included, and this may offset some possible double counting. It should be noted that, in the case of the AHS lane user costs, the total cost was found by multiplying the vehicle-hours by the unit cost and dividing by three, thereby accounting for this study’s assumption that each convoy requires only one driver. Appendix P shows the calculation tables.

10.5 AHS-Cost Summaries

A summary of the costs calculations for the AHS is shown in Table 10.12. From the table it can be seen that the travel-time savings do not offset the costs for adding the lane.

TABLE 10.9. VEHICLE OPERATING COSTS AND COST DIFFERENCES (AHS-LANE CONFIGURATION VERSUS BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Miles		2001-Equiv. Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	2,633,471	11,720,109	1.77	0.325	4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488
AHS Lane - Base Volume	752,388	0	1.48	0	1,112,031	0	405,891,260	0	405,891,260
Remaining Conventional Lanes	1,881,084	11,720,109	1.77	0.325	3,322,014	3,809,035	1,212,535,157	1,390,297,906	2,602,833,064
Total - AHS and Conventional Lanes	2,633,471	11,720,109			4,434,045	3,809,035	1,618,426,417	1,390,297,906	3,008,724,324
Cost Difference					-216,694	0	-79,093,165	0	-79,093,165

TABLE 10.10. SUMMARY OF DAILY VEHICLE HOURS FOR AHS-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	25,637	94,944
	Nighttime Off-Peak	5,273	14,690
	Daytime Off-Peak	21,759	87,652
TOTAL		52,669	197,286
AHS Lane - Base Volume	Peak Period	5,328	0
	Nighttime Off-Peak	1,268	0
	Daytime Off-Peak	4,153	0
TOTAL		10,748	0
Remaining Conventional Lanes	Peak Period	18,175	93,926
	Nighttime Off-Peak	3,498	14,690
	Daytime Off-Peak	15,949	87,696
TOTAL		37,622	196,312

TABLE 10.11. TRAVEL TIME COSTS AND COST DIFFERENCES (AHS-LANE CONFIGURATION VERSUS BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Hours		2001-Equiv. Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	52,669	197,286	28.27	9.16	1,489,196	1,806,253	543,556,672	659,282,458	1,202,839,130
AHS - Base Volume	10,748	0	28.27	0	101,301	0	36,975,030	0	36,975,030
Remaining Conventional Lanes	37,622	196,312	28.27	9.16	1,063,730	1,797,337	388,261,545	656,027,844	1,044,289,389
Total - AHS and Conventional Lanes	48,370	196,312			1,165,032	1,797,337	425,236,575	656,027,844	1,081,264,419
Cost Difference					-324,165	-8,917	-118,320,097	-3,254,614	-121,574,711

TABLE 10.12. INCREMENTAL COST SUMMARY FOR ADDED-AHS-LANE CONFIGURATION AT BASE VOLUMES

Cost Increments	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	263,421,576
Rehabilitation	19,381,065
System Maintenance	102,045
System Operating	5,013
Vehicle Operating	-79,093,165
Travel Time	-121,574,711
Total Incremental Cost	82,241,825

10.6 References

1. *A Policy of the Geometric Design of Highways and Streets.* AASHTO. 2001
2. Caltrans Standard Plans. Online. July 1999. <http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/stdplns-met-new99.htm>
3. Caltrans Cost Data Information. Online. 2001. <http://www.dot.ca.gov/hq/esc/oe/awards/>
4. "Economic Analysis of Transportation Investments and Economic Development." Transportation Research Record 984. Transportation Research Board, National Research Council. 1984.
5. Bonnet, C., Fritz, H. "Fuel Consumption Reduction Experienced by Two Promote-Chauffeur Trucks in Electronic Towbar Operation." ITS World Congress 2000. Torino, Italy.

11 DEDICATED TRUCK LANE COSTS

11.1 Dedicated Truck Lane Operating Concept

An overview of the basic operating concept was provided in Section 8.2.4. Key points of the dedicated truck lane operating concepts are as follows:

- The dedicated truck lane system includes one lane in each direction, with provision for passing a stalled vehicle at reduced speeds.
- The dedicated truck lanes provide exclusive right-of-way to trucks operated manually, and are separated from regular traffic lanes and opposing dedicated truck lanes by physical barriers.
- Convoying does not occur.

In the case of dedicated truck lanes, the system was assumed to operate the same way as the AHS lane with regard to access points and truck volumes. The truck volumes using the dedicated lane will probably be different from those using the AHS lane, but the extent to which they differ is considered to outside the scope of this study. They are assumed to be identical here. A basic operating concept for the dedicated truck lane in the median is shown in Figure 11.1.

11.2 Dedicated Truck Lane Cross Section

The width of the dedicated truck lane was assumed to be identical to that identified for the AHS system, as discussed in Section 10.2. Figure 11.2 provides a schematic layout for the dedicated truck lane when it is placed in the median. As for the AHS and added conventional lane, the non-median alignment is not shown here because there are multiple possibilities (e.g. – elevated structure, underground right-of-way, or parallel right-of-way) that are possible when the system is placed outside the median.

11.3 Dedicated Truck Lane Section Characterization

The lane section characterization was carried out in the same manner as outlined in Section 9.2, except that (like the AHS) the limitation on placing the extra road space in the center was more restrictive because of the greater space requirements. Consequently the road was divided into more sections. Since AHS and dedicated-truck-land widths are both 48 feet**,** the segments given in Appendix O apply to the dedicated truck lane as well. The segmentations are shown in Appendix Q.

11.4 Dedicated Truck Lane Cost Calculations – Base Volume

11.4.1 Dedicated Truck Lane Planning, Design and Construction Costs

The planning, design and construction costs related to the dedicated truck lane were generally determined in identical fashion to the methods used to calculate the corresponding costs for

AHS lane planning, design, and construction, less the costs of the magnetic strips necessary for guiding the automated vehicles and the construction of the transfer terminals. It is assumed for this study that access to the dedicated truck lane is provided from local streets and highways using access/egress interchanges, but without staging areas.

The total incremental dedicated truck lane planning, design, and construction costs (including interchanges) amounted to an EUAC of $248,300,381 and are shown in Table 11.1. Appendix Q shows calculation tables.

11.4.2 Dedicated Truck Lane Rehabilitation Costs

Since the cross-sectional widths for the AHS and Dedicated-Truck-Lane options are identical, most costs are identical. The cost of rehabilitation was calculated in the same way as presented for the addition of the AHS lanes, less the cost of rehabilitating transfer terminals and replacing magnetic strips used for automation. Rehabilitation costs associated with the dedicated truck lane amounted to $15,673,987 in 2001-EUAC dollars and are shown in Table 11.1.

11.4.3 Dedicated Truck Lane Maintenance Costs

The maintenance costs were also calculated in an identical fashion as was done for the addition of the AHS lane except, again, less the cost of maintaining transfer terminals. Table 11.2 shows the related maintenance costs, which sum to $90,617 in 2001-EUAC dollars.

11.4.4 Dedicated Truck Lane System Administration and Operating Costs

Although it is likely that a dedicated-truck-lane system would incur more administrative costs than a conventional system (and perhaps more or less than an AHS system), the estimation of the difference in cost is outside the scope of this study. For this reason, costs for administration and operation of the dedicated truck lane are not included here.

11.4.5 Dedicated Truck Lane Vehicle Operating Costs

For the purpose of calculating vehicle operating costs, the same general procedure as used for the adding of the conventional lane was used. Table 11.3 shows a summary for daily vehicle-miles for the dedicated truck lane, and Table 11.4 shows vehicle operating costs. Appendix R shows supporting tables.

11.4.6 Dedicated Truck Lane User Costs

The user travel-time costs for all vehicles (those using the normal and dedicated lanes) were calculated in a similar fashion as was done for the addition of the conventional lane. Table 11.5 summarizes daily vehicle-hours for the dedicated truck lane, and Table 11.6 shows annual travel time costs for the base condition, the dedicated lane, and for the non-dedicated conventional lanes, and itemized according to vehicle type. Table 11.6 also shows the total

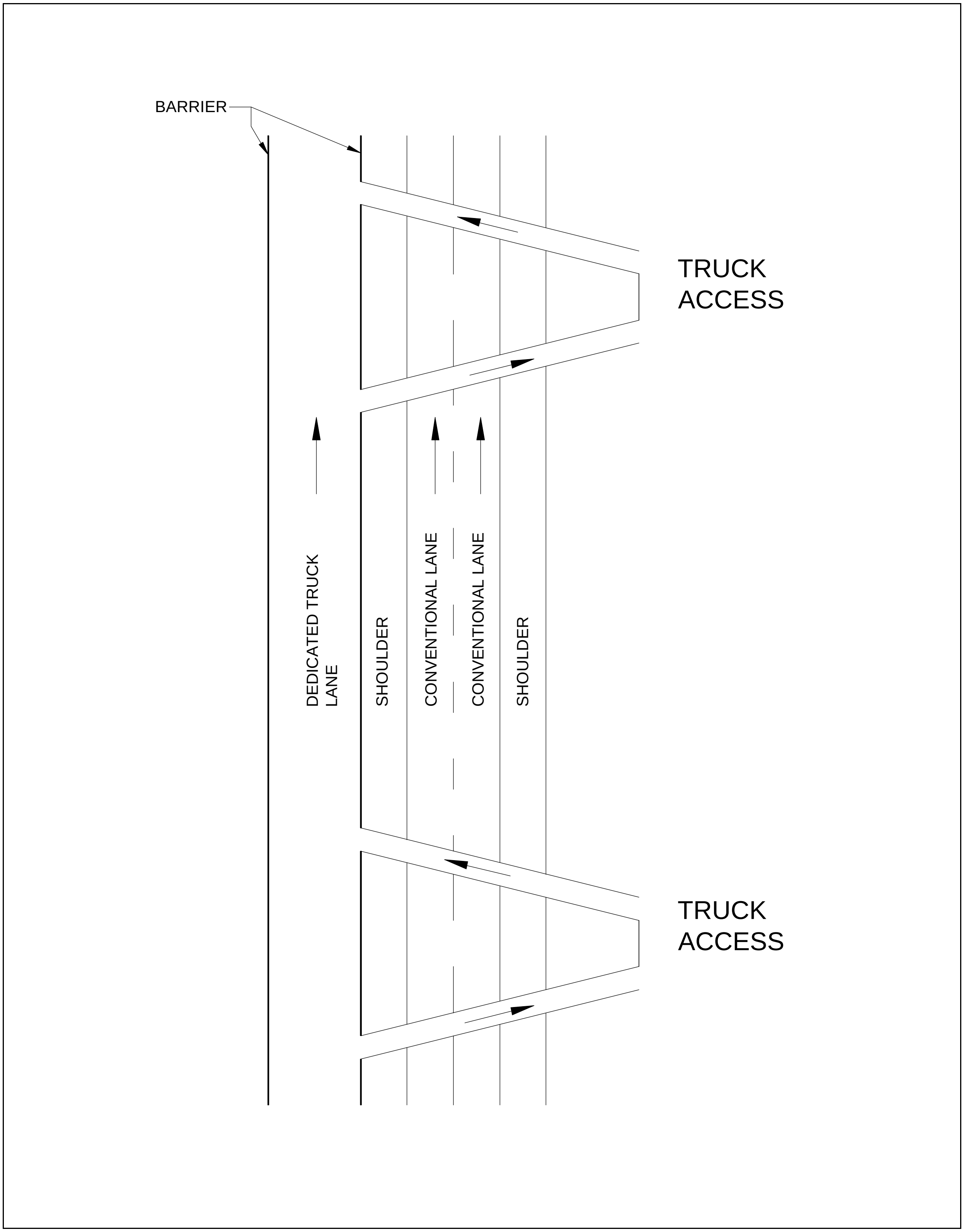

FIGURE 11.1 BASIC CONCEPT FOR DEDICATED TRUCK LANE

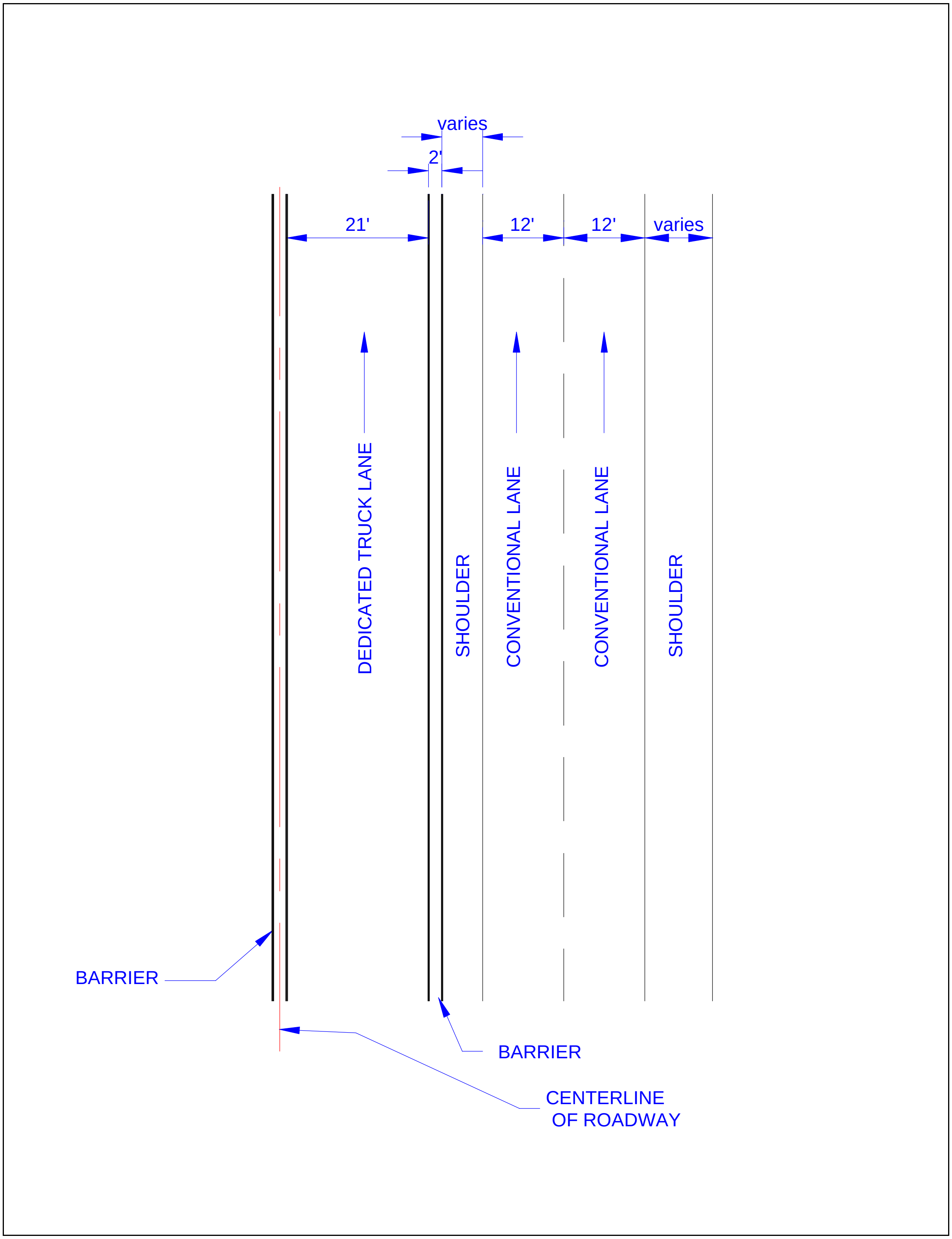

FIGURE 11.2 BASIC GEOMETRY FOR DEDICATED-TRUCK-LANE CONFIGURATION

annual cost difference between the added lane configuration and the base condition. Appendix R shows supporting tables.

TABLE 11.1 INCREMENTAL COST SUMMARY FOR DEDICATED-TRUCK-LANE CONFIGURATION AT BASE VOLUMES

Cost Increments	Incremental Cost (20014-Equiv. EUAC)
System Administration, Planning, Design and Construction	248,300,381
Rehabilitation	15,673,987
System Maintenance	90,617
Vehicle Operating Cost	0
Travel Time	-3,254,614
Total Incremental Cost	260,810,372

TABLE 11.2. SUMMARY OF DEDICATED-TRUCK-LANE MAINTENANCE COSTS

Cost Category	2001-Equiv. EUAC
Travel Lane	86,479
Interchange	4,138
TOTAL	90,617

TABLE 11.3. SUMMARY OF DAILY VEHICLE MILES FOR DEDICATED-TRUCK-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	1,281,866	5,588,784
	Nighttime Off-Peak	263,637	913,331
	Daytime Off-Peak	1,087,968	5,217,993
TOTAL		2,633,471	11,720,109
Dedicated Truck Lane - Base Volume	Peak Period	372,928	0
	Nighttime Off-Peak	88,740	0
	Daytime Off-Peak	290,720	0
TOTAL		752,388	0
Remaining Conventional Lanes	Peak Period	908,725	5,586,341
	Nighttime Off-Peak	174,898	913,331
	Daytime Off-Peak	797,461	5,220,436
TOTAL		1,881,084	11,720,109

TABLE 11.4. VEHICLE OPERATING COSTS AND COST DIFFERENCES (DEDICATED-TRUCK-LANE CONFIGURATION VERSUS BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	2,633,471	11,720,109	1.77	0.325	4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488
Dedicated Lane - Base Volume	752,388	0	1.77	0.00	1,328,724	0	484,984,425	0	484,984,425
Remaining Conventional Lanes	1,881,084	11,720,109	1.77	0.325	3,322,014	3,809,035	1,212,535,157	1,390,297,906	2,602,833,064
Total - Dedicated Lane and Conventional Lanes	2,633,471	11,720,109			4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488
Cost Difference					0	0	0	0	0

TABLE 11.5. SUMMARY OF DAILY VEHICLE HOURS FOR DEDICATED-TRUCK-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	25,637	94,944
	Nighttime Off-Peak	5,273	14,690
	Daytime Off-Peak	21,759	87,652
TOTAL		52,669	197,286
Dedicated Truck Lane - Base Volume	Peak Period	7,459	0
	Nighttime Off-Peak	1,775	0
	Daytime Off-Peak	5,814	0
TOTAL		15,048	0
Remaining Conventional Lanes	Peak Period	18,175	93,926
	Nighttime Off-Peak	3,498	14,690
	Daytime Off-Peak	15,949	87,696
TOTAL		37,622	196,312

TABLE 11.6. TRAVEL TIME COSTS AND COST DIFFERENCES (DEDICATED-TRUCK-LANE CONFIGURATION VERSUS BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	52,669	197,286	28.27	9.16	1,489,196	1,806,253	543,556,672	659,282,458	1,202,839,130
Dedicated Lane - Base Volume	15,048	0	28.27	0.00	425,466	0	155,295,127	0	155,295,127
Remaining Conventional Lanes	37,622	196,312	28.27	9.16	1,063,730	1,797,337	388,261,545	656,027,844	1,044,289,389
Total - Dedicated and Conventional Lanes	52,669	196,312			1,489,196	1,797,337	543,556,672	656,027,844	1,199,584,516
Cost Difference					0	-8,917	0	-3,254,614	-3,254,614

11.5 Dedicated Truck Lane Cost Summaries

Table 11.1 shows cost summaries for the addition of dedicated lanes. The results show that the savings in vehicle operating costs and travel-time costs do not offset the costs of adding the lane.

12 EVALUATION OF VARIOUS TRAFFIC VOLUMES ON COSTS OF ROAD-BASED FREIGHT OPTIONS

In order to determine the effect of various volume levels on the relative costs associated with building and operating the three systems under study here (added conventional freeway lane, AHS, and dedicated truck lane), the road sections were sorted according to the passenger car per hour per lane (pcphpl) flow rates. The sections were then divided at a flow rate of 1000 and 2000 pcphpl, respectively. This resulted in having sections of road that represented flow rates designated as follows:

"low" – flow rates between zero and 1000
"medium" – flow rates between 1000 and 2000
"high" – flow rates between 2000 and 2500.

Although the sections of roadway in each of the categories were not contiguous, the result could be thought of as a simulated road section that is based on existing roadway conditions. The sections were sorted according to the existing roadway and base (existing) volumes and grouped together using the categories shown above. All ensuing calculations were based on these same sections – even though flow rates for individual sections may have changed after addition of extra lanes. The AHS transfer terminals were allocated to the physical sections with which they are associated geographically.

The procedures followed to calculate the costs were identical to the methodologies outlined in Sections 9 through 11. A summary of the costs for all categories are shown in Tables 12.1 though 12.3. Some details of the calculations are shown in Appendices S through X, and the intermediate calculation and summary tables are contained in Appendix Y.

From the results shown in Tables 12.1 through 12.3, it can be seen that the reduction in user costs for the AHS-truck option exceeds the agency costs for the low-volume road option, indicating that the addition of the AHS lane may be beneficial for a low-volume road condition.

TABLE 12.1. SUMMARY OF ANNUAL COSTS FOR CONVENTIONAL LANE – BASED ON VOLUME

Category	Cost Category	Incremental Cost (2001-Equiv. $)					
		High Volume Road		Medium Volume Road		Low Volume Road	
		Incremental Cost (EUAC)	EUATC	Incremental Costs (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC
Agency	System Administration, Planning, Design and Construction	26,863,668	28,564,445	36,444,072	38,083,304	50,151,403	52,255,294
	Rehabilitation	1,692,657		1,618,982		2,045,782	
	System Maintenance	8,120		20,250		58,109	
User	Vehicle Operating	0	-10,831,041	0	-574,339	0	0
	Travel Time	-10,831,041		-574,339		0	
Total Incremental Cost		17,733,404	17,733,404	37,508,965	37,508,965	52,255,294	52,255,294

TABLE 12.2 SUMMARY OF COSTS FOR AHS LANE ($) - BASED ON VOLUME

Category	Cost Category	Incremental Cost (EUAC)					
		High Volume Road		Medium Volume Road		Low Volume Road	
		Incremental Cost (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC
Agency	System Administration, Planning, Design and Construction	67,072,902	71,839,702	89,355,273	95,060,455	106,993,402	116,009,543
	Rehabilitation	4,753,134		5,679,363		8,948,569	
	System Maintenance	12,213		24,511		65,321	
	System Operating	1,453		1,308		2,252	
User	Vehicle Operating	-7,960,958	-23,011,709	-10,621,093	-26,622,935	-60,511,113	-151,033,231
	Travel Time	-15,050,751		-16,001,842		-90,522,118	
Total Incremental Cost		48,827,992	48,827,992	68,437,520	68,437,520	-35,023,688	-35,023,688

TABLE 12.3. SUMMARY OF ANNUAL COSTS FOR DEDICATED TRUCK LANE - BASED ON VOLUME

Category	Cost Category	Incremental Costs (2001-Equiv. $)					
		High Volume Road		Medium Volume Road		Low Volume Road	
		Incremental Cost (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC
Agency	System Administration, Planning, Design and Construction	61,708,821	65,492,294	84,946,588	89,732,428	101,644,972	108,840,264
	Rehabilitation	3,774,525		4,764,349		7,135,113	
	System Maintenance	8,948		21,491		60,178	
User	Vehicle Operating	0	-3,141,488	0	-113,126	0	0
	Travel Time	-3,141,488		-113,126		0	
Total Incremental Cost		62,350,806	62,350,806	89,619,302	89,619,302	108,840,264	108,840,264

13 COST COMPARISON OF ROAD-BASED FREIGHT OPTIONS

A comparison of incremental costs among the different alternative lane additions for the whole road is shown in Table 13.1. It can be seen that the lowest total incremental cost is for the AHS lane, although the cost associated with constructing and operating the lane still exceeds the cost savings for users. In making this comparison, an attempt was made to make the systems functionally as equivalent as possible. The same number of vehicles travel over the same distances for all three system options; however, the level of service (LOS) may not be the same for all systems. Operating speeds differ, and access to the systems is not equivalent, because all trucks have access at any existing access point for the conventional system, whereas truck access to the dedicated lanes is restricted to the designated access/egress points.

TABLE 13.1. SUMMARY OF ANNUAL COSTS FOR ALL LANE TYPES - WHOLE ROAD

Category	Cost Category	Incremental Cost (2001-Equiv. $)					
		Added Conventional Lane		AHS Lane		Dedicated Lane	
		Incremental Cost (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC	Incremental Cost (EUAC)	EUATC
Agency	System Administration, Planning, Design and Construction	113,459,142	118,903,043	263,421,576	282,909,700	248,300,381	264,064,986
	Rehabilitation	5,357,421		19,381,065		15,673,987	
	System Maintenance	86,479		102,045		90,617	
	System Operating	0		5,013		0	
User	Vehicle Operating	0	-11,405,380	-79,093,165	-200,667,875	0	-3,254,614
	Travel Time	-11,405,380		-121,574,711		-3,254,614	
Total Incremental Cost		107,497,663	107,497,663	82,241,825	82,241,825	260,810,372	260,810,372

In Chapter 12, it was seen that addition of an AHS lane at low volumes (which generally occur in rural areas) was the only option where the decrease in user costs offsets the costs of constructing and operating the lane. This may be counterintuitive to an expectation that these types of lanes would be more attractive in urban congested areas. As stated in Chapter 12, the principal reason for this result was the fact that the infrastructure unit costs used in this report for non-urban areas were significantly lower than the costs associated with infrastructure in urban areas.

Direct total cost comparisons between the sets of alternatives, based on the whole road, and the segmentations, which are based on volume, are not appropriate. The reason for this is that the segmentations based on volume are shorter in length, and therefore not functionally equivalent to the whole-road alternatives. To gain some understanding of the performance of each alternative per unit of investment by the agency, the benefit-cost ratios were calculated. Table 13.2 shows these benefit-cost ratios for all categories of analysis. These ratios were calculated using the vehicle-operating and travel-time cost savings as benefits, and using all other costs as costs.

TABLE 13.2 BENEFIT-COST RATIO ANALYSIS FOR ALL CATEGORIES OF LANES

Category	Conventional Lane	AHS Lane	Dedicated Lane
Whole Road	0.096	0.709	0.012
High Volume	0.379	0.320	0.048
Medium Volume	0.015	0.280	0.001
Low Volume	0.000	1.302	0.000

It is important to note that the calculated b/c ratios shown in Table 13.2 cannot be interpreted to make a direct comparison among alternatives. If these alternatives were mutually exclusive, meaning that only one could be implemented in a specific location, then an incremental benefit-cost analysis would have had to be carried out. For instance, if more than one alternative had a b/c ratio of greater than one, then an incremental benefit-cost ratio would have had to be calculated to determine whether one alternative with a larger investment than another would have an incremental b/c ratio greater than one.

As expected, based on the results discussed above, only the AHS lane option at low volumes resulted in an incremental b/c ration greater than 1. It should be kept in mind that these results are based on a number of assumptions, calculations, and unit costs that can all be varied with good reason. For instance, a doubling of the unit cost for travel time would significantly affect the outcome. If construction costs turned out to be less than were assumed, and this was combined with other values for travel time, the b/c ratios could be significantly affected. In order to evaluate these effects, a sensitivity analysis should be undertaken. Such an analysis is considered to be outside the scope of this study. However, it should be noted that because the b/c ratios for the AHS lane especially are not that far removed from a value of one, that such variations in parameter values could very well result in b/c ratios with values greater than one.

It is also noteworthy that costs for acquisition of right-of-way were not considered as part of this study, except in reference to the land costs for the AHS transfer terminals, because of the difficulty of doing so. This was explained in Section 8.3.3 of this report. It should be noted, however, that costs for right-of-way could add considerably to the total system costs, especially in urban areas. Land acquisition costs would decrease the benefit-cost ratio of each system alternative, and could potentially affect the feasibility of the AHS low-volume scenario (the only alternative shown to be economically feasible by this study). When the systems are compared incrementally, addition of land acquisition costs would favor the addition-of-a-conventional-freeway-lane option, since it requires less width for implementation, and consequently less land.

As construction costs had a large influence over the outcome, dealing more specifically with the physical environment and the effects thereof on the construction costs, as well as developing more accurate unit costs and considering real estate costs for local circumstances, could also influence the results in a meaningful way.

It should be further noted that a number of assumptions regarding truck speeds and diversion to the dedicated lanes were made, and unit costs for truck operations were assumed to be constant, even with varying speeds. Different assumptions could influence the results significantly, although the advantage of the AHS over the other alternatives should remain. In addition, all results would be significantly influenced by the costs associated with an increase or reduction in accidents, which were not considered in this study. In addition, the use of unit costs that vary with speed could be used to quantify the effect of varying speed on vehicle operating costs. These topics should be addressed in future research.

14 INTERMODAL FREIGHT TRANSPORTATION COST COMPARISON

14.1 Introduction

A comparison between AHS-truck and intermodal rail transportation was also conducted. Unlike the AHS and Dedicated Truck Lane (DTL) alternatives presented previously in this report, costs for building, maintaining, and operating an intermodal rail freight transport system are not presented here. Obtaining cost data for intermodal rail for a particular route is difficult due to the proprietary nature of such data. This makes a comparison on the same basis as the comparison of the road-based alternatives impossible. It should also be noted that the comparison that follows is, in a sense, more similar to the comparison made for the transit alternatives than the freight options discussed in the previous sections. This means that the comparison is only between two modes, and does not address the economic feasibility of either one of the two options as discussed in this section of the report. What follows is a "cost" comparison based on shipping rates.

14.2 Cost vs. Pricing

It is important to make the distinction here between "costs" and "pricing." For the purposes of this research, which examines total societal-level costs for operating different trucking systems, the term "costs" refers to the overall economic costs for constructing, rehabilitating, operating, and maintaining a system such as the three proposed previously in this report.

As used here, the term "pricing" refers to the current market freight shipping rates for a particular mode. It should be noted that prices are not necessarily a reflection of costs for several reasons. The price could be lower or higher than the true costs depending upon the pricing strategy followed by a particular business. The business costs which the prices are predicated have been compiled according to accounting principles, and these costs are not necessarily reflections of the true economic costs. Moreover, the way that the cost of infrastructure is reflected in pricing of trucking services versus rail service might not reflect the true cost of the infrastructure for the respective modes. In the case of trucking, the recovery of the cost of providing the infrastructure may not fully occur through the taxes that are collected from the trucking companies. Therefore, the shipping rates presented may be lower than they should be, were they to reflect the actual costs of the infrastructure. In addition, it should be noted that taxes are excluded in an economic cost comparison, but are normally reflected in pricing strategies. It should also be noted that pricing values presented here do not reflect the difference in delivery time for trucking mode versus intermodal rail.

14.3 Cost Calculations

14.3.1 General Procedure

Rough calculations were made to determine costs for the comparison between the trucking and the intermodal rail shipping alternatives. The following general procedure was used to achieve the desired objectives:

1. Unit costs (in terms of dollars per revenue-mile) were calculated for the AHS and dedicated-truck-lane systems. These calculations were based on the costs and vehicle-miles reported in previous sections of this report.
2. Market-rate unit pricing rates (in terms of dollars per vehicle-mile) for freight shipping via truck and intermodal rail were obtained for relatively-short (less than 800 miles) and relatively long (greater than 800 miles) haul routes.
3. Unit pricing rates for AHS freight shipping were estimated (for both low- and high-mileage options).
4. Costs for the intermodal rail option were calculated based on the shipping rates (for both short- and long-haul options).

The reason for having low- and high-mileage options is explained in Section 14.3.2.

14.3.2 Estimations of AHS-Truck and Truck-on-Dedicated-Lane Unit Costs

Table 14.1 shows unit cost calculations for the AHS and dedicated-truck-lane systems. The costs were comprised of the (additional) costs of the AHS lane and the dedicated lane, respectively, less the time-related user costs. The reason for excluding the time-related costs were that differences in shipping times (for trucking and intermodal rail) were not considered in this part of the study. It is worth stressing that the unit costs for the AHS and dedicated truck lanes do not include the vehicle operations costs for those vehicles not operating on the dedicated lane. The unit costs were calculated by dividing the EUAC by the total annual vehicle-revenue-miles operated on the system.

TABLE 14.1. UNIT COSTS FOR AHS AND DEDICATED TRUCK LANES

TYPE	Total Cost in $ (Exc. Travel Time Cost)	Total Annual Veh-Rev-Mi	Unit Cost ($ per Veh-Rev-Mi)
AHS LANE	688,800,960	274,621,620	2.72
DEDICATED TRUCK LANE	749,049,410	274,621,620	2.73

14.3.3 Shipping Rates

Market-rate unit pricing rates were obtained from J. B. Hunt Transport, Inc., a shipping company that offers container-based truck and intermodal shipping. According to J.B. Hunt personnel, intermodal rail is, where available, generally the preferred shipping method for freight due to its relatively-low cost compared to comparable truck-based freight movement when the movement is longer than 800 miles. When the trip is less than 800 miles, truck freight movement is generally the more economical of the two alternatives. Consequently, regional movements are generally made by truck, and long-haul movements employ relatively more intermodal rail shipping. For the 418-mile study section presented in this analysis (extending from Long Beach to Sacramento), then, intermodal rail could be the less economically advantageous option when compared to shipping via truck.

As discussed earlier in this report, the analysis performed here would, ideally, compare intermodal and trucking rates along the same corridor. However, the shipping companies that were contacted for rate information did not offer intermodal shipping services between Sacramento and Long Beach. For this reason, the study section used for the previous parts of the study was not used as a base system for this part of the analysis. Rather, rates for freight transport via both trucking and intermodal rail were acquired for alternate routes for this portion of the analysis. In order to maintain the integrity of the comparison, routes were chosen where rates for shipping via both modes were available.

As previously mentioned, the study segment (with a length of 418 miles) is less than the ideal length for comparison of intermodal rail and truck freight shipping options because intermodal rail shipping is most cost-efficient when the shipping route is greater than 800 miles (according to J.B. Hunt Transport, Inc. personnel). For this reason, and also because the study section is less than 800 miles, two comparisons are made here to account for the substantial pricing differential for intermodal rail trip lengths below 800 miles and higher than 800 miles.

According to J.B. Hunt Transport, Inc. personnel, the rates for freight shipping exhibit a high degree of fluctuation with seasonality, with rates generally higher in the third and fourth quarters as retailers acquire stock for the winter holidays. The rates quoted here are shown as a range of values for this reason. The low values in each range represent first- and second-quarter rates, and the high values represent third- and fourth-quarter rates. It is a general trend that trucking rates are more subject to seasonal pricing fluctuations than rates associated with intermodal rail.

Four routes were identified where intermodal rail and trucking services were available. The identified routes with associated lengths are:

- Oakland, California to Los Angeles, California (375 miles)
- Los Angeles to Dallas, Texas (1350 miles)
- Los Angeles to Kansas City (1589 miles)
- Los Angeles to Elizabeth, New Jersey (2763 miles)

The rates quoted for all routes are in terms of cost per 53-foot trailer load per mile, hauling a weight up to approximately 45,000 pounds, and transporting non-perishable and non-fragile goods.

Table 14.2 shows rates and average rates for various trip lengths. Since only one data point was gathered for a less-than-800-mile trip, the average rates shown for the Oakland-to-Los Angeles trip are based on this one data point. For longer trip lengths, the average of the three data points that were obtained for long-haul shipping was used in subsequent calculations.

TABLE 14.2. RATES ($ PER MILE) FOR TRUCKING AND INTERMODAL RAIL FREIGHT SHIPPING ($)

Route	Route Mileage	Truck			Intermodal Rail		
		Low	High	Average	Low	High	Average
Oakland-to-Los Angeles	375	1.13	1.20	1.17	2.20	2.20	2.20
Los Angeles-to-Dallas	1350	1.25	1.75	1.50	1.15	1.20	1.18
Los Angeles-to-Kansas City	1589	1.05	1.50	1.28	0.95	1.00	0.98
Los Angeles-to-Elizabeth	2763	1.10	1.45	1.28	0.84	0.89	0.87
Average of Long-Distance Trips				1.35			1.01

As can be seen from Table 14.2, the rates associated with shipping via intermodal rail for a route comparable in length to the 418-mile study system route are substantially higher than trucking rates on the same route. However, for routes above 800 miles in length, intermodal rail rates are substantially less than trucking rates for identical routes. Both intermodal rail and truck shipping rates decrease substantially as haul lengths increase.

14.3.4 Estimation of AHS Shipping Rates

It was assumed that the shipping rates obtained were based on cost plus an allowance for profit. Given this assumption, it was further assumed that the following relationship held:

(AHS Rate)/(AHS Cost per Vehicle-Mile) = (Truck Shipping Rate)/(DTL Costs)

Based on the unit costs contained in Table 14.1 and the shipping rates contained in Table 14.2, the following relationship resulted for a shipping distance shorter than 800 miles:

(AHS Rate)/2.72 = 1.17/2.73

which implies that

AHS Rate = $1.16 per vehicle-mile

The AHS rate for the longer-haul option (greater than 800 miles) was calculated similarly. The rates are contained in Table 14.3 show the results for the low- and high-mileage scenarios, respectively.

TABLE 14.3. COSTS AND SHIPPING RATES BY MODE

Haul Type	Type	Intermodal Rail	AHS	Dedicated Truck Lane
Short Haul	Cost ($ per veh-mi)	5.15	2.72	2.73
	Shipping Rates ($ per veh-mi)	2.20	1.16	1.17
Long Haul	Cost ($ per veh-mi)	2.03	2.72	2.73
	Shipping Rates ($ per veh-mi)	1.01	1.35	1.35

It should be noted that the truck shipping rates are based on traffic conditions that may not be the same as those on the dedicated lane. Also, in the case of the dedicated lane, the full recovery of the cost of the infrastructure was allocated to the dedicated truck lane, while the full recovery of infrastructure costs is probably not reflected in the trucking rates.

14.3.5 Estimation of Intermodal Rail Unit Costs

Assuming a similar ratio between costs and shipping rates, as was used for trucking, the unit costs for intermodal rail were estimated. The following relationship was then assumed to hold:

$$\text{(Intermodal Rail Unit Cost)/(Intermodal Rail Shipping Rate)} = \text{(DTL Unit Costs)/(DTL Shipping Rate)}$$

The estimated unit cost for intermodal rail for a shipping distance less than 800 miles is, then,

$$\text{Intermodal Rail Unit Cost} = 2.20(2.73)/1.35 = \$2.03 \text{ per vehicle-mile}$$

The results of the calculations are shown in Table 14.3 for the short- and long-haul scenarios, respectively. It should be noted again that the true costs of infrastructure and operations for rail are probably not reflected in the shipping rates because of accounting procedures and the fact that rail infrastructure was created some time ago.

14.4 Intermodal Option Comparison

According to the results presented in Table 14.3, the unit costs for intermodal rail are the highest for the three study systems for short-haul shipping distances (shorter than 800 miles), and are lower for long-haul shipping distances (greater than 800 miles). The results also show that, for distances shorter than 800 miles, the cost of conventional trucking is very similar to that of AHS-truck. It could be surmised that, at very short distances, conventional truck costs would be less than the costs of AHS-truck because conventional trucking does not include costs associated with activity in transfer terminals. It could be further surmised that AHS-truck may become less costly than conventional trucking at longer distances because the cost of freight transfer will be spread over a longer travel distance. It should be noted, however, that the analysis conducted does not indicate at which distances one mode may become more advantageous than another.

It should be noted again, however, that these conclusions are based on simple assumptions that may not be true for a specific corridor. It is also important to remember that the cost allocation of infrastructure for rail is not the same as for trucking options. Based on the foregoing statements, it is unlikely that the estimates as produced in Table 14.3 are very accurate. However, because these values are not different by orders of magnitude, it probably implies that there could be a situation where shipping by AHS-truck could be an economical option as opposed to conventional trucking or intermodal rail.

15 ADDITIONAL IMPACTS

Any of the transportation systems analyzed in this report would have significant impacts in addition to the benefits and costs that have been estimated. Some of the important impacts are:

- Safety costs
- Air pollution, noise, and other environmental impacts
- Impact on land-use decisions, and the associated costs
- Service quality, comfort, and perceptions of personal safety, and their impacts on ridership for each system
- Impact on surrounding traffic and transportation systems

Safety considerations (i.e. – accident costs) may be the most significant unexplored cost for the three systems being compared here. Safety impacts were not included in this study, but as was pointed out in several places in the report, they would have a critical impact on the desirability and feasibility of implementing the automated systems. This would imply inclusion of costs of possible accidents in the economic comparison (i.e. – predicting accident frequency and severity, placing a monetary value on each type of accident, and calculating total equivalent annual costs of accidents). Predicting accidents related to the automated options would be difficult because the accident rates cannot be related to past experience, as is the case for the conventional alternatives. Accident costs could be a large cost item, and could influence the feasibility of a proposed project significantly. Also, the impact of the variation in the predicted accident rates would be significant and, therefore, a great deal of accuracy in the study of the safety costs would be required.

Reference has already been made regarding the issue of safe automated bus- and truck-convoy sizes. Assumptions were made about the possible size of these convoys, but these assumptions may prove to be inaccurate when such automated technologies are implemented and empirical data become available. There are also several other safety issues that could have an impact on the feasible configuration of an automated system. These include: safe minimum headways, stopping distances, etc.

Implementation of ABUS could result in greater noise pollution than a comparable light-rail system, but possibly less noise pollution than would be generated by conventional bus systems. The amount of pollution generated by ABUS would depend upon the degree to which smooth acceleration and deceleration could be maintained with automation. Light rail also has an advantage over bus systems with regard to air pollution in the urban setting where the project would be implemented. By replacing conventional bus engines with fuel-cell or hybrid engines, the impacts on air quality could become less for the bus systems, and consequently for the automated bus system as well. In the case of the freight systems, the difference among the truck and rail systems' air and noise pollution should be less significant, although that would depend on how much of the rail operation would be in an urban area. Notwithstanding the importance of the environmental impacts, it is difficult, given the current state of knowledge of air and noise pollution impacts, to accurately quantify the differences in impacts among the alternatives at a project level.

The impacts of each system on land use vary in scope from using available land (which could be used for other purposes) for the transit system to impacts on community and regional development. The latter is more relevant to the transit component of this report than to the trucking because a smaller portion of the freight system would be in an urban area. It would be difficult to quantify the impacts on regional and community development in a general sense, considering that the difference between the widest and narrowest widths for the transit systems amount to seven feet, and twenty-two feet for the trucking systems. While it is true that, in the case of the freeway, implementing projects in the available space in the freeway right-of-way (high-occupancy-vehicle lanes, for example) might yield some additional economic benefits for an option requiring a narrower right-of-way, the quantification of these benefits is beyond the scope of this study.

In regards to community- and regional-level land-use decisions and their relation to the transit system chosen, it may again reasonable to argue that one transit system may be better able than others to complement land-use strategies and fit the regional plans for transportation and land. However, quantification of transportation impacts on land-use decisions is excluded in this study. It should also be noted that two of the underlying specifications of this study were maintaining functional equivalence of all systems and holding demand constant for all the systems, and over time. This excluded consideration of changes in transportation demand because of the system and/or any land-use changes that are effected by the system.

The issue of service quality and its potential effects on choices among the transit alternatives were addressed in Chapter 7, and it was concluded that it could have an effect on the selection of an alternative. With regard to the freight options, the quality-of-service issue is harder to quantify. For the freight segment, this is unlikely to be a significant issue, since freight shipping via rail and truck are generally considered to be of similar quality, and diversion issues are more likely to be centered around cost.

The impact of the automated freight system on the remainder of the freeway lanes was accounted for in the cost comparisons; however, the impact beyond the freeway route itself (i.e. – on the corridor and on the surface collection and distribution systems) was not included in the comparison. This could be a significant issue in urban areas, and should be considered in further research.

Some reference is made in a previous section to the desirability of having “bunched” vehicles, such as light rail trains and bus convoys, on the intersections of the dedicated system. However, the effects of each system on surrounding vehicular, pedestrian, and bicycle traffic have not been included and should be considered in further research.

16 SOME ASPECTS OF STAKEHOLDER CONCERNS

16.1 Introduction

The various stakeholder viewpoints will be briefly discussed in this section. These viewpoints will of course be better articulated by the stakeholders themselves. Also, since the evaluation in this study was undertaken from the societal viewpoint, it does not take into account some of the economic and financial analysis that would have to be undertaken by the stakeholders to evaluate a proposal from their point of view. It should also be noted that it is not intended that this discussion of stakeholders' concerns would be exhaustive and that all subgroups' viewpoints would be represented.

16.2 Transit Systems

For the transit system, the major stakeholders are the transit-system users, the users of other transportation systems that could be affected, the taxpayers and the providers of the systems. The latter group ranges from the design professionals to the operators and administrators of the systems.

From the users' point of view, the introduction of an automated bus system could be viewed from different perspectives. If the automated system could be more easily introduced because of lower total costs and would result in greater access to potential users, they should be in favor of such a system. It is worth noting, again, that the total cost for a system, as presented in this study, does not include passenger fares. Based on the analysis contained in this report, however, it would not seem that the cost advantages of ABUS over a conventional bus could be sufficiently large to affect access. However, substitution of an automated bus system for a rail system could result in a loss of service quality because of the potentially smoother ride of a rail system, and because it could be viewed negatively by potential users.

As stated before, a convoy of buses could have less of an impact on the surrounding transportation system than a large volume of single buses using the same route. This would probably be true if the signal system were coordinated and possibly also in the absence of signal coordination (buses stopping to load and unload passengers interfere with street traffic).

The taxpayers would likely appreciate the introduction of an ABUS system that could reduce costs for public transportation at certain passenger volume levels. Also, because of the lower fixed cost (roadway construction etc.) as opposed to a rail system, would make the initial commitment to the introduction of ABUS easier. It would also make the abandonment of the system at a later date easier, especially if the road space could easily be converted to conventional road use.

Introduction of ABUS as opposed to a BDL system would result in fewer drivers, but would likely increase the complexity of both the design and operation of the system, which could have the consequence of having to develop and maintain expertise in more advanced system design and operation.

Safety would be a very important concern for all the stakeholders. Because of the unknown safety implications of the ABUS, it would likely mean that the system safety would have to be pre-proven and demonstrated before full-scale introduction. It will be essential to evaluate and enumerate the safety impacts and include that as part of the overall evaluation, as conducted in this study.

16.3 Freight Systems

The major stakeholders for the freight system are similar to those of the transit system, with an additional stakeholder group arising from competing freight companies who would not be able to use the implemented system and draw benefits from it. These additional stakeholder groups could include the truckers not using the AHS, intermodal rail as well as possible shippers that make use of air and water transportation. Trucking companies that would use the AHS, most likely because of cost advantages offered by such a system, could change their pricing strategies and consequently their competitive position relative to that of their competitors. In this respect, the way in which they would pay or not pay for the infrastructure would influence their cost and the concomitant effects.

The introduction of an AHS-Truck system would only be successful if the potential users would find it financially rewarding to outfit their vehicles for this purpose and be willing to pay any tolls that may be levied to pay for the construction, maintenance and operation of the infrastructure.

It is possible that the taxpayers, through the agency(ies) responsible for providing the infrastructure may find it worthwhile to provide the infrastructure without charging tolls if the safety benefits would offset the cost of the infrastructure. It is also conceivable that the agency may find it worthwhile to provide the infrastructure, in the absence of tolls, if the capacity could be more economically provided through an AHS system than otherwise. Providing this additional capacity would benefit all road users although not equally.

The AHS system would in many respects require additional functions to that currently practiced by road agencies. Operation of the infrastructure to make it serviceable and safe would require a degree of participation that exceeds that required for normal operation of roads or toll roads. Legal issues related to accidents will require serious consideration.

17 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A summary of the major conclusions and recommendations follows:

17.1 Transit Conclusions

viii. Based on the findings of this study, the Automated Busway System (ABUS) and Bus-on-Dedicated-Lane (BDL) system have been found to have substantially lower costs than a functionally-equivalent light rail system for relatively low passenger volumes (the same volumes were used for all systems). This analysis was based on the current passenger volumes served on the Santa Clara Valley Transit Authority (VTA) light rail system. The primary source of the difference comes from the relatively-high costs for planning, designing, and constructing the light rail system. There is some difference in the costs for vehicle operations among the three systems, with the ABUS favored and the BDL the least favored. Costs in the category of vehicle maintenance did not prove to be very different, while the light rail non-vehicle maintenance costs were higher than those for the bus systems. There is some difference among the costs for system administration, but this could be attributable to assumptions regarding the unit costs used for the calculations. The analysis indicates some differences in user wait-time costs (a subcategory of user costs), which favors the BDL system. It is noteworthy that all costs are a function of the specific project chosen as the base system, and a different base system might have yielded different costs. The results are also a function of the basis on which the calculations were carried out. Vehicle-hours and vehicle-miles of travel were used in many of the calculations, and a different basis could produce different results. It should be noted that the results of the analysis do not indicate that any of the systems that were studied are economically feasible. To determine feasibility, the transit alternatives should also be compared to a no-build condition, and an incremental analysis should be undertaken to determine the best transit alternative.

ix. To determine feasibility, these alternatives should also be compared with alternative uses of the space, such as providing lanes for mixed traffic. Note also that the base condition could be a condition without a transit alternative. Such an analysis should also consider the incremental costs over the base (i.e. – existing) condition.

x. For the base configuration at the relatively-low base volume levels, the overall costs of the ABUS scenarios were comparable to those of the non-automated BDL system. ABUS is the favored alternative in terms of infrastructure (due to narrower lanes) and driver-related vehicle operating costs (due to bus convoying). The advantage of the BDL system is primarily related to the shorter headways, and thus less wait time-related costs for passengers. The system administration costs for the BDL system were found to be less costly than the corresponding ABUS costs. Again, the latter may be due to assumptions. Given that individual cost items may vary from place to place, some or all of these differences may be insignificant.

xi. The analysis presented here does not attempt to quantify safety considerations as part of the evaluation of the systems. Due to the different natures of the ABUS, BDL, and light rail systems, it is possible that costs associated with safety could vary considerably among the alternatives. Such costs could include those related to accidents, infrastructure, and others. This study also does not attempt to quantify the differences in costs among the systems resulting from environmental factors, ridership and user diversion, or impact on the surrounding transportation systems. These types of costs could be substantial, and could alter the outcomes of the analysis and, consequently, the conclusions presented here.

xii. At relatively-small increases in passenger volumes, the BDL system would likely be the best-performing system, since it would still have the advantage over the other systems with regard to passenger wait time. At significantly-large volumes, the light rail system could be the preferred system. It would be capable of offering a larger capacity than the other systems, and probably at greater safety standards.

xiii. At moderate volume increases, when decreasing headways becomes a safety problem for the BDL system, the ABUS would have an advantage over the BDL system – largely due to proportionally-smaller driver-related vehicle-operating costs for the ABUS. It should again be noted that a major cost difference between the ABUS and BDL system is related to the system administration costs and, as noted previously, this difference could be smaller, and could result in the ABUS system being the preferred system at lower volumes (such as those volumes used as a basis for this report). At very low volumes and large headways, the advantage that the ABUS offers, i.e. – of not requiring drivers in all buses, would not be reasonable, since convoys would not be justified based on passenger volumes. Also, at intermediate volumes, the ABUS would have the advantage over the light rail system because it would have a cost advantage in all categories except for user costs (where they have equal costs) and fleet renewal, which was not included in this comparison because it was outside the comparison period. Inclusion of this cost would still favor the ABUS.

xiv. One advantage for bus systems, versus light rail, is that buses could enter a dedicated lane from a feeder route and thereby eliminate the need for passengers to transfer from a feeder bus line. This, in turn, could reduce costs associated with wait time. Another potential advantage (which was discussed only qualitatively in this study) is an increase in demand resulting from eliminating the need to transfer for some passengers. However, in the case of ABUS convoy formation, time would be lost due to having buses enter the automated system, drop off a driver, and form-up into a convoy, from which individual buses could split along the way to proceed to regular city streets. Without considering changes in demand, the transfer-time savings associated with this type of configuration could potentially outweigh the additional driver-related costs required to implement the system with this configuration. This would only be true, though, if few passengers would have to transfer to another bus because their destination would not match that of the bus on which they entered. These potential savings would also diminish when headways decrease (as a result of passenger-volume increases). Implementation of such an ABUS configuration would require a high level of system modification, administration, and coordination to operate properly, to maximize the efficiency of bus operators' time, to assure that a driver is on a bus when it leaves the main line, and to assure that passengers either board a bus bound for their destinations, or can transfer easily. In a configuration where automated or non-automated buses use the system without joining a convoy, there would be no time lost due to convoy formation or passenger transfers between buses.

xv. On-board travel time hours account for substantially more of the total user travel time than do wait time, so finding ways to decrease on-board travel time may be a more effective way to reduce travel-time costs. That could entail increasing the speed of operations on the system, which could require a better-protected right-of-way, and consequently, increased construction, rehabilitation, and maintenance costs. Also, at higher speeds, the issue of safety for the ABUS could become an issue of greater concern. This might not be favorable when comparing and ABUS versus a light rail or BDL system, and it may be construed that, for longer-distance commuting with greater distances between stations and increased cruising speeds, safety conditions may relatively favor the rail and BDL systems.

17.2 Transit Recommendations

i. As was stated at the beginning of this study, a conclusion could not be made whether an ABUS system would be economically feasible. In order to do this, the use of the space for means other than transit would first have to be investigated. Given the results of the study, a conclusion cannot be made that there would be obvious promise in creating an ABUS system. However, it could be beneficial to further investigate the effect of increased passenger volumes combined with different convey lengths. It is highly recommended that this analysis be conducted before additional funds are spent on further research or implementation of strategies involving automated buses in conveys.

ii. The extent to which bus convoys could be expanded would be a safety issue, whereas in the case of rail systems, it has been proven that long trains can be safely operated. The passenger volume at which light rail could become the favored option could then depend upon the safety issue, and not necessarily the economic criteria examined in this study and, therefore, further research into the level of safety that can be attained, as well as the economic operations thereof, should be conducted.

iii. The additional impacts of implementing the alternative systems should be further evaluated. Impacts such as noise and air pollution are hard to quantify, but some of the impacts of the implementation of the alternative systems on the surrounding street system could be quantified. The delay imparted to other vehicle traffic could be quantified and included in the economic analysis. The impacts on bicyclists and pedestrians are also important, but may be difficult to quantify.

iv. One of the assumptions used in this study was that passenger volumes would be the same for all three systems under study – at the base condition, and also under the configuration changes and passenger-volume increases discussed in this report. Changes in demand due to the attributes of each system could significantly alter the outcomes of the analysis, and the extent to which each system would attract users should be examined in future research.

v. Since the impact of rehabilitation and periodic maintenance of light rail systems beyond the 30-year assumed useful life of the systems was not investigated, definitive conclusions cannot be made regarding this issue. The issue of differing useful lives of the projects was identified early in this report, and should be addressed in subsequent research.

17.3 Freight Conclusions

i. The analysis presented for road-based freight options for the whole section of I-5 and SR-710 between Sacramento and Long Beach indicates that, based on current vehicle volumes, the reduction in user costs would not offset the increase in agency costs for any of the options (addition of a conventional lane, addition of an AHS lane, and addition of a dedicated truck lane). The AHS lane performed better than the other two alternatives primarily because of the decrease in vehicle operating and user costs. It should be noted that a number of assumptions regarding truck speeds and diversion to the dedicated lanes were made; different assumptions could influence the results significantly, although the advantage of the AHS over the other alternatives should remain. Construction costs had a large influence on the outcome. Dealing more specifically with the physical environment and the effects thereof on the construction costs, as well as developing more accurate unit costs and considering real estate costs for local circumstances, could also influence the results in a meaningful way. Additionally, accident costs were considered to be outside the scope of this study, and could affect the results significantly.

ii. An analysis based on a segmentation of the study section into low-, medium-, and high-volume sections indicates that, for a low-volume road, the agency costs were lower than the savings from user costs associated with the addition of an AHS at low volumes. This may appear to be counter-intuitive, but this result is a consequence of, among other factors, significantly-lower construction costs in rural areas, where passenger volumes are lower. Again, it should be noted that assumptions – especially regarding truck speeds, diversion, and unit costs – and the exclusion of accident and real estate costs, influenced those results significantly.

iii. Based on a different type of analysis (using shipping rates as a basis), it was found that the unit costs for intermodal rail were the highest for the three study systems for short-haul shipping distances (shorter than 800 miles), and the lowest for long-haul shipping distances (greater than 800 miles). The results of the analysis show that, for distances shorter than 800 miles, the cost of conventional trucking is very similar to that of AHS-truck. It could be surmised that, at very short distances, conventional truck costs would be less than the costs of AHS-truck because conventional trucking does not include costs associated with activity in transfer terminals. It could be further surmised that AHS-truck may become less costly than conventional trucking at longer distances because the cost of freight transfer will be spread over a longer travel distance. It should be noted, however, that the analysis conducted does not indicate at which distances one mode may become more advantageous than another.

17.4 Freight Recommendations

i. The analysis presented here for road-based freight indicates that, based on current vehicle volumes, the reduction in user costs did not offset the increase in agency costs for any of the options (addition of a conventional lane, addition of an AHS lane, and addition of a dedicated truck lane). The AHS lane performed better than the other two alternatives primarily because of the lower vehicle operating and user costs. It should be noted that different assumptions regarding truck speeds, diversion, and unit costs could influence the results significantly, although the advantage of the AHS over the other alternatives should remain. Construction costs had a large influence over the outcome. Dealing more specifically with the physical environment and the effects thereof on the construction costs, as well as developing more accurate unit costs and considering real estate costs for local circumstances, could also influence the results in a meaningful way. Additionally, accident costs were considered to be outside the scope of this study, and could affect the results significantly.

ii. It is recommended that an in-depth study be undertaken based on real costs to compare AHS-truck and intermodal rail; however, such a study should only be undertaken once a sensitivity analysis for the road-based freight alternatives has been undertaken. This should be done to ensure that AHS-truck is a viable option and that the envelope of constraints within which this would be true is established.

17.5 Overall Conclusions and Recommendations

It appears that there is some promise for automation of vehicles, as it was discussed in this report. In the case of the transit systems, there may be a niche for bus convoys serving intermediate passenger volumes. This niche could appear between the low-volume condition, where having non-automated buses operate in a dedicated lane might be the best alternative of those presented here, and a high-volume condition, where a light-rail system could be the best alternative. In the case of the freight transportation system, there is an indication that automation of trucks, and operation of them in convoys, holds promise. For both transit and freight automation, however, safety costs could affect the economic feasibility significantly.

It is recommended that this evaluation be continued and refined. Refining the costs and some other aspects of the analysis would not only make the analysis more definitive, but could also indicate where the most gains could be made through further development of automation. Possible benefits due to optimization of convoy sizes, development of different types of vehicles or roadways, and access, could be ascertained. It should be kept in mind that a benefit-cost analysis encompasses almost all aspects of the system, including design and operation. The amount spent to produce the analysis contained in this report is very modest compared to the funds that would be expended on the remainder of research, construction, and operation of transportation systems such as those in this report. Investing more resources in the study of the feasibility of the overall design and operation, both in concept and in the economic feasibility thereof, could lead to better decisions regarding how to spend finite funds for specific research and development of automation.

18 ACKNOWLEDGEMENTS

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Evaluation of Truck and Bus Automation Scenarios: Benefit-Cost Analysis

Volume 2

Appendices A Through J

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APPENDIX A

LIGHT RAIL, ABUS, AND BDL SYSTEM LENGTH AND STATION LINK LENGTH INFORMATION

System Length

In this study, a distinction is made between actual system length and effective system length for the light rail study system. For both ABUS and BDL, actual and effective system lengths are identical.

The study section is a 5.19-mile segment of the VTA light rail system extending from Japantown/Ayer Station north to Baypointe Station. Directional route track miles are 5.19 in each direction, for a total of 10.38 miles. However, this does not include mileage necessary for crossovers and yard tracks. Tables A1 and A2 show station and link information for the light rail base system, supplied by VTA. This data includes station link length for each link along the VTA Guadalupe line, within the domain of the study section. Table A3 summarizes route mileage from the VTA link information.

In order to estimate total effective system mileage for the light rail study section - which includes directional route miles, crossover and yard track miles – it was assumed that the percentage of crossover and yard track miles for the proposed system is the same as for the overall light rail system operated by VTA.

The VTA system consists of roughly 60 miles of track dedicated to route miles, and 2 additional miles dedicated to crossovers and yard miles. This means that the total effective mileage is equal to the total route mileage increased by roughly 2/60, or 3.33%.

Since no additional infrastructure is necessary for crossovers in the ABUS and BDL systems, actual and effective system lengths are assumed to be 5.19 miles for both of these cases. Implicit in this assumption is the neglect of yard roadway miles that might be constructed for these systems. The costs associated with this roadway length is considered to be negligible. Table A3 shows the calculated effective mileage.

Table A3 also shows an average route travel time of 17.42 minutes for the study section. This average route travel time represents the number of minutes required for a light rail vehicle to travel the length of the study section. This is a calculated value, and is based on a weighted average of the route travel times shown in Tables E18 through E23 in Appendix E. A calculated value was used here because exact travel times between the Baypointe and Japantown stations (the endpoints of the study system) were not available from VTA.

TABLE A1. SOUTHBOUND LINK LENGTH

Baypointe - Tasman	0.50
Tasman - River Oaks	0.53
River Oaks - Orchard	0.57
Orchard - Bonaventura	0.55
Bonaventura - Component	0.42
Component - Karina	0.55
Karina - Metro/Airport	0.52
Metro/Airport - Gish	0.59
Gish - Civic Center	0.82
Civic Center - Japantown/Ayer	0.14
Japantown/Ayer - St. James	0.96
St. James - Santa Clara	0.26
Santa Clara - San Antonio	0.27
San Antonio - Covention Center	0.39
Convention Center - Children's Discovery Mu	0.32
Children's Discovery Museum - Virginia	0.74
Virginia - Tamien	0.52
Tamien - Curtner	0.98
Curtner - Capitol	0.79
Capitol - Branham	0.48
Branham - Ohlone/Chynoweth	0.42
Ohlone/Chynoweth - Blossom Hill	1.04
Blossom Hill - Snell	0.49
Snell - Cottle	0.95
Cottle - Santa Teresa	0.73
TOTAL	14.53

TABLE A2. NORTHBOUND LINK LENGTH

Civic Center - Gish	0.82
Gish - Metro/Airport	0.59
Metro/Airport - Karina	0.52
Karina - Component	0.55
Component - Bonaventura	0.42
Bonaventura - Orchard	0.55
Orchard - River Oaks	0.57
River Oaks - Tasman	0.53
Tasman - Baypointe	0.50
Baypointe - Champion	0.50
Champion - Lick Mill	0.74
Lick Mill - Great America	0.69
Great America - Old Ironsides	0.27
Old Ironsides - Reamwood	0.46
Reamwood - Vienna	0.60
Vienna - Fair Oaks	0.61
Fair Oaks - Crossman	0.52
Crossman - Borregas	0.33
Borregas - Lockheed Martin	0.82
Lockheed Martin - Moffeit Park	0.83
Moffeit Park - Bayshore/Nasa	0.91
Bayshore/Nasa - Middlefield	0.74
Middlefield - Whisman	0.48
Whisman - Evelyn	0.56
Evelyn - Mountain View	0.67
TOTAL	14.76

TABLE A3. BAYPOINTE TO JAPANTOWN ROUTE LENGTH AND TRAVEL TIME

Link	Route Mileage	Effective Route Mileage	Average Route Travel Time (min)
Japantown - Baypointe	5.19	5.36	17.42

APPENDIX B

VTA LIGHT RAIL SCHEDULE
GUADALUPE LINE

Tables B1 through B4 show the Santa Clara Valley Transportation Authority (VTA) train schedule for the Guadalupe line for weekdays and weekends, north- and south-bound.

TABLE B1 VTA SCHEDULE - WEEKDAY NORTHBOUND

Period	Santa Teresa	Baypointe
AM	5:20	6:12
	5:38	6:30
	5:55	6:47
	6:10	7:02
	6:25	7:17
	6:40	7:32
	6:55	7:47
	7:10	8:02
	7:25	8:17
	7:40	8:32
	7:55	8:47
	8:10	9:02
	8:25	9:17
MID	8:40	9:32
	8:55	9:47
	9:10	10:02
	9:25	10:17
	9:40	10:32
	9:55	10:47
	10:10	11:02
	10:25	11:17
	10:40	11:32
	10:55	11:47
	11:10	12:02
	11:25	12:17
	11:40	12:32
	11:55	12:47
	12:10	1:02
	12:25	1:17
	12:40	1:32
	12:55	1:47
	1:10	2:02
	1:25	2:17
	1:40	2:32
	1:55	2:47
	2:10	3:02
	2:25	3:17
PM	2:40	3:32
	2:55	3:47
	3:10	4:02
	3:25	4:17
	3:40	4:32
	3:55	4:47
	4:10	5:02
	4:25	5:17
	4:40	5:32
	4:55	5:47
	5:10	6:02
	5:25	6:17
OFF	5:40	6:32
	5:55	6:47
	6:10	7:02
	6:25	7:17
	6:40	7:32
	6:55	7:47
	7:11	8:03
	7:26	8:18
	7:41	8:33
	7:57	8:51
	8:12*	-
	8:27	9:21
	8:57	9:51
	9:27	10:21
	9:57	10:51
	10:28	11:22
	10:58	11:52
	11:28	12:22
	11:49	12:39
	12:17	1:11
	1:18	2:11
	2:21	3:13
	3:21	4:13
	4:20	5:12
	4:40	5:32
	5:00	5:52

*Train terminates at Civic Center station, and does not continue to Baypointe, the terminal station.

TABLE B2. VTA SCHEDULE - WEEKDAY SOUTHBOUND

Period	Baypointe	Santa Teresa
AM	5:28	6:20
	5:48	6:40
	6:08	7:00
	6:23	7:15
	6:38	7:30
	6:53	7:45
	7:08	8:00
	7:23	8:15
	7:38	8:30
	7:53	8:45
	8:08	9:00
	8:23	9:15
MID	8:38	9:30
	8:53	9:45
	9:08	10:00
	9:23	10:15
	9:38	10:30
	9:53	10:45
	10:08	11:00
	10:23	11:15
	10:38	11:30
	10:53	11:45
	11:08	12:00
	11:23	12:15
	11:38	12:30
	11:53	12:45
	12:08	1:00
	12:23	1:15
	12:38	1:30
	12:53	1:45
	1:08	2:00
	1:23	2:15
	1:38	2:30
	1:53	2:45
	2:08	3:00
	2:23	3:15
PM	2:38	3:30
	2:53	3:45
	3:08	4:00
	3:23	4:15
	3:38	4:30
	3:53	4:45
	4:08	5:00
	4:23	5:15
	4:38	5:30
	4:53	5:45
	5:08	6:00
	5:23	6:15
OFF	5:38	6:30
	5:53	6:45
	6:08	7:00
	6:23	7:15
	6:38	7:30
	6:53	7:45
	7:08	8:00
	7:23	8:15
	7:40	8:32
	8:00	8:56
	8:30	9:26
	9:00	9:56
	9:30	10:26
	10:01	10:56
	10:31	11:26
	11:01	11:56
	11:31	12:26
	12:05	12:56
	12:35	1:26
	1:23	2:14
	2:23	3:14
	3:23	4:14
	4:23	5:14

TABLE B3. VTA SCHEDULE - WEEKEND NORTHBOUND

Period	Santa Teresa	Baypointe
AM	5:20	6:14
	5:55	6:46
	6:25	7:16
	6:40	7:31
	6:55	7:46
	7:10	8:01
	7:25	8:16
	7:40	8:31
	7:55	8:46
	8:10	9:01
	8:25	9:16
MID	8:40	9:31
	8:55	9:46
	9:10	10:01
	9:25	10:16
	9:40	10:31
	9:55	10:46
	10:10	11:01
	10:25	11:16
	10:40	11:31
	10:55	11:46
	11:10	12:01
	11:25	12:16
	11:40	12:31
	11:55	12:46
	12:10	1:01
	12:25	1:16
	12:40	1:31
	12:55	1:46
	1:10	2:01
	1:25	2:16
	1:40	2:31
	1:55	2:46
	2:10	3:01
	2:25	3:16
PM	2:40	3:31
	2:55	3:46
	3:10	4:01
	3:25	4:16
	3:40	4:31
	3:55	4:46
	4:10	5:01
	4:25	5:16
	4:40	5:31
	4:55	5:46
	5:10	6:01
	5:25	6:16
OFF	5:40	6:31
	5:55	6:46
	6:10	7:01
	6:25	7:16
	6:40	7:31
	6:55	7:46
	7:10	8:01
	7:25	8:16
	7:41	8:32
	7:57	8:51
	8:12*	-
	8:27	9:21
	8:42*	-
	8:57	9:51
	9:27	10:21
	9:57	10:51
	10:27	11:21
	10:58	11:52
	11:28	12:22
	11:49	12:39
	12:17	1:11
	1:18	2:11
	2:21	3:13
	3:21	4:13
	4:20	5:12

*Train terminates at Civic Center station, and does not continue to Baypointe, the terminal station.

TABLE B4. VTA SCHEDULE - WEEKEND SOUTHBOUND

Period	Baypointe	Santa Teresa
AM	5:23	6:14
	5:51*	6:26
	6:06*	6:41
	6:21*	6:56
	6:34**	6:59**
	6:24	7:15
	6:57*	7:32
	6:54	7:45
	7:25*	8:00
	7:24	8:15
	7:39	8:30
	7:54	8:45
	8:09	9:00
	8:24	9:15
MID	8:39	9:30
	8:54	9:45
	9:09	10:00
	9:24	10:15
	9:39	10:30
	9:54	10:45
	10:09	11:00
	10:24	11:15
	10:39	11:30
	10:54	11:45
	11:09	12:00
	11:24	12:15
	11:39	12:30
	11:54	12:45
	12:09	1:00
	12:24	1:15
	12:39	1:30
	12:54	1:45
	1:09	2:00
	1:24	2:15
	1:39	2:30
	1:54	2:45
	2:09	3:00
	2:24	3:15
PM	2:39	3:30
	2:54	3:45
	3:09	4:00
	3:24	4:15
	3:39	4:30
	3:54	4:45
	4:09	5:00
	4:24	5:15
	4:39	5:30
	4:54	5:45
	5:09	6:00
	5:24	6:15
OFF	5:39	6:30
	5:54	6:45
	6:09	7:00
	6:24	7:15
	6:39	7:30
	6:54	7:45
	7:09	7:59
	7:22	8:13
	7:36	8:27
	7:51	8:42
	8:06	8:57
	8:31	9:26
	9:01	9:56
	9:31	10:26
	10:01	10:56
	10:31	11:26
	11:01	11:56
	11:31	12:26
	12:05	12:56
	12:35	1:26
	1:23	2:14
	2:23	3:14
	3:23	4:14
	4:23	5:14

*Train terminates at Civic Center station, and does not continue to Baypointe, the terminal station.

**Trains 1 and 3 are taken out-of-service at Civic Center station, and do not continue on to Baypointe.

APPENDIX C

LIGHT RAIL SYSTEM AGENCY COSTS

Introduction

This appendix details methodologies and procedures for calculating the agency costs associated with the light rail study system. These costs include:

- System Planning and Design Costs
- Construction, Rehabilitation, and Other Infrastructure-Related Capital Costs
- Vehicle Operations Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs

LIGHT RAIL SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE-RELATED CAPITAL COSTS

Light Rail Cross-Sectional Geometry (Width Requirements)

As with the VTA Guadalupe light rail line on the segment being studied, the proposed light rail system is assumed to operate at-grade, with no physical separation of travel lanes from each other, or from street traffic.

According to the Santa Clara Valley Transportation Authority (VTA), the smallest possible right-of-way (ROW) width required for two light rail lanes to operate side-by-side and at normal speeds is 28.9 feet. This width includes a 12-foot spacing between the innermost rails and a track gauge of 4.7 ft (56.5 inches). The minimum distance between the center of the track and the edge of the light rail right-of-way is 5.44 ft. Figure 3.2 in the main report shows a schematic representation of the light rail system at minimum width.

It is important to note the distinction between the minimum allowable ROW width and the average ROW width for the study section. The minimum allowable ROW width refers to the smallest possible ROW for safe light-rail operation, as described above. The average ROW width for the study section refers to a calculated average of the 5.19-mile stretch of the VTA Guadalupe line, which was used as a base system for this study. Both of these lengths will be used in the subsequent sections of this appendix. The length used for a particular calculation depends upon which would be the more representative of the system with reference to the cost being calculated.

Light Rail Study System Actual and Effective Lengths

The actual length of the study section is 5.19 miles, in correspondence of the length of the VTA light rail segment running between Baypointe and Japantown. However, for the purposes of this study, a distinction is made between actual study section length, the one-directional effective length, and the effective length. These values are 5.19 miles and 5.36 miles, respectively.

The reason for this distinction is, in short, as follows: The VTA system consists of roughly 60 miles of track dedicated to route miles, and 2 additional miles dedicated to crossovers and yard miles. This implies that there is additional track mileage that must be constructed for the study section which is not included in the 5.19-mile one-directional operating length. The total one-directional effective mileage is an adjustment to account for the aforementioned service track mileage. The one-directional effective mileage is equal to the total route mileage increased by roughly 2/60, or 3.33%. A more detailed explanation is available in Appendix A.

It is important to distinguish the calculations where the 5.19-mile actual track length is appropriate, and where it is appropriate to use the 5.36-mile effective length in calculations. Effective track mileage is used in the following calculations:

- System planning and design costs
- Infrastructure and construction costs, excluding those pertaining to right-of-way.

For all other calculations, it is appropriate to use the actual track mileage in calculations. It is noteworthy that right-of-way cost calculations are not included in the set of calculations based on effective track mileage because, for crossover sections and yard miles, it is not necessary to purchase additional right-of-way on which to place the tracks.

Light Rail System Planning and Design Costs

Planning and design costs include agency labor, consulting and legal costs associated with system design. The costs for the VTA Tasman West light rail project were used as a basis for estimating planning and design costs for the proposed light rail system. The 7.6-mile double-track Tasman West line was completed in 1999, and information on system planning and design was provided by the VTA as part of a summary of construction costs.

Table C1 shows system planning and design costs and cost calculations for the Tasman West line. The following paragraphs describe procedures and show sample calculations for the columns in Table C1.

“VTA Total Cost” figures were obtained from Tasman West project contract documents provided by VTA.

The “Unit Cost” quantities were calculated by dividing the applicable “VTA Total Cost” quantity by 15.2 miles (twice 7.6 miles) to arrive at a cost per track-mile.

Sample Calculation (Design Consultants): $3,964,933 = $60,266,983/15.2

The “Unit Cost (2001-Equiv.)” figures were obtained by adjusting the “Unit Cost” quantities for inflation. The inflation factor for adjustment from 1999 to 2001-equivalent dollars is 1.0353 (1). Therefore, numbers in the “Unit Cost (2001-Equiv.)” column were obtained by multiplying “Unit Cost” quantities by 1.0353.

TABLE C1. LIGHT RAIL SYSTEM PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS

Cost Element	Item	Year	VTA Total Cost ($)	Unit Cost ($)[a]	Unit	Unit Cost (2001-Equiv. $)	Unit	# of Units in Study Section	Unit	One-Time Cost ($)	EUAC (2001-Equiv. $)
System Planning and Design Costs	Design Consultants	1999	60,266,983	3,964,933	track mile	4,104,895	track mile	10.73	track miles	44,027,686	3,198,563
	Professional Consultants	1999	49,651,941	3,266,575	track mile	3,381,885	track mile	10.73	track miles	36,272,930	2,635,189
	VTA Labor	1999	25,086,106	1,650,402	track mile	1,708,661	track mile	10.73	track miles	18,326,506	1,331,401
	Non-Technical Services	1999	3,453,199	227,184	track mile	235,204	track mile	10.73	track miles	2,522,714	183,272
	TOTAL										7,348,425
Infrastructure Costs	Property Costs/ ROW Acquistion	1999	34,166,626	23.65	sq. foot	24.49	sq. foot	791,952	sq. feet	19,391,768	1,408,791
	Utility Relocations	1999	9,015,859	593,149	track mile	614,087	track mile	10.73	track miles	6,586,482	478,501
	Material and Equipment	1999	12,619,406	830,224	track mile	859,531	track mile	10.73	track miles	9,219,032	669,753
	Civil/Structural Construction	1999	113,150,901	7,444,138	track mile	7,706,916	track mile	10.73	track miles	82,661,718	6,005,284
	Systems	1999	19,547,712	1,286,034	track mile	1,331,431	track mile	10.73	track miles	14,280,465	1,037,460
	TOTAL										9,599,788
Non-Infrastructure Capital Costs	Fleet Purchase (Vehicle Purchase)	2001	N/A	3,000,000	vehicle	3,000,000	USD per veh	6.288	vehicles	18,863,654	1,370,424
Periodic Capital Costs	Major Rehabilitation (Tangent Track Sections)[b]	2002	N/A	0	year	0	per year per veh	N/A	N/A	0	0
	Major Rehabilitation (Curved Track Sections)	2002	N/A	134,228	per 10 years per track mile	8,319	per year per track mile	4.037	track miles	N/A	33,586
	Major Rehabilitation (System/ Wayside Maintenance)	2002	N/A	50,000	per year per double-track mile	49,020	per year per double-track mile	5.19	double-track miles	N/A	254,414
	TOTAL										287,999
Fleet Renewal	Vehicle Replacement Costs			0	per year per veh.	0	per year per veh.	0	veh.	0	0
TOTAL CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS											11,258,212
TOTAL SYSTEM PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS											18,606,637

[a] *Based on 7.6-mile line length, double-track system, for a total of 15.2 trackway miles.*

[b] *Rehabilitation of tangent track sections is estimated by VTA personnel to occur every 75 to 100 years. This time period is beyond the scope of this study, and tangent section rehabilition is thus considered to be negligable.*

Sample Calculation (Design Consultants): $4,104,895 = $3,964,933 x 1.0353

The "One-Time Cost" quantities were calculated by multiplying "Unit Cost (2001—Equiv.)" quantities by 10.73, the total number of track-miles in the light rail section under study (5.36 miles in each direction).

Sample Calculation (Design Consultants): $44,027,686 = $4,104,895 x 10.73

Finally, the Equivalent Uniform Annual Cost for the base year of 2001 ["EUAC (2001-Equiv.)"] values were calculated, assuming a 30-year useful project life and a discount rate of 6%. All formulae were obtained from Sullivan (2). Methodologies are as follows:

[EUAC (2001-Equiv.)] = [One-Time Cost] x [A/P, i, n], where i=6% and n=30.
= [One-Time Cost] x $[i(1+i)^n)]/[(1+i)^n-1]$
= [One-Time Cost] x 0.0726

Sample Calculation (Design Consultants): 3,198,563 = 44,027,686 x 0.0726

Light Rail Infrastructure Costs

Construction costs for the light rail system were also estimated using the completed VTA Tasman West light rail project as a model. For all costs except those associated with right-of-way acquisition, the same procedure used to determine light rail system planning and design costs was used to determine the construction costs. Construction costs include those expenses associated with civil infrastructure, electrical systems, right-of-way acquisition, utilities, materials and equipment, and non-technical services. This cost category does not include vehicle procurement. The resulting costs are shown in Table C1.

Right-of-way acquisition costs were calculated according to the following procedure:

1. Right-of-Way unit costs ($ per Sq. Ft.) were calculated**.**
2. Square footage of the light project right-of-way was estimated.
3. Unit costs were adjusted for inflation to 2001-equivalent dollars.
4. Adjusted unit costs were multiplied by cost per square foot to get a total cost.
5. Total cost was converted to EUAC (2001-Equivalent).

Right-of-Way Unit Cost Calculations

All proposed systems (light rail, ABUS, and BDL) follow the existing alignment of the Santa Clara Valley Transportation Authority (VTA) light rail system over a 5.19-mile segment of the Guadalupe Line. Although the line has some curved segments, it is relatively straight in alignment. It is noteworthy that the 5.19-mile actual system length is used for this calculation, rather than the 5.36-mile effective track length

Costs for acquiring right-of-way for the proposed systems were based, as were most construction costs, on data from the completed the VTA Tasman West light rail project. For the VTA, right-of-way is generally acquired in two ways:

1. Fee Acquisition
2. Easement

In fee acquisition, land for right-of-way is purchased at market value and retained for use by the agency. In an easement, use of the land is granted by the owner, but the transit agency does not gain ownership of the land.

In general, right-of-way acquired by fee acquisition is substantially more expensive than land acquired via easement. In some cases, easements may be granted at no cost – for instance, if the land is owned by the city where the project is being built.

For the VTA Tasman West project – upon which the right-of-way costs derived here is based – substantially more land was acquired via easement than via fee acquisition. Exact figures regarding the breakdown between easement and fee acquisition were not readily available from the VTA.

Additionally, right-of-way is generally acquired for a project for the following reasons (this list is not meant to be comprehensive, but to show some examples of need for land acquisition):

1. Trackway placement
2. Passenger stations
3. Roadway widening (so median placement of tracks is possible)
4. Park & Ride Stations
5. Electrical sub-stations
6. Maintenance stations
7. Temporary (for construction)

The VTA Tasman West light rail project was used as a base system to estimate costs per square foot of land acquired for a light rail system. For the purposes of this project, one unit cost representing an average cost for all right-of-way – regardless of whether it was acquired by fee acquisition or easement – was desired. This unit cost would be used to calculate right-of-way costs for all three systems being compared. Implicit in the use of this simplified unit cost are the following assumptions:

1. Proportions of fee-acquired and easement lands are equal for all proposed systems and the VTA Tasman West line.
2. All land used for such a construction project must be acquired. In the case of the VTA Tasman West line, the owner agency (VTA) had to acquire land from the City of San Jose and other landholders in order to install the light rail infrastructure. The VTA originally owned only a small portion of the land where the line was built. In the case where the same agency owns and operates the systems, and is also the

principal landowner (e.g. – if the City of San Jose built and operated its own light rail system, rather than cooperating with VTA), the calculations presented here may not be representative of land costs.

Calculation of the said unit cost occurred via the following procedure:

1. Total cost for right-of-way acquisition was obtained from Tasman West project contract documents.
2. Total square footage for the Tasman West light rail project was estimated.
3. Division of total cost by square footage yielded unit cost.

Calculation of Total Study Section Square Footage

Calculation of total square footage for the Tasman West light rail project was conducted in an imprecise manner, and is meant only to give a ballpark figure on project square footage. The following assumptions are implicit in the process, which will be described below:

1. The Tasman West line is assumed to be straight, and the surface area of the project rectangular. Curved sections of the line add negligible area to the total project area.
2. The calculated area for the Tasman West project is based on average width occupied by the stations and trackway. It does not include such infrastructure as maintenance stations, park & ride stations, or electrical sub-stations. Notably, total costs for land acquisition, which were used to find the unit cost for land, also include land area for maintenance stations, park & ride lots, and other infrastructure. The result of using this approach is that total cost for all land acquired is represented in terms of a unit cost for average trackway plus passenger station width. The assumption implicit here is that costs for these types of infrastructure are proportional to the length of the line.

It is noteworthy that a figure for the land area used in the Tasman West light rail project was unavailable through VTA. Given the high variability in land costs, both within a region and among different regions, error introduced into the land-cost calculations presented here would probably be more-significantly impacted by variations in price than by a more or less-accurate estimation of land area.

An average width for the Tasman West right-of-way was estimated by taking evenly-spaced point measurements from seventeen locations along the Tasman West line. Civil engineering plans were used for the said width measurements, which were read at mid-block locations, intersections, and station locations – thus representing an average width for the right-of-way that includes stations and trackway, but not other supporting infrastructure. This average width, which was found to be roughly 36 feet, was multiplied by the system length to obtain a project square footage.

Right-of-Way Unit Cost Calculation

Unit cost (in $ per square foot) for land acquisition was obtained by dividing total land acquisition costs for the Tasman West by the previously-calculated square footage. Table C2 shows tabulated values and cost calculations. The length of the Tasman West line appears in the columns headed "Tasman West Line Length." Table C2 also shows the average width of the Tasman West line -- assumed, also, to be the average width of the proposed light rail line – in the column headed "Avg. Width." The column headed "Tasman Project Square Footage" shows the calculated Tasman project area. The column headed "$ per Sq. Foot" gives the estimated unit cost for land acquisition.

TABLE C2. RIGHT-OF-WAY UNIT COSTS ($ PER SQUARE FOOT) - 1999-EQUIV.

Total VTA Cost ($)	Tasman West Line Length		Avg. Width (ft)	Tasman Project Square Footage	$ per Sq. Foot
	Miles	Feet			
34,166,626	7.6	40,128	36	1,444,608	23.65

Square Footage of Light Rail Study Section Right-of-Way

In order to maintain functional equivalence between the light rail study section and the ABUS and BDL study sections discussed in subsequent sections of this report, the right-of-way width used for the light rail study section was assumed to be the minimum allowable (28.9 feet), as discussed previously in this appendix. Assuming that the added area due to curved sections is negligible, the area of the light rail study section was approximated by multiplying system length by minimum allowable width of the double-trackway. Area required for stations and other supporting infrastructure was neglected because it is assumed that space requirements for these infrastructure elements are similar for all three systems being compared.

Table C3 shows system length, width, and area for the light rail study section.

TABLE C3. LIGHT RAIL STUDY SECTION DIMENSIONS

System Length		Width (Feet)	Area (Sq. Feet)
Miles	Feet	Min. Allowable	Two Directions
5.19	27,403	28.9	791,952

2001-Equivalent EUAC for Proposed Light Rail Right-of-Way

Light rail right-of-way costs are contained in Table C1.

The unit cost was converted to 2001-equivalent dollars using an inflation index of 1.0353 (3). The following sample calculation showing unit cost conversion to 2001-equivalent dollars comes from Table C1:

$24.49 per sq. ft. = [$23.65 per sq. ft.] x [1.0353]

This unit cost was then multiplied by the light rail system two-directional square footage (see Table C3) to arrive at "One-Time Cost (2001-Equiv.)," as per the following sample calculation:

$19,391,768 = [$24.49 per sq. ft.] x [791,952 sq. ft.]

Finally, costs were converted to EUAC (2001-equivalent). Methodologies for this calculation are identical to other EUAC calculations in Table C1.

Non-Infrastructure Capital Costs

For this project, the only costs considered under the initial, non-infrastructure heading were those associated with fleet purchase. Initial fleet purchase costs for the light rail study system depend on the cost per vehicle and the number of vehicles purchased. VTA personnel estimate that an average light rail vehicle purchased in 2001 cost in the range of $2.5 - $3 million, depending on traction, drive, integration, and other factors. A cost of $3 million per light rail vehicle was assumed for the purposes of this project.

To determine the cost of the light rail vehicles associated with the study section, it was assumed that the number of vehicles necessary is proportional to the length of the line. Since the proposed system is a portion of the existing VTA Guadalupe light rail line, the following proportion was utilized:

$$\frac{L_G}{L_P} = \frac{C_G}{C_P}$$

where
L_G = the length of the Guadalupe Line,
L_p = the length of the study section,
C_G = the number of cars in operating on the existing Guadalupe line,
C_p = the number of light rail cars necessary for the light rail study system.

Then,

$$C_P = \frac{L_P C_G}{L_G}$$

Table C4 shows calculations for the number of light rail cars needed to service the study section. The calculations that appear in this table are based on the following assumptions:

1. The highest volume and the shortest headways for the light rail system occur during the PM pear period, so the highest number of light rail vehicles in operation during any period in the system operation would also occur during this period. Therefore, the number of light rail vehicles necessary to operate the system during the PM peak period would be adequate to accommodate the system operating needs during the other daily periods.
2. According to VTA personnel, for purposes of maintenance and contingency purposes, the system requires a 20 percent vehicle reserve, meaning that one out of every six vehicles must be withheld from operation at any given time.

TABLE C4. LIGHT RAIL VEHICLES REQUIRED DURING PM PEAK HOUR

Train #	# Train Cars			
	Guadalupe Line	Proposed System		
	Existing	Scale Factor	Scaled # Cars	Effective # Cars
1	3	0.250	0.749	0.898
2	3	0.250	0.749	0.898
3	2	0.250	0.499	0.599
4	3	0.250	0.749	0.898
5	2	0.250	0.499	0.599
6	3	0.250	0.749	0.898
7	2	0.250	0.499	0.599
8	3	0.250	0.749	0.898
TOTAL	21		5.240	6.288

A total of eight trains are operated on the VTA system during any given period. The column entitled “Train #” refers to the train in operation, and the column entitled “Existing # Veh” refers to the number of train cars currently operated on that train during the PM peak period.

The column entitled “Scale Factor” refers to the ratio used to scale the number of vehicles from Guadalupe-line size to proposed-system size. Since the Guadalupe line is 20.8 miles in length (not including crossover miles and yard miles), and the study section is 5.19 miles in length (again, not including crossover and yard miles), the applicable scale factor was calculated as follows:

Scale Factor = 5.19/20.8 = 0.250

This implies that one-half of the vehicles necessary to operate the Guadalupe line would be allocated to the study section.

The values in the column “Scaled # Cars” was calculated by multiplying the number of vehicles used in the existing Guadalupe line by the scale factor.

Sample Calculation (Train 1): 0.749 = 3 x 0.250

The “Effective # Cars” calculation exists due to the assumption above (regarding the additional 20 percent of the fleet required for maintenance and contingency). The effective number of light rail cars required was calculated as follows:

[Effective # Cars[= [Scaled # Cars] x 1.2
Sample Calculation (Train 1): 0.898 = 0.749 x 1.2

Three decimal places are maintained throughout the fleet size calculations to distinguish the fleet size as a calculated value, and also because rounding to the next whole number could produce substantial error.

Periodic Capital Costs

Periodic capital costs, or rehabilitation costs, can be subdivided into three categories:

- Tangent Track Sections
- Curved Track Sections
- System/Wayside Maintenance

Tangent and Curved Track Mileages

For the entire VTA system, the 60 miles of single track is comprised of 22.35 miles of curved track and 39.65 miles of tangent sections (this figure does not include approximately 2 miles of track dedicated to crossovers and yard tracks). Assuming crossover mileage fits into the curved track category, and yard tracks are tangent sections, and assuming that one mile of the aforementioned two miles is used for crossovers, this implies that roughly 37.66% (23.35/62) of the VTA rail system is made up of curved track. Applying this percentage to the 10.72-effective track-mile (5.36 miles in each direction) study section would result in the following lengths of curved and tangent tracks:

Curved track: 4.037 miles
Tangent track: 6.683 miles

Tangent Track Section Costs

For tangent track sections, VTA personnel estimate that rehabilitation occurs at a 75 to 100-year frequency. Because the rehabilitation cycle is longer than the 30-year assumed life of this project, costs associated with tangent trackway rehabilitation are considered to be negligible for the purposes of this study.

Curved Track Section Costs

The listed unit cost (in $ per year per track mile) for curved track section rehabilitation appears in Table C1 under the columns headed “Unit Cost (2001-Equiv.). The following procedure was followed to arrive at this unit cost:

1. Cost per track mile per ten years was calculated.
2. Cost per track mile per ten years was converted to 2001-equivalent dollars.
3. Costs per track mile per ten years were brought to present worth.
4. Annual costs were calculated in $ per track mile.

Table C5 shows the details of the calculations.

TABLE C5. CURVED TRACK REHABILITATION

Total VTA Costs (2002)		VTA Curved Track Mileage	Unit Cost ($ per Track Mile per 10 Years)	Unit Cost (2001-Equiv.) ($ per Track Mile per 10 Years)	Present Worth ($)	Unit Cost (2001-Equiv.) ($ per Track Mile per year)
$	Unit					
3,000,000	per mile per ten years	22.35	134,228	131,597	114,516	8,319

VTA personnel estimate that $3,000,000 (in 2002 dollars) is required every ten years to rehabilitate the curved sections of the existing Guadalupe light rail line. With 22.35 miles of curved segments, this implies a cost of $134,228 per ten years, as per the following formula:

[$134,228 per track mile per 10 years] = [$3,000,000 per 10 years]/[22.35 track miles]

This figure was adjusted for inflation. Conversion to 2001-equivalent dollars is as follows (1):

[$131,597 per track mile per 10 years] = [$134,228 per track mile per 10 years] x 0.9804

Rehabilitation occurs at year 10 and 20 (but not at year 30, since this is the end of the project life). The following formula converts rehabilitation costs to 2001-equivalent present worth (2):

$$\begin{aligned} PW &= \$131{,}597 \times [(P/F,i,10) + (P/F,i,20)] \\ &= \$131{,}597 \times \left[\left(\frac{1}{1+i}\right)^{10} + \left(\frac{1}{1+i}\right)^{20}\right] \text{ where } i=6\% \\ &= \$131{,}597 \times [0.5584 + 0.3118] \\ &= \$114{,}516 \end{aligned}$$

The following formula converts the present worth to an annuity (2):

$$\begin{aligned} A &= \$114{,}516 \times [A/P,i,30] \text{ where discount rate } i=6\%. \\ &= \$114{,}516 \times \left[\frac{i(1+i)^{30}}{(1+i)^{30}-1}\right] \\ &= \$114{,}516 \times 0.0726 \\ &= \$8{,}319 \text{ per year per track mile} \end{aligned}$$

Thus, a 2001-equivalent unit cost of $8,319 per year per track mile applies to the light rail rehabilitation for curved track sections.

The EUAC (2001-equivalent) was calculated by multiplying the $8,319 annual per-mile unit cost by 4.037, the number of curved track miles in the study system. Table C1 shows the results of the calculations.

System/Wayside Rehabilitation

Table C6 shows unit cost calculations for wayside rehabilitation. These calculations are based on the entire Guadalupe line. VTA personnel estimate system and wayside rehabilitation costs to be approximately $50,000 per year per double-track mile (in 2002-dollars) for the existing Guadalupe line. Effective track mileage is not used here because the unit cost per double-track mile includes crossover and yard mileage, according to VTA personnel.

TABLE C6. LIGHT RAIL WAYSIDE REHABILITATION		
Total VTA Costs (2002)		Unit Cost (2001-Equiv.) ($ per Double-Track Mile per Year)
$	Unit	
50,000	per year per double-track mile	49,020

Adjusting for inflation, the unit cost in terms of 2001-equivalent dollars was found to be:

$$\text{[Unit Cost (2001-Equiv.) (\$ per double-track mile per year)]} = \$50{,}000 \times 0.9804 = \$49{,}020$$

This value appears both as a result in Table C6 and in the column headed "Unit Cost (2001-Equiv.)" in Table C1. Calculation of the EUAC (2001-equivalent) follows the same methodologies as that of the curved track section rehabilitation.

Fleet Renewal

According to VTA personnel, modern light rail vehicles are built to have a useful life of 30 years, with a 25-year amortization period required by the federal government. Since the assumed life of this project is also 30 years, fleet renewal would have a zero cost in the domain of this project. It is noteworthy that VTA is currently replacing its 15-year-old fleet – not due to vehicle wear, but because the vehicles are being upgraded with low-floor light rail cars.

LIGHT RAIL SYSTEM NON-INFRASTRUCTURE AGENCY COSTS

Light rail system non-infrastructure agency costs include:

- Vehicle Operating Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs

The cost elements included in these categories will be discussed subsequently.

Determination of the light rail study section costs was performed in several major phases for each of the four aforementioned cost categories:

1. Determination of individual cost elements that comprise costs in that category
2. Determination of vehicle-revenue-miles and vehicle-revenue-hours (the calculation of which is discussed in Appendix D).

3. Determination of annual train-revenue-miles and –hours for the study section (the calculation of which is discussed in Appendix D).
4. Determination of unit costs for each cost element, based on the VTA light rail system, in terms of vehicle-revenue-miles and vehicle-revenue-hours, or train-revenue-miles and –hours.
5. Calculation of light rail study system annual costs based on unit costs and calculated vehicle-revenue-miles and –hours, or train-revenue-miles and –hours.

Items 1, 4, and 5 are the foci of this appendix.

Agency Cost Category Descriptions

Light Rail Vehicle Operations

Costs associated with vehicle operations include daily costs necessary to run the system, including operators' salaries, wages, and benefits, fuel and oil, utilities, and other expenses. Vehicle operating costs do not include costs for routine vehicle maintenance, such as tire replacement and labor costs for workers performing the maintenance.

Light Rail Vehicle Maintenance Costs

Costs associated with vehicle maintenance include those costs for materials, supplies, fuels, lubricants, utilities, and labor used to keep the system in good working order, which are not included in vehicle operating costs.

Light Rail System (Non-Vehicle) Maintenance Costs

Costs associated with system maintenance include maintenance expenses for stations and trackways.

Light Rail System Administration Costs

Costs associated with system administration include expenses incurred for system support personnel in the offices of the operating agency.

Unit Cost Calculations

The procedures described herein are general to the four cost categories discussed in this section. Procedures are illustrated here using the "Vehicle Operating Costs" tables and quantities as a model.

The VTA's 1999-2000 report to the National Transit Database (NTD) itemizes operating expenses according to "Expense Object Classes" (EOCs) and also according to function (Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, and General Administration) in Form 301 of the report (3). The EOCs listed in Form 301 were used to compile a list of cost elements associated with these four categories for the light rail.

Tables C7a, C7b, C8a, C8b, C9a, C9b, C10a, and C10b show itemized lists of cost elements, raw source data, and unit cost data for light rail. The VTA report to the NTD (3) also gives total annual vehicle-revenue-miles and total annual vehicle-revenue-hours to be 2,421,865 and 163,350, respectively, for the fiscal year ending in June 2000. Unit costs (in 2002 dollars) in terms of vehicle-revenue-miles and vehicle-revenue-hours for all EOCs excluding operator wages and operator fringe benefits were found by dividing the given VTA total operating expenses for the year 2000 by 2,421,865 miles and 163,350 hours, respectively.

Unit costs for operator wages and fringe benefits were calculated according to train-revenue-miles and train-revenue-hours. The VTA report to NTD (3) gives the two aforementioned quantities as 1,614,566 and 109,120, respectively.

It was necessary in this report to distinguish operators' wages and fringe benefits from other wages and fringe benefits. In its report to NTD, VTA distinguishes between operators' salaries and wages and other salaries and wages, but does not distinguish between operators' fringe benefits and other fringe benefits. In order to itemize fringe benefits according to operator/other cost categories, it was assumed that salaries and wages are proportional to fringe benefits, and the following ratio was applied:

$$O_{SW}/T_{SW} = O_{FB}/T_{FB}$$

Where O_{SW} represents operators' salaries and wages, O_{FB} represents other fringe benefits, T_{SW} represents total salaries and wages, and T_{FB} represents total fringe benefits.

Then,

$$O_{FB} = O_{SW}T_{FB}/T_{SW}$$

and

$$\text{Operator Fringe Benefits} = T_{FB} - O_{FB}$$

This procedure yielded the following "Annual Cost (VTA Total)" quantities listed in Table C7a:

Operators' Fringe Benefits = $2,951,068
Other Fringe Benefits = $929,156

TABLE C7a. LIGHT RAIL VEHICLE OPERATING COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Revenue-Miles		Revenue-Hours	
				Unit Cost (2000 $)	Unit	Unit Cost (2000 $)	Unit
Salaries and Wages	Operators' Salaries and Wages	2000	3,588,844	2.22	train-revenue-mile	32.89	train-revenue-hour
	Other Salaries and Wages	2000	1,129,962	0.47	vehicle-revenue-mile	6.92	vehicle-revenue-hour
Fringe Benefits	Operators' Fringe Benefits	2000	2,951,068	1.83	train-revenue-mile	27.04	train-revenue-hour
	Other Fringe Benefits	2000	929,156	0.38	vehicle-revenue-mile	5.69	vehicle-revenue-hour
Services	Services	2000	722,888	0.30	vehicle-revenue-mile	4.43	vehicle-revenue-hour
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	2000	19,016	0.01	vehicle-revenue-mile	0.12	vehicle-revenue-hour
Utilities	Utilities	2000	1,943,008	0.80	vehicle-revenue-mile	11.89	vehicle-revenue-hour
Taxes	Taxes						
Misc.	Miscellaneous Expenses	2000	-34,734	-0.01	vehicle-revenue-mile	-0.21	vehicle-revenue-hour
Expense Transfers	Expense Transfers						
TOTAL OPERATING COSTS			11,249,208				

TABLE C7b. LIGHT RAIL VEHICLE OPERATIONS

Cost Element	Item	Revenue-Miles				Revenue-Hours			
		Unit Cost (2001-Equiv. $)	Annual Units in LR System	Unit	EUAC (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in LR System	Unit	EUAC (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages	2.27	276,035	Train-Rev-Mi	625,840	33.55	15,439	Train-Rev-Hr	517,923
	Other Salaries and Wages	0.48	448,068	Veh-Rev-Mi	213,235	7.06	25,061	Veh-Rev-Hr	176,823
Fringe Benefits	Operators' Fringe Benefits	1.86	276,035	Train-Rev-Mi	514,622	27.59	15,439	Train-Rev-Hr	425,883
	Other Fringe Benefits	0.39	448,068	Veh-Rev-Mi	175,341	5.80	25,061	Veh-Rev-Mi	145,400
Services	Services	0.30	448,068	Veh-Rev-Mi	136,416	4.51	25,061	Veh-Rev-Mi	113,122
Materials and Supplies	Fuel and Lubricants								
	Tires and Lubes								
	Other Materials and Supplies	0.01	448,068	Veh-Rev-Mi	3,589	0.12	25,061	Veh-Rev-Mi	2,976
Utilities	Utilities	0.82	448,068	Veh-Rev-Mi	366,665	12.13	25,061	Veh-Rev-Mi	304,054
Taxes	Taxes								
Misc.	Miscellaneous Expenses	-0.01	448,068	Veh-Rev-Mi	-6,555	-0.22	25,061	Veh-Rev-Mi	-5,435
Expense Transfers	Expense Transfers								
TOTAL OPERATING COSTS					2,029,153				1,680,746

TABLE C8a. LIGHT RAIL VEHICLE MAINTENANCE COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mile ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	3,227,297	1.33	19.76
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	2,260,198	0.93	13.84
Services	Services	2000	522,588	0.22	3.20
Materials and Supplies	Fuel and Lubricants	2000	64,369	0.03	0.39
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	1,171,171	0.48	7.17
Utilities	Utilities	2000	4,919	0.00	0.03
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	15,683	0.01	0.10
Expense Transfers	Expense Transfers	2000			
TOTAL LIGHT RAIL VEHICLE MAINTENANCE COSTS			7,266,225	3.00	44.48

TABLE C8b. LIGHT RAIL VEHICLE MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in LR System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in LR System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	1.36	448,068	609,023	20.15	25,061	505,027
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.95	448,068	426,521	14.11	25,061	353,690
Services	Services	0.22	448,068	98,617	3.26	25,061	81,778
Materials and Supplies	Fuel and Lubricants	0.03	448,068	12,147	0.40	25,061	10,073
	Tires and Lubes						
	Other Materials and Supplies	0.49	448,068	221,011	7.31	25,061	183,272
Utilities	Utilities	0.00	448,068	928	0.03	25,061	770
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	448,068	2,960	0.10	25,061	2,454
Expense Transfers	Expense Transfers						
TOTAL LIGHT RAIL VEHICLE MAINTENANCE COSTS		3.06		1,371,208	45.37		1,137,063

TABLE C9a. LIGHT RAIL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	2,483,915	1.03	15.21
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	1,554,703	0.64	9.52
Services	Services	2000	883,608	0.36	5.41
Materials and Supplies	Fuel and Lubricants	2000	10,751	0.00	0.07
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	93,932	0.04	0.58
Utilities	Utilities	2000	464,846	0.19	2.85
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	24,725	0.01	0.15
Expense Transfers	Expense Transfers	2000			
TOTAL LIGHT RAIL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS			5,516,480	2.28	33.77

TABLE C9b. LIGHT RAIL SYSTEM (NON-VEHICLE) MAINTENANCE

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	# Units in LR System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	# Units in LR System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	1.05	448,068	468,739	15.51	25,061	388,698
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.65	448,068	293,388	9.71	25,061	243,289
Services	Services	0.37	448,068	166,745	5.52	25,061	138,272
Materials and Supplies	Fuel and Lubricants	0.00	448,068	2,029	0.07	25,061	1,682
	Tires and Lubes						
	Other Materials and Supplies	0.04	448,068	17,726	0.59	25,061	14,699
Utilities	Utilities	0.20	448,068	87,721	2.90	25,061	72,742
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	448,068	4,666	0.15	25,061	3,869
Expense Transfers	Expense Transfers						
TOTAL LIGHT RAIL VEHICLE MAINTENANCE COSTS		2.32		1,041,014	34.45		863,252

TABLE C10a. LIGHT RAIL SYSTEM ADMINISTRATION COSTS - SOURCE DATA

Cost Category	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	5,934,604	2.45	36.33
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	5,369,604	2.22	32.87
Services	Services	2000	1,658,116	0.68	10.15
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	295,744	0.12	1.81
Utilities	Utilities	2000	46,731	0.02	0.29
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	432,480	0.18	2.65
Expense Transfers	Expense Transfers	2000			
TOTAL LIGHT RAIL SYSTEM ADMINISTRATION COSTS			13,737,279	5.67	84.10

TABLE C10b. LIGHT RAIL SYSTEM ADMINISTRATION COSTS

Cost Category	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	# Units in LR System	EUAC (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	# Units in LR System	EUAC (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	2.50	448,068	1,119,918	37.06	25,061	928,683
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	2.26	448,068	1,013,297	33.53	25,061	840,268
Services	Services	0.70	448,068	312,903	10.35	25,061	259,472
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.12	448,068	55,810	1.85	25,061	46,280
Utilities	Utilities	0.02	448,068	8,819	0.29	25,061	7,313
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.18	448,068	81,613	2.70	25,061	67,677
Expense Transfers	Expense Transfers						
TOTAL LIGHT RAIL SYSTEM ADMINISTRATION COSTS		5.79		2,592,359	85.78		2,149,693

Unit costs were then calculated according to the same procedure outlined above. The following sample calculation comes from Table C7a, from the line entitled "Operators' Salaries and Wages."

> Sample Calculation: $32.89 per train-revenue-hour = $3,588,844/109,120 train-revenue-hours

Unit Cost Conversions to Base Year – 2001-Equivalent

The procedures described herein are general to the four cost categories discussed in this section. Procedures are illustrated here using the "Vehicle Operating Costs" tables and quantities as a model.

Unit costs derived from source data were found in terms of 2000-dollars, and were converted to 2001-dollars (the project base year) by accounting for inflation. An inflator of 1.02—corresponding to a 2 percent inflation rate--was used to perform the conversion (1).

The following sample calculation comes from Tables C7a and C7b, from the line entitled "Operators' Salaries and Wages."

> Sample Calculation: $2.27 per train-revenue-mile = $2.22 per train-revenue-mile x 1.02

Calculation of Annual Costs for Proposed Light Rail System

The procedures described herein are general to the four cost categories mentioned discussed in this section. Procedures are illustrated here using the "Vehicle Operating Costs" tables and quantities as a model.

The 2001-equivalent unit costs were multiplied by the number of service units in the project domain to obtain 2001-equivalent costs for each cost element. Appendix D discusses methodologies for determining the annual vehicle-revenue-miles and vehicle-revenue-hours, train-revenue-miles and train-revenue-hours for the light rail study system.

Tables C7b, C8b, C9b, andC10b show the tabulated costs for light rail study system vehicle operations, vehicle maintenance, system (non-vehicle) maintenance, and system administration. The following sample calculation comes from Table C7b, from the line entitled "Operators' Salaries and Wages."

> Sample Calculation: $625,840 = 276,035 train-revenue-miles x $2.27 per train-revenue-mile

References

1. Gross Domestic Product Deflator Inflation Calculator. http://www.jsc.nasa.gov/bu2/inflateGDP.html

2. Sullivan, W. G., et al. *Engineering Economy: Seventh Edition.* Prentice Hall. Upper Saddle River, New Jersey. 2000.
3. *Final Annual Report 1999-2000.* Prepared for Federal Transit Administration National Transit Database by Santa Clara County Transportation Authority.

APPENDIX D

LIGHT RAIL SYSTEM ANNUAL REVENUE-MILES AND REVENUE-HOURS OF OPERATION

Introduction

Determination of the light rail system vehicle operating costs was performed in several major phases, the first and second of which are the foci of this appendix:

1. Determination of individual cost elements that comprise costs in that category
2. Determination of vehicle-revenue-miles and vehicle-revenue-hours.
3. Determination of annual train-revenue-miles and –hours for the study section.
4. Determination of unit costs for each cost element, based on the VTA light rail system, in terms of vehicle-revenue-miles and vehicle-revenue-hours, or train-revenue-miles and –hours.
5. Calculation of light rail study system annual costs based on unit costs and calculated vehicle-revenue-miles and –hours, or train-revenue-miles and –hours.

Definitions

For the purposes of this report, language was adapted from the Santa Clara Valley Transportation Authority (VTA) 1999-2000 report to the National Transit Database (1) to describe operational quantities of the light rail system. The following pertinent terms defined here are used throughout the report:

Vehicle-Revenue-Mile: Defined as one light rail vehicle or bus traveling one mile during revenue operation.

Vehicle-Revenue-Hour: Defined as one light rail vehicle or bus operating for one hour under revenue-generating operation.

Train-Revenue-Mile: Defined as one light rail or bus train traveling one mile during revenue-generating operation.

Train-Revenue-Hour: Defined as one light rail or bus train traveling for one hour under revenue-generating operation.

Additionally, the terms “revenue-miles” and “revenue-hours” are used in this report to discuss these defined terms in a more general sense.

Determination of Annual Revenue-Miles and –Hours Used by the Proposed Light Rail System – General Procedure

The calculation of annual revenue-miles and –hours for the proposed light rail study section was carried out in the following phases:

1. The number of train trips occurring on the study system during each daily period, both for the weekday and weekend condition, were extrapolated from data obtained from the VTA.
2. Daily train trips on the system during each daily period were calculated.

3. Daily revenue-miles and revenue-hours were calculated for the study section.
4. Annual revenue-miles and revenue-hours were calculated for the study section.

Calculation of Daily Train Trips on System

Weekday

VTA personnel were consulted for data related to train operation during each daily period. In the VTA system on the Guadalupe line (the base system for this study), eight trains were operated in 2003. Based on VTA input, the following patterns, where each number refers to the number of cars per train, were applied to the VTA schedule:

AM Peak: 3-2-3-2-3-2-3-3
Midday: 2-2-2-2-2-2-2-2
PM Peak: 3-2-3-2-3-2-3-3
Off-Peak: 1-1-1-1-1-1-1-1

The application of these patterns to the VTA schedule is shown in Tables D1 and D2. Table D3 summarizes train trips for weekdays, as determined by Tables D1 and D2, according to 3-car, 2-car, and 1-car trains.

Weekend

Procedures for determining weekend train trips is identical to the procedure for determination of weekday trips; however, the following alteration was made to align with VTA operating procedures for the Guadalupe line:

- All trains operate on a 1-1-1-1-1-1-1-1 pattern (i.e. – only one-car trains operate during the weekends)

Tables D4 and D5 show the train pattern aligned with the weekend train schedule. Table D6 summarizes weekend daily train trips.

Calculation of Daily Revenue-Miles and Revenue-Hours

Tables D7 and D8 show weekday and weekend revenue-mile and revenue-hours. They are divided into sections for 3-car trains, 2-car trains, 1-car trains, and totals.

Each of these tables shows four previously-defined data points for each category of train:

- Train-Revenue-Miles
- Vehicle-Revenue-Miles
- Train-Revenue-Hours
- Vehicle-Revenue-Hours

TABLE D1. VTA SCHEDULE WITH TRAIN PATTERN - WEEKDAY NORTHBOUND

Period	Santa Teresa	Train #	Train Pattern	Baypointe
AM	5:20	1	3	6:12
	5:38	2	2	6:30
	5:55	3	3	6:47
	6:10	4	2	7:02
	6:25	5	3	7:17
	6:40	6	2	7:32
	6:55	7	3	7:47
	7:10	8	3	8:02
	7:25	1	3	8:17
	7:40	2	2	8:32
	7:55	3	3	8:47
	8:10	4	2	9:02
	8:25	5	3	9:17
MID	8:40	6	2	9:32
	8:55	7	2	9:47
	9:10	8	2	10:02
	9:25	1	2	10:17
	9:40	2	2	10:32
	9:55	3	2	10:47
	10:10	4	2	11:02
	10:25	5	2	11:17
	10:40	6	2	11:32
	10:55	7	2	11:47
	11:10	8	2	12:02
	11:25	1	2	12:17
	11:40	2	2	12:32
	11:55	3	2	12:47
	12:10	4	2	1:02
	12:25	5	2	1:17
	12:40	6	2	1:32
	12:55	7	2	1:47
	1:10	8	2	2:02
	1:25	1	2	2:17
	1:40	2	2	2:32
	1:55	3	2	2:47
	2:10	4	2	3:02
	2:25	5	2	3:17
PM	2:40	6	3	3:32
	2:55	7	2	3:47
	3:10	8	3	4:02
	3:25	1	2	4:17
	3:40	2	3	4:32
	3:55	3	2	4:47
	4:10	4	3	5:02
	4:25	5	3	5:17
	4:40	6	3	5:32
	4:55	7	2	5:47
	5:10	8	3	6:02
	5:25	1	2	6:17
OFF	5:40	2	1	6:32
	5:55	3	1	6:47
	6:10	4	1	7:02
	6:25	5	1	7:17
	6:40	6	1	7:32
	6:55	7	1	7:47
	7:11	8	1	8:03
	7:26	1	1	8:18
	7:41	2	1	8:33
	7:57	3	1	8:51
	8:12	4	1	-
	8:27	5	1	9:21
	8:57	6	1	9:51
	9:27	7	1	10:21
	9:57	8	1	10:51
	10:28	1	1	11:22
	10:58	2	1	11:52
	11:28	3	1	12:22
	11:49	4	1	12:39
	12:17	5	1	1:11
	1:18	6	1	2:11
	2:21	7	1	3:13
	3:21	8	1	4:13
	4:20	1	1	5:12
	4:40	2	1	5:32
	5:00	3	1	5:52

TABLE D2. VTA SCHEDULE WITH TRAIN PATTERN - WEEKDAY SOUTHBOUND

Period	Baypointe	Train #	Train Pattern	Santa Teresa
AM	5:28	6	2	6:20
	5:48	7	3	6:40
	6:08	8	3	7:00
	6:23	1	3	7:15
	6:38	2	2	7:30
	6:53	3	3	7:45
	7:08	4	2	8:00
	7:23	5	3	8:15
	7:38	6	2	8:30
	7:53	7	3	8:45
	8:08	8	3	9:00
	8:23	1	3	9:15
MID	8:38	2	2	9:30
	8:53	3	2	9:45
	9:08	4	2	10:00
	9:23	5	2	10:15
	9:38	6	2	10:30
	9:53	7	2	10:45
	10:08	8	2	11:00
	10:23	1	2	11:15
	10:38	2	2	11:30
	10:53	3	2	11:45
	11:08	4	2	12:00
	11:23	5	2	12:15
	11:38	6	2	12:30
	11:53	7	2	12:45
	12:08	8	2	1:00
	12:23	1	2	1:15
	12:38	2	2	1:30
	12:53	3	2	1:45
	1:08	4	2	2:00
	1:23	5	2	2:15
	1:38	6	2	2:30
	1:53	7	2	2:45
	2:08	8	2	3:00
	2:23	1	2	3:15
PM	2:38	2	3	3:30
	2:53	3	2	3:45
	3:08	4	3	4:00
	3:23	5	2	4:15
	3:38	6	3	4:30
	3:53	7	2	4:45
	4:08	8	3	5:00
	4:23	1	3	5:15
	4:38	2	3	5:30
	4:53	3	2	5:45
	5:08	4	3	6:00
	5:23	5	2	6:15
OFF	5:38	6	1	6:30
	5:53	7	1	6:45
	6:08	8	1	7:00
	6:23	1	1	7:15
	6:38	2	1	7:30
	6:53	3	1	7:45
	7:08	4	1	8:00
	7:23	5	1	8:15
	7:40	6	1	8:32
	8:00	7	1	8:56
	8:30	8	1	9:26
	9:00	1	1	9:56
	9:30	2	1	10:26
	10:01	3	1	10:56
	10:31	4	1	11:26
	11:01	5	1	11:56
	11:31	6	1	12:26
	12:05	7	1	12:56
	12:35	8	1	1:26
	1:23	1	1	2:14
	2:23	2	1	3:14
	3:23	3	1	4:14
	4:23	4	1	5:14

TABLE D3. LIGHT RAIL WEEKDAY TRAINS TRAVELED ON SYSTEM

	Northbound			Southbound		
Period	3-Car	2-Car	1-Car	3-Car	2-Car	1-Car
AM Peak	8	5	0	8	4	0
Midday	0	24	0	0	24	0
PM Peak	7	5	0	7	5	0
Off-Peak	0	0	26	0	0	23
TOTAL	15	34	26	15	33	23

TABLE D4. VTA SCHEDULE WITH TRAIN PATTERN - WEEKEND NORTHBOUND

Period	Santa Teresa	Train #	Train Pattern	Baypointe
AM	5:20	7	1	6:14
	5:55	8	1	6:46
	6:25	1	1	7:16
	6:40	2	1	7:31
	6:55	3	1	7:46
	7:10	5	1	8:01
	7:25	6	1	8:16
	7:40	7	1	8:31
	7:55	8	1	8:46
	8:10	1	1	9:01
	8:25	2	1	9:16
MID	8:40	3	1	9:31
	8:55	4	1	9:46
	9:10	5	1	10:01
	9:25	6	1	10:16
	9:40	7	1	10:31
	9:55	8	1	10:46
	10:10	1	1	11:01
	10:25	2	1	11:16
	10:40	3	1	11:31
	10:55	4	1	11:46
	11:10	5	1	12:01
	11:25	6	1	12:16
	11:40	7	1	12:31
	11:55	8	1	12:46
	12:10	1	1	1:01
	12:25	2	1	1:16
	12:40	3	1	1:31
	12:55	4	1	1:46
	1:10	5	1	2:01
	1:25	6	1	2:16
	1:40	7	1	2:31
	1:55	8	1	2:46
	2:10	1	1	3:01
	2:25	2	1	3:16
PM	2:40	3	1	3:31
	2:55	4	1	3:46
	3:10	5	1	4:01
	3:25	6	1	4:16
	3:40	7	1	4:31
	3:55	8	1	4:46
	4:10	1	1	5:01
	4:25	2	1	5:16
	4:40	3	1	5:31
	4:55	4	1	5:46
	5:10	5	1	6:01
	5:25	6	1	6:16
OFF	5:40	7	1	6:31
	5:55	8	1	6:46
	6:10	1	1	7:01
	6:25	2	1	7:16
	6:40	3	1	7:31
	6:55	4	1	7:46
	7:10	5	1	8:01
	7:25	6	1	8:16
	7:41	7	1	8:32
	7:57	8	1	8:51
	8:12*	1	1	-
	8:27	2	1	9:21
	8:42*	3	1	-
	8:57	4	1	9:51
	9:27	5	1	10:21
	9:57	6	1	10:51
	10:27	7	1	11:21
	10:58	8	1	11:52
	11:28	2**	1	12:22
	11:49	4**	1	12:39
	12:17	5	1	1:11
	1:18	6	1	2:11
	2:21	7	1	3:13
	3:21	8	1	4:13
	4:20	2**	1	5:12

*Train terminates at Civic Center station, and does not continue to Baypointe, the terminal station.

**Trains 1 and 3 are taken out-of-service at Civic Center station, and do not continue on to Baypointe.

TABLE D5. VTA SCHEDULE WITH TRAIN PATTERN - WEEKEND SOUTHBOUND

Period	Baypointe	Train #	Train Pattern	Santa Teresa
AM	5:23	1	1	6:14
	5:51*	2	1	6:26
	6:06*	3	1	6:41
	6:21*	5	1	6:56
	6:34**	-	-	6:59**
	6:24	6	1	7:15
	6:57*	7	1	7:32
	6:54	8	1	7:45
	7:25*	1	1	8:00
	7:24	2	1	8:15
	7:39	3	1	8:30
	7:54	4	1	8:45
	8:09	5	1	9:00
	8:24	6	1	9:15
MID	8:39	7	1	9:30
	8:54	8	1	9:45
	9:09	1	1	10:00
	9:24	2	1	10:15
	9:39	3	1	10:30
	9:54	4	1	10:45
	10:09	5	1	11:00
	10:24	6	1	11:15
	10:39	7	1	11:30
	10:54	8	1	11:45
	11:09	1	1	12:00
	11:24	2	1	12:15
	11:39	3	1	12:30
	11:54	4	1	12:45
	12:09	5	1	1:00
	12:24	6	1	1:15
	12:39	7	1	1:30
	12:54	8	1	1:45
	1:09	1	1	2:00
	1:24	2	1	2:15
	1:39	3	1	2:30
	1:54	4	1	2:45
	2:09	5	1	3:00
	2:24	6	1	3:15
PM	2:39	7	1	3:30
	2:54	8	1	3:45
	3:09	1	1	4:00
	3:24	2	1	4:15
	3:39	3	1	4:30
	3:54	4	1	4:45
	4:09	5	1	5:00
	4:24	6	1	5:15
	4:39	7	1	5:30
	4:54	8	1	5:45
	5:09	1	1	6:00
	5:24	2	1	6:15
OFF	5:39	3	1	6:30
	5:54	4	1	6:45
	6:09	5	1	7:00
	6:24	6	1	7:15
	6:39	7	1	7:30
	6:54	8	1	7:45
	7:09	1	1	7:59
	7:22	2	1	8:13
	7:36	3	1	8:27
	7:51	4	1	8:42
	8:06	5	1	8:57
	8:31	6	1	9:26
	9:01	7	1	9:56
	9:31	8	1	10:26
	10:01	1	1	10:56
	10:31	2	1	11:26
	11:01	3	1	11:56
	11:31	4	1	12:26
	12:05	5	1	12:56
	12:35	6	1	1:26
	1:23	7	1	2:14
	2:23	8	1	3:14
	3:23	1	1	4:14
	4:23	2	1	5:14

* Denotes train with originating at Civic Center station.

**Trains 1 and 3 are taken out-of-service at Civic Center station, and do not continue on to Baypointe.

TABLE D6. LIGHT RAIL WEEKEND TRAINS TRAVELED ON SYSTEM

Period	Northbound			Southbound		
	3-Car	2-Car	1-Car	3-Car	2-Car	1-Car
AM Peak	0	0	11	0	0	13
Midday	0	0	24	0	0	24
PM Peak	0	0	12	0	0	12
Off-Peak	0	0	25	0	0	24
TOTAL	0	0	72	0	0	73

TABLE D7. LIGHT RAIL WEEKDAY REVENUE-MILES AND REVENUE-HOURS

Period	3-Car-Train					2-Car-Train					1-Car-Train				
	# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour	
		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour
AM Peak	16	83.04	249.12	4.64	13.93	9	46.71	93.42	2.61	5.23	0	0.00	0.00	0.00	0.00
Midday	0	0.00	0.00	0.00	0.00	48	249.12	498.24	13.93	27.87	0	0.00	0.00	0.00	0.00
PM Peak	14	72.66	217.98	4.06	12.19	10	51.90	103.80	2.90	5.81	0	0.00	0.00	0.00	0.00
Off-Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	49	254.31	254.31	14.22	14.22
TOTAL	30	155.70	467.10	8.71	26.13	67	347.73	695.46	19.45	38.90	49	254.31	254.31	14.22	14.22

TABLE D8. LIGHT RAIL WEEKEND REVENUE-MILES AND REVENUE-HOURS

Period	3-Car-Train					2-Car-Train					1-Car-Train				
	# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour	
		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour
AM Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	24	124.56	124.56	6.97	6.97
Midday	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	48	249.12	249.12	13.93	13.93
PM Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	24	124.56	124.56	6.97	6.97
Off-Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	49	254.31	254.31	14.22	14.22
TOTAL	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	145	752.55	752.55	42.09	42.09

Calculation methodologies and sample calculations are shown below. The sample calculations shown here apply to the 3-car train, Weekday AM Peak scenario, from Table D7. Values for route mileage and total travel time come from Table D9. It is noteworthy that calculations for revenue-miles and –hours are based on actual route mileage (5.19 miles) rather than effective route mileage (5.36 miles). This is because vehicles would not be expected to use a significant portion of crossover rails or yard rails while in normal operation.

TABLE D9. BAYPOINTE TO JAPANTOWN ROUTE LENGTH AND TRAVEL TIME

Link	Route Mileage	Effective Route Mileage	Average Route Travel Time (min)
Japantown - Baypointe	5.19	5.36	17.42

Table D9 also shows an average route travel time of 17.42 minutes for the study section. This average route travel time represents the number of minutes required for a light rail vehicle to travel the length of the study section. This is a calculated value, and is based on a weighted average of the route travel times shown in Tables E18 through E23 in Appendix E. A calculated value was used here because exact travel times between the Baypointe and Japantown stations (the endpoints of the study system) were not available from VTA.

Train-Revenue-Miles

Train-Revenue-Miles = [# Trains Traveled (2 Directions)] x [Route Mileage]
Sample Calculation (from Table D7): 83.04 = 16 x 5.19

Vehicle-Revenue-Miles

Vehicle-Revenue-Miles = [# Vehicles per Train] x [Train-Revenue-Miles]
Sample Calculation (from Table D7): 249.12 = 3 x 83.04

Train-Revenue-Hours

Train-Revenue-Hours = [# Trains Traveled (2 Directions)] x [Total Travel Time (min)/60]
Sample Calculation (from Table D7): 4.64 = 16 x 17.42/60

Vehicle-Revenue-Hours

Vehicle-Revenue-Hours = [# Vehicles per Train] x [Train-Revenue-Hours]
Sample Calculation (from Table D7): 13.93 = 4.64 x 3

Calculation of Annual Revenue-Miles and –Hours

Tables D10 and D11 show calculated annual revenue-miles and –hours. Tables D12 and D13 summarize the values tabulated in Tables D10 and D11. Sample calculation values again apply to the 3-car train, Weekday AM Peak scenario. The methodology for calculation is as follows:

The values in Tables D10 and D11 are computed by multiplying the appropriate value from Table D14, which shows the number of weekdays, Saturdays, and Sundays in the year, by the corresponding values in Tables D7 and D8.

The following sample calculation comes from Table D10, from the column entitled “# Trains Traveled (2 Directions),” and uses values from Table D14:

Sample Calculation: 4176 = 261 x 16

Reference

1. *Final Annual Report 1999-2000.* Prepared for Federal Transit Administration National Transit Database by Santa Clara Valley Transportation Authority.

TABLE D10. LIGHT RAIL WEEKDAY ANNUAL REVENUE-MILES AND REVENUE-HOURS

Weekday	3-Car-Train					2-Car-Train					1-Car-Train				
	# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour	
		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour
AM Peak	4176	21673	65020	1212	3637	2349	12191	24383	682	1364	0	0	0	0	0
Midday	0	0	0	0	0	12528	65020	130041	3637	7273	0	0	0	0	0
PM Peak	3654	18964	56893	1061	3182	2610	13546	27092	758	1515	0	0	0	0	0
Off-Peak	0	0	0	0	0	0	0	0	0	0	12789	66375	66375	3712	3712
TOTAL	7830	40638	121913	2273	6819	17487	90758	181515	5076	10152	12789	66375	66375	3712	3712

TABLE D11. LIGHT RAIL WEEKEND ANNUAL REVENUE-MILES AND REVENUE-HOURS

Weekend	3-Car-Train					2-Car-Train					1-Car-Train				
	# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour		# Trains Traveled (2 Directions)	Revenue Mile		Revenue Hour	
		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour		Train-Mile	Car-Mile	Train-Hour	Car-Hour
AM Peak	0	0	0	0	0	0	0	0	0	0	2496	12954	12954	725	725
Midday	0	0	0	0	0	0	0	0	0	0	4992	25908	25908	1449	1449
PM Peak	0	0	0	0	0	0	0	0	0	0	2496	12954	12954	725	725
Off-Peak	0	0	0	0	0	0	0	0	0	0	5096	26448	26448	1479	1479
TOTAL	0	0	0	0	0	0	0	0	0	0	15080	78265	78265	4377	4377

TABLE D12. LIGHT RAIL ANNUAL REVENUE-MILES OF OPERATION

Day	Car Miles				Train Miles			
	3-Car Train	2-Car Train	1-Car Train	TOTAL	3-Car Train	2-Car Train	1-Car Train	TOTAL
Weekday	121913	181515	66375	369803	40638	90758	66375	197770
Weekend	0	0	78265	78265	0	0	78265	78265
TOTAL				448068				276035

TABLE D13. LIGHT RAIL ANNUAL REVENUE-HOURS OF OPERATION

Day	Car Hours				Train Hours			
	3-Car Train	2-Car Train	1-Car Train	TOTAL	3-Car Train	2-Car Train	1-Car Train	TOTAL
Weekday	6819	10152	3712	20683	2273	5076	3712	11061
Weekend	0	0	4377	4377	0	0	4377	4377
TOTAL				25061				15439

TABLE D14. DAYS OF WEEK PER YEAR

Day of Week	# of Days
Weekday	261
Saturday	52
Sunday	52

APPENDIX E

LIGHT RAIL SYSTEM USER COSTS

Introduction

For the purposes of this study, user costs are assumed to be costs associated with rider wait and on-board travel time, and do not include fares.

Tables E1 through E24 show tables containing user time calculations. Table E25 shows a summary of calculated user costs for the previously-described light rail system. Table E26 shows the annual number of weekdays and weekends assumed for the calculations.

User costs were calculated based on relevant on-off ridership data for the VTA light rail system. On-off data were obtained from VTA, and were given for weekday, Saturday, and Sunday ridership in both the northbound and southbound directions. Data for each day are divided into four periods: AM Peak (5:30-8:30 am), Midday (8:30 am – 2:30 pm), PM Peak (2:30 pm – 5:30 pm), and Off-Peak (5:30 pm – 5:30 am). Appendix F contains the VTA on/off data for the Guadalupe line, which is the base system for this study.

Cost calculations for overall user costs were completed in the following sequence:

1. Determination of user wait- and travel-time value (in $).
2. Calculation of daily passenger wait time for weekdays and weekends.
3. Calculation of daily passenger on-board travel time for weekdays and weekends.
4. Summation of daily wait time and travel time, and of annual wait time and travel time.
5. Calculation of wait- and travel-time costs.

Value of User Wait- and On-Board Travel Time

California Life-Cycle Benefit/Cost Analysis Model (1) gives a value of user time as $8.16 per hour in 2000-dollars. Adjusting this value for inflation using an inflation factor of 1.02 (2), we see that the value of user time is given as follows:

Cost/User Hour = 8.16 x 1.02 = $8.32.

Daily Passenger Wait-Time

The following procedures describe the methodologies used to calculate light rail user wait-time costs:

1. Per-station passenger "on" volume data for weekdays, Saturdays and Sundays, in both the northbound and southbound directions, are shown in Tables E1 through E6. These data represent passengers waiting to board the system at a given station during a given daily time period, and were extracted from the VTA data tables shown in Appendix F.
2. The VTA light rail schedule was used to approximate average headways for the system for each daily period during weekdays, Saturdays, and Sundays. Appendix B

contains the VTA schedules used. The schedule shown in the appendix is for the entire Guadalupe line, rather than for the study section only, which is a subset of the Guadalupe line; however, it is assumed that headways remain constant over the entire run. Table E7 shows summarized headways for each time period.

3. Total passenger wait time for each segment during each daily time period was calculated for weekdays, Saturdays, and Sundays. The following formula was used:

Wait time = (0.5) x (Headway) x (# Passengers Waiting to Board)

TABLE E1. LIGHT RAIL WEEKDAY NB PASSENGERS WAITING TO BOARD

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	46	47	26	23	142
Civic Center	98	158	71	80	407
Gish	36	36	9	19	100
Metro/Airport	17	33	19	9	78
Karina Court	14	28	28	14	84
Component	1	5	6	6	18
Bonaventura	5	20	12	6	43
Orchard	3	2	5	2	12
River Oaks	2	5	6	3	16
Tasman	1	2	3	0	6
Baypointe	0	0	0	0	0
TOTAL	223	336	185	162	906

TABLE E2. LIGHT RAIL WEEKDAY SB PASSENGERS WAITING TO BOARD

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	166	281	294	298	1,039
Tasman	46	46	61	44	197
River Oaks	30	57	112	34	233
Orchard	12	30	48	25	115
Bonaventura	14	93	90	43	240
Component	10	34	76	24	144
Karina Court	35	81	122	73	311
Metro/Airport	20	111	127	79	337
Gish	69	171	132	69	441
Civic Center	81	404	259	95	839
Japantown/Ayer	43	138	54	39	274
TOTAL	526	1,446	1,375	823	4,170

TABLE E3. LIGHT RAIL SATURDAY NB PASSENGERS WAITING TO BOARD

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	11	41	16	19	87
Civic Center	31	99	41	72	243
Gish	4	28	6	15	53
Metro/Airport	2	20	12	8	42
Karina Court	3	20	10	12	45
Component	2	1	2	3	8
Bonaventura	0	3	1	1	5
Orchard	0	4	4	0	8
River Oaks	0	3	1	1	5
Tasman	3	0	0	2	5
Baypointe	0	0	0	0	0
TOTAL	56	219	93	133	501

TABLE E4. LIGHT RAIL SATURDAY SB PASSENGERS WAITING TO BOARD

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	61	222	172	272	727
Tasman	3	23	11	8	45
River Oaks	6	17	8	6	37
Orchard	4	11	9	9	33
Bonaventura	5	17	14	12	48
Component	5	13	14	6	38
Karina Court	15	53	43	46	157
Metro/Airport	14	83	45	54	196
Gish	41	127	63	50	281
Civic Center	33	189	108	100	430
Japantown/Ayer	20	79	33	44	176
TOTAL	207	834	520	607	2,168

TABLE E5. LIGHT RAIL SUNDAY NB PASSENGERS WAITING TO BOARD

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	11	34	14	7	66
Civic Center	18	65	36	67	186
Gish	3	13	8	15	39
Metro/Airport	0	24	14	25	63
Karina Court	1	7	4	4	16
Component	1	0	3	0	4
Bonaventura	0	2	2	4	8
Orchard	0	2	3	0	5
River Oaks	0	1	0	1	2
Tasman	0	1	0	2	3
Baypointe	0	0	0	0	0
TOTAL	34	149	84	125	392

TABLE E6. LIGHT RAIL SUNDAY SB PASSENGERS WAITING TO BOARD

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	49	191	141	265	646
Tasman	4	18	9	10	41
River Oaks	1	13	6	5	25
Orchard	2	9	7	10	28
Bonaventura	6	15	10	4	35
Component	2	7	5	10	24
Karina Court	9	46	32	44	131
Metro/Airport	15	59	48	63	185
Gish	20	90	51	44	205
Civic Center	25	161	164	58	408
Japantown/Ayer	18	56	28	23	125
TOTAL	151	665	501	536	1,853

TABLE E7. LIGHT RAIL HEADWAYS (min)

Period	Weekday		Weekend	
	NB	SB	NB	SB
AM	15	15	18	18
MID	15	15	15	15
PM	15	15	15	15
OFF	27	27	26	26

TABLE E8. LIGHT RAIL WEEKDAY NB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	345	353	195	311	1203
Civic Center	735	1185	533	1080	3533
Gish	270	270	68	257	864
Metro/Airport	128	248	143	122	639
Karina Court	105	210	210	189	714
Component	8	38	45	81	171
Bonaventura	38	150	90	81	359
Orchard	23	15	38	27	102
River Oaks	15	38	45	41	138
Tasman	8	15	23	0	45
Baypointe	0	0	0	0	0
TOTAL	1673	2520	1388	2187	7767
TOTAL (Hours)					129

TABLE E9. LIGHT RAIL WEEKDAY SB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	1245	2108	2205	4023	9581
Tasman	345	345	458	594	1742
River Oaks	225	428	840	459	1952
Orchard	90	225	360	338	1013
Bonaventura	105	698	675	581	2058
Component	75	255	570	324	1224
Karina Court	263	608	915	986	2771
Metro/Airport	150	833	953	1067	3002
Gish	518	1283	990	932	3722
Civic Center	608	3030	1943	1283	6863
Japantown/Ayer	323	1035	405	527	2289
TOTAL	3945	10845	10313	11111	36213
TOTAL (Hours)					604

TABLE E10. LIGHT RAIL SATURDAY NB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	99	308	120	247	774
Civic Center	279	743	308	936	2265
Gish	36	210	45	195	486
Metro/Airport	18	150	90	104	362
Karina Court	27	150	75	156	408
Component	18	8	15	39	80
Bonaventura	0	23	8	13	43
Orchard	0	30	30	0	60
River Oaks	0	23	8	13	43
Tasman	27	0	0	26	53
Baypointe	0	0	0	0	0
TOTAL	504	1643	698	1729	4573
TOTAL (Hours)					76

TABLE E11. LR SATURDAY SB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	549	1665	1290	3536	7040
Tasman	27	173	83	104	386
River Oaks	54	128	60	78	320
Orchard	36	83	68	117	303
Bonaventura	45	128	105	156	434
Component	45	98	105	78	326
Karina Court	135	398	323	598	1453
Metro/Airport	126	623	338	702	1788
Gish	369	953	473	650	2444
Civic Center	297	1418	810	1300	3825
Japantown/Ayer	180	593	248	572	1592
TOTAL	1863	6255	3900	7891	19909
TOTAL (Hours)					332

TABLE E12. LIGHT RAIL SUNDAY NB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	99	255	105	91	550
Civic Center	162	488	270	871	1791
Gish	27	98	60	195	380
Metro/Airport	0	180	105	325	610
Karina Court	9	53	30	52	144
Component	9	0	23	0	32
Bonaventura	0	15	15	52	82
Orchard	0	15	23	0	38
River Oaks	0	8	0	13	21
Tasman	0	8	0	26	34
Baypointe	0	0	0	0	0
TOTAL	306	1118	630	1625	3679
TOTAL (Hours)					61

TABLE E13. LIGHT RAIL SUNDAY SB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	441	1433	1058	3445	6376
Tasman	36	135	68	130	369
River Oaks	9	98	45	65	217
Orchard	18	68	53	130	268
Bonaventura	54	113	75	52	294
Component	18	53	38	130	238
Karina Court	81	345	240	572	1238
Metro/Airport	135	443	360	819	1757
Gish	180	675	383	572	1810
Civic Center	225	1208	1230	754	3417
Japantown/Ayer	162	420	210	299	1091
TOTAL	1359	4988	3758	6968	17072
TOTAL (Hours)					285

TABLE E14. LIGHT RAIL TOTAL DAILY PASSENGER WAIT TIME SUMMARY (hrs)

Day	NB	SB	TOTAL
Weekday	129	604	733
Saturday	76	332	408
Sunday	61	285	346
TOTAL	267	1220	1487

TABLE E15. LIGHT RAIL BAYPOINT-TO-CIVIC CENTER SEGMENT TRAVEL TIME CALCULATIONS

Direction	Period	Segment Travel Time (min)	Segment Length (mi)	Dwell Time				Segment Running Time + Delay	
				Percentage of Segment Travel Time	Min	# Station Dwell Periods	Per Station (min)	Running Time + Delay (min)	(Running Time + Delay) (min per mile)
North-bound	AM Peak	17	5.05	17.3%	2.94	10.00	0.29	14.06	2.78
	Midday	17	5.05	13.4%	2.27	10.00	0.23	14.73	2.92
	PM Peak	17	5.05	14.5%	2.47	10.00	0.25	14.53	2.88
	Off-Peak	17	5.05	13.4%	2.27	10.00	0.23	14.73	2.92
South-bound	AM Peak	17	5.05	11.2%	1.90	10.00	0.19	15.10	2.99
	Midday	17	5.05	13.2%	2.25	10.00	0.22	14.75	2.92
	PM Peak	17	5.05	7.1%	1.20	10.00	0.12	15.80	3.13
	Off-Peak	17	5.05	7.1%	1.20	10.00	0.12	15.80	3.13

TABLE E16. LIGHT RAIL SYSTEM NB SEGMENT TRAVEL TIME

Station	Segment Length (mi)	Total Segment Travel Time (min)			
		AM Peak	Midday	PM Peak	Off-Peak
Japantown/Ayer - Civic Center	0.14	0.68	0.64	0.65	0.64
Civic Center - Gish	0.82	2.58	2.62	2.61	2.62
Gish - Metro/Airport	0.59	1.94	1.95	1.94	1.95
Metro/Airport - Karina	0.52	1.74	1.74	1.74	1.74
Karina - Component	0.55	1.83	1.83	1.83	1.83
Component - Bonaventura	0.42	1.46	1.45	1.46	1.45
Bonaventura - Orchard	0.55	1.83	1.83	1.83	1.83
Orchard - River Oaks	0.57	1.88	1.89	1.89	1.89
River Oaks - Tasman	0.53	1.77	1.77	1.77	1.77
Tasman - Baypointe	0.5	1.69	1.69	1.69	1.69
TOTAL	5.19	17.39	17.41	17.40	17.41

TABLE E17. LIGHT RAIL SYSTEM SB SEGMENT TRAVEL TIME

Station	Segment Length (mi)	Total Segment Travel Time (min)			
		AM Peak	Midday	PM Peak	Off-Peak
Baypointe - Tasman	0.50	1.69	1.69	1.68	1.68
Tasman - River Oaks	0.53	1.77	1.77	1.78	1.78
River Oaks - Orchard	0.57	1.89	1.89	1.90	1.90
Orchard - Bonaventura	0.55	1.83	1.83	1.84	1.84
Bonaventura - Component	0.42	1.45	1.45	1.43	1.43
Component - Karina	0.55	1.83	1.83	1.84	1.84
Karina - Metro/Airport	0.52	1.74	1.74	1.75	1.75
Metro/Airport - Gish	0.59	1.95	1.95	1.97	1.97
Gish - Civic Center	0.82	2.64	2.62	2.69	2.69
Civic Center - Japantown/Ayer	0.14	0.61	0.63	0.56	0.56
TOTAL	5.19	17.42	17.41	17.44	17.44

TABLE E18. LIGHT RAIL WEEKDAY NB ON-BOARD PASSENGER TRAVEL TIME

Station*	On	Off	No. Passengers On-Board for Segment	Segment Travel Time (min)					Total Passenger Time (hr)
				AM Peak	Midday	PM Peak	Off-Peak	Weighted Average	
Santa Teresa	772	0	772						
Cottle	321	18	1,075						
Snell	324	32	1,367						
Blossom Hill	421	43	1,745						
Ohlone-Chynoweth	1,000	139	2,606						
Branham	253	70	2,789						
Capitol	579	240	3,128						
Curtner	390	192	3,326						
Tamien	518	463	3,381						
Virginia	126	129	3,378						
Childrens' Discovery Museum	78	211	3,245						
Convention Center	338	411	3,172						
San Antonio	491	881	2,782						
Santa Clara	1,414	816	3,380						
St. James	384	237	3,527						
TOTAL PASSENGERS ON BOARD AT ST JAMES			3,527						
Japantown/Ayer	142	268	3,401	0.68	0.64	0.65	0.64	0.64	36.46
Civic Center	407	866	2,942	2.58	2.62	2.61	2.62	2.61	128.08
Gish	100	498	2,544	1.94	1.95	1.94	1.95	1.95	82.52
Metro/Airport	78	382	2,240	1.74	1.74	1.74	1.74	1.74	65.09
Karina Court	84	328	1,996	1.83	1.83	1.83	1.83	1.83	60.89
Component	18	207	1,807	1.46	1.45	1.46	1.45	1.45	43.79
Bonaventura	43	238	1,612	1.83	1.83	1.83	1.83	1.83	49.17
Orchard	12	97	1,527	1.88	1.89	1.89	1.89	1.89	48.05
River Oaks	16	220	1,323	1.77	1.77	1.77	1.77	1.77	39.08
Tasman	6	186	1,143	1.69	1.69	1.69	1.69	1.69	32.11
Baypointe	0	1,143	0						
TOTAL				17.39	17.41	17.40	17.41	17.41	585.23

* Stations from Santa Teresa to St. James are not part of the proposed LR system, an are shown here only for calculation purposes.

TABLE E19. LIGHT RAIL WEEKDAY SB OB-BOARD PASSENGER TRAVEL TIME

Station	On	Off	No. Passengers On-Board for Segment	Segment Travel Time (min)					Total Passenger Time (hr)
				AM Peak	Midday	PM Peak	Off-Peak	Weighted Average	
Baypointe	1,039	0	1,039	1.69	1.69	1.68	1.68	1.68	29.17
Tasman	197	3	1,233	1.77	1.77	1.78	1.78	1.78	36.51
River Oaks	233	28	1,438	1.89	1.89	1.90	1.90	1.90	45.51
Orchard	115	15	1,538	1.83	1.83	1.84	1.84	1.84	47.11
Bonaventura	240	57	1,721	1.45	1.45	1.43	1.43	1.44	41.30
Component	144	24	1,841	1.83	1.83	1.84	1.84	1.84	56.39
Karina Court	311	80	2,072	1.74	1.74	1.75	1.75	1.75	60.29
Metro/Airport	337	94	2,315	1.95	1.95	1.97	1.97	1.96	75.62
Gish	441	96	2,660	2.64	2.62	2.69	2.69	2.66	118.09
Civic Center	839	365	3,134	0.61	0.63	0.56	0.56	0.58	30.47
Japantown/Ayer	274	116	3,292						
TOTAL				17.42	17.41	17.44	17.44	17.43	540.46

TABLE E20. LIGHT RAIL SATURDAY NB ON-BOARD TRAVEL TIME

Station*	On	Off	No. Passengers On-Board for Segment	Segment Travel Time (min)					Total Passenger Time (hr)
				AM Peak	Midday	PM Peak	Off-Peak	Weighted Average	
Santa Teresa	439	0	439						
Cottle	164	17	586						
Snell	181	24	743						
Blossom Hill	252	32	963						
Ohlone-Chynoweth	503	118	1,348						
Branham	102	35	1,415						
Capitol	289	158	1,546						
Curtner	225	104	1,667						
Tamien	295	205	1,757						
Virginia	83	82	1,758						
Childrens' Discovery Museum	58	151	1,665						
Convention Center	274	357	1,582						
San Antonio	266	286	1,562						
Santa Clara	757	517	1,802						
St. James	216	147	1,871						
TOTAL PASSENGERS ON BOARD AT ST JAMES			1,871						
Japantown/Ayer	87	181	1,777	0.68	0.64	0.65	0.64	0.64	19.05
Civic Center	243	493	1,527	2.58	2.62	2.61	2.62	2.61	66.48
Gish	53	305	1,275	1.94	1.95	1.94	1.95	1.95	41.35
Metro/Airport	42	202	1,115	1.74	1.74	1.74	1.74	1.74	32.40
Karina Court	45	191	969	1.83	1.83	1.83	1.83	1.83	29.56
Component	8	50	927	1.46	1.45	1.46	1.45	1.45	22.46
Bonaventura	5	58	874	1.83	1.83	1.83	1.83	1.83	26.66
Orchard	8	26	856	1.88	1.89	1.89	1.89	1.89	26.94
River Oaks	5	37	824	1.77	1.77	1.77	1.77	1.77	24.34
Tasman	5	50	779	1.69	1.69	1.69	1.69	1.69	21.88
Baypointe	0	779	0						
TOTAL				17.39	17.41	17.40	17.41	17.41	311.13

* Stations from Santa Teresa to St. James are not part of the proposed LR system, an are shown here only for calculation purposes.

TABLE E21. LIGHT RAIL SATURDAY SB PASSENGER ON-BOARD TRAVEL TIME

Station	On	Off	No. Passengers On-Board for Segment	Segment Travel Time (min)					Total Passenger Time (hr)
				AM Peak	Midday	PM Peak	Off-Peak	Weighted Average	
Baypointe	727	0	727	1.69	1.69	1.68	1.68	1.68	20.41
Tasman	45	1	771	1.77	1.77	1.78	1.78	1.78	22.83
River Oaks	37	10	798	1.89	1.89	1.90	1.90	1.90	25.25
Orchard	33	3	828	1.83	1.83	1.84	1.84	1.84	25.36
Bonaventura	48	6	870	1.45	1.45	1.43	1.43	1.44	20.88
Component	38	4	904	1.83	1.83	1.84	1.84	1.84	27.69
Karina Court	157	38	1,023	1.74	1.74	1.75	1.75	1.75	29.77
Metro/Airport	196	37	1,182	1.95	1.95	1.97	1.97	1.96	38.61
Gish	281	49	1,414	2.64	2.62	2.69	2.69	2.66	62.77
Civic Center	430	183	1,661	0.61	0.63	0.56	0.56	0.58	16.15
Japantown/Ayer	176	62	1,775						
TOTAL				17.42	17.41	17.44	17.44	17.43	289.73

TABLE E22. LIGHT RAIL SUNDAY NB PASSENGER ON-BOARD TRAVEL TIME

Station*	On	Off	No. Passengers On-Board for Segment	Segment Travel Time (min)					Total Passenger Time (hr)
				AM Peak	Midday	PM Peak	Off-Peak	Weighted Average	
Santa Teresa	400	0	400						
Cottle	111	7	504						
Snell	140	30	614						
Blossom Hill	170	23	761						
Ohlone-Chynoweth	360	94	1,027						
Branham	81	25	1,083						
Capitol	239	130	1,192						
Curtner	223	111	1,304						
Tamien	207	173	1,338						
Virginia	87	62	1,363						
Childrens' Discovery Museum	66	144	1,285						
Convention Center	210	219	1,276						
San Antonio	191	198	1,269						
Santa Clara	648	412	1,505						
St. James	149	111	1,543						
TOTAL PASSENGERS ON BOARD AT ST JAMES			1,543						
Japantown/Ayer	66	158	1,451	0.68	0.64	0.65	0.64	0.64	15.55
Civic Center	186	432	1,205	2.58	2.62	2.61	2.62	2.61	52.46
Gish	39	223	1,021	1.94	1.95	1.94	1.95	1.95	33.12
Metro/Airport	63	163	921	1.74	1.74	1.74	1.74	1.74	26.76
Karina Court	16	115	822	1.83	1.83	1.83	1.83	1.83	25.08
Component	4	32	794	1.46	1.45	1.46	1.45	1.45	19.24
Bonaventura	8	27	775	1.83	1.83	1.83	1.83	1.83	23.64
Orchard	5	38	742	1.88	1.89	1.89	1.89	1.89	23.35
River Oaks	2	32	712	1.77	1.77	1.77	1.77	1.77	21.03
Tasman	3	51	664	1.69	1.69	1.69	1.69	1.69	18.65
Baypointe	0	664	0						
TOTAL				17.39	17.41	17.40	17.41	17.41	258.88

* Stations from Santa Teresa to St. James are not part of the proposed LR system, an are shown here only for calculation purposes.

TABLE E23. LIGHT RAIL SUNDAY SB PASSENGER ON-BOARD TRAVEL TIME

Station	On	Off	No. Passengers On-Board for Segment	Segment Travel Time (min)					Total Passenger Time (hr)
				AM Peak	Midday	PM Peak	Off-Peak	Weighted Average	
Baypointe	646	0	646	1.69	1.69	1.68	1.68	1.68	18.14
Tasman	41	2	685	1.77	1.77	1.78	1.78	1.78	20.28
River Oaks	25	7	703	1.89	1.89	1.90	1.90	1.90	22.25
Orchard	28	4	727	1.83	1.83	1.84	1.84	1.84	22.27
Bonaventura	35	3	759	1.45	1.45	1.43	1.43	1.44	18.22
Component	24	0	783	1.83	1.83	1.84	1.84	1.84	23.98
Karina Court	131	28	886	1.74	1.74	1.75	1.75	1.75	25.78
Metro/Airport	185	32	1,039	1.95	1.95	1.97	1.97	1.96	33.94
Gish	205	51	1,193	2.64	2.62	2.69	2.69	2.66	52.96
Civic Center	408	129	1,472	0.61	0.63	0.56	0.56	0.58	14.31
Japantown/Ayer	125	62	1,535						
TOTAL				17.42	17.41	17.44	17.44	17.43	252.13

TABLE E24. LIGHT RAIL DAILY ON-BOARD TRAVEL TIME SUMMARY

Element	Daily User-Hours
Weekday	1126
Saturday	601
Sunday	511

TABLE E25. LIGHT RAIL TOTAL USER COSTS

Day	Element	Daily User-Hours	Cost/User-Hour ($)	Daily Cost ($)	Annual Cost ($)
Weekday	Wait Time	733	8.32	6099	1,591,724
	On-Board Travel Time	1126	8.32	9366	2,444,462
Saturday	Wait Time	408	8.32	3395	176,532
	On-Board Travel Time	601	8.32	4999	259,952
Sunday	Wait Time	346	8.32	2877	149,625
	On-Board Travel Time	511	8.32	4252	221,084
TOTAL WAIT TIME					1,917,881
TOTAL ON-BOARD TRAVEL TIME					2,925,498
TOTAL				30,987	4,843,378

TABLE E26. DAYS OF WEEK PER YEAR

Day of Week	# of Days
Weekday	261
Saturday	52
Sunday	52

Tables E8 through E13 show the calculated total passenger wait time values for weekdays, Saturdays, and Sundays. Table E14 shows summarized values for passenger wait time.

Daily Passenger On-Board Travel Time

Tables E15 through E23 show computation of passenger on-board travel time for both the northbound and southbound directions on weekdays, Saturdays, and Sundays. The following procedure describes the calculation methodologies:

1. Number of passengers aboard the VTA system at each station was determined.
2. Segment travel time was estimated for each segment of the light rail system.
3. Total passenger on-board travel time (in hours) for each segment was calculated.

Determination of Passengers Aboard System at Each Station

On-off data from VTA were used to determine how many passengers would be on-board the system at each station in the study section. The source data appears in Appendix F. The number of passengers on-board at any given station is the sum of the previous on-board total and the number getting on at that particular station, less the number getting off at that station.

Stations listed in boldface were not included in the study section, but it was necessary to display them in the tables because they are used in the calculation of subsequent values.

Calculation of Segment Travel Time

Tables E15 through E17 show the applicable calculations for segment travel time. Tables E16 and E17 show travel times for each segment according to day-of-week, direction (NB or SB) and time of day. The segment travel time for each station-to-station segment for the study section was calculated according to the following procedure:

1. Calculation of individual-train travel rates and delay rates for each segment (both in minutes per mile), and dwell time per station.
2. Calculation of total segment travel time for each segment of the study section.
3. Calculation of total passenger on-board travel time (in hours) for all station-to-station segments on the route.

<u>Calculation of Individual-Train Travel Rates and Delay Rates for Each Segment (both in minutes per mile), and Dwell Time per Station</u>

Calculations for individual-train travel time and delay rates (in minutes per mile), and calculation of per-station dwell times, were based on data from Breslin and Botha (3) regarding dwell time on the VTA Guadalupe line. The segment of the Guadalupe line studied by Breslin and Botha spans all but 0.14 miles of the study section presented in this report, so the data are considered to be highly applicable. Once per-station dwell rates, and running-time-plus-delay rates (in minutes per mile) were determined, these rates were applied to the study section.

Values for segment travel time were calculated based on an assumed constant 17-minute total route travel time for the Baypointe-to-Civic Center segment of the Guadalupe line. This 17-minute travel time was acquired from the VTA schedule that was effective as of July 8, 2002, and was assumed here to apply to the Baypointe-to-Civic Center segment on weekdays and weekends, all four daily periods, and both the north- and southbound directions. Dwell time, as cited here, varies according to time-of-day and travel direction. It is unknown whether variation of overall travel time for day, period, and direction would significantly affect overall passenger travel time, but the effect in this case was assumed to be negligible considering that the VTA light rail system operates with signal priority on a separated right-of-way.

The Baypointe-to-Civic Center segment length is 5.05 miles. In their study of VTA Guadalupe line operational characteristics, Breslin and Botha (3) give the "Percentage of Segment Travel Time" that is constituted by dwell time for each daily period in the northbound and southbound directions. These percentages are shown in Table E15.

Dwell time is calculated as follows:

> Dwell Time (min) = [Total Segment Travel Time (min)] x [Percentage of Segment Travel Time that is Dwell Time]
> Sample Calculation: 2.94 min = 17 min x 17.3%

The column entitled "# Station Dwell Periods" in Table E15 refers to the number of times a train dwells at a station on the segment during a specified period (e.g. – AM Peak). The following assumptions were applied:

- One-half of a dwell period is assumed at the beginning- and end-of-line stations.
- Each station between the beginning- and end-of-line stations uses one whole dwell period.

In total, the study section contains ten dwell periods, with eleven total stations included in the segment (two endpoint stations and nine in-between).

"Dwell Time Per Station" in Table E15 is calculated by dividing the total dwell time by the number of dwell periods.

> Sample Calculation: 0.29 min/station = 2.94 min/10.00 stations

“Running Time + Delay (min)” is a quantity that represents time spent by a train in both transit and delayed at intersections due to traffic and pedestrians. It was calculated by subtracting the minutes of dwell time from the segment travel time (min).

Sample Calculation: 14.06 (min) = 17 min – 2.94 min

“(Running Time + Delay) (min. per mile)” is a quantity that represents the amount of running time and delay per mile of train travel, and is calculated here by dividing the (Running Time + Delay) (min) by the total segment mileage.

Sample Calculation: 2.78 min/mile = 14.06min /5.05 miles

<u>Calculation of Total Segment Travel Time for Each Segment of the Study Section.</u>

Table E16 shows northbound travel times for each segment along the light rail route according to time-of-day, and Table E17 shows southbound travel times. “Segment Length” quantities were obtained from VTA.

The following formula was used in the calculation:

[Total Segment Travel Time (min)] = [Segment Length] x [(Running Time + Delay) (min. per mile)] + [Dwell Time per Station (min)]

And the following assumptions were applied to the calculations:

- One full station dwell period is utilized along any segment, including one-half at the origin station and one-half at the destination station.
- The quantity (Running Time + Delay) is a rate given in minutes per mile. This rate is applicable to all segments along the route, including the Japantown-to-Civic Center segment.

Sample Calculation: For the northbound AM peak segment travel time shown in Table E16,

0.68 min = (0.14 miles x 2.78 min/mile) + 0.29 min

<u>Calculation of Total Passenger On-Board Travel Time (in hours) for Each Segment</u>

Tables E18 through E23 show calculated passenger on-board travel times for each segment. Table E24 summarizes on-board passenger travel time from Tables E18 through E23. Total passenger time (in hours) for each segment was calculated by multiplying the total segment travel time by the number of passengers aboard the system on each segment during each daily period, then summing those values. The following formula was used for these calculations:

Total Passenger Time (hr) =

No. Pass. On-Board for Segment) x (Weighted Average Segment Travel Time (min))/60

The value of 60 in the formula is used to convert calculated passenger travel time from minutes to hours, and “Weighted Average Segment Travel Time (min)” is an average travel time calculated by the following formula:

Weighted Average Segment Travel Time (min) =
(3/24) x Segment Travel Time (min), AM Peak +
(6/24) x Segment Travel Time (min), Midday +
(3/24) x Segment Travel Time (min), PM Peak +
(12/24) x Segment Travel Time (min), Off-Peak

Sample Calculation from Table E18, AM Peak **:**

Total Passenger Time (hr) = 36.46 hr = 3401 passengers x 0.64 min / (60 min/hr)

User Travel Time Summary and Annual User Cost Calculations

Table E25 summarizes all user time, including passenger wait and on-board travel time from Tables E14 and E24. This table also shows cost per user hour, daily user costs, and annual user costs itemized by day-of-week and wait time/on-board travel time. The value of cost/user hour is calculated above. Calculation methodologies for daily and annual user costs are as follows:

1. Daily Cost = (Daily User-Hours) x (Cost/User Hour)

2. Annual Cost = (Daily Cost) x (Number of Days per Year)

Table E26 shows the number of days per year for weekdays, Saturdays, and Sundays.

References

1. *California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C).* A Report to the California Department of Transportation. Prepared by Booz-Allen & Hamilton Inc. September 1999.
2. Gross Domestic Product Deflator Inflation Calculator. http://www.jsc.nasa.gov/bu2/inflateGDP.html
3. Breslin, A., Botha, J. *Santa Clara Light Rail Transit: Travel Time, Station Dwell Time, and Intersection Delay Between Japantown/Ayer Station and Old Ironsides Station.* Department of Civil Engineering, San Jose State University. November 1992.

APPENDIX F

VTA LIGHT RAIL SYSTEM ON/OFF DATA
GUADALUPE LINE

Passenger on/off data pertaining to Santa Clara Valley Transportation Authority (VTA) Guadalupe line passenger volumes are shown in Tables F1 through F6. This information was provided by the VTA.

Data in the columns labeled “ON” represent passengers boarding the light rail system at the corresponding station. Likewise, data in the columns labeled “OFF” represent passengers exiting the system at the corresponding station. “NB” refers to data collected for trains traveling in the northbound direction. “SB” refers to data collected for trains traveling southbound.

TABLE F1. VTA GUADALUPE LINE ON/OFF DATA - WEEKDAY NB

Station	AM PEAK 530 to 830		MID PEAK 830 to 1430		PM PEAK 1430 to 1730		OFF PEAK 1730 to 530		TOTAL	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Santa Teresa	220	0	235	0	152	0	165	0	772	0
Cottle	94	1	114	4	54	9	59	4	321	18
Snell	86	7	117	13	63	5	58	7	324	32
Blossom Hill	136	7	158	12	72	12	55	12	421	43
Ohlone-Chynoweth	219	25	307	59	296	25	178	30	1,000	139
Branham	107	13	76	15	37	25	33	17	253	70
Capitol	164	33	230	72	106	83	79	52	579	240
Curtner	111	31	155	62	61	59	63	40	390	192
Tamien	177	106	200	140	76	137	65	80	518	463
Virginia	35	14	47	38	20	47	24	30	126	129
Childrens' Discovery Museum	12	45	36	87	18	46	12	33	78	211
Convention Center	22	101	140	199	111	64	65	47	338	411
San Antonio	98	279	194	390	104	130	95	82	491	881
Santa Clara	416	176	526	312	223	173	249	155	1,414	816
St. James	72	45	196	113	67	47	49	32	384	237
Japantown/Ayer	46	33	47	117	26	64	23	54	142	268
Civic Center	98	208	158	390	71	154	80	114	407	866
Gish	36	115	36	170	9	102	19	111	100	498
Metro/Airport	17	120	33	143	19	49	9	70	78	382
Karina Court	14	127	28	87	28	50	14	64	84	328
Component	1	100	5	62	6	19	6	26	18	207
Bonaventura	5	88	20	101	12	27	6	22	43	238
Orchard	3	53	2	19	5	15	2	10	12	97
River Oaks	2	103	5	53	6	34	3	30	16	220
Tasman	1	78	2	43	3	36	0	29	6	186
Baypointe	0	284	0	366	0	233	0	260	0	1,143
TOTAL	2,192	2,192	3,067	3,067	1,645	1,645	1,411	1,411	8,315	8,315

TABLE F2. VTA GUADALUPE LINE ON/OFF DATA - WEEKDAY SB

Station	AM PEAK 530 to 830		MID PEAK 830 to 1430		PM PEAK 1430 to 1730		OFF PEAK 1730 to 530		TOTAL	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Baypointe	166	0	281	0	294	0	298	0	1,039	0
Tasman	46	1	46	1	61	0	44	1	197	3
River Oaks	30	9	57	13	112	5	34	1	233	28
Orchard	12	7	30	7	48	0	25	1	115	15
Bonaventura	14	24	93	21	90	8	43	4	240	57
Component	10	12	34	9	76	2	24	1	144	24
Karina Court	35	30	81	25	122	11	73	14	311	80
Metro/Airport	20	12	111	32	127	26	79	24	337	94
Gish	69	6	171	33	132	30	69	27	441	96
Civic Center	81	52	404	132	259	119	95	62	839	365
Japantown/Ayer	43	10	138	37	54	35	39	34	274	116
St. James	20	46	106	170	72	114	27	53	225	383
Santa Clara	126	124	263	476	198	432	169	257	756	1,289
San Antonio	52	77	321	188	243	123	138	70	754	458
Convention Center	14	37	162	213	163	89	108	38	447	377
Childrens' Discovery Museum	30	8	51	24	65	21	40	21	186	74
Virginia	37	11	36	35	23	43	19	28	115	117
Tamien	113	35	127	137	104	203	90	90	434	465
Curtner	50	46	61	128	49	126	25	97	185	397
Capitol	55	77	74	171	60	185	38	110	227	543
Branham	18	20	13	63	9	89	7	54	47	226
Ohlone-Chynoweth	13	175	52	312	40	249	22	135	127	871
Blossom Hill	8	41	16	118	8	133	5	76	37	368
Snell	3	32	18	81	7	103	8	66	36	282
Cottle	3	54	2	84	1	67	2	61	8	266
Santa Teresa	0	122	0	238	0	204	0	196	0	760
TOTAL	1,068	1,068	2,748	2,748	2,417	2,417	1,521	1,521	7,754	7,754

TABLE F3. VTA GUADALUPE LINE ON/OFF DATA - SATURDAY NB

Station	AM PEAK 530 to 830		MID PEAK 830 to 1430		PM PEAK 1430 to 1730		OFF PEAK 1730 to 530		TOTAL	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Santa Teresa	56	0	158	0	77	0	148	0	439	0
Cottle	14	3	68	3	36	3	46	8	164	17
Snell	20	1	77	10	33	3	51	10	181	24
Blossom Hill	41	1	125	9	46	4	40	18	252	32
Ohlone-Chynoweth	38	10	180	50	138	30	147	28	503	118
Branham	10	3	35	10	21	12	36	10	102	35
Capitol	27	5	128	55	54	47	80	51	289	158
Curtner	26	5	104	31	40	29	55	39	225	104
Tamien	39	18	136	81	47	49	73	57	295	205
Virginia	13	1	40	31	13	19	17	31	83	82
Childrens' Discovery Museum	6	13	19	79	21	26	12	33	58	151
Convention Center	8	48	108	180	95	84	63	45	274	357
San Antonio	30	28	105	98	49	53	82	107	266	286
Santa Clara	145	55	312	217	134	121	166	124	757	517
St. James	31	13	92	71	38	34	55	29	216	147
Japantown/Ayer	11	10	41	62	16	62	19	47	87	181
Civic Center	31	45	99	251	41	72	72	125	243	493
Gish	4	46	28	82	6	63	15	114	53	305
Metro/Airport	2	45	20	74	12	29	8	54	42	202
Karina Court	3	42	20	72	10	24	12	53	45	191
Component	2	14	1	23	2	6	3	7	8	50
Bonaventura	0	17	3	25	1	5	1	11	5	58
Orchard	0	5	4	10	4	3	0	8	8	26
River Oaks	0	4	3	12	1	7	1	14	5	37
Tasman	3	4	0	17	0	13	2	16	5	50
Baypointe	0	124	0	353	0	137	0	165	0	779
TOTAL	560	560	1,906	1,906	935	935	1,204	1,204	4,605	4,605

TABLE F4. VTA GUADALUPE LINE ON/OFF DATA - SATURDAY SB

Station	AM PEAK 530 to 830		MID PEAK 830 to 1430		PM PEAK 1430 to 1730		OFF PEAK 1730 to 530		TOTAL	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Baypointe	61	0	222	0	172	0	272	0	727	0
Tasman	3	0	23	0	11	0	8	1	45	1
River Oaks	6	2	17	3	8	2	6	3	37	10
Orchard	4	0	11	0	9	1	9	2	33	3
Bonaventura	5	1	17	4	14	0	12	1	48	6
Component	5	2	13	1	14	1	6	0	38	4
Karina Court	15	4	53	8	43	14	46	12	157	38
Metro/Airport	14	6	83	19	45	4	54	8	196	37
Gish	41	3	127	17	63	18	50	11	281	49
Civic Center	33	22	189	80	108	42	100	39	430	183
Japantown/Ayer	20	8	79	20	33	15	44	19	176	62
St. James	17	15	64	81	31	35	28	35	140	166
Santa Clara	54	66	180	284	135	202	143	205	512	757
San Antonio	20	18	97	112	56	53	110	51	283	234
Convention Center	8	21	106	137	119	59	97	41	330	258
Childrens' Discovery Museum	13	8	42	39	70	19	37	25	162	91
Virginia	12	2	32	18	20	23	16	37	80	80
Tamien	42	22	98	80	52	62	46	86	238	250
Curtner	19	17	54	89	39	76	36	80	148	262
Capitol	11	31	66	114	30	78	31	92	138	315
Branham	4	14	12	33	10	25	5	33	31	105
Ohlone-Chynoweth	7	75	32	202	50	134	40	117	129	528
Blossom Hill	4	15	10	81	6	65	13	50	33	211
Snell	3	22	9	61	6	47	10	61	28	191
Cottle	1	8	0	38	3	53	5	49	9	148
Santa Teresa	0	40	0	115	0	119	0	166	0	440
TOTAL	422	422	1,636	1,636	1,147	1,147	1,224	1,224	4,429	4,429

TABLE F5. VTA GUADALUPE LINE ON/OFF DATA - SUNDAY NB

Station	AM PEAK 530 to 830		MID PEAK 830 to 1430		PM PEAK 1430 to 1730		OFF PEAK 1730 to 530		TOTAL	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Santa Teresa	55	0	146	0	64	0	135	0	400	0
Cottle	13	1	49	1	24	0	25	5	111	7
Snell	13	6	59	9	38	8	30	7	140	30
Blossom Hill	13	1	73	10	33	4	51	8	170	23
Ohlone-Chynoweth	15	11	143	39	93	27	109	17	360	94
Branham	12	0	37	10	11	9	21	6	81	25
Capitol	23	8	94	44	65	38	57	40	239	130
Curtner	18	9	105	53	47	24	53	25	223	111
Tamien	32	12	97	67	31	45	47	49	207	173
Virginia	7	3	46	21	13	13	21	25	87	62
Childrens' Discovery Museum	3	14	19	75	22	32	22	23	66	144
Convention Center	2	18	54	99	104	46	50	56	210	219
San Antonio	18	16	87	85	36	45	50	52	191	198
Santa Clara	99	30	305	149	95	96	149	137	648	412
St. James	15	10	84	50	22	23	28	28	149	111
Japantown/Ayer	11	6	34	69	14	43	7	40	66	158
Civic Center	18	31	65	258	36	60	67	83	186	432
Gish	3	33	13	55	8	41	15	94	39	223
Metro/Airport	0	33	24	72	14	27	25	31	63	163
Karina Court	1	24	7	36	4	22	4	33	16	115
Component	1	4	0	12	3	10	0	6	4	32
Bonaventura	0	7	2	7	2	6	4	7	8	27
Orchard	0	4	2	16	3	12	0	6	5	38
River Oaks	0	2	1	8	0	11	1	11	2	32
Tasman	0	3	1	20	0	15	2	13	3	51
Baypointe	0	86	0	282	0	125	0	171	0	664
TOTAL	372	372	1,547	1,547	782	782	973	973	3,674	3,674

TABLE F6. VTA GUADALUPE LINE ON/OFF DATA - SUNDAY SB

Station	AM PEAK 530 to 830		MID PEAK 830 to 1430		PM PEAK 1430 to 1730		OFF PEAK 1730 to 530		TOTAL	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Baypointe	49	0	191	0	141	0	265	0	646	0
Tasman	4	0	18	1	9	0	10	1	41	2
River Oaks	1	1	13	1	6	1	5	4	25	7
Orchard	2	0	9	1	7	2	10	1	28	4
Bonaventura	6	0	15	3	10	0	4	0	35	3
Component	2	0	7	0	5	0	10	0	24	0
Karina Court	9	1	46	8	32	6	44	13	131	28
Metro/Airport	15	4	59	12	48	11	63	5	185	32
Gish	20	3	90	14	51	15	44	19	205	51
Civic Center	25	9	161	59	164	35	58	26	408	129
Japantown/Ayer	18	6	56	21	28	16	23	19	125	62
St. James	12	14	41	59	21	42	17	39	91	154
Santa Clara	41	52	140	223	79	177	123	182	383	634
San Antonio	10	11	57	66	52	59	82	48	201	184
Convention Center	7	16	51	101	115	34	67	27	240	178
Childrens' Discovery Museum	9	4	28	35	50	16	38	18	125	73
Virginia	8	4	20	17	18	23	22	29	68	73
Tamien	29	17	74	53	40	56	39	71	182	197
Curtner	14	20	54	80	19	71	20	62	107	233
Capitol	7	22	60	75	24	62	27	55	118	214
Branham	3	6	9	19	5	15	4	22	21	62
Ohlone-Chynoweth	14	48	23	176	23	110	23	93	83	427
Blossom Hill	1	9	8	43	5	50	7	44	21	146
Snell	1	12	8	37	5	35	5	51	19	135
Cottle	0	9	1	30	3	32	2	46	6	117
Santa Teresa	0	39	0	105	0	92	0	137	0	373
TOTAL	307	307	1,239	1,239	960	960	1,012	1,012	3,518	3,518

APPENDIX G

ABUS AGENCY COSTS

Introduction

This appendix details methodologies and procedures for calculating the agency costs associated with the ABUS study system. These costs include:

- System Planning and Design Costs
- Construction, Rehabilitation, and Other Infrastructure-Related Capital Costs
- Vehicle Operations Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs

ABUS SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE-RELATED CAPITAL COSTS

ABUS Cross-Sectional Geometry (Width Requirements)

As with the VTA Guadalupe light rail line on the segment being studied, the ABUS system is assumed to operate at-grade, with no physical separation of ABUS travel lanes from each other, or from regular traffic. Two potential design scenarios were selected for determining the necessary cross-sectional width for the ABUS system. They are described in the following paragraphs.

Scenario 1: Cross-Sectional Design Based on AASHTO Standards

The design for this project assumes that the ABUS system will operate on a dedicated right-of-way in the median of a regular roadway. As with the light rail system, the ABUS lanes operate at-grade, without physical barriers to separate the ABUS lanes from each other, or from the regular traffic. Exhibit 3-54 (1) requires that a 15-foot pavement width be used in this case to accommodate any design bus; however, included in this15 feet is a Z-factor of two feet, which accounts for wandering of the vehicle within the lane (see Exhibit 3-53). Because it is assumed that automated technology will guide these buses without the wandering associated with manual steering, this Z-factor can be subtracted from the lane width. The resulting requirement is a 13-foot pavement width for each direction of travel.

The design was based on standards provided in the American Association of State Highway Transportation Officials (AASHTO) for streets and highways in its *A Policy on the Geometric Design of Highways and Streets* (1). For ABUS lanes running in both directions, a width of 26 feet is required for the right-of-way, including two 13-foot pavement widths. Figure 3.3 in the main report shows a schematic layout of this ABUS concept. Table G1 shows system dimensions.

TABLE G1. ABUS PROJECT DIMENSIONS - SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

Length		Effective System Length*		Width (Feet)	Area	Scale Factor
Miles	Feet	Miles	Feet	Two Directions	Sq. Feet	21.64
5.19	27,403	5.19	27,403	26	712,483	

Scenario 2: Cross-Sectional Design Reduced-Width

In this scheme, dimensions of the cross-sectional design are based on a design standard, contributed by Dr. Steven Shladover of PATH, that travel lanes for trucks and buses using automated technologies need be only 30 cm (0.98 feet) wider than the vehicles using them. The design vehicle chosen is the City Transit Bus, which and is 8.5 feet wide (1); however, it should be noted that 8.5 feet is the widest of any design bus, so all buses can be accommodated on a system designed for a vehicle of width 8.5 feet. By the reduced-width design standard, this bus would require a total travel lane width of 9.5 feet to operate on an automated lane, and a total ABUS system width of 19 feet. Figure 3.4 in the main report shows a schematic layout of this ABUS concept. Table G2 shows system dimensions.

TABLE G2. ABUS PROJECT DIMENSIONS - SCENARIO 2: REDUCED-WIDTH DESIGN

Length		Effective System Length*		Width (Feet)	Area	Scale Factor
Miles	Feet	Miles	Feet	Two Directions	Sq. Feet	15.82
5.19	27,403	5.19	27,403	19	520,661	

ABUS Infrastructure Costs

Costs associated with infrastructure appear in Tables G3a and G3b for Design Scenarios 1 and 2, respectively**.**

As ABUS is a theoretical system, costs for infrastructure and other capital costs are not directly available. Costs associated with construction, rehabilitation, and other capital expenses were estimated based on a recent City of San Jose roadway improvement project where the roadway was widened but some existing pavement was salvaged for the new design. This project, the Hope Street Improvement Project, was chosen for several reasons:

1. The project was completed in 2002, so cost data are recent.
2. City of San Jose personnel recommended this project as representative of a typical (in terms of cost) roadway improvement/widening project.
3. The project site is in the City of San Jose, as is the site of the proposed ABUS route.
4. Information was readily available.
5. Pavement design was deemed acceptable for frequent use by heavy vehicles.

Prior to construction, the stretch of Hope Street between Mill Street and Catherine Street in San Jose had an irregular traveled way with sections of varying widths. The roughly 850-linear foot stretch of improved road has a 20-foot standard width for each travel direction at all cross sections. This width is from centerline to face of curb, including shoulder width.

Varying widths of existing pavement were able to be salvaged. These widths range from 25 feet to about 18 feet.

There are at least two potential shortcomings of using the Hope Street project as a base system for ABUS infrastructure cost estimations. The first is that the Hope Street improvement spanned only about 850 linear feet of roadway, compared to the 5.19-mile proposed ABUS stretch**.** Although it is acknowledged that unit costs for the larger system are likely to be smaller, the City of San Jose has very little, if any, data available on such large roadway improvement projects. Typically, a project as large as the proposed ABUS would be broken into several smaller projects, with each project bid separately. This is to allow small local contractors with more limited bonding capacity to bid on these local projects, rather than having large national contracting companies winning bids because no local companies have sufficient bonding capacity.

It was assumed here that the differentials between unit costs associated with the Hope Street project quantities, and also with a potential ABUS, would be negligible, and thus were ignored. To deal with the size-inconsistency for unit quantities in application of the data from Hope Street to ABUS, the Hope Street Project unit quantities were scaled up to ABUS project size. Scaling methodologies are discussed in subsequent sections.

The second potential difficulty with justifying the use of Hope Street data for an ABUS lane is that Hope Street is a roadway zoned for light commercial traffic, meaning that the pavement is designed to support mostly residential traffic, with occasional heavy truck traffic. An ABUS lane, in contrast, will carry heavy vehicle traffic.

While it is acknowledged that a project dealing with modifications on a commercially-zoned arterial would be ideal for estimating construction costs in this situation, the City of San Jose has established arterials that have not required major widening or other applicable work in recent years. Despite this potential shortcoming, discussion with pavement design experts led to the belief that the rehabilitated Hope Street pavement design could be sufficient to accommodate frequent heavy vehicle traffic.

General Procedure

For all costs except those associated with right-of-way acquisition and magnetic reference markers for vehicle automation, the following general procedure was followed to calculate construction costs for the ABUS system:

1. The cost items were divided into two categories: those which would be applicable to any ABUS section, and those which were site-specific, meaning that they are dependent on the location of the project.
2. Unit costs for work items were identified from the Hope Street project contract documents.
3. Quantities associated with each work item were determined for the ABUS by scaling the Hope Street project quantities to the size of the ABUS project, based on square footage of roadway.

TABLE G3a. ABUS SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS - DESIGN SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

	Item	Year	Unit Cost ($)	Unit	Unit Cost (2001-Equiv.	Unit	# of Units in ABUS System	One-Time Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
System Planning and Design Costs									
	VTA Personnel Labor Costs and Design Expenses	2002	2,077,842	One-Time	2,037,115.83	One-Time	1	2,037,116	147,994
Construction, Rehabilitation, and Other Infrastructure Capital Costs									
Infrastructure Costs	Right-of-Way Acquisition	1999	23.65	Sq. Foot	24.49	Sq. Foot	712,483	17,445,882	1,267,424
	Street Clean-Up	2002	150.00	Day	147.06	Day	433	63,660	4,625
	Mobilization	2002	10,000.00	Lump Sum	9,804.00	Lump Sum	21.64	212,200	15,416
	Traffic Control	2002	2,000.00	Lump Sum	1,960.80	Lump Sum	21.64	42,440	3,083
	Clearing, Grubbing, and Removal of Obstructions	2002	2,500.00	Lump Sum	2,451.00	Lump Sum	21.64	53,050	3,854
	Roadway Excavation	2002	30.00	Cu. Yard	29.41	Cu. Yard	7,359	216,444	15,724
	Subgrade Preparation-Class A	2002	1.00	Sq. Foot	0.98	Sq. Foot	467,514	458,351	33,299
	Imported Fill Materials	2002	30.00	Cu. Yard	29.41	Cu. Yard	7,359	216,444	15,724
	Deeplift/Base AC (8" max.)	2002	70.00	Ton	68.63	Ton	13,203	906,092	65,827
	AC Surface Course	2002	80.00	Ton	78.43	Ton	5,757	451,561	32,805
	AC Base Course	2002	80.00	Ton	78.43	Ton	9,091	712,991	51,798
	Cold Planing	2002	1.50	Sq. Foot	1.47	Sq. Foot	21,644	31,830	2,312
	Pavement Reinforcing Fabric	2002	1.00	Sq. Yard	0.98	Sq. Yard	75,755	74,270	5,396
	Gravel Conform	2002	50.00	Ton	49.02	Ton	433	21,220	1,542
	Traffic Stripes and Pavement Markings	2002	800.00	Lump Sum	784.32	Lump Sum	21.64	16,976	1,233
	Street Lighting System	2002	60,000.00	Lump Sum	58,824.00	Lump Sum	21.64	1,273,197	92,496
	Geotextile	2002	3.00	Linear Foot	2.94	Linear Foot	23,809	70,026	5,087
	Site-SpecificWork Items	2002	9,828,623.28	Lump Sum	9,635,982.26	Lump Sum	1.00	9,635,982	700,044
	Magnetic Reference Markers - Includes Installation	2001	5,000.00	Lane Mile	5,000.00	Lane Mile	10.38	51,900	3,770
	TOTAL INFRASTRUCTURE COST								2,321,461
Non-Infrastructure Capital Costs	Fleet Purchase	2002	293,000.00	Bus	287,257.20	Bus	10.180	2,924,389	212,454
	Automation Technology Outfitting for Vehicle	2001	25,000.00	Bus	25,000.00	Bus	10.180	254,510	18,490
Periodic Capital Costs	Minor Rehabilitation - Seals	2002	See Table G11	N/A	N/A	N/A	N/A	N/A	30,732
	Major Rehabilitation - Resurfacing	2002	See Table G11	N/A	N/A	N/A	N/A	N/A	84,443
	Magnetic Reference Markers - Includes Installation	2001	See Table G11	N/A	N/A	N/A	N/A	N/A	8,550
Fleet Renewal	Bus Replacement Costs	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
	Vehicle Automation Technology Replacement Costs	2001	25,000.00	Bus	25,000.00	Bus	10.180	N/A	16,967
TOTAL CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									2,888,056
TOTAL DESIGN, PLANNING, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									3,036,050

TABLE G3b. ABUS SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS - SCENARIO 2: DESIGN FOLLOWS 30-CM PRINCIPLE

	Item	Year	Unit Cost ($)	Unit	Unit Cost (2001-Equiv. $)	Unit	# of Units in ABUS System	One-Time Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
System Planning and Design Costs									
	VTA Personnel Labor Costs and Design Expenses	2002	1,518,422.65	One-Time	1,488,661.57	One-Time	1	1,488,662	108,150
Construction, Rehabilitation, and Other Infrastructure Capital Costs									
Infrastructure Costs	Right-of-Way Acquisition	1999	23.65	Sq. Foot	24.49	Sq. Foot	520,661	12,748,913	926,195
	Street Clean-Up	2002	150.00	Day	147.06	Day	316	46,521	3,380
	Mobilization	2002	10,000.00	Lump Sum	9,804.00	Lump Sum	15.82	155,069	11,266
	Traffic Control	2002	2,000.00	Lump Sum	1,960.80	Lump Sum	15.82	31,014	2,253
	Clearing, Grubbing, and Removal of Obstructions	2002	2,500.00	Lump Sum	2,451.00	Lump Sum	15.82	38,767	2,816
	Roadway Excavation	2002	30.00	Cu. Yard	29.41	Cu. Yard	5,378	158,170	11,491
	Subgrade Preparation-Class A	2002	1.00	Sq. Foot	0.98	Sq. Foot	341,645	334,949	24,334
	Imported Fill Materials	2002	30.00	Cu. Yard	29.41	Cu. Yard	5,378	158,170	11,491
	Deeplift/Base AC (8" max.)	2002	70.00	Ton	68.63	Ton	9,648	662,144	48,104
	AC Surface Course	2002	80.00	Ton	78.43	Ton	4,207	329,987	23,973
	AC Base Course	2002	80.00	Ton	78.43	Ton	6,643	521,032	37,852
	Cold Planing	2002	1.50	Sq. Foot	1.47	Sq. Foot	15,817	23,260	1,690
	Pavement Reinforcing Fabric	2002	1.00	Sq. Yard	0.98	Sq. Yard	55,359	54,274	3,943
	Gravel Conform	2002	50.00	Ton	49.02	Ton	316	15,507	1,127
	Traffic Stripes and Pavement Markings	2002	800.00	Lump Sum	784.32	Lump Sum	15.82	12,406	901
	Street Lighting System	2002	60,000.00	Lump Sum	58,824.00	Lump Sum	15.82	930,413	67,594
	Geotextile	2002	3.00	Linear Foot	2.94	Linear Foot	17,399	51,173	3,718
	Site-SpecificWork Items	2002	7,182,455.47	Lump Sum	7,041,679.35	Lump Sum	1.00	7,041,679	511,570
	Magnetic Reference Markers - Includes Installation	2001	5,000.00	Lane Mile	5,000.00	Lane Mile	10.38	51,900	3,770
	TOTAL INFRASTRUCTURE COST								1,697,467
Non-Infrastructure Capital Costs	Fleet Purchase	2002	293,000.00	Bus	287,257.20	Bus	10.180	2,924,389	212,454
	Automation Technology Outfitting for Vehicle	2001	25,000.00	Bus	25,000.00	Bus	10.180	254,510	18,490
Periodic Capital Costs	Minor Rehabilitation - Seals	2002	See Table G12	N/A	N/A	N/A	N/A	N/A	22,458
	Major Rehabilitation - Resurfacing	2002	See Table G12	N/A	N/A	N/A	N/A	N/A	61,708
	Magnetic Reference Markers - Includes Installation	2001	See Table G12	N/A	N/A	N/A	N/A	N/A	8,550
Fleet Renewal	Vehicle Replacement Costs	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
	Vehicle Automation Technology Replacement Costs	2001	25,000.00	Bus	25,000.00	Bus	10.180	N/A	16,967
TOTAL CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									2,233,054
TOTAL SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE COSTS									2,341,204

4. Unit costs were converted to 2001- equivalent costs by adjusting for inflation.
5. One-time construction costs were calculated based on adjusted unit costs and unit quantities for the ABUS system.
6. Costs were converted to Equivalent Uniform Annual Costs (EUAC) with 2001 as the base year.

Costs associated with right-of-way acquisition and magnetic reference markers are discussed in the section below entitled “Right-of-Way Cost Calculations” and “Magnetic Reference Marker Cost Calculations.”

Site-Specific Work Items

To estimate the cost for installing an ABUS lane, it was assumed that unit costs for ABUS would be the same as the costs associated with the Hope Street Improvement project in San Jose. Some items that were site-specific to the Hope Street project, such as manhole relocation, sewage line additions or relocations, or resident driveway readjustments to the new grade, were lumped together as cost element “Site-Specific Work Items.” Such items are those construction tasks that occur on an as-needed basis at a construction site, but cannot be included as a task that is common to all potential ABUS construction projects because their occurrence is dependent on the existing conditions at the specific job site. This cost element will be associated with a percentage of the total project cost.

Tables G4 and G5 show a comprehensive list of construction tasks for the Hope Street project, with site-specific work items highlighted, and Tables G6 and G7 show a summary of site-specific and non-site-specific work-items as percentages of the project cost, for Design Scenarios 1 and 2, respectively. Site-specific work items are shaded. For the Hope Street project, site-specific work items were determined to comprise 66.7 percent of the total project cost. The general assumption of this approach is that all construction will have site-specific elements that comprise roughly the same percentage of the total project cost. To this end, Tables G3a and G3b show the site-specific work items summed to comprise one unit cost. This unit cost is applied as a lump sum.

Unit Costs

For the Hope Street project, unit costs were extracted directly from the Hope Street Project engineer’s estimate from the bid documents. The unit costs for the contractor awarded the project were not used because several unit costs quoted by the winning bidder varied vastly from the engineer’s estimate and from the other bidders’ unit costs. It was assumed that the engineer’s estimate would more accurately reflect the cost associated with a particular work item. It should be noted that the engineer’s estimate for the total project cost was roughly 20 percent higher than the contractor’s estimate.

Quantities

Quantities of units for each work item were found by scaling-up from the Hope Street project size to the proposed ABUS project size. The scaling procedure is discussed in the following paragraphs.

In order to scale the Hope Street project to the size of the ABUS system, quantities of materials and resources used were resized accordingly. Unit costs were held constant. For the purposes of this study, it was assumed that the ratio of total surface area to unit cost is proportional for the Hope Street project and ABUS system, and the following ratio equivalence was used:

$$\frac{HS_A}{HS_Q} = \frac{ABUS_A}{ABUS_Q} \quad \Rightarrow \quad ABUS_Q = \frac{ABUS_A * HS_Q}{HS_A}$$

where
HS_A is the total Hope Street new-pavement surface area
HS_Q is the corresponding unit cost from the Hope Street bid documents
$ABUS_A$ is the total new-pavement surface area for the ABUS system
$ABUS_Q$ is the derived corresponding unit cost.

To estimate ABUS and Hope Street new-pavement surface areas, engineering plans for the Hope Street project were used to determine scale factors, which were then applied to the number of units used in the Hope Street project to arrive at the number of units necessary for construction of the ABUS system. Approximately 32,918 square feet of new pavement were laid for the project, and 16,589 square feet of pavement was allowed to remain.

Table G4 shows derived unit quantities necessary for construction of the ABUS system for the scenario based on AASHTO standards. The ABUS system has a length of 5.19 miles (27,403 feet) and a width of 26 feet for both directions of travel. Assuming a straight trunkline, this implies a surface area of roughly 712,483 square feet.

Given that $ABUS_A$ = 712,483 sq. ft. and HS_A = 32,918 sq. ft., then, the aforementioned equation reduces to:

$$ABUS_Q = \frac{712{,}483 * HS_Q}{32{,}918} = 21.64 * HS_Q$$

In short, the quantities necessary to complete a project the size of the ABUS system is approximately 21.64 times the corresponding quantity necessary for the Hope Street project. Table G1 shows the scale factor for Design Scenario 1. Table G4 shows the applicable calculations for Design Scenario 1.

For example, street clean-up on the Hope Street project (Design Scenario 1) requires 20 days (see Table G4). Then, to find the number of days required for street clean-up on the ABUS project, the following calculation was performed:

$$ABUS_Q = 21.64 * HS_Q = 21.64 * 20 = 433$$

Thus, 433 days of street clean-up units are required. It is important to note that it is not expected that 433 days will be taken to perform this task. The quantity of 433 days is simply a reflection of the relative size of the ABUS and Hope Street projects.

All but one of the scaled quantities shown in Table G4 for Design Scenario 1 were calculated based on the procedure above. The exception to this rule was the calculation related to AC surface course. The procedure for this calculation is outlined in the following paragraphs.

A 2-inch asphalt concrete overlay was applied to the entire surface area of the Hope Street project, including the 16,589 square feet (SF) of remaining pavement. For the ABUS project, only the costs of surface course for the ABUS lanes are computed, since lane widths of existing pavements would detract from the generality of the calculations.

Thus, the appropriate tonnage of asphalt had to be removed from the original 400 tons of AC surface course, so as not to include the 2-inch overlay that was laid on the 16,589 SF of remaining pavement**.** The total overlay surface area for the Hope Street project covers 49,507 SF – the sum of 16,589 SF of remaining pavement and 32,918 SF of new pavement. Of this 49,507 SF, remaining pavement constitutes approximately 33.5% of the surface area, and new pavement constitutes 66.5%.

Assuming that the 2-inch overlay was applied uniformly to the new and remaining surfaces, then, it is reasonable to assume that 33.5% of the AC surface course used in the Hope Street project was used on remaining pavement. Since it is assumed here that the surface course applied only to new pavement, this 33.5% must be removed from the quantity (in tons) of AC surface course applied to the Hope Street project.

The original Hope Street project contract documents show that 400 tons of AC surface course are required for the Hope Street project. The required tonnage for the new-pavement surface course for the Hope Street project is calculated as follows:

Hope Street New Pavement Surface Tonnage = 400 x 0.665 = 266 tons.

The surface course applied to the new pavement must then be scaled to the ABUS project size. Since only the course applied to the new pavement is scaled, the scale factor used above is applicable.

The surface course tonnage for the ABUS system, then, would be calculated by the following equation:

ABUS AC Surface Course = (400) x (66.5%) x (21.64) = 266 x 21.64 = 5,757 tons
where 21.64 is the scale factor between the two projects, and 66.5% is the percentage of the Hope Street AC surface course applied to the new-pavement surface.

After scaling, annual costs were calculated, and those costs were then converted to an

TABLE G4. ABUS CONSTRUCTION COST CALCULATIONS - SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

Item	Cost Element	Year	Hope Street Project Total Cost (Engineer's Estimate)	Hope Street Project Unit Cost (Engineer's Estimate)	Unit	Hope Street Project Units		Derived ABUS Project Units		ABUS Cost (2002-$)
						Number	Unit	Number	Unit	
1	Street Clean-Up	2002	3000.00	150.00	Day	20	Day	433	Day	64,933
2	Mobilization	2002	10000.00	10,000.00	Lump Sum	1	Lump Sum	22	Lump Sum	216,442
3	Traffic Control	2002	2000.00	2,000.00	Lump Sum	1	Lump Sum	22	Lump Sum	43,288
4	Adjust Water Valve to Grade	2002	1500.00	250.00	Each	6	Each	130	Each	32,466
5	Adjust Manhole to Grade	2002	5000.00	500.00	Each	10	Each	216	Each	108,221
6	Relocating County Park Sign	2002	1500.00	1,500.00	Each	1	Each	22	Each	32,466
7	Replace Existing Detector Looop	2002	4200.00	700.00	Each	6	Each	130	Each	90,906
8	Adjust Fire Hydrant to Grade	2002	2400.00	1,200.00	Each	2	Each	43	Each	51,946
9	Relocate and Adjust Fire Hydrant to Grade	2002	3600.00	3,600.00	Each	1	Each	22	Each	77,919
10	Clearing, Grubbing, and Removal of Obstructions	2002	2500.00	2,500.00	Lump Sum	1	Lump Sum	22	Lump Sum	54,110
11	Roadway Excavation	2002	10200.00	30.00	Cu. Yard	340	Cu. Yard	7,359	Cu. Yard	220,771
12	Plant New Trees	2002	20400.00	600.00	Each	34	Each	736	Each	441,541
13	Misc. Landscaping	2002	9600.00	2.00	Sq. Foot	4,800	Sq. Foot	103,892	Sq. Foot	207,784
14	Tree, Schrub, and Landscape Maintenance	2002	10000.00	10,000.00	Lump Sum	1	Lump Sum	22	Lump Sum	216,442
15	Polythylene Root Barrier	2002	700.00	1.00	Linear Foot	700	Linear Foot	15,151	Linear Foot	15,151
16	Subgrade Preparation-Class A	2002	21600.00	1.00	Sq. Foot	21,600	Sq. Foot	467,514	Sq. Foot	467,514
17	Imported Fill Materials	2002	10200.00	30.00	Cu. Yard	340	Cu. Yard	7,359	Cu. Yard	220,771
18	Deeplift/Base AC (8" max.)	2002	42700.00	70.00	Ton	610	Ton	13,203	Ton	924,207
19	AC Surface Course	2002	32000.00	80.00	Ton	400	Ton	5,757	Ton	460,588
20	AC Base Course	2002	33600.00	80.00	Ton	420	Ton	9,091	Ton	727,245
21	Cold Planing	2002	1500.00	1.50	Sq. Foot	1,000	Sq. Foot	21,644	Sq. Foot	32,466
22	Pavement Reinforcing Fabric	2002	3500.00	1.00	Sq. Yard	3,500	Sq. Yard	75,755	Sq. Yard	75,755
23	Redwood Retaining Wall	2002	12000.00	40.00	Linear Foot	300	Linear Foot	6,493	Linear Foot	259,730
24	PCC Curb and Gutter - Type A2	2002	51000.00	30.00	Linear Foot	1,700	Linear Foot	36,795	Linear Foot	1,103,853
25	PCC Sidewalk, Plain finish, including 1" of Structural Fill)	2002	60300.00	9.00	Sq. Foot	6,700	Sq. Foot	145,016	Sq. Foot	1,305,144
26	PCC Driveway	2002	21600.00	12.00	Sq. Foot	1,800	Sq. Foot	38,960	Sq. Foot	467,514
27	PCC Wheelchair Ramp	2002	3200.00	800.00	Each	4	Each	87	Each	69,261
28	PCC Driveway Conform	2002	27000.00	10.00	Sq. Foot	2,700	Sq. Foot	58,439	Sq. Foot	584,393
29	PCC Berm (Type A1-B3)	2002	600.00	6.00	Linear Foot	100	Linear Foot	2,164	Linear Foot	12,987
30	Gravel Conform	2002	1000.00	50.00	Ton	20	Ton	433	Ton	21,644
31	Install New Survey Monument	2002	2500.00	500.00	Each	5	Each	108	Each	54,110
32	Traffic Stripes and Pavement Markings	2002	800.00	800.00	Lump Sum	1	Lump Sum	22	Lump Sum	17,315
33	Street Lighting System	2002	60000.00	60,000.00	Lump Sum	1	Lump Sum	22	Lump Sum	1,298,651
34	Install New Water Valve	2002	3000.00	3,000.00	Each	1	Each	22	Each	64,933
35	Remove Existing Water Valve and Reconnect Existing Waterlin	2002	3000.00	3,000.00	Each	1	Each	22	Each	64,933
36	12" Diameter RCP	2002	19800.00	110.00	Linear Foot	180	Linear Foot	3,896	Linear Foot	428,555
37	27" Diameter RCP	2002	12000.00	160.00	Linear Foot	75	Linear Foot	1,623	Linear Foot	259,730
38	8" Diameter PVC Pipe	2002	6000.00	40.00	Linear Foot	150	Linear Foot	3,247	Linear Foot	129,865
39	Abandon and Cap Off Exist. 12" Dia. RCP	2002	3200.00	800.00	Each	4	Each	87	Each	69,261
40	Cap off New 27" Dia. RCP	2002	800.00	800.00	Each	1	Each	22	Each	17,315
41	Remove Exist. VCP, Replace with PVC	2002	79000.00	100.00	Linear Foot	790	Linear Foot	17,099	Linear Foot	1,709,890
42	Geotextile	2002	3300.00	3.00	Linear Foot	1,100	Linear Foot	23,809	Linear Foot	71,426
43	Trench Sheeting, Shoring,a dn Bracing	2002	6000.00	6,000.00	Lump Sum	1	Lump Sum	22	Lump Sum	129,865
44	Trench Dewatering	2002	12000.00	12,000.00	Lump Sum	1	Lump Sum	22	Lump Sum	259,730
45	Sewer Lateral Verification	2002	300.00	30.00	Each	10	Each	216	Each	6,493
46	Reconnect Exist. Sanitary Sewer	2002	2000.00	200.00	Each	10	Each	216	Each	43,288
47	Replace 4" Dia. Sanitary Sewer	2002	9000.00	90.00	Linear Foot	100	Linear Foot	2,164	Linear Foot	194,798
48	Install Std. Storm Manhole	2002	6400.00	3,200.00	Each	2	Each	43	Each	138,523
49	Install Large Hooded Inlet	2002	14000.00	2,000.00	Each	7	Each	152	Each	303,019
50	Install Std. Flat Grate Inlet	2002	16500.00	1,500.00	Each	11	Each	238	Each	357,129
51	Remove and Replace SS Manhole	2002	24000.00	4,800.00	Each	5	Each	108	Each	519,460
	Total Cost		**692,000.00**	**133,386.50**						**14,745,749**

TABLE G5. ABUS CONSTRUCTION COST CALCULATIONS - SCENARIO 2: REDUCED-WIDTH DESIGN

Item	Cost Element	Year	Hope Street Project Total Cost ($) (Engineer's Estimate)	Hope Street Project Unit Cost ($) (Engineer's Estimate)	Unit	Hope Street Project Units Number	Hope Street Project Units Unit	Derived ABUS Project Units Number	Derived ABUS Project Units Unit	ABUS Cost (2002 $)
1	Street Clean-Up	2002	3000.00	150.00	Day	20	Day	316	Day	47,451
2	Mobilization	2002	10000.00	10,000.00	Lump Sum	1	Lump Sum	16	Lump Sum	158,169
3	Traffic Control	2002	2000.00	2,000.00	Lump Sum	1	Lump Sum	16	Lump Sum	31,634
4	Adjust Water Valve to Grade	2002	1500.00	250.00	Each	6	Each	95	Each	23,725
5	Adjust Manhole to Grade	2002	5000.00	500.00	Each	10	Each	158	Each	79,085
6	Relocating County Park Sign	2002	1500.00	1,500.00	Each	1	Each	16	Each	23,725
7	Replace Existing Detector Looop	2002	4200.00	700.00	Each	6	Each	95	Each	66,431
8	Adjust Fire Hydrant to Grade	2002	2400.00	1,200.00	Each	2	Each	32	Each	37,961
9	Relocate and Adjust Fire Hydrant to Grade	2002	3600.00	3,600.00	Each	1	Each	16	Each	56,941
10	Clearing, Grubbing, and Removal of Obstructions	2002	2500.00	2,500.00	Lump Sum	1	Lump Sum	16	Lump Sum	39,542
11	Roadway Excavation	2002	10200.00	30.00	Cu. Yard	340	Cu. Yard	5,378	Cu. Yard	161,332
12	Plant New Trees	2002	20400.00	600.00	Each	34	Each	538	Each	322,665
13	Misc. Landscaping	2002	9600.00	2.00	Sq. Foot	4,800	Sq. Foot	75,921	Sq. Foot	151,842
14	Tree, Schrub,a nd Landscape Maintenance	2002	10000.00	10,000.00	Lump Sum	1	Lump Sum	16	Lump Sum	158,169
15	Polythylene Root Barrier	2002	700.00	1.00	Linear Foot	700	Linear Foot	11,072	Linear Foot	11,072
16	Subgrade Preparation-Class A	2002	21600.00	1.00	Sq. Foot	21,600	Sq. Foot	341,645	Sq. Foot	341,645
17	Imported Fill Materials	2002	10200.00	30.00	Cu. Yard	340	Cu. Yard	5,378	Cu. Yard	161,332
18	Deeplift/Base AC (8" max.)	2002	42700.00	70.00	Ton	610	TON	9,648	Ton	675,382
19	AC Surface Course	2002	32000.00	80.00	Ton	400	TON	4,207	Ton	336,584
20	AC Base Course	2002	33600.00	80.00	Ton	420	TON	6,643	Ton	531,448
21	Cold Planing	2002	1500.00	1.50	Sq. Foot	1,000	Sq. Foot	15,817	Sq. Foot	23,725
22	Pavement Reinforcing Fabric	2002	3500.00	1.00	Sq. Yard	3,500	Sq. Yard	55,359	Sq. Yard	55,359
23	Redwood Retaining Wall	2002	12000.00	40.00	Linear Foot	300	Linear Foot	4,745	Linear Foot	189,803
24	PCC Curb and Gutter - Type A2	2002	51000.00	30.00	Linear Foot	1,700	Linear Foot	26,889	Linear Foot	806,662
25	PCC Sidewalk, Plain finish, including 1" of Structural Fill)	2002	60300.00	9.00	Sq. Foot	6,700	Sq. Foot	105,973	Sq. Foot	953,759
26	PCC Driveway	2002	21600.00	12.00	Sq. Foot	1,800	Sq. Foot	28,470	Sq. Foot	341,645
27	PCC Wheelchair Ramp	2002	3200.00	800.00	Each	4	Each	63	Each	50,614
28	PCC Driveway Conform	2002	27000.00	10.00	Sq. Foot	2,700	Sq. Foot	42,706	Sq. Foot	427,056
29	PCC Berm (Type A1-B3)	2002	600.00	6.00	Linear Foot	100	Linear Foot	1,582	Linear Foot	9,490
30	Gravel Conform	2002	1000.00	50.00	Ton	20	TON	316	Ton	15,817
31	Install New Survey Monument	2002	2500.00	500.00	Each	5	Each	79	Each	39,542
32	Traffic Stripes and Pavement Markings	2002	800.00	800.00	Lump Sum	1	Lump Sum	16	Lump Sum	12,654
33	Street Lighting System	2002	60000.00	60,000.00	Lump Sum	1	Lump Sum	16	Lump Sum	949,014
34	Install New Water Valve	2002	3000.00	3,000.00	Each	1	Each	16	Each	47,451
35	Remove Existing Water Valve and Reconnect Existing Waterlin	2002	3000.00	3,000.00	Each	1	Each	16	Each	47,451
36	12" Diameter RCP	2002	19800.00	110.00	Linear Foot	180	Linear Foot	2,847	Linear Foot	313,175
37	27" Diameter RCP	2002	12000.00	160.00	Linear Foot	75	Linear Foot	1,186	Linear Foot	189,803
38	8" Diameter PVC Pipe	2002	6000.00	40.00	Linear Foot	150	Linear Foot	2,373	Linear Foot	94,901
39	Abandon and Cap Off Exist. 12" Dia. RCP	2002	3200.00	800.00	Each	4	Each	63	Each	50,614
40	Cap off New 27" Dia. RCP	2002	800.00	800.00	Each	1	Each	16	Each	12,654
41	Remove Exist. VCP, Replace with PVC	2002	79000.00	100.00	Linear Foot	790	Linear Foot	12,495	Linear Foot	1,249,535
42	Geotextile	2002	3300.00	3.00	Linear Foot	1,100	Linear Foot	17,399	Linear Foot	52,196
43	Trench Sheeting, Shoring,a dn Bracing	2002	6000.00	6,000.00	Lump Sum	1	Lump Sum	16	Lump Sum	94,901
44	Trench Dewatering	2002	12000.00	12,000.00	Lump Sum	1	Lump Sum	16	Lump Sum	189,803
45	Sewer Lateral Verification	2002	300.00	30.00	Each	10	Each	158	Each	4,745
46	Reconnect Exist. Sanitary Sewer	2002	2000.00	200.00	Each	10	Each	158	Each	31,634
47	Replace 4" Dia. Sanitary Sewer	2002	9000.00	90.00	Linear Foot	100	Linear Foot	1,582	Linear Foot	142,352
48	Install Std. Storm Manhole	2002	6400.00	3,200.00	Each	2	Each	32	Each	101,228
49	Install Large Hooded Inlet	2002	14000.00	2,000.00	Each	7	Each	111	Each	221,437
50	Install Std. Flat Grate Inlet	2002	16500.00	1,500.00	Each	11	Each	174	Each	260,979
51	Remove and Replace SS Manhole	2002	24000.00	4,800.00	Each	5	Each	79	Each	379,606
	Total Cost		**692,000.00**	**133,386.50**						**10,775,739**

Equivalent Uniform Annual Cost (EUAC) with 2001 as the base year. Methodologies for EUAC computations are discussed in subsequent sections. Table G4 shows the values calculated above. Table G3a shows summarized costs.

Procedures and methodologies used for scaling the Hope Street project quantities to an ABUS-scale project for the reduced-width design scenario, were similar to those used for computation of unit quantities for Design Scenario 1.

In Design Scenario 2, the dimensions of the cross-sectional design are based on the principle that travel lanes for trucks and buses using automated technologies need be only 30 cm (0.98 feet) wider than the vehicles using them. This design guideline was provided by Dr. Steven Shladover of PATH. The design vehicle chosen is the City Transit Bus, which and is 8.5 feet wide (1). This implies a total travel lane width of 9.48 feet. Rounding to 9.5 feet, this implies a total AHS system width of 19 feet.

Table G2 shows applicable calculations for the system scale factor, which was computed according to the same procedures as in Scenario 1. Table G5 shows scaled construction costs. Table G3b shows tabulated costs and EUAC.

Adjusted Unit Costs (Conversion to 2001-Equivalent Unit Costs)

As the Hope Street project was completed in 2002, the engineer's estimates for unit costs is assumed to be in 2002-dollars. Conversion to 2001-equivalent dollars was necessary. An inflation factor of 0.9804 (2) was applied to all Hope Street project unit costs to convert them to 2001-equivalent costs. The following formula was used:

Unit Cost (2001-Equiv.) = Unit Cost x 0.9804

TABLE G6. ABUS CONSTRUCTION COST CALCULATIONS - SITE-SPECIFIC WORK ITEMS - SCENARIO 1

Type of Work Item	Total Cost ($)	Percent Cost
Site-Specific Work Items	9,828,623	66.7%
General Work Items Associated with ABUS	4,917,125	33.3%
TOTAL	14,745,749	100.00%

TABLE G7. SUMMARY - ABUS CONSTRUCTION COSTS - SCENARIO 2

Type of Work Item	Total Cost ($)	Percent Cost
Site-Specific Work Items	7,182,455	66.7%
General Work Items Associated with ABUS	3,593,284	33.3%
TOTAL	10,775,739	100.00%

The following sample calculation comes from Table G3a, from the line pertaining to Street Clean-Up:

$147.06 = 150.00 x 0.9804

<u>One-Time Construction Costs</u>

For both Scenarios 1 and 2, 2001-equivalent one-time costs for construction are calculated by multiplying the scaled unit quantities by the appropriate 2001-equivalent unit costs (see previous sections). The following sample calculation is taken from Table G3a for Scenario 1, from the row pertaining to Street Clean-Up.

$63,660 = $147.06 x 433

<u>Equivalent Uniform Annual Cost (EUAC) Calculations</u>

One-time construction costs were converted to annual costs for compatibility with other cost calculations in this study, which generally appear in source data as annuities. Table G3a shows itemized construction costs for Design Scenario 1, and Table G3b shows itemized construction costs for Design Scenario 2, as adapted for the ABUS system, and also converted to 2001-equivalent EUAC. The following formula was used for the EUAC calculation:

EUAC (2001-Equiv.) = One-Time Cost (2001-Equiv.) x [A/P,i,n]
= One-Time Cost (2001-Equiv.) x [i(1+i)^n)]/[((1+i)^n)-1]
= One-Time Cost (2001-Equiv.) x 0.0726
where the discount rate i=6% and project life n=30 years.

The following sample calculation was taken from Table G3a, from the line pertaining to Street Clean-Up:

$4,625 = $63,660 x 0.0726

Right-of-Way (ROW) Cost Calculations

Right-of-way costs for the ABUS system were calculated according to the following procedure:

1. Right-of-way unit costs ($ per Sq. Ft.) were assumed to be the same as those used in the light rail infrastructure calculations.
2. Square footage of ABUS project right-of-way was estimated.
3. Unit costs were adjusted for inflation to 2001-equivalent dollars.
4. Adjusted unit costs were multiplied by cost per square foot to get a total cost.
5. Total cost was converted to EUAC (2001-Equivalent).

Square Footage of ABUS Project Right-of-Way

Assuming that the added area due to curved sections is negligible, the area of the ABUS project was approximated by multiplying the 5.19-mile system length by the total width of the right-of-way for both directions. The area required for stations and other supporting infrastructure was neglected because it is assumed that space requirements for these infrastructure elements are similar for all three systems being compared.

Tables G1 and G2 show effective system length (which is the same as the base system length for the ABUS system), two-directional width, and total (two-directional) area for ABUS Scenarios 1 and 2, respectively.

2001-Equivalent EUAC for ABUS Project Right-of-Way

The following description applies to ABUS Design Scenarios 1 and 2, of which the costs are summarized in Tables G3a and G3b, respectively.

The unit cost of ROW was calculated in Appendix C and was converted to 2001-equivalent dollars using an inflation index of 1.0353 (2). The following sample calculation showing unit cost conversion to 2001-equivalent dollars comes from Table G3a (Design Scenario 1):

$24.49 per sq. ft. = [$23.65 per sq. ft.] x [1.0353]

This unit cost was then multiplied by the ABUS square footage to arrive at "One-Time Cost (2001-Equiv.)," as per the following sample calculation (see Table G3a Design Scenario 1):

$17,445,882 = [$24.49 per sq. ft.] x [712,483 sq. ft.]

Finally, costs were converted to EUAC (2001-equivalent). Methodologies for this calculation are identical to other EUAC calculations in Tables G3a and G3b.

Magnetic Reference Marker Cost Calculations

Magnetic strips used to interact with AHS technology on automated vehicles would be placed on the roadway for both ABUS scenarios. Estimated costs for this amount to approximately $5000 per mile**,** according to Professor Randolph Hall of the University of Southern California. With a 10.73-mile system length, this amounts to $51,900 in total construction costs, or $3,770 annually over a 30-year project life. EUAC calculations follow identical methodologies as construction costs. Results are shown in Table G3a.

ABUS System Planning and Design Costs

Project engineers for the City of San Jose, which supplied all personnel and expenses for the Hope Street project design, estimate the planning and design costs for the project to be roughly $96,000. The researchers acknowledge that the larger-scale ABUS project might imply increased efficiency and, therefore, lower design costs per unit area; however, due to unknown complexities that might arise in the ABUS design, the relationship between the Hope Street and ABUS system is assumed to be linear. No adjustments are made for increased complexity or efficiency. Thus, since the Hope Street project is much smaller than the ABUS system, the system planning and design costs were scaled according to the same scale factor as the construction costs to obtain an estimated ABUS system planning and design cost. Tables G8 and G9 show the applicable calculations for Design Scenarios 1 and 2, respectively. Tables G3a and G3b show the tabulated estimated system planning and design costs for Design Scenarios 1 and 2.

TABLE G8. ABUS SYSTEM PLANNING AND DESIGN COSTS - SCENARIO 1

Hope St. Project Costs ($)	Scale Factor	ABUS System Costs ($)
96,000	21.64	2,077,842

TABLE G9. ABUS SYSTEM PLANNING AND DESIGN COSTS - SCENARIO 2

Hope St. Project Costs ($)	Scale Factor	ABUS System Costs ($)
96,000	15.82	1,518,423

ABUS Non-Infrastructure Capital Costs

Non-infrastructure capital costs include those costs associated with vehicle purchase, and also with the initial purchase of the automating technology outfitting for the automated vehicles.

Fleet Purchase

Values for fleet purchase are identical for Design Scenarios 1 and 2. Calculations for determining fleet purchase costs were completed in the following sequence:

1. Cost per bus was determined (in 2001-equivalent dollars).
2. Fleet size was determined.
3. One-time fleet purchase costs were calculated.
4. One-time fleet purchase costs were converted to Equivalent Uniform Annual Costs (EUAC), with 2001 as the base year.

<u>Cost per Bus</u>

In 2002, VTA purchased 40-foot, low-floor buses at $315,000 each. Of that cost, the $22,000 attributed to taxes was not included in bus cost used in this study. The effective cost per bus for this study, without considering the cost of automating technologies, would be $293,000. Automation technology would be purchased for every vehicle at a cost of roughly $25,000 per bus. It is noteworthy that PATH personnel, who supplied this figure, believe that technology costs could be reduced to as low as $5,000 per vehicle if large numbers of vehicles are outfitted. The $25,000 per-bus cost used in this study, then, is a conservative estimate of technology costs. The unit cost per bus was adjusted for inflation to 2001-equivalent dollars. Tables G3a and G3b show the tabulated values for Design Scenarios 1 and 2, respectively.

The applicable calculations were performed according to the following formula:

Unit Cost (2001-Equiv.) = Unit Cost x 0.9804

For the bus itself, the per-bus unit costs for both Scenarios 1 and 2 were:

$287,257 = $293,000 x 0.9804

For the automating technology, the per-bus unit costs for both scenarios were $25,000 in 2001-dollars.

<u>Fleet Size</u>
To operate an ABUS system equivalent to the VTA light rail operations on the project segment, 10.180 buses are required. This number appears in the "# Units in ABUS System" column in Tables G3a and G3b for Design Scenarios 1 and 2, respectively.

Table G10 shows the applicable calculations. The methodology is discussed here.

TABLE G10. ABUS BUSES REQUIRED DURING PM PEAK HOUR

Train #	# LR Cars	# Buses		
	Guad. Line	ABUS-Equiv.	# Buses in Operation	Effective # Buses*
1	3	5	1.248	1.497
2	3	5	1.248	1.497
3	2	3	0.749	0.898
4	3	5	1.248	1.497
5	2	3	0.749	0.898
6	3	5	1.248	1.497
7	2	3	0.749	0.898
8	3	5	1.248	1.497
TOTAL	21	34	8.484	10.180

Guadalupe Line Length (miles) = 20.8
Project System Length (miles) = 5.19
*Approx. 20% of fleet assumed to be withheld from service for maintenance and contingency.

The number of buses required for this system was arrived at by designing a system which would be functionally equivalent to the light rail system. Given the capacity of the buses and light rail cars, the following equivalencies for light rail trains and bus convoys were assumed:

- 3 light rail vehicles = 5 buses
- 2 light rail vehicles = 3 buses
- 1 light rail vehicle = 1 bus

To determine the total number of buses required, the schedule for the peak light rail train usage was assumed, and the same number of bus convoys as light rail trains was assumed to run during that period. Bus convoy size was adjusted according to the equivalencies above. Based on information obtained from the VTA, then, the number of required buses was adjusted to account for the additional vehicles that would be withheld from service at any given time. Like the light rail, an additional 20 percent of the maximum number of vehicles needed for normal operations are withheld from service for maintenance and contingency purposes. The column entitled "Effective # Buses" in Table G10 refers to the necessary bus fleet size plus the additional 20 percent.

The VTA Guadalupe light rail line, which is the base system for the ABUS, operates eight trains during the PM Peak period. Table C4 (in Appendix C) shows the number of light-rail vehicles required. The number of light rail cars per train is also shown in Table G10.

Also shown in Table G10 is the ABUS-system bus-equivalence for each of the eight trains. This equivalence is based on the ABUS-light rail vehicle equivalences described above.

As previously stated, it is assumed that the number of buses necessary to operate on the 5.19-mile proposed ABUS system length is proportional to the length of the line. This assumption is possible because it is assumed that the proposed project system is a portion of the regular system, and not a stand-alone system in itself. In symbolic notation, then:

$$\frac{L_{ABUS}}{L_{Guadalupe}} = \frac{V_{ABUS}}{V_{Guadalupe}}$$

where
L_{ABUS} = the one-directional length of the proposed ABUS line (5.19 miles)
$L_{Guadalupe}$ = the one-directional length of the existing VTA Guadalupe line (20.8 miles). This figure was supplied by VTA personnel.
V_{ABUS} = the number of vehicles operated on the proposed ABUS system
$V_{Guadalupe}$ = the number of vehicles operated on the existing VTA Guadalupe line

Then,

$$V_{ABUS} = \frac{L_{ABUS}}{L_{Guadaluoe}} V_{Guadalupe} = \frac{5.19}{20.8} x V_{Guadalupe}$$

The column entitled "# Buses in Operation" in Table G10 shows the proportional number of ABUS vehicles necessary for the 5.19-mile ABUS system. The calculations for this column were completed using the preceding equation. The following sample calculation refers to the TOTAL row:

8.484 buses = (5.19/20.8) x 34 buses

It is noteworthy that three significant figures have been retained in the calculation of ABUS-system fleet requirements to distinguish this number as being a derived quantity, and a portion of a whole, rather than a self-contained system.

As stated previously, the number of buses in the ABUS system was adjusted to reflect that an additional 20 percent of the fleet is routinely held from service for maintenance and contingency. To this end, the column entitled “Effective # Buses” refers to the actual number of buses in the fleet, including those in operation, and those withheld from service. The following formula was used to determine “Effective # Buses:”

Effective # Buses = #Buses in Operation System x 1.2

The following sample calculation refers to the TOTAL row:

10.180 buses = 8.484 buses x 1.2

As previously stated, three significant figures have been retained in the calculation of ABUS-system fleet requirements to distinguish this number as being a derived quantity, and a portion of a whole, rather than a self-contained system.

<u>One-Time Cost (2001-Equivalent)</u>

Tables G3a and G3b show a column entitled “One-Time Cost (2001-Equivalent),” which refers to the total cost for the ABUS system fleet purchase in 2001-dollars for Design Scenarios 1 and 2, respectively. This number was arrived at by multiplying the 2001-equivalent cost per bus by the number of buses in the ABUS system, as per the following sample calculation from Table G3a:

$2,924,389 = $287,257 x 10.180

<u>EUAC (2001-Equivalent)</u>

Tables G3a and G3b (for Design Scenarios 1 and 2, respectively) show a column entitled “EUAC (2001-Equiv.),” which refers to an annualized cost for fleet purchase, assuming a 30-year project life and a 6% discount rate. EUAC was calculated according to the following formulae:

[EUAC (2001-Equiv.)] = [One-Time Cost (2001-Equiv.)] x [A/P,i,n]
= [One-Time Cost (2001-Equiv.)] x [i(1+i)^n]/[((1+i)^n)-1))]
= [One-Time Cost (2001-Equiv.)] x 0.0726

Thus, numerically,

$212,454 = $2,924,389 x 0.0726

Automation Technology for Vehicles

Automating technology is assumed to cost $25,000 per bus, and was assumed to be purchased for each bus using the system. Methodologies for vehicle automation technology purchase are identical to those used to calculate fleet purchase costs in the previous section. Tables G3a and G3b show the calculated costs for Design Scenarios 1 and 2, respectively.

ABUS Periodic Capital Costs

Periodic capital costs for the ABUS system include routine pavement sealing and resurfacing costs, replacement of automated technology on vehicles, and replacement of magnetic reference markers when the roadway is rehabilitated. Pavement maintenance is not included in the VTA "System Maintenance" cost category. Costs for pavement sealing and resurfacing were obtained from engineers in the City of San Jose pavement design division, and are historic costs based on previous projects. They are considered to be accurate for the years 2002 and 2003. The unit costs used in this study are all-inclusive, meaning that all costs associated with the given type of work are included in the figure. These costs include overhead, internal costs, engineering, contract costs, etc.

Tables G3a and G3b show tabulated rehabilitation costs for the ABUS system, itemized by rehabilitation type, for each design scenario (design following AASHTO standards, and the reduced-width design). Tables G11 and G12 show rehabilitation cost calculations for the two design scenarios. The rehabilitation types are:

- Minor Rehabilitation – Seals
- Major Rehabilitation – Resurfacing
- Magnetic Reference Marker Replacement

Minor Rehabilitation –Seals

As part of routine preventative roadway maintenance, a sealant is applied to the surface of a typical asphalt concrete roadway with a frequency of 5 to 7 years according to City of San Jose (CSJ) pavement department engineers. A unit cost of $3.90 per square yard (in 2002-dollars) was cited, also by CSJ engineers, as representative of the cost of preventative sealants. This cost is all-inclusive, as described above, and also includes the repair of localized failures, such as potholes, before the sealant is applied.

Assuming a 5-year sealant frequency, the annual cost for this type of minor rehabilitation to the roadway surface was calculated. Tables G11 and G12 show cost calculations for Design Scenario 1 (where design follows AASHTO standards) and Design Scenario 2 (where design follows the previously-described reduced-width standards).

Methodologies and sample calculations appear in the section of this appendix entitled "ABUS Rehabilitation Cost Calculations – Methodologies and Sample Calculations."

TABLE G11. ROADWAY REHABILITATION COSTS - SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

Type	Unit Cost (2002 $)		Unit Cost (2001-Equiv. $)		Project Dimensions					Total Cost ($) per Rehab. Cycle (2001-Equiv.)	Frequency		Annual Cost (2001-Equiv. $)
	Cost	Unit	Cost	Unit	Length	Area	Unit	Area	Unit				
Minor - Seals	3.90	SY	3.82	SY	N/A	712,483	SF	79,165	SY	302,691	5	years	30,732
Major - Resurfacing	17.21	SY	16.87	SY	N/A	712,483	SF	79,165	SY	1,335,723	10	years	84,443
Magnetic Reference Markers - Includes Installation	5,000	Lane Mile	5,000	Lane Mile	10.38	N/A	N/A	N/A	N/A	51,900	5	years	8,550

TABLE G12. ROADWAY REHABILITATION COSTS - SCENARIO 2: REDUCED-WIDTH DESIGN

Type	Unit Cost (2002 $)		Unit Cost (2001-Equiv. $)		Project Dimensions					Total Cost ($) per Rehab. Cycle (2001-Equiv.)	Frequency		Annual Cost (2001-Equiv. $)
	Cost	Unit	Cost	Unit	Length	Area	Unit	Area	Unit				
Minor - Seals	3.90	SY	3.82	SY	N/A	520,661	SF	57,851	SY	221,198	5	years	22,458
Major - Resurfacing	17.21	SY	16.87	SY	N/A	520,661	SF	57,851	SY	976,105	10	years	61,708
Magnetic Reference Markers - Includes Installation	5,000	Lane Mile	5,000	Lane Mile	10.38	N/A	N/A	N/A	N/A	51,900	5	years	8,550

Major Rehabilitation – Resurfacing

According to City of San Jose engineers, a typical resurfacing of an asphalt concrete roadway occurs every 2-to-3 sealant cycles. For this study, a conservative 2-cycle, or 10-year, resurfacing cycle was assumed. A unit cost of $17.21 per square yard (in 2002 dollars) was given by City of San Jose personnel. Like costs for preventative sealants, this cost is all-inclusive, as described above, and also includes the repair of localized failures, such as potholes, before resurfacing.

Tables G11 and G12 show cost calculations for Design Scenario 1 (where design follows AASHTO standards) and Design Scenario 2 (where design follows the previously-described reduced-width standards).

Methodologies and sample calculations appear in subsequent sections.

ABUS Magnetic Reference Markers

For the purposes of this study, magnetic reference markers were assumed to be replaced each time the roadway would be resealed or resurface. This works out to a five-year replacement frequency, at $5,000 per mile.

Tables G11 and G12 show cost calculations for Design Scenario 1 (where design follows AASHTO standards) and Design Scenario 2 (where design follows the reduced-width standard).

Methodologies and sample calculations appear in subsequent sections.

ABUS Rehabilitation Cost Calculations – Methodologies and Sample Calculations

The following cost calculations apply to Table G11, costs for "Minor Rehabilitation – Preventative Sealants" pertaining to Design Scenario 1. Identical methodologies were used to calculate all costs in Table G12, which pertain to Design Scenario 2.

<u>Unit Cost (2001-Equiv.)</u>

> [Unit Cost (2001-Equiv.)] = [Unit Cost (2002)] x [2002-to-2001 Inflation Factor)]
> Sample Calculation: $3.82 = $3.90 x 0.9804 (see Reference (2))

<u>Project Surface Area</u>

ABUS project surface area is previously-calculated in square feet for Design Scenarios 1 and 2 in Tables G1 and G2. It was converted here to square yards by dividing the square footage by 9.

Total Cost per Rehab. Cycle

[Total Cost per Rehab. Cycle (2001-Equiv.)] = [Project Surface Area] x [Unit Cost (2001-Equiv.)]
Sample Calculation: $302,691 = 79,165 x $3.82

Frequency

This column refers to the frequency of rehabilitation, in years. These values were taken from data given by VTA personnel.

Annual Cost (2001-Equiv.)

Minor Rehabilitation – Seals

[Annual Cost (2001-Equiv.)] = [Total Cost per Rehab. Cycle (2001-Equiv.)] x [(P/F,i,5) + (P/F,i,15) + (P/F,i,25)] x [A/P,i,30]
where the interest rate i=6%, the project life (n) is assumed to be 30 years, and where the formulae for [P/F,i,n] and [A/P,i,n] are given as follows:

$[P/F,i,n] = 1/(1+i)^n$
$[A/P,i,n] = i(1+i)^n/[(1+i)^n-1]$

Sample Calculation: $30,732 = $302,691 x
(0.7473+0.4173+0.2330) x 0.0726

Major Rehabilitation - Resurfacing

[Annual Cost (2001-Equiv.)] = [Total Cost per Rehab. Cycle (2001-Equiv.)] x [(P/F,i,10) + (P/F,i,20)] x [A/P,i,30]
where the interest rate i=6%, the project life (n) is assumed to be 30 years, and where the formulae for [P/F,i,n] and [A/P,i,n] are as given in the previous calculation for Minor Rehabilitation.

Magnetic Reference Markers

[Annual Cost (2001-Equiv.)] = [Total Cost per Rehab. Cycle (2001-Equiv.)] x [(P/F,i,5) + (P/F,i,10) + (P/F,i,15) + (P/F,i,20) + (P/F,i,25)] x [A/P,i,30]
where the interest rate i=6%, the project life (n) is assumed to be 30 years, and where the formulae for [P/F,i,n] and [A/P,i,n] are as given in the previous calculation for Minor Rehabilitation.

Fleet Renewal

Fleet renewal involves replacing the buses that serve the study system, and also the automating technology used on the buses.

Bus Replacement Costs

It was assumed for the purposes of this study that, when additional buses would be purchased, the associated automating technology for the bus would also be replaced. Fleet renewal calculations are identical for Design Scenarios 1 and 2. Tables G3a and G3b show the tabulated values. The following procedures were used:

VTA personnel were consulted, and it was determined that the organization typically replaces an operating bus after 14 years of service. The buses used for this project cost $287,257 in 2001-equivalent dollars, as discussed in previous sections of this appendix.

For compatibility with the ABUS study system 30-year life cycle, a 15-year fleet replacement cycle was assumed. Thus, it was assumed that $1/15^{th}$ of the fleet would be replaced each year, at a per-bus cost of $287,257 per bus (in 2001-equivalent dollars). Tables G3a and G3b show the calculated costs for Design Scenarios 1 and 2, respectively. Calculations and methodologies are as follows:

It was previously calculated that 10.180 buses were required to service the study segment. If $1/15^{th}$ of these were replaced each year, then the annual cost, in 2001-equivalent dollars, would be calculated as follows:

EUAC (2001-Equiv.) = $194,959 = [10.180/15] x $287,257

Vehicle Automation Technology Replacement Costs

Automating technology is assumed to cost $25,000 per bus, and is assumed to be replaced at the same frequency as the bus fleet. Methodologies for vehicle automation technology replacement are identical to those used to calculate fleet renewal costs in the previous section. Tables G3a and G3b show the calculated costs for Design Scenarios 1 and 2, respectively.

ABUS SYSTEM NON-INFRASTRUCTURE AGENCY COSTS

ABUS system non-infrastructure agency costs include those costs for operation and maintenance of the ABUS system. They include:

- Vehicle Operating Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs

Descriptions of the cost elements included in these categories will be discussed below.

Determination of the ABUS study system vehicle operating costs was performed in several major phases for each of the four aforementioned cost categories:

1. Determination of individual cost elements that comprise costs in that category.
2. Determination of unit costs for those cost elements in terms of vehicle-revenue-miles and vehicle-revenue-hours (discussed in Appendix H).
3. Determination of annual convoy-revenue-miles and –hours for the study section (discussed in Appendix H).
4. Determination of unit costs for each cost element, based on the VTA bus system, in terms of vehicle-revenue-miles and vehicle-revenue-hours, or convoy-revenue-miles and –hours.
5. Calculation of ABUS study system annual costs based on unit costs and calculated vehicle-revenue-miles and –hours, or convoy-revenue-miles and –hours.

Items 1, 4 and 5 are the focus of this appendix.

Agency Cost Category Descriptions

ABUS Vehicle Operations

Costs associated with vehicle operations include daily costs necessary to run the system, including operators' salaries, wages, and benefits, fuel and oil, utilities, and other expenses. Vehicle operating costs do not include costs for routine vehicle maintenance, such as tire replacement and labor costs for workers performing the maintenance.

ABUS System Vehicle Maintenance Costs

Costs associated with vehicle maintenance include those costs for materials, supplies, fuels, lubricants, utilities, and labor used to keep the system in good working order, which are not included in vehicle operating costs.

ABUS System (Non-Vehicle) Maintenance Costs

Costs associated with system maintenance include maintenance expenses for bus stops and other infrastructure, and also for minor roadway maintenance activities such as street sweeping, cleaning of storm sewers, landscaping, streetlights, traffic signals, signs, and markings. System maintenance does not include resurfacing or rehabilitation (i.e. – resurfacing and preventative sealants) for the roadways on which the buses travel. Roadway rehabilitation of this sort is included in infrastructure and capital costs, under the heading of "Rehabilitation."

ABUS System Administration Costs

Costs associated with system administration include expenses incurred for system support personnel in VTA's offices.

Unit Cost Calculations

Four types of unit costs were calculated for this study:

1. Unit cost per vehicle-revenue-mile
2. Unit cost per vehicle-revenue-hour
3. Unit cost per convoy-revenue-mile
4. Unit cost per convoy-revenue-hour

The procedures described herein are general to the four cost categories discussed in this section. Procedures are illustrated here using the "Vehicle Operating Costs" tables and quantities as a model.

For the ABUS system, data for the operation of VTA buses were used to estimate most costs to operate ABUS vehicles. VTA's 1999-2000 report to the National Transit Database (NTD) itemizes operating expenses for buses according to "Expense Object Classes" (EOCs) and also according to function (Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, and General Administration) in Form 301 of the report (3). The general "Expense Object Classes" listed in Form 301 was used to construct a working list of potential cost elements for the light rail, bus, and ABUS components of this benefit/cost analysis.

Tables G13a through G16b show itemized lists of cost elements, raw source data, and unit cost data for ABUS vehicle operating costs, vehicle maintenance costs, system maintenance costs, and system administration costs, respectively. The NTD (3) gives total annual vehicle-revenue-miles and total annual vehicle-revenue-hours for the VTA bus system to be 19,140,121 and 1,471,604, respectively, for the fiscal year ending in June 2000. Unit costs in terms of revenue miles and revenue hours for all EOCs excluding operator wages and operator fringe benefits (discussed in a later section) were found by dividing the given VTA total operating expenses for the year 2000 by 19,140,121 and 1,471,604, respectively.

For costs associated with vehicle operations, vehicle maintenance, and system administration, VTA data reported to the NTD were assumed to be an exhaustive list of costs associated with operating an ABUS system. This assumption was not applicable, however, in the case of system (non-vehicle) maintenance costs. The discrepancy arises because the VTA does not maintain the streets on which its buses operate. For the purposes of this study, it is assumed that the agency that builds and maintains the ABUS system also maintains the roadways, so costs for street maintenance (such as sweeping and culvert cleaning) had to be added.

In Tables G15a and G15b, the costs itemized under the heading "Street Maintenance" were obtained from the City of San Jose (CSJ) Department of Transportation Street Maintenance division. Table G17 shows calculations and tabulated values for determining costs for roadway maintenance activities. For reasons described in subsequent paragraphs, no distinction was made between costs for Design Scenarios 1 and 2; all street maintenance calculations are assumed to apply to both scenarios. Methodologies and sample calculations are discussed in the following paragraphs.

TABLE G13a. ABUS VEHICLE OPERATING COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Revenue-Miles		Revenue-Hours	
				Unit Cost ($)	Unit	Unit Cost ($)	Unit
Salaries and Wages	Operators' Salaries and Wages	2000	3,588,844	2.22	convoy-revenue-mile	32.89	convoy-revenue-hour
	Other Salaries and Wages	2000	9,092,463	0.48	bus-revenue-mile	6.18	bus-revenue-hour
Fringe Benefits	Operators' Fringe Benefits	2000	2,951,068	1.83	convoy-revenue-mile	27.04	convoy-revenue-hour
	Other Fringe Benefits	2000	5,259,043	0.27	bus-revenue-mile	3.57	bus-revenue-hour
Services	Services	2000	3,473,770	0.18	bus-revenue-mile	2.36	bus-revenue-hour
Materials and Supplies	Fuel and Lubricants	2000	5,668,049	0.30	bus-revenue-mile	3.85	bus-revenue-hour
	Tires and Lubes	2000	1,263,850	0.07	bus-revenue-mile	0.86	bus-revenue-hour
	Other Materials and Supplies	2000	148,627	0.01	bus-revenue-mile	0.10	bus-revenue-hour
Utilities	Utilities	2000	2,252,658	0.12	bus-revenue-mile	1.53	bus-revenue-hour
Taxes	Taxes						
Misc.	Miscellaneous Expenses	2000	586,232	0.03	bus-revenue-mile	0.40	bus-revenue-hour
Expense Transfers	Expense Transfers						
TOTAL OPERATING COSTS			34,284,604				

TABLE G13b. ABUS VEHICLE OPERATING COSTS

Cost Element	ITEM	Revenue-Miles				Revenue-Hours			
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Unit	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Unit	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages	2.27	276,035	convoy-revenue-hour	625,840	33.55	15,439	convoy-revenue-hour	517,923
	Other Salaries and Wages	0.48	620,101	bus-revenue-hour	300,469	6.30	34,683	bus-revenue-hour	218,577
Fringe Benefits	Operators' Fringe Benefits	1.86	276,035	convoy-revenue-hour	514,622	27.59	15,439	convoy-revenue-hour	425,883
	Other Fringe Benefits	0.28	620,101	bus-revenue-hour	173,790	3.65	34,683	bus-revenue-hour	126,424
Services	Services	0.19	620,101	bus-revenue-hour	114,794	2.41	34,683	bus-revenue-hour	83,507
Materials and Supplies	Fuel and Lubricants	0.30	620,101	bus-revenue-hour	187,306	3.93	34,683	bus-revenue-hour	136,256
	Tires and Lubes	0.07	620,101	bus-revenue-hour	41,765	0.88	34,683	bus-revenue-hour	30,382
	Other Materials and Supplies	0.01	620,101	bus-revenue-hour	4,912	0.10	34,683	bus-revenue-hour	3,573
Utilities	Utilities	0.12	620,101	bus-revenue-hour	74,441	1.56	34,683	bus-revenue-hour	54,152
Taxes	Taxes								
Misc.	Miscellaneous Expenses	0.03	620,101	bus-revenue-hour	19,373	0.41	34,683	bus-revenue-hour	14,093
Expense Transfers	Expense Transfers								
TOTAL OPERATING COSTS					2,057,312				1,610,770

TABLE G14a. ABUS VEHICLE MAINTENANCE COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	17,090,526	0.89	11.61
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	10,171,267	0.53	6.91
Services	Services	2000	3,257,024	0.17	2.21
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	5,339,616	0.28	3.63
Utilities	Utilities	2000	2,708	0.00	0.00
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	168,299	0.01	0.11
Expense Transfers	Expense Transfers	2000			
TOTAL ABUS VEHICLE MAINTENANCE COSTS			36,029,440	1.88	24.48

TABLE G14b. ABUS VEHICLE MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001 Equiv. $)	Annual Units in ABUS System	Annual Cost (2001 Equiv. $)	Unit Cost (2001 Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.91	620,101	564,772	11.85	34,683	410,845
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.54	620,101	336,119	7.05	34,683	244,510
Services	Services	0.17	620,101	107,631	2.26	34,683	78,297
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.28	620,101	176,453	3.70	34,683	128,361
Utilities	Utilities	0.00	620,101	89	0.00	34,683	65
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	620,101	5,562	0.12	34,683	4,046
Expense Transfers	Expense Transfers						
TOTAL ABUS VEHICLE MAINTENANCE COSTS		1.92		1,190,627	24.97		866,123

TABLE G15a. ABUS SYSTEM (NON-VEHICLE) MAINTENANCE COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	2,775,476	0.15	1.89
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	1,426,458	0.07	0.97
Services	Services	2000	2,425,464	0.13	1.65
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	273,506	0.01	0.19
Utilities	Utilities	2000	343,855	0.02	0.23
Taxes	Taxes	2000			
Street Maintenance*	Street Sweeping	2002	See Table G17	N/A	N/A
	Storm Sewers (Includes Inlet Cleaning)	2002	See Table G17	N/A	N/A
	Landscaping (Includes Median Islands)	2002	See Table G17	N/A	N/A
	Streetlights	2002	See Table G17	N/A	N/A
	Traffic Signals	2002	See Table G17	N/A	N/A
	Signs	2002	See Table G17	N/A	N/A
	Markings	2002	See Table G17	N/A	N/A
Misc	Miscellaneous Expenses	2000	55,906	0.00	0.04
Expense Transfers	Expense Transfers	2000			
TOTAL ABUS SYSTEM (NON-VEHICLE) MAINTENANCE COSTS					

*See Table G17 for street maintenance cost calculations.

TABLE G15b. ABUS SYSTEM (NON-VEHICLE) MAINTENANCE COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.15	620,101	91,718	1.92	34,683	66,721
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.08	620,101	47,139	0.99	34,683	34,291
Services	Services	0.13	620,101	80,152	1.68	34,683	58,307
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.01	620,101	9,038	0.19	34,683	6,575
Utilities	Utilities	0.02	620,101	11,363	0.24	34,683	8,266
Taxes	Taxes						
Street Maintenance*	Street Sweeping	N/A	N/A	6,988	N/A	N/A	6,988
	Storm Sewers (Includes Inlet Cleaning)	N/A	N/A	3,669	N/A	N/A	3,669
	Landscaping (Includes Median Islands)	N/A	N/A	7,903	N/A	N/A	7,903
	Streetlights	N/A	N/A	4,517	N/A	N/A	4,517
	Traffic Signals	N/A	N/A	3,910	N/A	N/A	3,910
	Signs	N/A	N/A	1,681	N/A	N/A	1,681
	Markings	N/A	N/A	2,684	N/A	N/A	2,684
Misc	Miscellaneous Expenses	0.00	620,101	1,847	0.04	34,683	1,344
Expense Transfers	Expense Transfers						
TOTAL ABUS SYSTEM (NON-VEHICLE) MAINTENANCE COSTS				272,609			206,855

*See Table G17 for street maintenance cost calculations.

TABLE G16a. ABUS SYSTEM ADMINISTRATION COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	5,934,604	2.45	36.33
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	5,369,604	2.22	32.87
Services	Services	2000	1,658,116	0.68	10.15
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	295,744	0.12	1.81
Utilities	Utilities	2000	46,731	0.02	0.29
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	432,480	0.18	2.65
Expense Transfers	Expense Transfers	2000			
TOTAL ABUS SYSTEM ADMINISTRATION COSTS			13,737,279	5.67	84.10

TABLE G16b. ABUS SYSTEM ADMINISTRATION COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in ABUS System	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	2.50	620,101	1,549,903	37.06	34,683	1,285,245
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	2.26	620,101	1,402,346	33.53	34,683	1,162,884
Services	Services	0.70	620,101	433,040	10.35	34,683	359,095
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.12	620,101	77,238	1.85	34,683	64,049
Utilities	Utilities	0.02	620,101	12,204	0.29	34,683	10,120
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.18	620,101	112,948	2.70	34,683	93,661
Expense Transfers	Expense Transfers						
TOTAL ABUS SYSTEM ADMINISTRATION COSTS		5.79		3,587,679	85.78		2,975,054

In Table G17, the columns headed "CSJ Total Annual Cost ($)," "CSJ Profile," and "CSJ 30-Foot Equivalent Miles in System" contain values obtained directly from CSJ. "CSJ Total Annual Cost ($)" refers to the dollar amount that the City of San Jose (CSJ) spent in 2002 forall maintenance activity in the corresponding cost category (street sweeping, etc.). "CSJ Profile" refers to the total quantity of infrastructure maintained by the City of San Jose in 2002 (for instance, CSJ maintained 8,320 curb miles that year). "CSJ 30-Foot Equivalent Miles in System" is a figure that refers to the total roadway mileage maintained by the City of San Jose. One 30-foot equivalent mile is equal to thirty feet of roadway width that is one mile in length.

The columns headed "Units per 30-Foot Equiv. Mile" contain calculated values in units per 30-foot equivalent mile. The following sample calculation is for the row entitled "Street Sweeping:"

> [3.62 curb miles/ 30-foot equiv. mile] = [8,320 curb miles] / [2300 30-foot equiv. miles]

The column headed "ABUS System Mileage (30-Foot Equiv. Miles)" represents the number of 30-foot equivalent miles assumed to be in the ABUS system. Although the ABUS system is at maximum 26 feet (for Design Scenario 1) in width, adjusting the 30-foot equivalent mileage figure to reflect a width of 26 feet (or, in the case of Design Scenario 2, 21 feet) was deemed unnecessary by the authors. Resulting adjustments made to annual costs would have been negligible. For this reason, also, the resulting costs are assumed to apply to Design Scenarios 1 and 2.

The columns headed "Equivalent ABUS Profile" contains calculated values resulting from the following formula:

> Equivalent ABUS Profile = [Units per 30-Foot Equiv. Mile] x [ABUS System Mileage (30-Foot Equiv. Miles)]

The following sample calculation comes from the row entitled "Street Sweeping:"

> 18.77 Curb Miles = [3.62 Curb Miles per 30-Foot Equiv. Mile] x [5.19 30-Foot Equiv. Miles]

The columns headed "Unit Cost ($)" contain values for the unit cost for each work item, and were calculated by dividing the "CSJ Total Annual Cost ($)" by the number of units from the "CSJ Profile" column. The following sample calculation comes from the row entitled "Street Sweeping:"

> $379.64 per Curb Mile = $3,158,619 / 8,320 Curb Miles

The column headed "Annual Cost (2002)" is a calculated quantity arrived at by the following formula:

> Annual Cost (2002) = [Equivalent ABUS Profile] x [Unit Cost ($)]

TABLE G17. ROADWAY MAINTENANCE

Activity	CSJ Total Annual Cost ($)	CSJ Profile		CSJ 30-Foot Equivalent Miles in System	Units per 30-Foot Equiv. Mile		ABUS System Mileage (30-Foot Equiv. Miles)	Equivalent ABUS Profile		Unit Cost ($)		Annual Cost (2002 $)	Annual Cost (2001-Equiv. $)
		Number	Unit		Number	Unit		Number	Unit	Number	Unit		
Street Sweeping	3,158,619	8,320	Curb Miles	2300	3.62	Curb Miles/30-Foot Equiv Mile	5.19	18.77	Curb Miles	379.64	per Curb Mile	7,127	6,988
Storm Sewers (Includes Inlet Cleaning)	1,658,511	907	Miles	2300	0.39	Miles/30-Foot Equiv. Mile	5.19	2.05	Miles	1,828.57	per Mile	3,742	3,669
Landscaping (Includes Median Islands)	3,572,324	187	Acres	2300	0.08	Acres/30-Foot Equiv. Mile	5.19	0.42	Acres	19,103.34	per Acre	8,061	7,903
Streetlights	2,041,814	55,480	Streetlights	2300	24.12	Streetlights/30-Foot Equiv. Mile	5.19	125.19	Streetlights	36.80	per Streetlight	4,607	4,517
Traffic Signals	1,767,422	803	Traffic Signals	2300	0.35	Traffic Signals/30-Foot Equiv. Mile	5.19	1.81	Traffic Signals	2,201.02	per Traffic Signal	3,988	3,910
Signs	759,736	95,000	Signs	2300	41.30	Signs/30-Foot Equiv. Mile	5.19	214.37	Signs	8.00	per Sign	1,714	1,681
Markings	1,213,094	12,600,000	Sq. Feet	2300	5,478.26	Sq. Feet/30-Foot Equiv. Mile	5.19	28,432.17	Sq. Feet	0.10	per Sq. Foot	2,737	2,684

The following sample calculation comes from the row entitled “Street Sweeping:”

$7,127 = [18.77 Curb Miles] x $379.64

Then, annual costs for the ABUS system were adjusted for inflation to 2001-equivalent values. An inflator of 0.9804 (2) was used, as per the following sample calculation (for street sweeping):

$6,988 = $7,127 x 0.9804

Table G15b shows annual 2001-equivalent costs applied to the system (non-vehicle) maintenance costs for the ABUS system.

Unit Costs for Operators’ Wages and Fringe Benefits

Unit costs for operators’ wages and fringe benefits for the ABUS system were assumed to be identical to unit costs for operator wages and fringe benefits for the light rail system. Because VTA buses do not convoy as do the buses in the proposed ABUS system, and because it is assumed for the study system that the ABUS and light rail systems are functionally equivalent (meaning that transport the same number of passengers in the same time periods), the VTA light rail unit cost data pertaining to driver wages and fringe benefits was considered to be a more accurate reflection of potential ABUS driver costs than would VTA bus system unit costs. Thus, the unit costs appearing in Table G13a are copied directly from Table C7a, the comparable table in the light rail section of the report. Subsequent calculations were carried out via the same methodologies as in previous sections using vehicle-revenue-miles and –hours calculated for the ABUS system. Separation of fringe benefits into operators’ and other categories were calculated according to the same methodology used in Appendix C.

Calculation of Annual Costs for ABUS Study System

Conversion of unit costs to the base year (2001) and calculation of annual costs for the proposed ABUS system were performed using an identical methodology as was used for comparable light rail calculations. This process is described in Appendix C.

References

1. *A Policy of the Geometric Design of Highways and Streets.* AASHTO. 2001
2. Gross Domestic Product Deflator Inflation Calculator. <http://www.jsc.nasa.gov/bu2/inflateGDP.html>
3. *Final Annual Report 1999-2000.* Prepared for Federal Transit Administration National Transit Database by Santa Clara County Transportation Authority.

APPENDIX H

ABUS ANNUAL REVENUE-MILES AND REVENUE-HOURS OF OPERATION

Introduction

Determination of the ABUS system vehicle operating costs was performed in several major phases, the first and second of which are the focus of this appendix:

1. Determination of annual vehicle-revenue-miles and –hours used by the proposed ABUS system.
2. Determination of annual convoy-revenue-miles and –hours used by the proposed light rail system.
3. Determination of unit costs for the VTA bus system in terms of vehicle-revenue-miles and vehicle-revenue-hours, and in some cases, convoy-revenue-miles and convoy-revenue-hours.
4. Calculation of proposed ABUS system annual costs.

Definitions

The following pertinent terms will listed defined here are used throughout this appendix:

Bus-Revenue-Mile: Defined as one bus traveling one mile during revenue operation.

Bus-Revenue-Hour: Defined as one bus operating for one hour under revenue-generating operation.

Convoy-Revenue-Mile: Defined as one bus-train traveling one mile during revenue operation.

Convoy-Revenue-Hour: Defined as one bus-train traveling for one hour under revenue-generating operation.

Additionally, the more terms "revenue-miles" and "revenue-hours" are used in this in this appendix to discuss these defined terms in a more general sense.

Equivalence Relations for ABUS System Compatibility with the Light Rail System

In order to maintain consistency with the light rail system passenger and train volumes shown previously, ABUS system operations were converted to an equivalent system, with buses replacing light rail vehicles as follows:

1 light rail vehicle = 1 bus
2 light rail vehicles = 3 buses
3 light rail vehicles = 5 buses

These conversions are based on a light rail vehicle seating capacity of 67 and a bus seating capacity of 45. Generally, VTA guidelines dictate that adding a car to a light rail train occurs when standees are consistently observed on the cars. This same rule was adopted for the

ABUS vehicles, and the number of buses in a bus-train that would be equivalent to the number of cars in a light-rail train was assumed as shown:

Light Rail		Bus	
# of Cars	Seated Capacity	# of Buses	Seated Capacity
3	201	5	225
2	134	3	135
1	67	1	45

From the above, it can be seen that the capacities for the two types of vehicles are not exactly the same. They were, however, considered close enough that the differences could be accommodated by standees. It should be noted that in two cases, the bus capacity exceeds the standing capacity, and in one case, the reverse is true.

Determination of Annual Revenue-Miles and –Hours Used by the Proposed ABUS System – General Procedure

Unless otherwise specified, procedures used to determine annual revenue-miles and –hours for the ABUS system are identical to those procedures employed to determine such quantities for the light rail system. Determination of annual revenue-miles and –hours used by the proposed ABUS system was accomplished as follows:

1. Data on how many trains travel on the system during each daily period, both for the weekday and weekend condition, were determined for the light rail system in Appendix D.
2. The proposed ABUS system was assumed to operate the same number of bus-convoys as the VTA light rail system on the 5.19-mile project domain at the same headways. The difference between the two systems is the number of vehicles per train/convoy, which were determined using the bus-to-light rail vehicle equivalencies shown in the previous section.
3. Daily train trips on the system during each daily period were determined. These are identical to the number of train trips used by the light rail system (see Tables D7 and D8). Values reappear in Tables H1 and H2, are based upon schedules shown in Appendix B.
4. Daily revenue-miles and revenue-hours were calculated for the system. The calculations appear in Tables H1 and H2.
5. Annual revenue-miles and revenue-hours were calculated for the system. Tables H3 and H4 show summaries of the annual revenue-miles and –hours in terms of train-revenue-miles, vehicle-revenue-miles, train-revenue-hours, and vehicle-revenue-hours.

Calculation of Daily Train Trips on System

Tables H1 and H2 show daily train trips traveled weekdays and weekends in the columns entitled “# of Convoy Trips (2 Directions).” The values in these columns are extracted directly from Tables D7 and D8, from the corresponding columns labeled “# Trains Traveled (2 Directions).” The number of light rail train trips and ABUS convoy trips are identical.

Calculation of Daily Revenue-Miles and Revenue-Hours

Procedures used are identical to those used for the light rail system. Tables H1 and H2 show weekday and weekend revenue-mile and revenue-hour calculations. They are divided into sections for 5-bus convoys, 3-bus convoys, 1-bus convoys, and totals.

Each of these tables shows four previously-defined data points for each category of train:

- Convoy-Revenue-Miles
- Bus-Revenue-Miles
- Convoy-Revenue-Hours
- Bus-Revenue-Hours

Calculation methodologies are identical to those used for the light rail system, with adjustments in formulas made to account for 5-, 3-, and 1-bus convoys as opposed to 3-, 2-, and 1-car trains.

Calculation of Annual Revenue-Miles and –Hours

Calculation procedures are identical to those employed in the light rail system annual revenue-miles and –hours calculations. Tables H3 and H4 show calculated annual revenue-miles and –hours, and summaries. Tables H5 and H6 show summaries of annual revenue-miles and –hours. Table H7 shows the number of days per year, itemized according to weekday, Saturday, and Sunday.

TABLE H1. ABUS WEEKDAY REVENUE-MILES AND REVENUE-HOURS

Period	5-Bus Convoy					3-Bus-Convoy					1-Bus-Convoy					Total Buses Traveled (2-Directions)
	Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		
		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour	
AM Peak	16	83.04	415.20	4.64	23.22	9	46.71	140.13	2.61	7.84	0	0.00	0.00	0.00	0.00	107.00
Midday	0	0.00	0.00	0.00	0.00	48	249.12	747.36	13.93	41.80	0	0.00	0.00	0.00	0.00	144.00
PM Peak	14	72.66	363.30	4.06	20.32	10	51.90	155.70	2.90	8.71	0	0.00	0.00	0.00	0.00	100.00
Off-Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	49	254.31	254.31	14.22	14.22	49.00
TOTAL	30	155.70	778.50	8.71	43.54	67.00	347.73	1043.19	19.45	58.35	49.00	254.31	254.31	14.22	14.22	400.00

TABLE H2. ABUS WEEKEND REVENUE-MILES AND REVENUE-HOURS OF OPERTION

Period	5-Bus Convoy					3-Bus-Convoy					1-Bus-Convoy					Total Buses Traveled (2-Directions)
	Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		
		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour	
AM Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	24	124.56	124.56	6.97	6.97	24.00
Midday	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	48	249.12	249.12	13.93	13.93	48.00
PM Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	24	124.56	124.56	6.97	6.97	24.00
Off-Peak	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	49	254.31	254.31	14.22	14.22	49.00
TOTAL	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	145	752.55	752.55	42.09	42.09	145.00

TABLE H3. ABUS ANNUAL WEEKDAY REVENUE-MILES AND REVENUE-HOURS

Period	5-Bus Convoy					3-Bus Convoy					1-Bus Convoy				
	Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour	
		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour
AM Peak	4176	21673	108367	1212	6061	2349	12191	36574	682	2046	0	0	0	0	0
Midday	0	0	0	0	0	12528	65020	195061	3637	10910	0	0	0	0	0
PM Peak	3654	18964	94821	1061	5303	2610	13546	40638	758	2273	0	0	0	0	0
Off-Peak	0	0	0	0	0	0	0	0	0	0	12789	66375	66375	3712	3712
TOTAL	7830	40638	203189	2273	11364	17487	90758	272273	5076	15228	12789	66375	66375	3712	3712

TABLE H4. ABUS ANNUAL WEEKEND REVENUE-MILES AND REVENUE-HOURS

Period	5-Bus Convoy					3-Bus Convoy					1-Bus Convoy				
	Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour		Total Convoy Trips (2 Directions)	Revenue Mile		Revenue Hour	
		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour		Convoy-Mile	Bus-Mile	Convoy-Hour	Bus-Hour
AM Peak	0	0	0	0	0	0	0	0	0	0	2496	12954	12954	725	725
Midday	0	0	0	0	0	0	0	0	0	0	4992	25908	25908	1449	1449
PM Peak	0	0	0	0	0	0	0	0	0	0	2496	12954	12954	725	725
Off-Peak	0	0	0	0	0	0	0	0	0	0	5096	26448	26448	1479	1479
TOTAL	0	0	0	0	0	0	0	0	0	0	15080	78265	78265	4377	4377

TABLE H5. SUMMARY - ABUS ANNUAL REVENUE-MILES OF OPERATION

	Bus Miles				Convoy Miles			
	5-Bus Convoy	3-BusConvoy	1-Bus Convoy	TOTAL	5-Bus Convoy	3-BusConvoy	1-Bus Convoy	TOTAL
Weekday	203,189	272,273	66,375	541,836	40,638	90,758	66,375	197,770
Weekend	0	0	78,265	78,265	0	0	78,265	78,265
TOTAL	203,189	272,273	144,640	620,101	40,638	90,758	144,640	276,035

TABLE H6. SUMMARY - ABUS ANNUAL VEHICLE-REVENUE-HOURS OF OPERATION

	Bus Hours				Train Hours			
	5-Bus Convoy	3-BusConvoy	1-Bus Convoy	TOTAL	5-Bus Convoy	3-BusConvoy	1-Bus Convoy	TOTAL
Weekday	11,364	15,228	3,712	30,305	2,273	5,076	3,712	11,061
Weekend	0	0	4,377	4,377	0	0	4,377	4,377
TOTAL	11,364	15,228	8,090	34,683	2,273	5,076	8,090	15,439

TABLE H7. DAYS OF WEEK PER YEAR

Day of Week	# of Days
Weekday	261
Saturday	52
Sunday	52

APPENDIX I

BDL SYSTEM AGENCY COSTS

Introduction

This appendix details methodologies and procedures for calculating the agency costs associated with the BDL study system. These costs include:

- System Planning and Design Costs
- Construction, Rehabilitation, and Other Infrastructure-Related Capital Costs
- Vehicle Operations Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs

BUS-ON-DEDICATED-LANE SYSTEM PLANNING AND DESIGN, CONSTRUCTION, REHABILITATION, AND OTHER INFRASTRUCTURE-RELATED CAPITAL COSTS

Procedures and assumptions for the design of the Bus-on-Dedicated-Lane (BDL) system are identical to those used for the ABUS system. Numerical differences occur due to differing lane width requirements between the BDL and ABUS systems.

BDL Cross-Sectional Geometry (Width Requirements)

The American Association of State Highway Transportation Officials (AASHTO) gives universally-accepted geometric design standards for streets and highways in its *A Policy on the Geometric Design of Highways and Streets* (1). Because the Bus-on-Dedicated-Lane (BDL) system operates on urban streets, the system concepts were designed according to AASHTO standards.

Like the ABUS system, the BDL system operates on a dedicated right-of-way in the median of a regular roadway, without physical barriers separating the dedicated lanes from each other or from the regular traffic. Exhibit 3-54 (1) requires a 15-foot pavement width be used in this case to accommodate any design bus.

Thus, for dedicated bus lanes running in both directions, a width of 30 feet would be required for the right-of-way, including two 15-foot pavement widths. Figure 3.5 in the main report shows a schematic layout of this BDL concept.

Bus-on-Dedicated-Lane Infrastructure, System Planning, and Design Costs

Costs for construction, planning, and design of the BDL infrastructure are derived in the same manner as the ABUS system construction, planning, and design costs. The differing costs shown for the BDL system and the ABUS system result from differences in pavement widths for the two systems.

Table I1 shows the BDL system width requirements. The procedure used for scaling is identical to the ABUS procedure outline in Appendix G. Table I1 also shows the computed scale factor used in construction cost calculations. Table I2 shows scaling for each work item. It also indicates site-specific work items by shading. Non-site-specific work items are unshaded. The percentage of site-specific and non-site-specific costs are shown in Table I3. Table I4 shows rehabilitation costs. Table I5 shows planning and design cost calculations. Table I6 shows final EUAC 2001-equivalent costs for infrastructure, planning, and design.

TABLE I1. BDL PROJECT DIMENSIONS - SCENARIO 1: DESIGN FOLLOWS AASHTO STANDARDS

Actual System Length		Effective System Length		Width	Area	Scale Factor
Miles	Feet	Miles	Feet	Feet	Sq. Feet	24.98
5.19	27,403	5.36	28308	30	822,096	

Bus-on-Dedicated-Lane Non-Infrastructure Capital Costs

Fleet purchase is the only cost element associated with this category. Methodologies for determining the BDL system fleet purchase costs are identical for those of the ABUS system. In order to maintain functional equivalence between the ABUS and BDL systems, it was assumed that the same number of buses operate on each system during each daily period, carrying the same number of passengers. Appendix G shows calculations and describes methodologies for determining the required number of buses needed to serve the proposed ABUS system. One notable difference between the calculations for the BDL system and the corresponding ABUS-system calculations is that there is no convoying in the BDL system, However, this difference does not affect fleet purchase costs (it does affect user costs due by changing headways). Table I6 shows fleet purchase costs.

Bus-On-Dedicated-Lane Periodic Capital Costs

BDL rehabilitation costs, like ABUS system rehabilitation costs, include routine pavement resealing and resurfacing costs:

- Minor Rehabilitation – Seals
- Major Rehabilitation – Resurfacing

Assumptions and methodologies for determining BDL rehabilitation costs are identical to those for the ABUS system. Differences in numeric values between the BDL and ABUS systems arise due to the differences in surface area requirements of the ABUS and BDL systems. Magnetic strips for automation are also not necessary for the BDL system, as they are for the ABUS.

Tables I4 and I6 show the applicable cost calculations.

Bus-On-Dedicated-Lane Fleet Renewal

Methodologies for the BDL study system fleet renewal costs are identical for those of the ABUS study system, where calculations are made based on a 15-year renewal cycle for the fleet (with 1/15th of the fleet replaced each year). Table I6 shows the calculated costs for

TABLE I2: BDL CONSTRUCTION COST CALCULATIONS

Item	Cost Element	Year	Hope Street Project	Hope Street Project		Hope Street Project Units		Derived BDL Project Units		BDL Cost (2002 $)
			Total Cost ($)	Unit Cost ($)	Unit					
			(Engineer's Estimate)	(Engineer's Estimate)		Number	Unit	Number	Unit	
1	Street Clean-Up	2002	3000.00	150.00	Day	20	Day	500	Day	74,945.82
2	Mobilization	2002	10000.00	10,000.00	Lump Sum	1	Lump Sum	25	Lump Sum	249,819.41
3	Traffic Control	2002	2000.00	2,000.00	Lump Sum	1	Lump Sum	25	Lump Sum	49,963.88
4	Adjust Water Valve to Grade	2002	1500.00	250.00	Each	6	Each	150	Each	37,472.91
5	Adjust Manhole to Grade	2002	5000.00	500.00	Each	10	Each	250	Each	124,909.70
6	Relocating County Park Sign	2002	1500.00	1,500.00	Each	1	Each	25	Each	37,472.91
7	Replace Existing Detector Looop	2002	4200.00	700.00	Each	6	Each	150	Each	104,924.15
8	Adjust Fire Hydrant to Grade	2002	2400.00	1,200.00	Each	2	Each	50	Each	59,956.66
9	Relocate and Adjust Fire Hydrant to Grade	2002	3600.00	3,600.00	Each	1	Each	25	Each	89,934.99
10	Clearing, Grubbing, and Removal of Obstructions	2002	2500.00	2,500.00	Lump Sum	1	Lump Sum	25	Lump Sum	62,454.85
11	Roadway Excavation	2002	10200.00	30.00	Cu. Yard	340	Cu. Yard	8,494	Cu. Yard	254,815.80
12	Plant New Trees	2002	20400.00	600.00	Each	34	Each	849	Each	509,631.59
13	Misc. Landscaping	2002	9600.00	2.00	Sq. Foot	4,800	Sq. Foot	119,913	Sq. Foot	239,826.63
14	Tree, Schrub,a nd Landscape Maintenance	2002	10000.00	10,000.00	Lump Sum	1	Lump Sum	25	Lump Sum	249,819.41
15	Polythylene Root Barrier	2002	700.00	1.00	Linear Foot	700	Linear Foot	17,487	Linear Foot	17,487.36
16	Subgrade Preparation-Class A	2002	21600.00	1.00	Sq. Foot	21,600	Sq. Foot	539,610	Sq. Foot	539,609.92
17	Imported Fill Materials	2002	10200.00	30.00	Cu. Yard	340	Cu. Yard	8,494	Cu. Yard	254,815.80
18	Deeplift/Base AC (8" max.)	2002	42700.00	70.00	Ton	610	Ton	15,239	Ton	1,066,728.87
19	AC Surface Course	2002	32000.00	80.00	Ton	400	Ton	9,993	Ton	799,422.10
20	AC Base Course	2002	33600.00	80.00	Ton	420	Ton	10,492	Ton	839,393.21
21	Cold Planing	2002	1500.00	1.50	Sq. Foot	1,000	Sq. Foot	24,982	Sq. Foot	37,472.91
22	Pavement Reinforcing Fabric	2002	3500.00	1.00	Sq. Yard	3,500	Sq. Yard	87,437	Sq. Yard	87,436.79
23	Redwood Retaining Wall	2002	12000.00	40.00	Linear Foot	300	Linear Foot	7,495	Linear Foot	299,783.29
24	PCC Curb and Gutter - Type A2	2002	51000.00	30.00	Linear Foot	1,700	Linear Foot	42,469	Linear Foot	1,274,078.98
25	PCC Sidewalk, Plain finish, including 1" of Structural Fill)	2002	60300.00	9.00	Sq. Foot	6,700	Sq. Foot	167,379	Sq. Foot	1,506,411.02
26	PCC Driveway	2002	21600.00	12.00	Sq. Foot	1,800	Sq. Foot	44,967	Sq. Foot	539,609.92
27	PCC Wheelchair Ramp	2002	3200.00	800.00	Each	4	Each	100	Each	79,942.21
28	PCC Driveway Conform	2002	27000.00	10.00	Sq. Foot	2,700	Sq. Foot	67,451	Sq. Foot	674,512.40
29	PCC Berm (Type A1-B3)	2002	600.00	6.00	Linear Foot	100	Linear Foot	2,498	Linear Foot	14,989.16
30	Gravel Conform	2002	1000.00	50.00	Ton	20	Ton	500	Ton	24,981.94
31	Install New Survey Monument	2002	2500.00	500.00	Each	5	Each	125	Each	62,454.85
32	Traffic Stripes and Pavement Markings	2002	800.00	800.00	Lump Sum	1	Lump Sum	25	Lump Sum	19,985.55
33	Street Lighting System	2002	60000.00	60,000.00	Lump Sum	1	Lump Sum	25	Lump Sum	1,498,916.44
34	Install New Water Valve	2002	3000.00	3,000.00	Each	1	Each	25	Each	74,945.82
35	Remove Existing Water Valve and Reconnect Existing Waterlin	2002	3000.00	3,000.00	Each	1	Each	25	Each	74,945.82
36	12" Diameter RCP	2002	19800.00	110.00	Linear Foot	180	Linear Foot	4,497	Linear Foot	494,642.43
37	27" Diameter RCP	2002	12000.00	160.00	Linear Foot	75	Linear Foot	1,874	Linear Foot	299,783.29
38	8" Diameter PVC Pipe	2002	6000.00	40.00	Linear Foot	150	Linear Foot	3,747	Linear Foot	149,891.64
39	Abandon and Cap Off Exist. 12" Dia. RCP	2002	3200.00	800.00	Each	4	Each	100	Each	79,942.21
40	Cap off New 27" Dia. RCP	2002	800.00	800.00	Each	1	Each	25	Each	19,985.55
41	Remove Exist. VCP, Replace with PVC	2002	79000.00	100.00	Linear Foot	790	Linear Foot	19,736	Linear Foot	1,973,573.31
42	Geotextile	2002	3300.00	3.00	Linear Foot	1,100	Linear Foot	27,480	Linear Foot	82,440.40
43	Trench Sheeting, Shoring, and Bracing	2002	6000.00	6,000.00	Lump Sum	1	Lump Sum	25	Lump Sum	149,891.64
44	Trench Dewatering	2002	12000.00	12,000.00	Lump Sum	1	Lump Sum	25	Lump Sum	299,783.29
45	Sewer Lateral Verification	2002	300.00	30.00	Each	10	Each	250	Each	7,494.58
46	Reconnect Exist. Sanitary Sewer	2002	2000.00	200.00	Each	10	Each	250	Each	49,963.88
47	Replace 4" Dia. Sanitary Sewer	2002	9000.00	90.00	Linear Foot	100	Linear Foot	2,498	Linear Foot	224,837.47
48	Install Std. Storm Manhole	2002	6400.00	3,200.00	Each	2	Each	50	Each	159,884.42
49	Install Large Hooded Inlet	2002	14000.00	2,000.00	Each	7	Each	175	Each	349,747.17
50	Install Std. Flat Grate Inlet	2002	16500.00	1,500.00	Each	11	Each	275	Each	412,202.02
51	Remove and Replace SS Manhole	2002	24000.00	4,800.00	Each	5	Each	125	Each	599,566.58
	Total Cost		**692,000.00**	**133,386.50**						**17,287,502.96**

TABLE I3. BDL SITE-SPECIFIC WORK ITEMS

Type	Total Cost	Percent Cost
Site-Specific Work Items	11,369,281.21	65.77%
General Work Items Associated with ABUS	5,918,221.75	34.23%
TOTAL	17,287,502.96	100.00%

TABLE I4. BDL ROADWAY REHABILITATION COSTS

Type	Unit Cost (2002)		Unit Cost (2001-Equiv.)		Project Surface Area				Total Cost ($) per Rehab. Cycle (2001-Equiv.)	Frequency		Annual Cost (2001-Equiv. $)
	Cost	Unit	Cost	Unit	Area	Unit	Area	Unit				
Minor - Seals	3.90	SY	3.82	SY	822,096	Sq. Feet	91,344	Sq. Yards	349,259	5	years	35,460
Major - Resurfacing	17.21	SY	16.87	SY	822,096	Sq. Feet	91,344	Sq. Yards	1,541,218	10	years	97,434

TABLE I5. 2002-EQUIVALENT BDL SYSTEM PLANNING AND DESIGN COSTS

Hope St. Project Costs	Scale Factor	BDL System Costs
96,000	24.98	2,398,266

TABLE I6. BUS-ON-DEDICATED LANE CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS									
	Item	Year	Unit Cost ($)	Unit	Unit Cost (2001-Equiv. $)	Unit	# of Units in ABUS System	One-Time Cost (2001-Equiv. $)	EUAC (2001-Equiv. $)
System Planning and Design Costs									
	VTA Personnel Labor Costs and Design Expenses	2002	2,398,266	One-Time	2,351,260.29	One-Time	1	2,351,260	170,817
Construction, Rehabilitation, and Other Infrastructure Capital Costs									
Infrastructure Costs	Property Costs/ ROW Acquistion	1999	23.65	Sq. Foot	24.49	Sq. Foot	826,848	20,246,221	1,470,866
	Street Clean-Up	2002	150.00	Day	147.06	Day	500	73,477	5,338
	Mobilization	2002	10,000.00	Lump Sum	9,804.00	Lump Sum	25	244,923	17,793
	Traffic Control	2002	2,000.00	Lump Sum	1,960.80	Lump Sum	25	48,985	3,559
	Clearing, Grubbing, and Removal of Obstructions	2002	2,500.00	Lump Sum	2,451.00	Lump Sum	25	61,231	4,448
	Roadway Excavation	2002	30.00	Cu. Yard	29.41	Cu. Yard	8,494	249,821	18,149
	Subgrade Preparation-Class A	2002	1.00	Sq. Foot	0.98	Sq. Foot	539,610	529,034	38,434
	Imported Fill Materials	2002	30.00	Cu. Yard	29.41	Cu. Yard	8,494	249,821	18,149
	Deeplift/Base AC (8" max.)	2002	70.00	Ton	68.63	Ton	15,239	1,045,821	75,978
	AC Surface Course	2002	80.00	Ton	78.43	Ton	9,993	783,753	56,939
	AC Base Course	2002	80.00	Ton	78.43	Ton	10,492	822,941	59,786
	Cold Planing	2002	1.50	Sq. Foot	1.47	Sq. Foot	24,982	36,738	2,669
	Pavement Reinforcing Fabric	2002	1.00	Sq. Yard	0.98	Sq. Yard	87,437	85,723	6,228
	Gravel Conform	2002	50.00	Ton	49.02	Ton	500	24,492	1,779
	Traffic Stripes and Pavement Markings	2002	800.00	Lump Sum	784.32	Lump Sum	25	19,594	1,423
	Street Lighting System	2002	60,000.00	Lump Sum	58,824.00	Lump Sum	25	1,469,538	106,760
	Geotextile	2002	3.00	Linear Foot	2.94	Linear Foot	27,480	80,825	5,872
	Site-SpecificWork Items	2002	9,828,623.28	Lump Sum	9,635,982.26	Lump Sum	1	9,635,982	700,044
	TOTAL INFRASTRUCTURE COST								2,594,214
Non-Infrastructure Capital Costs	Vehicle Purchase*	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
Periodic Capital Costs	Minor - Seals	2002	See Table I3	N/A	See Table I3	N/A	See Table I3	N/A	35,460
	Major - Resurfacing	2002	See Table I3	N/A	See Table I3	N/A	See Table I3	N/A	97,434
Fleet Renewal	Vehicle Replacement Costs	2002	293,000.00	Bus	287,257.20	Bus	10.180	N/A	194,959
TOTAL CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS									3,117,027
TOTAL SYSTEM PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, INFRASTRUCTURE, AND OTHER CAPITAL COSTS									3,287,843

*Required number of vehicles is considered to be the same for the ABUS and BDL systems.

BDL study system fleet renewal. Methodologies are identical to those for the ABUS system, presented in Appendix G.

BDL SYSTEM NON-INFRASTURCTURE AGENCY COSTS

Bus-on-Dedicated-Lane (BDL) system non-infrastructure agency costs include those costs for operation and maintenance of the system. They include:

- Vehicle Operating Costs
- Vehicle Maintenance Costs
- System (Non-Vehicle) Maintenance Costs
- System Administration Costs

The cost elements included in these categories will be discussed subsequently.

Determination of the BDL system vehicle operating costs was performed in several major phases for each of the four aforementioned cost categories:

1. Determination of individual cost elements that comprise costs in that category (these are identical to those for the ABUS study system).
2. Determination of annual vehicle-revenue-miles and –hours used by the proposed BDL system (discussed in Appendix H).
3. Determination of unit costs for the VTA bus system in terms of vehicle-revenue-miles and vehicle-revenue-hours.
4. Calculation of proposed BDL system annual costs.

Bulleted items 3 and 4 are the focus of this section of this appendix.

Agency Cost Category Descriptions

BDL Vehicle Operations

Costs associated with vehicle operations include daily costs necessary to run the system, including operators' salaries, wages, and benefits, fuel and oil, utilities, and other expenses. Vehicle operating costs do not include costs for routine vehicle maintenance, such as tire replacement and labor costs for workers performing the maintenance.

BDL System Vehicle Maintenance Costs

Costs associated with vehicle maintenance include those costs for materials, supplies, fuels, lubricants, utilities, and labor used to keep the system in good working order, which are not included in vehicle operating costs.

BDL System (Non-Vehicle) Maintenance Costs

Costs associated with system maintenance include maintenance expenses for bus stops and other infrastructure, and also for minor roadway maintenance activities such as street sweeping, cleaning of storm sewers, landscaping, streetlights, traffic signals, signs, and markings. System maintenance does not include resurfacing or rehabilitation (i.e. – resurfacing and preventative seals) for the roadways on which the buses travel. Roadway rehabilitation of this sort is included in infrastructure and capital costs, under the heading of "Rehabilitation."

BDL System Administration Costs

Costs associated with system administration include expenses incurred for system support personnel in the offices of the operating agency.

Unit Cost Calculations

The procedures described herein are general to the four cost categories aforementioned. For the BDL system, as for the ABUS system, the operating expenses incurred by the Santa Clara Valley Transportation Authority (VTA) for bus operations were used to calculate unit costs in terms of cost-per-vehicle-revenue-mile and cost-per-vehicle-revenue-hour. For most calculations, procedures for calculating unit costs for the BDL system are identical to those calculated for the ABUS system, since both are based on VTA's bus operating expenses, as reported in the 1999-2000 VTA report to the National Transit Database (NTD) (2). Exceptions to this rule are the unit costs associated with driver wages and fringe benefits, and for system administration. For both of these items in the ABUS system, it was reasoned that light rail unit costs would be more accurate than bus unit costs for the ABUS system. However, for the BDL system, unit costs are derived from the bus data provided to the NTD by VTA.

Procedures for calculating unit costs are identical to those reported in the ABUS section of the report, and are based on the following annual quantities, as reported to the NTD by VTA (2): the total annual vehicle-revenue-miles for the VTA bus system accrue to 19,140,121; total annual vehicle-revenue-hours for the VTA bus system accrue to 1,471,604. Numeric unit cost values are tabulated in Tables I7a and I7b, I8a and I8b, I9a and I9b, and I10a and I10b for vehicle operations, vehicle maintenance, system maintenance, and system administration costs, respectively.

Unit Cost Conversions to Base Year – 2001-Equivalent

The procedures described herein are general to the four cost categories aforementioned mentioned.

Unit cost conversion procedures to base-year 2001 are identical to those employed for the ABUS and light rail tables. Unit costs adjusted to base-year 2001 are tabulated in Tables I7b, I8b, I9b, and I10b.

TABLE I7a. BDL VEHICLE OPERATIONS COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages				
	Operating Time	2000	34,016,476	1.78	23.12
	Paid Non-Operating Work Time	2000	2,677,189	0.14	1.82
	Other Salaries and Wages	2000	9,092,463	0.48	6.18
Fringe Benefits	Operators' Fringe Benefits				
	Operating Time	2000	19,674,989	1.03	13.37
	Paid Non-Operating Work Time	2000	1,548,475	0.08	1.05
	Other Fringe Benefits	2000	5,259,043	0.27	3.57
Services	Services	2000	3,473,770	0.18	2.36
Materials and Supplies	Fuel and Lubricants	2000	5,668,049	0.30	3.85
	Tires and Lubes	2000	1,263,850	0.07	0.86
	Other Materials and Supplies	2000	148,627	0.01	0.10
Utilities	Utilities	2000	2,252,658	0.12	1.53
Taxes	Taxes				
Misc.	Miscellaneous Expenses	2000	586,232	0.03	0.40
Expense Transfers	Expense Transfers				
TOTAL OPERATING COSTS		2000	85,661,821		

TABLE I7b. BDL VEHICLE OPERATIONS COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in BDL System	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in BDL System	Unit Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time	1.81	620,101	1,124,106	23.58	34,683	817,733
	Paid Non-Operating Work Time	0.14	620,101	88,470	1.86	34,683	64,358
	Other Salaries and Wages	0.48	620,101	300,469	6.30	34,683	218,577
Fringe Benefits	Operators' Fringe Benefits						
	Operating Time	1.05	620,101	650,178	13.64	34,683	472,973
	Paid Non-Operating Work Time	0.08	620,101	51,171	1.07	34,683	37,224
	Other Fringe Benefits	0.28	620,101	173,790	3.65	34,683	126,424
Services	Services	0.19	620,101	114,794	2.41	34,683	83,507
Materials and Supplies	Fuel and Lubricants	0.30	620,101	187,306	3.93	34,683	136,256
	Tires and Lubes	0.07	620,101	41,765	0.88	34,683	30,382
	Other Materials and Supplies	0.01	620,101	4,912	0.10	34,683	3,573
Utilities	Utilities	0.12	620,101	74,441	1.56	34,683	54,152
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.03	620,101	19,373	0.41	34,683	14,093
Expense Transfers	Expense Transfers						
TOTAL OPERATING COSTS				2,830,775	59.37		2,059,252

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

TABLE I8a. BDL VEHICLE MAINTENANCE COSTS - SOURCE DATA

Cost Elements	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	17,090,526	0.89	11.61
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	10,171,267	0.53	6.91
Services	Services	2000	3,257,024	0.17	2.21
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	5,339,616	0.28	3.63
Utilities	Utilities	2000	2,708	0.00	0.00
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	168,299	0.01	0.11
Expense Transfers	Expense Transfers	2000			
TOTAL BDL VEHICLE MAINTENANCE COSTS			36,029,440	1.88	24.48

TABLE I8b. BDL VEHICLE MAINTENANCE COSTS

Cost Elements	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001 Equiv. $)	Annual Units in System*	Annual Cost (2001 Equiv. $)	Annual Cost (2001 Equiv. $)	Annual Units in System*	Annual Cost (2001 Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.91	620,101	564,772	11.85	34,683	410,845
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.54	620,101	336,119	7.05	34,683	244,510
Services	Services	0.17	620,101	107,631	2.26	34,683	78,297
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.28	620,101	176,453	3.70	34,683	128,361
Utilities	Utilities	0.00	620,101	89	0.00	34,683	65
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.01	620,101	5,562	0.12	34,683	4,046
Expense Transfers	Expense Transfers						
TOTAL BDL VEHICLE MAINTENANCE COSTS		1.92		1,190,627	24.97		866,123

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

TABLE I9a. BDL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh-Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	2,775,476	0.15	1.89
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	1,426,458	0.07	0.97
Services	Services	2000	2,425,464	0.13	1.65
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	273,506	0.01	0.19
Utilities	Utilities	2000	343,855	0.02	0.23
Taxes	Taxes	2000			
Street Maintenance	Street Sweeping	2002	See Table G17	N/A	N/A
	Storm Sewers (Includes Inlet Cleaning)	2002	See Table G17	N/A	N/A
	Landscaping (Includes Median Islands)	2002	See Table G17	N/A	N/A
	Streetlights	2002	See Table G17	N/A	N/A
	Traffic Signals	2002	See Table G17	N/A	N/A
	Signs	2002	See Table G17	N/A	N/A
	Markings	2002	See Table G17	N/A	N/A
Misc	Miscellaneous Expenses	2000	55,906	0.00	0.04
Expense Transfers	Expense Transfers	2000			
TOTAL BDL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS					

TABLE I9b. BUS-ON-DEDICATED-LANE SYSTEM (NON-VEHICLE) MAINTENANCE COSTS

Cost Elements	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in ABUS System*	Annual Cost (2001-Equiv. $)	Annual Cost (2001-Equiv. $)	Annual Units in ABUS System*	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.15	620,101	91,718	1.92	34,683	66,721
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	0.08	620,101	47,139	0.99	34,683	34,291
Services	Services	0.13	620,101	80,152	1.68	34,683	58,307
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.01	620,101	9,038	0.19	34,683	6,575
Utilities	Utilities	0.02	620,101	11,363	0.24	34,683	8,266
Taxes	Taxes						
Street Maintenance	Street Sweeping	N/A	N/A	6,988	N/A	N/A	6,988
	Storm Sewers (Includes Inlet Cleaning)	N/A	N/A	3,669	N/A	N/A	3,669
	Landscaping (Includes Median Islands)	N/A	N/A	7,903	N/A	N/A	7,903
	Streetlights	N/A	N/A	4,517	N/A	N/A	4,517
	Traffic Signals	N/A	N/A	3,910	N/A	N/A	3,910
	Signs	N/A	N/A	1,681	N/A	N/A	1,681
	Markings	N/A	N/A	2,684	N/A	N/A	2,684
Misc	Miscellaneous Expenses	0.00	620,101	1,847	0.04	34,683	1,344
Expense Transfers	Expense Transfers						
TOTAL BDL SYSTEM (NON-VEHICLE) MAINTENANCE COSTS				272,609			206,855

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

TABLE I10a. BDL SYSTEM ADMINISTRATION COSTS - SOURCE DATA

Cost Element	Item	Year	Annual Cost (VTA Total $)	Unit Cost per Veh Rev-Mi ($)	Unit Cost per Veh-Rev-Hr ($)
Salaries and Wages	Operators' Salaries and Wages	2000			
	Operating Time	2000			
	Paid Non-Operating Work Time	2000			
	Other Salaries and Wages	2000	16,047,769	0.84	10.90
Fringe Benefits	Operators' Fringe Benefits	2000			
	Other Fringe Benefits	2000	23,939,690	1.25	16.27
Services	Services	2000	8,435,843	0.44	5.73
Materials and Supplies	Fuel and Lubricants	2000			
	Tires and Lubes	2000			
	Other Materials and Supplies	2000	1,190,895	0.06	0.81
Utilities	Utilities	2000	108,301	0.01	0.07
Taxes	Taxes	2000			
Misc.	Miscellaneous Expenses	2000	1,570,444	0.08	1.07
Expense Transfers	Expense Transfers	2000			
TOTAL BDL SYSTEM ADMINISTRATION COSTS			51,292,942		

TABLE I10b. BDL SYSTEM ADMINISTRATION COSTS

Cost Element	Item	Vehicle-Revenue-Miles			Vehicle-Revenue-Hours		
		Unit Cost (2001-Equiv. $)	Annual Units in System*	Annual Cost (2001-Equiv. $)	Unit Cost (2001-Equiv. $)	Annual Units in System*	Annual Cost (2001-Equiv. $)
Salaries and Wages	Operators' Salaries and Wages						
	Operating Time						
	Paid Non-Operating Work Time						
	Other Salaries and Wages	0.86	620,101	530,314	11.12	34,683	385,778
Fringe Benefits	Operators' Fringe Benefits						
	Other Fringe Benefits	1.28	620,101	791,109	16.59	34,683	575,494
Services	Services	0.45	620,101	278,770	5.85	34,683	202,792
Materials and Supplies	Fuel and Lubricants						
	Tires and Lubes						
	Other Materials and Supplies	0.06	620,101	39,354	0.83	34,683	28,628
Utilities	Utilities	0.01	620,101	3,579	0.08	34,683	2,603
Taxes	Taxes						
Misc.	Miscellaneous Expenses	0.08	620,101	51,897	1.09	34,683	37,752
Expense Transfers	Expense Transfers						
TOTAL BDL SYSTEM ADMINISTRATION COSTS		2.73		1,695,023	35.55		1,233,048

*Annual vehicle-revenue-miles and vehicle-revenue-hours are equal for the ABUS and BDL systems.

Calculation of Annual Costs for Proposed BDL System

Annual cost calculation procedures are identical to those employed for the ABUS and light rail tables. Annual costs with base-year 2001 are tabulated in Tables I7b, I8b, I9b, and I10b for vehicle operations, vehicle maintenance, system (non-vehicle) maintenance, and system administration, respectively.

References

1. *A Policy of the Geometric Design of Highways and Streets.* AASHTO. 2001.
2. *Final Annual Report 1999-2000.* Prepared for Federal Transit Administration National Transit Database by Santa Clara County Transportation Authority.

APPENDIX J

BDL SYSTEM USER COSTS

Introduction

User costs for the ABUS system, like the light rail system, are based on user on-board travel time and wait time. Unlike the ABUS system, the Bus-on-Dedicated-Lane (BDL) system would not employ convoying, so each bus would be operated by a driver.

For the purpose of maintaining functional equivalence between the study systems, annual and daily vehicle-revenue-hours and –miles were assumed to be the same for the ABUS and BDL systems. Implicit in this is that the same number of buses traverse the system in each daily time period for the ABUS and BDL systems. However, since the BDL buses do not convoy, the implication is that the buses running on the route would need to be dispersed – with headways adjusted to account for non-convoying.

Cost calculations for overall user costs were completed in the following sequence:

1. Calculation of BDL headways for each daily period, both on weekdays and weekends.
2. Calculation of daily passenger wait time for weekdays and weekends
3. Determination of daily passenger on-board travel time for weekdays and weekends.
4. Summation of daily wait time and travel time, and of annual wait time and travel time.
5. Calculation of wait- and travel-time costs.

The general assumptions used in this process are:

- Headways are constant over each daily time period.
- Buses in the ABUS convoys and the BDL system travel at the same speeds, so passenger on-board travel time is unaffected.

Value of User Wait- and On-Board Travel Time

As with the light rail and ABUS systems, the value travel time for passengers using the BDL system was calculated to be $8.32 per user-hour.

Headway Calculations

Table J1 shows tabulated headway values for weekdays and weekends, and for all daily time periods (AM Peak, Midday, PM Peak, and Off-Peak). The calculation methodologies and sample calculations are discussed in this section.

In Table J2, the values in the columns headed “Total Bus Trips (2 Directions)” refer to the total number of times a single bus traverses the system length during a given time period, and are taken directly from ABUS Tables H1 and H2, the column entitled “Total Convoy Trips (2 Directions).” As mentioned previously in this appendix, total annual vehicle-

TABLE J1. BDL HEADWAYS

Period	Weekday		Saturday		Sunday	
	NB	SB	NB	SB	NB	SB
AM	4	4	15	15	15	15
MID	5	5	15	15	15	15
PM	4	4	15	15	15	15
OFF	30	30	30	30	30	30

revenue-miles and –hours were held constant for ABUS and BDL systems for functional equivalency purposes, which underlies the idea (reflected in Table J2) that the total number of buses traveled is the same on the ABUS and BDL systems for each daily period.

To arrive at the values in the columns headed "Total Bus Traveled (1 Direction)," corresponding values in the columns headed "Total Bus Trips (2 Directions)" were halved.

In Table J2, the column headed "Length of Period" refers to the number of hours that the period lasts each day.

To arrive at the values in the "Headway" columns in Table J2, the length of period (in minutes) was divided by the total number of buses per period (in one direction) to arrive at headways for each daily period. Each headway was rounded up to the nearest minute.

The following sample calculation is for the AM peak period weekday headway calculation:

> Headway (min) = [3 hours x 60 min/hr]/53.5 = 3.36 min
> Round the answer to 4 min.

Daily Passenger Wait-Time

The procedure used to calculate BDL user wait-time costs were identical to that employed in the light rail and ABUS system calculations; however, differing headways in the BDL system yielded different wait time values. The following procedure was used in the calculations:

1. Per-station passenger "on" volume data for weekdays, Saturdays and Sundays are shown in Tables E1 through E6 of Appendix E. These data represent passengers waiting to board system at a given station during a given daily time period, and were extracted from the VTA data tables shown in Appendix F.
2. Headways were calculated as per the procedures in the previous section of this appendix.
3. Total passenger wait time for each segment during each daily time period was calculated for weekdays, Saturdays, and Sundays. The following formula was used:

TABLE J2. BDL SYSTEM HEADWAY CALCULATIONS

Period	Total Bus Trips (2-Directions)		Total Bus Trips (1-Direction)		Length of Period (hrs)	Headway (min)	
	Weekday	Weekend	Weekday	Weekend		Weekday	Weekend
AM Peak	107	24	53.5	12.0	3	4	15
Midday	144	48	72.0	24.0	6	5	15
PM Peak	100	24	50.0	12.0	3	4	15
Off-Peak	49	49	24.5	24.5	12	30	30
TOTAL	400	145	200.00	72.50			

Wait time = [0.5] x [headway] x [passengers waiting to board]

Tables J3 through J8 show the calculated total passenger wait time values for weekdays, Saturdays, and Sundays. Table J9 shows summarized values for passenger wait time.

Daily Passenger On-Board Travel Time

Values for on-board travel time are constant for the BDL, light rail, and ABUS systems, since all systems are assumed to transport the same number of passengers and travel at the same speeds on the line. The calculation tables are not reproduced here. Table J10 summarizes on-board daily travel time for all users. Appendix E (which pertains to light rail user costs) shows appropriate formulae and sample calculations, and Tables E15 through E23 in Appendix E show appropriate values.

User Travel Time Summary and Annual User Cost Calculations

Table J10 summarizes all user time, including passenger wait and on-board travel time. This table also shows cost per user hour, daily user costs, and annual user costs itemized by day-of-week and wait time/on-board travel time. The value of cost/user hour is calculated above. Calculation methodologies for daily and annual user costs are as follows:

1. Daily Cost = (Daily User-Hours) x (Cost/User Hour)

2. Annual Cost = (Daily Cost) x (Number of Days per Year)

Table J11 shows the number of days per year for weekdays, Saturdays, and Sundays.

TABLE J3. BDL WEEKDAY NB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	92	118	52	345	607
Civic Center	196	395	142	1200	1933
Gish	72	90	18	285	465
Metro/Airport	34	83	38	135	290
Karina Court	28	70	56	210	364
Component	2	13	12	90	117
Bonaventura	10	50	24	90	174
Orchard	6	5	10	30	51
River Oaks	4	13	12	45	74
Tasman	2	5	6	0	13
Baypointe	0	0	0	0	0
TOTAL	446	840	370	2430	4086
TOTAL (Hours)					68

TABLE J4. BDL WEEKDAY SB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	332	703	588	4470	6093
Tasman	92	115	122	660	989
River Oaks	60	143	224	510	937
Orchard	24	75	96	375	570
Bonaventura	28	233	180	645	1086
Component	20	85	152	360	617
Karina Court	70	203	244	1095	1612
Metro/Airport	40	278	254	1185	1757
Gish	138	428	264	1035	1865
Civic Center	162	1010	518	1425	3115
Japantown/Ayer	86	345	108	585	1124
TOTAL	1052	3615	2750	12345	19762
TOTAL (Hours)					329

TABLE J5. BDL SATURDAY NB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	83	308	120	285	795
Civic Center	233	743	308	1080	2363
Gish	30	210	45	225	510
Metro/Airport	15	150	90	120	375
Karina Court	23	150	75	180	428
Component	15	8	15	45	83
Bonaventura	0	23	8	15	45
Orchard	0	30	30	0	60
River Oaks	0	23	8	15	45
Tasman	23	0	0	30	53
Baypointe	0	0	0	0	0
TOTAL	420	1643	698	1995	4755
TOTAL (Hours)					79

TABLE J6. BDL SATURDAY SB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	458	1665	1290	4080	7493
Tasman	23	173	83	120	398
River Oaks	45	128	60	90	323
Orchard	30	83	68	135	315
Bonaventura	38	128	105	180	450
Component	38	98	105	90	330
Karina Court	113	398	323	690	1523
Metro/Airport	105	623	338	810	1875
Gish	308	953	473	750	2483
Civic Center	248	1418	810	1500	3975
Japantown/Ayer	150	593	248	660	1650
TOTAL	1553	6255	3900	9105	20813
TOTAL (Hours)					347

TABLE J7. BDL SUNDAY NB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Japantown/Ayer	83	255	105	105	548
Civic Center	135	488	270	1005	1898
Gish	23	98	60	225	405
Metro/Airport	0	180	105	375	660
Karina Court	8	53	30	60	150
Component	8	0	23	0	30
Bonaventura	0	15	15	60	90
Orchard	0	15	23	0	38
River Oaks	0	8	0	15	23
Tasman	0	8	0	30	38
Baypointe	0	0	0	0	0
TOTAL	255	1118	630	1875	3878
TOTAL (Hours)					65

TABLE J8. BDL SUNDAY SB TOTAL PASSENGER WAIT TIME (min)

Station	AM Peak	Midday	PM Peak	Off-Peak	TOTAL
	530 to 830	830 to 1430	1430 to 1730	1730 to 530	
Baypointe	368	1433	1058	3975	6833
Tasman	30	135	68	150	383
River Oaks	8	98	45	75	225
Orchard	15	68	53	150	285
Bonaventura	45	113	75	60	293
Component	15	53	38	150	255
Karina Court	68	345	240	660	1313
Metro/Airport	113	443	360	945	1860
Gish	150	675	383	660	1868
Civic Center	188	1208	1230	870	3495
Japantown/Ayer	135	420	210	345	1110
TOTAL	1133	4988	3758	8040	17918
TOTAL (Hours)					299

TABLE J9. BDL TOTAL DAILY PASSENGER WAIT TIME SUMMARY (hours)

Day	NB	SB	TOTAL
Weekday	68	329	397
Saturday	79	347	426
Sunday	65	299	363

TABLE J10. BDL TOTAL USER COSTS ($)

Day	Element	Daily User-Hours	Cost/User-Hour	Daily Cost	Annual Cost
Weekday	Wait Time	397	8.32	3307	863,107
	On-Board Travel Time	1126	8.32	9366	2,444,462
Saturday	Wait Time	426	8.32	3545	184,359
	On-Board Travel Time	601	8.32	4999	259,952
Sunday	Wait Time	363	8.32	3022	157,156
	On-Board Travel Time	511	8.32	4252	221,084
TOTAL WAIT TIME					1,204,622
TOTAL ON-BOARD TRAVEL TIME					2,925,498
TOTAL				28,491	4,130,120

TABLE J11. DAYS OF WEEK PER YEAR

Day of Week	# of Days
Weekday	261
Saturday	52
Sunday	52

Evaluation of Truck and Bus Automation Scenarios: Benefit-Cost Analysis

Volume 3

Appendices K Through Y

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March 2004

APPENDIX K

FREIGHT SYSTEMS SEGMENT CHARACTERIZATION

Introduction

This appendix describes the procedure developed to partition the study section into segments. The study section of the roadway was partitioned into segments that are relatively homogeneous with respect to average annual daily traffic volumes (AADT), the number of existing travel lanes in each direction, the availability of space in the median, and the type of development (i.e. – rural, urban, or suburban). Using only one direction for analysis, it was assumed that the northbound traffic volumes were representative of traffic volumes in the northbound and southbound directions, and that the roadway was generally symmetric, so roadway characteristics (i.e. – number of lanes, traveled way width) in the north- and southbound directions are generally the same.

General Procedure

The following general procedure for route partitioning was used to determine the route segmentation shown in Table 9.1 of the main report:

1. For each county, Caltrans traffic volume data (1) were consulted, and the route was partitioned at each mile marker where there appeared to be significant changes in traffic volumes, read "Ahead." (In the Caltrans data, both "Ahead" and "Back" traffic volume data were available, where "Ahead" means that traffic counts were taken looking downstream, or toward higher mile markers, from the mile marker indicated; "Behind" means that traffic counts were taken looking upstream, or toward lower mile markers, from the mile marker indicated. Mile markers increase on I-5 from south to north. For the sake of consistency, the "Ahead" data were used exclusively for the results reported here.

2. The segments were further partitioned according to available median widths, based on data drawn from the *California State Highway Log* (2). For the conventional-lane segmentation shown in Table 9.1, partitions were made based on whether the minimum required linear footage is available in the roadway median to accommodate the two added conventional lanes and supporting infrastructure. Each time the available median width changed from greater than the required 26-foot width to less than the required width (or vice versa), a new partition was formed. The same procedure was followed for both AHS and dedicated truck lanes, except that the cutoff width was 48 feet.

3. For each of the subsequent partitions, *California State Highway Log* (2) data were consulted, and each partition was further partitioned based on the number of regular travel lanes that exist. The number of travel lanes were determined by dividing the left roadbed traveled way width by 12, the assumed standard lane width (in feet) for freeway lanes. Also, partitions were not created at each mile marker where the roadbed width changes. The following criteria were used to partition according to number of lanes:

- Short segments (less than one mile) of roadway that are flanked by relatively long segments of uniform roadway were assumed to be absorbed by the dominant width. For instance, the following 3.1-mile roadway segment would be classified for the purposes of this study as having two travel lanes in each direction: a 48-foot (four-lane) roadway of 0.1 miles in length bordered on both sides by a 24-foot (two-lane) roadway of three-mile length.

- Significant widening of the roadway at interchanges is attributed to merging lanes and other auxiliary lanes, and the included segments are assumed to have width (and, consequently, number of travel lanes) equal to the roadway width either before or after the interchange.

References

1. Caltrans Traffic Volume Data, 2001. www.dot.ca.gov.
2. *California State Highway Log.* California Department of Transportation. 1997.

APPENDIX L

ADDED CONVENTIONAL FREEWAY LANE PLANNING, DESIGN, CONSTRUCTION, AND REHABILITATION COSTS

Summary of Cost Calculation Procedure

Costs for planning, design, construction, and rehabilitation of the added conventional freeway lane (26-foot cross section) were calculated on a segment-by-segment basis. Costs for a unit-length of freeway were considered to be dependent on whether the roadway is classified as rural, urban, or suburban, and also on whether the lane would be placed within the median or outside the median.

Tables 9.2, 9.3, and 9.4 (in the main report) show unit costs for design, planning, construction, and rehabilitation of urban and rural sections placed within and outside the median. In the assignment of costs to each roadway segment, the segment was matched to the appropriate value in Table 9.3 based on the following paired characteristics:

Urban Median Lane – low urban unit costs
Urban Non-Median Lane – high urban unit costs
Suburban Median Lane – average of low urban and rural unit costs
Suburban Non-Median Lane – average of high urban and rural unit costs
Rural Median Lane – low rural unit costs
Rural Non-Median Lane – high rural unit costs

Table L1 shows planning, design, and construction costs itemized according to each roadway segment. It is noteworthy that, in this study, costs associated with planning, design, and construction are shown as a single combined cost because source data (obtained from Caltrans) give costs in this format. The combined planning, design, and construction costs associated with the construction of the roadway were found by multiplying the appropriate unit cost per mile from Table 9.3 (these values also appear in Table L1) by the segment mileage.

For sections where the added freeway lane would be placed within the median, one barrier was assumed to be necessary to separate the traffic flow in opposing directions. One-half of the cost for that barrier was assigned to each travel direction. The barriers used for the design are Caltrans Standard Barriers (1) having two-foot width, and with a cost of $17.95 per linear foot (2). For the segments where the lane would be placed outside the median, no barriers were considered to be necessary, and no barrier costs were calculated.

Similarly, costs associated with rehabilitation were found by multiplying the appropriate unit cost per mile from Table 9.4 by the segment mileage, which appears in Table 9.1 of the main report (and also in Table L2 of this appendix). Equivalent Uniform Annual Costs (EUAC) were calculated based on a discount rate of 6 percent and a project life of 30 years. Procedures for EUAC calculations are identical to those followed for the transit construction costs calculations that appear in Appendix C.

References

1. *California Highway Design Manual.* Online version. July 1999. **http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/stdplns-met-new99.htm**
2. Caltrans Cost Data Information. 2001. <http://www.dot.ca.gov/hq/esc/oe/awards/>

TABLE L1. INCREMENTAL CONSTRUCTION COSTS OF CONVENTIONAL FREEWAY FOR ROADWAY SPACE AND BARRIERS

County	City/Suburban/Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AHS Lane Placement	New Freeway Costs ($)			Barrier Costs ($)				Total Construction Costs ($)	
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC	# of Barriers in One Direction	2001-Unit Cost per Lane Mile	Total Cost	EUAC	Total Cost	EUAC
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	2,389,154	11,420,155	829,662	0.5	94,776	226,515	16,456	11,646,670	846,118
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	3,654,000	10,706,220	777,795	0.5	94,776	138,847	10,087	10,845,067	787,882
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Median	3,654,000	913,500	66,365	0.5	94,776	11,847	861	925,347	67,225
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Median	3,654,000	4,238,640	307,933	0.5	94,776	54,970	3,994	4,293,610	311,926
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Median	3,654,000	3,727,080	270,768	0.5	94,776	48,336	3,512	3,775,416	274,280
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	13,702,500	19,320,525	1,403,615	0.0	94,776	0	0	19,320,525	1,403,615
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	13,702,500	15,072,750	1,095,019	0.0	94,776	0	0	15,072,750	1,095,019
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	13,702,500	38,915,100	2,827,140	0.0	94,776	0	0	38,915,100	2,827,140
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	13,702,500	4,658,850	338,460	0.0	94,776	0	0	4,658,850	338,460
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Median	3,654,000	7,746,480	562,773	0.5	94,776	100,463	7,298	7,846,943	570,072
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	3,654,000	8,184,960	594,628	0.5	94,776	106,149	7,712	8,291,109	602,340
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	2,389,154	34,547,165	2,509,814	0.5	94,776	685,230	49,781	35,232,395	2,559,595
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	2,389,154	22,314,697	1,621,138	0.5	94,776	442,604	32,155	22,757,301	1,653,293
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	2,389,154	28,407,039	2,063,740	0.5	94,776	563,443	40,934	28,970,483	2,104,674
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Median	3,654,000	803,880	58,401	0.5	94,776	10,425	757	814,305	59,158
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Median	3,654,000	12,935,160	939,725	0.5	94,776	167,754	12,187	13,102,914	951,912
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	2,389,154	24,990,549	1,815,536	0.5	94,776	495,678	36,011	25,486,228	1,851,547
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	2,389,154	3,942,104	286,390	0.5	94,776	78,190	5,680	4,020,294	292,070
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	2,389,154	2,126,347	154,477	0.5	94,776	42,175	3,064	2,168,522	157,541
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	2,389,154	28,192,015	2,048,119	0.5	94,776	559,178	40,624	28,751,194	2,088,743
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	2,389,154	67,039,657	4,870,358	0.5	94,776	1,329,707	96,602	68,369,364	4,966,960
I-5: Merced	Rural	0	32.45	32.45	2	Median	2,389,154	77,528,042	5,632,328	0.5	94,776	1,537,741	111,715	79,065,783	5,744,043
I-5: Fresno	Rural	0	66.16	66.16	2	Median	2,389,154	158,066,418	11,483,353	0.5	94,776	3,135,190	227,768	161,201,609	11,711,121
I-5: Kings	Rural	0	26.72	26.72	2	Median	2,389,154	63,838,191	4,637,775	0.5	94,776	1,266,207	91,989	65,104,398	4,729,764
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	2,389,154	170,036,079	12,352,936	0.5	94,776	3,372,604	245,016	173,408,683	12,597,952
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	2,389,154	1,863,540	135,384	0.5	94,776	36,963	2,685	1,900,503	138,069
I-5: Kern	Rural	10.35	15.08	4.73	4	Median	2,389,154	11,300,698	820,983	0.5	94,776	224,145	16,284	11,524,843	837,267
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	2,389,154	2,556,395	185,719	0.5	94,776	50,705	3,684	2,607,100	189,403
I-5: Kern	Rural	7.04	9.28	2.24	4	Median	2,389,154	5,351,705	388,796	0.5	94,776	106,149	7,712	5,457,854	396,507
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	2,389,154	1,505,167	109,349	0.5	94,776	29,854	2,169	1,535,021	111,518
I-5: Kern	Rural	5.36	6.41	1.05	4	Median	2,389,154	2,508,612	182,248	0.5	94,776	49,757	3,615	2,558,369	185,863
I-5: Kern	Rural	0.58	5.36	4.78	4	Median	2,389,154	11,420,155	829,662	0.5	94,776	226,515	16,456	11,646,670	846,118
I-5: Kern	Rural	0	0.58	0.58	4	Median	2,389,154	1,385,709	100,670	0.5	94,776	27,485	1,997	1,413,194	102,667
I-5: Los Angeles	Rural	84.76	88.61	3.85	4	Non-Median	3,981,923	15,330,404	1,113,737	0.0	94,776	0	0	15,330,404	1,113,737
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	2,389,154	15,123,344	1,098,694	0.5	94,776	299,966	21,792	15,423,310	1,120,487
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Median	2,389,154	20,976,771	1,523,940	0.5	94,776	416,067	30,227	21,392,837	1,554,166
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	2,389,154	3,703,188	269,033	0.5	94,776	73,451	5,336	3,776,640	274,369
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Median	2,389,154	6,379,041	463,430	0.5	94,776	126,526	9,192	6,505,567	472,622
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	2,389,154	13,092,563	951,160	0.5	94,776	259,686	18,866	13,352,249	970,026
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Median	2,389,154	13,833,201	1,004,967	0.5	94,776	274,377	19,933	14,107,577	1,024,900
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Median	2,389,154	4,372,152	317,632	0.5	94,776	86,720	6,300	4,458,872	323,932
I-5: Los Angeles	Urban	46.9	52.33	5.43	4	Median	3,654,000	19,841,220	1,441,443	0.5	94,776	257,317	18,694	20,098,537	1,460,137
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Median	3,654,000	1,096,200	79,638	0.5	94,776	14,216	1,033	1,110,416	80,671
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Median	3,654,000	2,448,180	177,858	0.5	94,776	31,750	2,307	2,479,930	180,164
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Median	3,654,000	3,032,820	220,331	0.5	94,776	39,332	2,857	3,072,152	223,189
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Median	3,654,000	3,982,860	289,350	0.5	94,776	51,653	3,753	4,034,513	293,103
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Median	3,654,000	401,940	29,201	0.5	94,776	5,213	379	407,153	29,579
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	13,702,500	31,515,750	2,289,585	0.0	94,776	0	0	31,515,750	2,289,585
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	13,702,500	18,224,325	1,323,977	0.0	94,776	0	0	18,224,325	1,323,977
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	13,702,500	6,303,150	457,917	0.0	94,776	0	0	6,303,150	457,917
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	13,702,500	6,166,125	447,962	0.0	94,776	0	0	6,166,125	447,962
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	13,702,500	37,133,775	2,697,728	0.0	94,776	0	0	37,133,775	2,697,728
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	3,654,000	803,880	58,401	0.5	94,776	10,425	757	814,305	59,158
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	3,654,000	767,340	55,746	0.5	94,776	9,951	723	777,291	56,469
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	13,702,500	3,836,700	278,732	0.0	94,776	0	0	3,836,700	278,732
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	13,702,500	92,902,950	6,749,298	0.0	94,776	0	0	92,902,950	6,749,298
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	13,702,500	12,469,275	905,879	0.0	94,776	0	0	12,469,275	905,879
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	13,702,500	74,952,675	5,445,230	0.0	94,776	0	0	74,952,675	5,445,230
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	13,702,500	6,851,250	497,736	0.0	94,776	0	0	6,851,250	497,736
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	13,702,500	11,921,175	866,060	0.0	94,776	0	0	11,921,175	866,060
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	13,702,500	11,373,075	826,242	0.0	94,776	0	0	11,373,075	826,242
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	13,702,500	46,177,425	3,354,740	0.0	94,776	0	0	46,177,425	3,354,740
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	3,654,000	1,132,740	82,292	0.5	94,776	14,690	1,067	1,147,430	83,360
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	13,702,500	37,544,850	2,727,592	0.0	94,776	0	0	37,544,850	2,727,592
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	3,654,000	1,388,520	100,874	0.5	94,776	18,007	1,308	1,406,527	102,183
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	8,842,212	91,163,201	6,622,907	0.0	94,776	0	0	91,163,201	6,622,907
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	8,842,212	24,669,770	1,792,232	0.0	94,776	0	0	24,669,770	1,792,232
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	8,842,212	46,156,344	3,353,208	0.0	94,776	0	0	46,156,344	3,353,208
TOTAL								**1,544,631,763**	**112,215,816**			**17,114,176**	**1,243,326**	**1,561,745,939**	**113,459,142**

TABLE L2. CONVENTIONAL FREEWAY INCREMENTAL REHABILITATION COSTS FOR ROADWAY SPACE

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	Added Lane Placement	Rehabilitation Costs ($)		
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	103,530	494,873	31,285
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	228,375	669,139	42,302
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Median	228,375	57,094	3,609
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Median	228,375	264,915	16,748
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Median	228,375	232,943	14,726
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	730,800	1,030,428	65,143
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	730,800	803,880	50,821
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	730,800	2,075,472	131,209
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	730,800	248,472	15,708
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Median	228,375	484,155	30,608
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	228,375	511,560	32,340
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	103,530	1,497,044	94,642
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	103,530	966,970	61,131
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	103,530	1,230,972	77,821
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Median	228,375	50,242	3,176
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Median	228,375	808,448	51,109
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	103,530	1,082,924	68,461
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	103,530	170,825	10,799
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	103,530	92,142	5,825
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	103,530	1,221,654	77,232
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	103,530	2,905,052	183,655
I-5: Merced	Rural	0	32.45	32.45	2	Median	103,530	3,359,549	212,387
I-5: Fresno	Rural	0	66.16	66.16	2	Median	103,530	6,849,545	433,022
I-5: Kings	Rural	0	26.72	26.72	2	Median	103,530	2,766,322	174,884
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	103,530	7,368,230	465,812
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	103,530	80,753	5,105
I-5: Kern	Rural	10.35	15.08	4.73	4	Median	103,530	489,697	30,958
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	103,530	110,777	7,003
I-5: Kern	Rural	7.04	9.28	2.24	4	Median	103,530	231,907	14,661
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	103,530	65,224	4,123
I-5: Kern	Rural	5.36	6.41	1.05	4	Median	103,530	108,707	6,872
I-5: Kern	Rural	0.58	5.36	4.78	4	Median	103,530	494,873	31,285
I-5: Kern	Rural	0	0.58	0.58	4	Median	103,530	60,047	3,796
I-5: Los Angeles	Rural	84.76	88.61	3.85	4	Non-Median	955,662	3,679,297	232,602
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	103,530	655,345	41,430
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Median	103,530	908,993	57,466
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	103,530	160,472	10,145
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Median	103,530	276,425	17,475
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	103,530	567,344	35,867
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Median	103,530	599,439	37,896
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Median	103,530	189,460	11,977
I-5: Los Angeles	Urban	46.9	52.33	5.43	4	Median	228,375	1,240,076	78,396
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Median	228,375	68,512	4,331
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Median	228,375	153,011	9,673
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Median	228,375	189,551	11,983
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Median	228,375	248,929	15,737
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Median	228,375	25,121	1,588
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	730,800	1,680,840	106,261
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	730,800	971,964	61,447
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	730,800	336,168	21,252
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	730,800	328,860	20,790
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	730,800	1,980,468	125,203
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	228,375	50,242	3,176
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	228,375	47,959	3,032
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	730,800	204,624	12,936
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	730,800	4,954,824	313,239
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	730,800	665,028	42,042
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	730,800	3,997,476	252,717
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	730,800	365,400	23,100
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	730,800	635,796	40,194
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	730,800	606,564	38,346
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	730,800	2,462,796	155,696
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	228,375	70,796	4,476
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	730,800	2,002,392	126,589
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	228,375	86,783	5,486
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	843,231	8,693,709	549,608
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	843,231	2,352,614	148,730
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	843,231	4,401,665	278,269
TOTAL								**84,743,776**	**5,357,421**

APPENDIX M

ADDED CONVENTIONAL FREEWAY LANE VEHICLE-HOURS AND VEHICLE-MILES, VEHICLE OPERATING COSTS, AND USER COSTS

Introduction

This appendix details the methodologies and procedures used to calculate the vehicle operating costs and user costs for both the trucks and regular cars operating on an added conventional freeway lane on the study section. In order to calculate vehicle operating costs, which were given in literature in terms of dollars per mile of operation, annual vehicle-miles of travel were determined. Similarly, user costs can be quantified in terms of dollars per hour of travel time. So, in order to determine user costs, annual vehicle-hours of operation were determined for the study section.

Assumptions and General Issues

The vehicle-miles of travel, vehicle-hours of travel, vehicle operations, and user costs were determined for one direction (northbound) of the roadway and were computed separately for trucks and other vehicles. All calculations were carried out for each of the homogeneous sections of roadway described in Appendix K. The calculations were done for three periods during the day: the peak period, a nighttime period and an off-peak period. The segmentation of the day into these different periods, which were based on volume levels, will be discussed in subsequent sections.

Also, for the purposes of the calculations presented here, a distinction is made between trucks (i.e. – heavy vehicles, or those vehicles having more than four tires touching the ground) and “other vehicles,” which are assumed to be passenger cars. No distinctions are made here for any other types of vehicles.

General Procedure (and Relevance to the Cost Calculations)

As aforementioned, the purpose of calculating annual vehicle-miles on the study section was to determine operations costs for the system configuration with an added conventional freeway lane. Vehicle-hours were calculated in order to estimate user costs for the added-lane configuration.

In studying the added-lane system, values for vehicle-miles and vehicle-hours were calculated for the base system (i.e. – the existing system, with no added lane), and also for the existing-system-plus-added-lane configuration. Cost calculations were carried out for each configuration, and the differences in costs for the two systems were found. The cost calculations are not discussed further in this appendix, but are mentioned here to add clarity and context.

Calculation Procedure for Vehicle-Miles and Vehicle-Hours

The following procedure was used to determine vehicle-miles and vehicle-hours for the base system (i.e. – the study segment with no added lane), and also for the configuration with the added lane.

- Determination of the average daily traffic (AADT)
- Determination of truck percentages and truck AADT
- Determination of the peak-period flows, durations, and volumes
- Determination of nighttime period flows, durations, and volumes
- Determination of daytime off-peak period flows, durations, and volumes
- Determination of vehicle speeds and passenger-car-equivalent flows
- Determination of daily vehicle-miles and vehicle-hours on the study section.

Sample calculations herein refer to the base condition. The difference between base-condition calculations and added-lane calculations is the result of the number of lanes on each study segment. For the added-lane configuration, an additional lane was added to the number of existing lanes on each segment, and subsequent calculations were affected accordingly.

AADT

Traffic volume data (AADT) for the year 2001 were obtained from the Caltrans website (1). The data includes two-directional (northbound and southbound) AADT at certain post-mile markers.

As described in Appendix K, the study section was partitioned into relatively homogeneous segments (in terms of traffic volume, existing number of lanes, and median width), so traffic volumes on each section were relatively constant over that section. For each partition, a volume was chosen that was representative of the AADT over the range. When volumes varied somewhat considerably on a segment, volumes were assigned to that section using approximate averages. These approximated averages took into account the length of the partition at each volume level, in case some of the individual sections were longer than some of the sections within the section of freeway for which the AADT was being determined, and the AADT was chosen so as to be an approximate weighted average of the volumes on the section. For all those sections of the freeway for which no data were available, the AADT was assumed to be same or nearly same as the section closest to the section whose data was available.

Once a two-directional AADT was assigned to each segment, half of that volume was assumed to apply to the northbound direction. This was considered to be a reasonable assumption because traffic daily traffic volumes were used, which would account for any variations in flow based on time-of-day. AADT for each partition is shown in Table M1a for the base condition, and in Table M2a for the added-lane scenario.

Truck Percentage and Truck AADT

For each partition of the study section, the percentage of the vehicles which were heavy vehicles (i.e. – more than four wheels touching the road) was determined using data obtained from the Caltrans website (2). This percentage was assumed to apply to the added-lane configuration.

Like AADT and peak period flows, the truck percentages were given in the data at specific mile markers. For each of the partitions determined in Appendix K, a truck percentage was assigned based on the Caltrans truck data. The mile marker for each truck-percentage reading was matched to the appropriate segment in the previously-partitioned study section, and the corresponding truck percentage was assigned to that partition.

It is noteworthy that truck-percentage readings were given in the source data at wider-spaced mile markers than the traffic volumes described in previous sections. For this reason, most of the study-section partitions contained three or fewer truck-percentage readings, and some of the partitions contained no truck-percentage readings. When only one truck-percentage reading fell into a given partition, the truck percentage assigned was that reading. When two or more truck-percentage readings fell into a partition, a rough average of the truck percentages was used. If no truck-percentage data were available for a section, then the data available for an adjacent section with similar characteristics (i.e. – AADT, number of lanes, etc.) was assumed as the truck percentage for that section.

The truck AADT was then calculated for each partition of the study section. Truck AADT is the product of truck percentage and the AADT. Calculated values for truck AADT for each partition of the study section are shown in Tables M1a and M2a for the base condition and the added-lane scenario, respectively. The following sample calculation is also taken from the first partition shown in Table M1a:

AADT = 40000
Truck percentage = 16%
Truck AADT = 40000*16% = 6400 trucks

Peak-Period Flows, Durations, and Volumes

Peak period flow (in vehicles per hour) were obtained from the same source as the AADT data discussed in the previous section. A peak period flow was assigned to each partition of the study section in the same manner that AADT was assigned. Like the AADT data, the peak period flows were given by Caltrans (1) as two-directional, and northbound flows were assumed to be half of the two-directional flows. Table M1a shows the peak period flows as assigned to each partition of the study section for the base condition, and Table M2a shows flows as assigned to each partition for the added-lane scenario.

A three-day average hourly traffic volume was used to determine peak period duration (i.e. – the length of the daily peak period, in hours) for each partition of the study section. This average was calculated from data obtained from Caltrans for the month of April for the dates 4/9/02, 4/10/02, and 4/11/02, which are Tuesday, Wednesday and Thursday respectively. These data were given in the form of a 14-hour profile of hourly traffic volumes at select mile markers. The aforementioned dates were chosen because, of the dates for which data was provided, they were the most representative of normal weekday traffic conditions (i.e. – no substantial holiday travel or other event-related changes in travel patterns were expected on these days). It is noteworthy that Caltrans data only provided readings for the month of April. It is also noteworthy that weekend travel conditions were assumed for the purposes of this study to be the same as weekday conditions.

Peak period duration was determined at each mile marker in the hourly-volume data provided by Caltrans according to the procedure outline in the next paragraph. Like the truck percentages discussed above, data were not available for each partition determined in Appendix K and shown in Tables M1a and M2a. Once peak-period durations were determined for the mile markers for which data were provided, durations were assigned to each partition of the study section using the same general rules as used to assign truck percentages (see above). The following procedure describes the process by which peak-hour durations were determined for each mile marker for which data was provided:

Bar charts were developed using the 3-day-average hourly traffic volumes. The peak period duration was then determined from those bar charts by observation: where obvious peaks occurred in hourly volumes, these were considered to be peak periods. The number of peak hours was the number of hours whose volumes which were included in the peak volume category.

The peak-period volume was then calculated by multiplying peak-period flow by the peak-period duration. The calculated flows are shown in Table M1a for the base condition, and in Table M2a for the added-lane scenario. The following sample calculation also appears in Table M1a, for the first segmentation of the study section:

Peak Period Flow = 3500 vph
Peak period duration = 6 hrs.
Peak period Volume = 3500*6 = 21000 vehicles

Nighttime Period Flows, Durations, and Volumes

Nighttime period duration (in hours) was determined in the same way as peak period duration. From the bar charts developed from given Caltrans hourly volume data for three consecutive weekdays (see previous section), the consecutive hours during which the lowest volumes occurred on a 24-hour profile were assumed to be the nighttime hours. The nighttime duration is the number of hours in this volume category. Tables M1a and M2a show nighttime durations as assigned to each partition of the study segment, for the base condition and the added-lane scenario, respectively. As with the assignment of peak period duration and truck percentages (see previous sections), data were not available for each partition determined in Appendix K and shown in Tables M1a and M2a. Once nighttime-period durations were determined for the mile markers for which data were provided, durations were assigned to each partition of the study section using the same general rules as used to assign truck percentages (see above).

From the nighttime period duration, the percentage of vehicles using the study section during nighttime hours was calculated. The ratio of the nighttime volume (total vehicles on the system during the nighttime hours) to the total daily volume (i.e. – the sum of all hourly volumes) resulted in the estimated nighttime off-peak percentage.

The nighttime volume was then calculated as the product of the nighttime traffic percentage and the traffic AADT given by Caltrans for 2001 (1), and nighttime flow rates were determined by dividing the nighttime period volume by the number of hours in the nighttime period (i.e. – the nighttime duration). The following sample calculation is from Table M1a.

Nighttime duration = 5 hrs.
Nighttime traffic percentage = 4.81%
AADT = 40000
Nighttime off-peak period volume = 4.81% * 40000 = 1923
Nighttime flow (vehicle per hour) = 1923/5 = 385

Daytime Off-Peak Period Flows, Duration, and Volumes

The daytime off-peak duration for each partition of the study section was, for the purposes of this study, considered to be the number of hours which were not classified as part of either peak or nighttime periods. Daytime off-peak period duration, then, was found by subtracting the peak-period and nighttime-period durations from twenty-four (the number of hours in a day). Daytime off-peak period durations were assigned to each partition of the study segment in a similar manner as durations were applied for the peak and off-peak periods. Tables M1a and M2a show daytime off-peak period durations as assigned to each of the partitions of the study section, for the base condition and the added-lane scenario, respectively.

Similarly, daytime off-peak period volume was, for the purposes of this study, considered to be that portion of the daily volume not accounted for in the peak and nighttime periods. Daytime off-peak volume was calculated by subtracting the peak and nighttime volumes from the AADT given by Caltrans (1). Hourly flows were then calculated by dividing the daytime off-peak period volume by the duration of the period. Flows and volumes for the daytime off-peak period for each partition of the study section appear in Tables M1a and M2a**.** The following sample calculation is taken from the same table, from the first partition:

AADT = 40000
Peak period volume = 21000
Nighttime off-peak period volume = 1923
Daytime off-peak period volume = 40000-(21000+1923) = 17077
Daytime off-peak period duration = 13
Nighttime/daytime off-peak flow = 17077/13 = 1314 vph

Passenger-Car-Equivalent Flows and Vehicle Speeds

Passenger Car Equivalent Flows

Flows for each partition of the study segment were determined, as discussed in previous sections, for the peak, nighttime, and daytime off-peak periods. Lane flows were then determined by dividing the hourly flow for all lanes by the number of lanes on the segment. Then, hourly passenger car equivalent flows (pcphpl) were determined. The process for this is described in the following paragraph.

For the purposes of this study, a passenger car-to-truck equivalence of 1.5 was assumed (i.e. – 1.5 passenger cars is equal to one truck), and all volumes were converted to passenger car equivalent volumes. This was done to assure an accurate comparison, since the ratio of trucks to passenger cars varies from partition to partition. The passenger car equivalent hourly flow per lane (pcphpl) for each period on each partition was determined by multiplying the truck flow by a factor of 1.5, and then adding that product to the remaining vehicular flow. The calculated passenger car equivalent flows appear in Tables M1b and M2b for the base and added-lane conditions, respectively. The following sample calculation was taken from Tables M1a and M1b, from the data pertaining to peak period flow for the first segment:

Peak Period Flow = 3500 vph (from Table M1a)
Peak period flow per lane = 1750 vphpl (see Table M1b)
% of trucks traveling in the section = 16% (from Table M1a)
Flow per lane for trucks = 0.16*1750 = 280 (intermediate step; not shown in tables)
Passenger equivalent flow (for trucks) = 280*1.5 = 420 (intermediate step; not shown in tables)
Flow per lane for other vehicles = 1750*(1-0.16) = 1470 (intermediate step; not shown in tables)
Passenger car equivalent flow for all vehicles = 1470 + 420 = 1890 pcphpl (see Table M1b)

Vehicle Speeds

The operating speed for trucks on the non-automated dedicated lanes, and also for trucks traveling in the conventional lanes, was assumed to be 50mph. For trucks traveling on the AHS lanes, the speed was assumed to be 70mph. This assumption was considered to be reasonable because the relatively widely-spaced system access points would decrease speed reductions associated with merging and exiting maneuvers, as compared to operations on a non-dedicated lane.

The non-truck vehicles operating on the conventional lanes were assumed to have free flow speeds of 55mph and 65mph on urban and suburban/rural road sections, respectively. These speeds were determined from the speed-flow charts in the *Highway Capacity Manual* (3), and were based on the input parameters of free flow speed and passenger car equivalent flow (pcphpl). The operating speeds for each type of vehicle considered in this study (truck or passenger car) on each type of lane (automated/dedicated,dedicated/non- automated, or conventional) for each daily period (peak, nighttime, and daytime off-peak) are shown for each partition of the study section in Tables M1b and M2b for the base condition and added-lane condition, respectively.

Vehicle-Miles and Vehicle-Hours

Vehicle-Miles

The vehicle-miles of travel were calculated for each partition during each daily period (peak, nighttime, and daytime off-peak), for both the base condition and the added-lane scenario. Vehicle-miles for a given segment during a given period are the product of the travel distance (in miles) for that partition and the volume of traffic estimated for that period. Vehicle-miles for a given daily period are equal to the sum of the vehicle-miles for each partition. Daily vehicle-miles are equal to the sum of vehicle-miles for all daily periods. Tables M1c and M2c show daily vehicle-miles for the base condition and the added-lane scenario, respectively. A summary of daily vehicle-miles appears in Table M3.

Vehicle-Hours

The vehicle-hours of travel were calculated for each partition during each daily period (peak, nighttime, and daytime off-peak). Vehicle-hours for a given segment during a given period are the product of the travel time for that partition and the volume of traffic estimated for that period. The travel time was calculated by dividing the section length by travel speed during the period (methodologies for determining travel speed appear in the previous section). Vehicle-hours for a given daily period are equal to the sum of the vehicle-hours for each partition. Daily vehicle-hours are equal to the sum of vehicle-hours for all daily periods. Tables M1c and M2c show daily vehicle-hours for the base condition and the added-lane scenario, respectively, for each partition of the study system. A summary of daily vehicle-hours appears in Table M4.

Vehicle Operations Costs

The calculations for annual vehicle operations costs are a function of annual vehicle-miles and per-mile unit costs for vehicle operations. Costs for vehicle operations were determined according to the following procedure:

- Determination of unit costs for vehicle operations (in terms of dollars per vehicle-mile)
- Determination of daily vehicle operating costs
- Determination of annual vehicle operating costs.

Unit Costs for Vehicle Operations

The vehicle operating costs are those expenses necessary to operate a vehicle on the freeway lane. Typically, costs for vehicle operations include driver wages and fringe benefits, other wages and fringe benefits, equipment rents and purchased transportation, insurance, depreciation, tires, outside maintenance, fuel, tax, licensing, and other miscellaneous items. For the purposes of this study, taxes and licensing fees were not included in vehicle operations costs because they are considered transferred costs. This exclusion is allowable because this analysis was performed from a societal perspective.

Unit costs for the operation of trucks on freeways were published in the *American Trucking Trends* (4). For the trucks operating without automation on the dedicated lane and the other conventional lanes, the per-mile cost was assumed to be equal to those costs published in *American Trucking Trends*, with adjustment for inflation from 1998 to 2001 (5). The 2001-equivalent unit costs used for trucks operating on conventional lanes was determined to be $1.77. Table M5 shows itemized unit costs for non-automated truck operations.

For non-truck traffic (assumed for the purposes of this study to be passenger-car traffic), the unit cost for operations was assumed to be equal to the mileage reimbursement given to San Jose State University employees for employment-related use of their personal vehicles. This figure ($0.325 per mile in 2001-dollars) was assumed to cover all costs associated with operating a passenger car under freeway conditions. This cost is also shown in Table M6.

Vehicle Operating Costs

The vehicle operating costs were calculated by multiplying the vehicle-miles with the per-mile unit cost of operating the vehicle. This calculation was performed for all vehicles operating on the study section, including trucks on the AHS lane, trucks on the dedicated lane, trucks on the conventional lanes, and other vehicles on the conventional lane. Costs were calculated for all of the aforementioned vehicles on each partition within the study section, and then summed to determine the total vehicle operating costs.

The vehicle operating costs were then calculated for each section for all vehicles. Tables M1d and M2d show details of vehicle operating costs calculations for the base condition and the base condition plus the added lane configuration, respectively.

The following sample calculation comes from Table M1d, and is associated with the first segment of the study section (VOC represents vehicle operating cost):

> Unit cost for truck operation on dedicated lane = $1.77
> Truck-Miles traveled on the system (peak period) = 16,061
> Truck VOC on the dedicated lane (per day) = 1.77* 16,061 = $28,364

Annual vehicle operating costs are summarized in Table M6. Total daily vehicle-miles were extracted from Table M1c and M2c for the base and added-lane scenarios. Total daily costs were calculated by multiplying the unit cost for operations by the appropriate number of vehicle-miles. Equivalent uniform annual cost (EUAC) was found by multiplying the daily cost by 365, for the “truck” and “other vehicles” categories. Then, equivalent uniform annual total cost (EUATC) was found by summing the EUACs of the "truck" and "other vehicles" traffic.

User Costs

System user costs include those costs associated with user travel time on the system. These costs do not include the costs incurred for driver wages and fringe benefits (these are considered to be part of vehicle operations). Tables M1e and M2e show calculated costs for each partition, for the base condition and the added-lane configurations, respectively.

The calculation of annual user costs was performed using the same procedure as for the annual vehicle operating costs in the previous section of this appendix. Per-hour user costs for passenger cars (considered here to represent all "other vehicles") and trucks were based on data from *California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C)* (6), and were determined to be $9.16 and $28.27, respectively. Table M7 shows a summary of the costs.

Summary of Results

The details for the calculations of vehicle-miles and vehicle-hours of travel are shown in Tables M1a through M1e for the existing configuration of the freeway, and in Tables M2a through M2e for the existing configuration plus the conventional added lane. Tables M1a and M2a show the flow rates, duration, and volumes for the various periods of the day for which analysis was conducted. The passenger-car equivalents and speeds are shown in Tables M1b and M2b. The vehicle-hours and –miles of travel calculations are presented in Tables M1c and M2c. Tables M1d and M2d show details of vehicle operating costs calculations, and Tables M1e and M2e show user cost calculations.

References

1. Caltrans Traffic Volumes. Online. 2001. <http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm>
2. Caltrans Truck Traffic. Online. 2001. <http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm>
3. *Highway Capacity Manual*. Transportation Research Board. 2001.
4. *American Trucking Trends*. American Trucking Associations' Economics and Statistics Group. 2000.
5. Gross Domestic Product Deflation Inflation Calculator. Online. <http://www.jsc.nasa.gov/bu2/inflateGDP.html>
6. Booz: Allen and Hamilton Inc. *California Life-Cycle Benefit/Cost Analysis Model* (Cal-B/C). California Department of Transportation. September 1999.

TABLE M1a. SECTION VOLUME DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 26 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AHS Lane Placement	Base AADT (One Direction)	Truck %	Truck AADT (One Direction)	Peak Period Duration (hours)	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration (hours)	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)															
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	40,000	16.0%	6,400	6	3,500	21,000	5	4.81%	1,923	385	13	17,077	1,314
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	49,000	11.0%	5,390	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Median	49,000	9.0%	4,410	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Median	67,000	13.0%	8,710	3	6,500	19,500	6	4.76%	3,189	532	15	44,311	2,954
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Median	73,000	9.0%	6,570	3	7,300	21,900	6	4.76%	3,475	579	15	47,625	3,175
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	80,000	10.0%	8,000	3	7,100	21,300	6	4.76%	3,808	635	15	54,892	3,659
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	75,000	11.0%	8,250	3	7,000	21,000	6	4.76%	3,570	595	15	50,430	3,362
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	65,000	14.0%	9,100	3	6,000	18,000	6	4.76%	3,094	516	15	43,906	2,927
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	63,000	14.0%	8,820	3	5,400	16,200	6	4.76%	2,999	500	15	43,801	2,920
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Median	50,000	14.0%	7,000	3	5,000	15,000	6	4.76%	2,380	397	15	32,620	2,175
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	40,000	14.0%	5,600	3	4,000	12,000	6	4.76%	1,904	317	15	26,096	1,740
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	30,000	25.0%	7,500	3	3,000	9,000	11	19.13%	5,738	522	10	15,262	1,526
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	25,000	24.0%	6,000	4	2,300	9,200	8	11.58%	2,895	362	12	12,905	1,075
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	40,000	23.0%	9,200	5	4,000	20,000	5	4.03%	1,613	323	14	18,387	1,313
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Median	45,000	24.0%	10,800	5	4,500	22,500	5	4.03%	1,814	363	14	20,686	1,478
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Median	50,000	24.0%	12,000	5	5,000	25,000	5	5.58%	2,791	558	14	22,209	1,586
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	40,000	26.0%	10,400	5	4,000	20,000	5	5.58%	2,233	447	14	17,767	1,269
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	63,000	26.0%	16,380	5	5,000	25,000	5	5.58%	3,517	703	14	34,483	2,463
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	42,000	26.0%	10,920	5	4,200	21,000	6	8.17%	3,430	572	13	17,570	1,352
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	10,000	26.0%	2,600	3	1,000	3,000	5	8.03%	803	161	16	6,197	387
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	10,000	28.0%	2,800	4	1,000	4,000	6	15.57%	1,557	259	14	4,443	317
I-5: Merced	Rural	0	32.45	32.45	2	Median	15,000	29.0%	4,350	4	1,500	6,000	6	15.57%	2,335	389	14	6,665	476
I-5: Fresno	Rural	0	66.16	66.16	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	18.05%	2,708	387	12	4,792	399
I-5: Kings	Rural	0	26.72	26.72	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	17.32%	2,597	371	12	4,903	409
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	17,000	29.0%	4,930	5	1,700	8,500	5	10.17%	1,728	346	14	6,772	484
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	30,000	28.0%	8,400	5	3,000	15,000	6	10.95%	3,284	547	13	11,716	901
I-5: Kern	Rural	10.35	15.08	4.73	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	7.04	9.28	2.24	4	Median	30,000	30.0%	9,000	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	5.36	6.41	1.05	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0.58	5.36	4.78	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0	0.58	0.58	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Los Angeles	Rural	84.76	88.61	3.85	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	35,000	19.0%	6,650	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Median	40,000	16.0%	6,400	5	4,000	20,000	5	6.08%	2,433	487	14	17,567	1,255
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Median	65,000	10.0%	6,500	5	6,500	32,500	5	6.08%	3,953	791	14	28,547	2,039
I-5: Los Angeles	Urban	46.9	52.33	5.43	4	Median	90,000	10.0%	9,000	6	8,600	51,600	5	5.89%	5,305	1,061	13	33,095	2,546
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Median	92,000	9.0%	8,280	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Median	92,000	10.0%	9,200	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Median	100,000	9.0%	9,000	6	8,900	53,400	5	5.89%	5,895	1,179	13	40,705	3,131
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Median	115,000	10.0%	11,500	6	9,100	54,600	5	5.89%	6,779	1,356	13	53,621	4,125
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Median	115,000	8.0%	9,200	6	8,500	51,000	5	6.62%	7,618	1,524	13	56,382	4,337
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	120,000	8.0%	9,600	6	9,500	57,000	5	6.62%	7,949	1,590	13	55,051	4,235
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	117,000	9.0%	10,530	4	4,600	18,400	5	4.88%	5,710	1,142	15	92,890	6,193
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	65,000	9.0%	5,850	4	4,800	19,200	5	4.88%	3,172	634	15	42,628	2,842
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	70,000	8.0%	5,600	4	5,000	20,000	5	4.88%	3,416	683	15	46,584	3,106
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	135,000	8.0%	10,800	5	10,200	51,000	5	4.20%	5,675	1,135	14	78,325	5,595
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	140,000	8.0%	11,200	5	10,000	50,000	5	4.20%	5,885	1,177	14	84,115	6,008
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	140,000	8.0%	11,200	5	9,600	48,000	5	4.20%	5,885	1,177	14	86,115	6,151
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	90,000	8.0%	7,200	5	6,800	34,000	5	4.20%	3,783	757	14	52,217	3,730
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	90,000	8.0%	7,200	5	7,200	36,000	5	4.20%	3,783	757	14	50,217	3,587
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	102,000	8.0%	8,160	5	8,200	41,000	5	4.20%	4,288	858	14	56,712	4,051
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	138,000	8.0%	11,040	8	9,900	79,200	5	4.48%	6,184	1,237	11	52,616	4,783
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	140,000	8.0%	11,200	8	9,600	76,800	5	4.48%	6,273	1,255	11	56,927	5,175
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	120,000	8.0%	9,600	8	8,000	64,000	5	4.48%	5,377	1,075	11	50,623	4,602
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	120,000	8.0%	9,600	6	7,900	47,400	5	2.79%	3,350	670	13	69,250	5,327
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	130,000	8.0%	10,400	6	8,000	48,000	5	2.79%	3,629	726	13	78,371	6,029
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	128,000	8.0%	10,240	6	8,400	50,400	5	2.79%	3,574	715	13	74,026	5,694
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	110,000	15.0%	16,500	8	8,000	64,000	5	4.48%	4,929	986	11	41,071	3,734
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	88,000	14.0%	12,320	8	7,500	60,000	5	4.48%	3,943	789	11	24,057	2,187
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	70,000	15.0%	10,500	8	6,000	48,000	5	4.48%	3,137	627	11	18,863	1,715

TABLE M1b. SECTION FLOW AND SPEED DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 26 FT. BASIS

County	City/Suburban /Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane (pcphpl)	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)		Nighttime Off-Peak Speed (mph)		Daytime Off-Peak Period Speed (mph)	
		Begin	End	Length (mi)							Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	1,750	1,890	192	208	657	709	50	63	50	65	50	65
I-5: Sacramento	Urban	26.94	29.87	2.93	1,633	1,723	157	166	442	466	50	55	50	55	50	55
I-5: Sacramento	Urban	26.69	26.94	0.25	1,633	1,707	157	164	442	462	50	55	50	55	50	55
I-5: Sacramento	Urban	25.53	26.69	1.16	2,167	2,308	177	189	985	1,049	50	48	50	55	50	55
I-5: Sacramento	Urban	24.51	25.53	1.02	1,825	1,907	145	151	794	829	50	55	50	55	50	55
I-5: Sacramento	Urban	23.1	24.51	1.41	1,420	1,491	127	133	732	768	50	55	50	55	50	55
I-5: Sacramento	Urban	22	23.1	1.1	2,333	2,462	198	209	1,121	1,182	50	38	50	55	50	55
I-5: Sacramento	Urban	19.16	22	2.84	1,500	1,605	129	138	732	783	50	55	50	55	50	55
I-5: Sacramento	Urban	18.82	19.16	0.34	1,080	1,156	100	107	584	625	50	55	50	55	50	55
I-5: Sacramento	Urban	16.7	18.82	2.12	1,250	1,338	99	106	544	582	50	55	50	55	50	55
I-5: Sacramento	Urban	14.46	16.7	2.24	1,333	1,427	106	113	580	621	50	55	50	55	50	55
I-5: Sacramento	Rural	0	14.46	14.46	1,500	1,688	261	293	763	859	50	64	50	65	50	65
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,150	1,288	181	203	538	602	50	65	50	65	50	65
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,333	1,487	108	120	438	488	50	65	50	65	50	65
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,500	1,680	121	135	493	552	50	65	50	55	50	55
I-5: San Joaquin	Urban	24.8	28.34	3.54	1,250	1,400	140	156	397	444	50	55	50	55	50	55
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,333	1,507	149	168	423	478	50	65	50	65	50	65
I-5: San Joaquin	Rural	12.69	14.34	1.65	1,000	1,130	141	159	493	557	50	65	50	65	50	65
I-5: San Joaquin	Rural	11.8	12.69	0.89	1,400	1,582	191	215	451	509	50	65	50	65	50	65
I-5: San Joaquin	Rural	0	11.8	11.8	500	565	80	91	194	219	50	65	50	65	50	65
I-5: Stanislaus	Rural	0	28.06	28.06	500	570	130	148	159	181	50	65	50	65	50	65
I-5: Merced	Rural	0	32.45	32.45	750	859	195	223	238	273	50	65	50	65	50	65
I-5: Fresno	Rural	0	66.16	66.16	750	863	193	222	200	230	50	65	50	65	50	65
I-5: Kings	Rural	0	26.72	26.72	750	863	186	213	204	235	50	65	50	65	50	65
I-5: Kern	Rural	15.86	87.03	71.17	850	973	173	198	242	277	50	65	50	65	50	65
I-5: Kern	Rural	15.08	15.86	0.78	750	855	137	156	225	257	50	65	50	65	50	65
I-5: Kern	Rural	10.35	15.08	4.73	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	9.28	10.35	1.07	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	7.04	9.28	2.24	750	863	137	157	182	209	50	65	50	65	50	65
I-5: Kern	Rural	6.41	7.04	0.63	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	5.36	6.41	1.05	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	0.58	5.36	4.78	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	0	0.58	0.58	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Los Angeles	Rural	84.76	88.61	3.85	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	78.43	84.76	6.33	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	69.65	78.43	8.78	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	68.1	69.65	1.55	875	958	127	139	237	260	50	65	50	65	50	65
I-5: Los Angeles	Rural	65.43	68.1	2.67	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	59.95	65.43	5.48	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	54.16	59.95	5.79	1,000	1,080	122	131	314	339	50	65	50	65	50	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	1,625	1,706	198	208	510	535	50	65	50	65	50	65
I-5: Los Angeles	Urban	46.9	52.33	5.43	2,150	2,258	265	279	636	668	50	50	50	55	50	55
I-5: Los Angeles	Urban	46.6	46.9	0.3	2,225	2,325	271	283	638	667	50	46	50	55	50	55
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,780	1,869	217	228	510	536	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,780	1,860	236	246	626	654	50	55	50	55	50	55
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,820	1,911	271	285	825	866	50	55	50	55	50	55
I-5: Los Angeles	Urban	43.9	44.01	0.11	2,125	2,210	381	396	1,084	1,128	50	51	50	55	50	55
I-5: Los Angeles	Urban	41.6	43.9	2.3	1,900	1,976	318	331	847	881	50	54	50	55	50	55
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,533	1,602	381	398	2,064	2,157	50	55	50	55	50	53
I-5: Los Angeles	Urban	39.81	40.27	0.46	1,200	1,254	159	166	710	742	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.36	39.81	0.45	1,000	1,040	137	142	621	646	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,040	2,122	227	236	1,119	1,164	50	53	50	55	50	55
I-5: Los Angeles	Urban	36.43	36.65	0.22	1,667	1,733	196	204	1,001	1,041	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.22	36.43	0.21	2,400	2,496	294	306	1,538	1,599	50	32	50	55	50	55
I-5: Los Angeles	Urban	35.94	36.22	0.28	1,700	1,768	189	197	932	970	50	55	50	55	50	55
I-5: Los Angeles	Urban	29.16	35.94	6.78	1,800	1,872	189	197	897	933	50	55	50	55	50	55
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,050	2,132	214	223	1,013	1,053	50	53	50	55	50	55
I-5: Los Angeles	Urban	22.78	28.25	5.47	1,900	1,967	219	226	1,101	1,139	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.28	22.78	0.5	2,375	2,458	273	283	1,376	1,424	50	40	50	55	50	55
I-5: Los Angeles	Urban	21.41	22.28	0.87	1,980	2,059	247	257	957	995	50	54	50	55	50	55
I-5: Los Angeles	Urban	20.58	21.41	0.83	2,400	2,496	314	326	1,294	1,346	50	32	50	55	50	55
I-5: Los Angeles	Urban	17.21	20.58	3.37	2,000	2,080	269	280	1,151	1,197	50	54	50	55	50	55
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,975	2,054	168	174	1,332	1,385	50	54	50	55	50	55
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,000	2,080	181	189	1,507	1,567	50	54	50	55	50	55
I-5: Los Angeles	Urban	13.78	14.16	0.38	2,100	2,184	179	186	1,424	1,481	50	52	50	55	50	55
CA 710: Los Angel	Suburban	12.97	23.28	10.31	2,000	2,150	246	265	933	1,003	50	59	50	65	50	65
CA 710: Los Angel	Suburban	10.18	12.97	2.79	1,875	2,006	197	211	547	585	50	59	50	65	50	65
CA 710: LA	Suburban	4.96	10.18	5.22	2,000	2,150	209	225	572	614	50	59	50	65	50	65

TABLE M1c. SECTION TRAVEL DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 26 FT. BASIS

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	16,061	84,319	1,471	7,722	13,060	68,567
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	9,476	76,666	759	6,143	5,558	44,968
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	662	6,689	53	536	388	3,923
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	2,941	19,679	481	3,219	6,682	44,718
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	2,010	20,328	319	3,225	4,372	44,206
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	3,003	27,030	537	4,833	7,740	69,658
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	2,541	20,559	432	3,495	6,102	49,371
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	7,157	43,963	1,230	7,557	17,457	107,236
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	771	4,737	143	877	2,085	12,807
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	4,452	27,348	706	4,339	9,682	59,473
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	3,763	23,117	597	3,668	8,184	50,271
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	32,535	97,605	20,742	62,226	55,173	165,519
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	20,623	65,305	6,489	20,547	28,929	91,607
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	54,694	183,106	4,410	14,763	50,284	168,343
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	1,188	3,762	96	303	1,092	3,459
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	21,240	67,260	2,371	7,510	18,869	59,750
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	54,392	154,808	6,073	17,284	48,319	137,524
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	10,725	30,525	1,509	4,294	14,793	42,104
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	4,859	13,831	794	2,259	4,066	11,572
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	9,204	26,196	2,464	7,013	19,012	54,111
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	31,427	80,813	12,231	31,450	34,910	89,769
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	56,463	138,237	21,974	53,798	62,721	153,558
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	148,860	347,340	53,743	125,401	95,117	221,939
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	60,120	140,280	20,821	48,583	39,299	91,697
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	175,434	429,511	35,667	87,323	139,767	342,188
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	3,276	8,424	717	1,845	2,559	6,579
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	23,839	61,301	4,350	11,185	11,543	29,682
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	5,393	13,867	984	2,530	2,611	6,714
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	12,096	28,224	2,207	5,150	5,857	13,666
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	3,175	8,165	579	1,490	1,537	3,953
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	5,292	13,608	966	2,483	2,562	6,589
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	24,091	61,949	4,396	11,304	11,665	29,996
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	2,923	7,517	533	1,372	1,415	3,640
I-5: Los Angeles	Rural	84.76	88.61	3.85	436.6	908.0	73.8	153.5	217.2	451.8	21,830	59,020	3,691	9,978	10,862	29,369
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	35,891	97,039	6,068	16,405	17,860	48,287
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	33,188	151,192	5,611	25,560	16,515	75,234
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	6,185	26,366	1,046	4,457	3,077	13,120
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	10,093	45,977	1,706	7,773	5,022	22,879
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	20,714	94,366	3,502	15,953	10,308	46,957
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	18,528	97,272	2,254	11,832	16,274	85,440
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	5,948	53,528	723	6,511	5,224	47,016
I-5: Los Angeles	Urban	46.9	52.33	5.43	560.4	5,043.4	57.6	471.4	359.4	2,940.6	28,019	252,169	2,881	25,927	17,970	161,734
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	1,442	14,578	146	1,481	896	9,057
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	3,578	32,200	363	3,270	2,223	20,006
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	3,989	40,333	440	4,452	3,041	30,745
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	5,951	53,563	739	6,650	5,845	52,602
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	449	5,161	67	771	496	5,706
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,233.6	29.3	305.8	202.6	2,118.0	10,488	120,612	1,463	16,821	10,129	116,487
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	2,202	22,270	683	6,910	11,119	112,425
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	795	8,037	131	1,328	1,765	17,844
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	720	8,280	123	1,414	1,677	19,286
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	11,057	127,153	1,230	14,149	16,981	195,280
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	880	10,120	104	1,191	1,480	17,025
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	806	9,274	99	1,137	1,447	16,637
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	762	8,758	85	975	1,170	13,451
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	19,526	224,554	2,052	23,599	27,238	313,231
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	2,985	34,325	312	3,590	4,129	47,479
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	18,188	241,637	2,092	27,800	29,497	391,886
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	1,663	22,088	191	2,541	2,696	35,821
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	5,512	63,392	430	4,949	3,662	42,114
I-5: Los Angeles	Urban	20.58	21.41	0.83	102.0	1,832.6	8.3	87.1	75.6	790.3	5,100	58,644	417	4,790	3,780	43,469
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	17,254	198,426	1,450	16,671	13,648	156,951
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	1,176	13,518	83	956	1,717	19,750
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	10,522	120,998	796	9,149	17,179	197,556
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	1,532	17,620	109	1,249	2,250	25,880
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	98,976	560,864	7,623	43,196	63,516	359,925
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,440.1	30.8	145.6	187.9	888.0	23,436	143,964	1,540	9,461	9,397	57,722
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,609.8	49.1	214.1	295.4	1,287.6	37,584	212,976	2,456	13,917	14,770	83,697
TOTAL					**25,633.1**	**95,243.4**	**5,271.0**	**14,675.4**	**21,765.4**	**87,710.7**	**1,281,653**	**5,586,341**	**263,550**	**912,542**	**1,088,269**	**5,221,226**

TABLE M1d. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME - SEGMENTATION 26 FT. BASIS

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Cost ($) Peak		Vehicle Operating Cost ($) Nighttime Off-Peak		Vehicle Operating Cost ($) Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Los Angeles	Rural	84.76	88.61	3.85	21,830	59,020	3,691	9,978	10,862	29,369	38,551	19,182	6,517	3,243	19,183	9,545
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,948	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Los Angeles	Urban	46.9	52.33	5.43	28,019	252,169	2,881	25,927	17,970	161,734	49,482	81,955	5,087	8,426	31,736	52,564
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,100	58,644	417	4,790	3,780	43,469	9,006	19,059	736	1,557	6,675	14,127
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
TOTAL					**1,281,653**	**5,586,341**	**263,550**	**912,542**	**1,088,269**	**5,221,226**	**2,263,413**	**1,815,561**	**465,431**	**296,576**	**1,921,894**	**1,696,898**

TABLE M1e. TRAVEL TIME COST - BASE CONDITION - BASE VOLUME - SEGMENTATION 26 FT BASIS

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	9,082	12,254	832	1,088	7,386	9,658
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	1,663	3,754	272	536	3,779	7,444
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	1,437	4,953	244	582	3,451	8,218
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	18,398	13,963	11,729	8,765	31,200	23,314
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	672	530	54	50	618	576
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Los Angeles	Rural	84.76	88.61	3.85	436.6	908.0	73.8	153.5	217.2	451.8	12,344	8,313	2,087	1,405	6,143	4,137
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Los Angeles	Urban	46.9	52.33	5.43	560.4	5,043.4	57.6	471.4	359.4	2,940.6	15,844	46,175	1,629	4,316	10,162	26,923
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	815	2,902	83	246	507	1,508
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	254	927	38	128	281	950
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,233.6	29.3	305.8	202.6	2,118.0	5,931	20,449	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	1,245	3,707	386	1,150	6,288	19,421
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	6,252	21,965	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	456	2,653	56	189	818	2,770
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	1,688	5,930	177	598	2,335	7,904
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	940	5,056	108	423	1,525	5,963
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	3,117	10,748	243	824	2,071	7,010
I-5: Los Angeles	Urban	20.58	21.41	0.83	102.0	1,832.6	8.3	87.1	75.6	790.3	2,884	16,779	236	797	2,138	7,236
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	9,757	33,642	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	665	2,292	47	159	971	3,288
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	5,950	20,515	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	866	3,102	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	55,970	87,034	4,311	6,084	35,918	50,697
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,440.1	30.8	145.6	187.9	888.0	13,253	22,340	871	1,333	5,314	8,130
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,609.8	49.1	214.1	295.4	1,287.6	21,253	33,049	1,389	1,960	8,352	11,789
TOTAL					**25,633.1**	**95,243.4**	**5,271.0**	**14,675.4**	**21,765.4**	**87,710.7**	**724,759**	**872,003**	**149,034**	**134,361**	**615,403**	**803,037**

TABLE M2a. SECTION VOLUME DATA - CONVENTIONAL LANES WITH ADDED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment Begin	End	Length (mi)	Conventional Freeway Lanes in One Direction	AADT (One Direction)	Truck % of Conventional Lanes AADT	Truck AADT (One Direction)	Peak Period Duration	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction	Daytime Off-Peak Period Duration	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
I-5: Sacramento	Rural	29.87	34.65	4.78	3	40,000	16.00%	6,400	6	3,500	21,000	5	5%	1,923	385	13	17,077	1,314
I-5: Sacramento	Urban	26.94	29.87	2.93	4	49,000	11.00%	5,390	6	4,900	29,400	5	5%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	26.69	26.94	0.25	4	49,000	9.00%	4,410	6	4,900	29,400	5	5%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	25.53	26.69	1.16	4	67,000	13.00%	8,710	3	6,500	19,500	6	5%	3,189	532	15	44,311	2,954
I-5: Sacramento	Urban	24.51	25.53	1.02	5	73,000	9.00%	6,570	3	7,300	21,900	6	5%	3,475	579	15	47,625	3,175
I-5: Sacramento	Urban	23.1	24.51	1.41	6	80,000	10.00%	8,000	3	7,100	21,300	6	5%	3,808	635	15	54,892	3,659
I-5: Sacramento	Urban	22	23.1	1.1	4	75,000	11.00%	8,250	3	7,000	21,000	6	5%	3,570	595	15	50,430	3,362
I-5: Sacramento	Urban	19.16	22	2.84	5	65,000	14.00%	9,100	3	6,000	18,000	6	5%	3,094	516	15	43,906	2,927
I-5: Sacramento	Urban	18.82	19.16	0.34	6	63,000	14.00%	8,820	3	5,400	16,200	6	5%	2,999	500	15	43,801	2,920
I-5: Sacramento	Urban	16.7	18.82	2.12	5	50,000	14.00%	7,000	3	5,000	15,000	6	5%	2,380	397	15	32,620	2,175
I-5: Sacramento	Urban	14.46	16.7	2.24	4	40,000	14.00%	5,600	3	4,000	12,000	6	5%	1,904	317	15	26,096	1,740
I-5: Sacramento	Rural	0	14.46	14.46	3	30,000	25.00%	7,500	3	3,000	9,000	11	19%	5,738	522	10	15,262	1,526
I-5: San Joaquin	Rural	40.45	49.79	9.34	3	25,000	24.00%	6,000	4	2,300	9,200	8	12%	2,895	362	12	12,905	1,075
I-5: San Joaquin	Rural	28.56	40.45	11.89	4	40,000	23.00%	9,200	5	4,000	20,000	5	4%	1,613	323	14	18,387	1,313
I-5: San Joaquin	Urban	28.34	28.56	0.22	4	45,000	24.00%	10,800	5	4,500	22,500	5	4%	1,814	363	14	20,686	1,478
I-5: San Joaquin	Urban	24.8	28.34	3.54	5	50,000	24.00%	12,000	5	5,000	25,000	5	6%	2,791	558	14	22,209	1,586
I-5: San Joaquin	Rural	14.34	24.8	10.46	4	40,000	26.00%	10,400	5	4,000	20,000	5	6%	2,233	447	14	17,767	1,269
I-5: San Joaquin	Rural	12.69	14.34	1.65	6	63,000	26.00%	16,380	5	5,000	25,000	5	6%	3,517	703	14	34,483	2,463
I-5: San Joaquin	Rural	11.8	12.69	0.89	4	42,000	26.00%	10,920	5	4,200	21,000	6	8%	3,430	572	13	17,570	1,352
I-5: San Joaquin	Rural	0	11.8	11.8	3	10,000	26.00%	2,600	3	1,000	3,000	5	8%	803	161	16	6,197	387
I-5: Stanislaus	Rural	0	28.06	28.06	3	10,000	28.00%	2,800	4	1,000	4,000	6	16%	1,557	259	14	4,443	317
I-5: Merced	Rural	0	32.45	32.45	3	15,000	29.00%	4,350	4	1,500	6,000	6	16%	2,335	389	14	6,665	476
I-5: Fresno	Rural	0	66.16	66.16	3	15,000	30.00%	4,500	5	1,500	7,500	7	18%	2,708	387	12	4,792	399
I-5: Kings	Rural	0	26.72	26.72	3	15,000	30.00%	4,500	5	1,500	7,500	7	17%	2,597	371	12	4,903	409
I-5: Kern	Rural	15.86	87.03	71.17	3	17,000	29.00%	4,930	5	1,700	8,500	5	10%	1,728	346	14	6,772	484
I-5: Kern	Rural	15.08	15.86	0.78	5	30,000	28.00%	8,400	5	3,000	15,000	6	11%	3,284	547	13	11,716	901
I-5: Kern	Rural	10.35	15.08	4.73	5	30,000	28.00%	8,400	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Kern	Rural	9.28	10.35	1.07	5	30,000	28.00%	8,400	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Kern	Rural	7.04	9.28	2.24	5	30,000	30.00%	9,000	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Kern	Rural	6.41	7.04	0.63	5	30,000	28.00%	8,400	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Kern	Rural	5.36	6.41	1.05	5	30,000	28.00%	8,400	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Kern	Rural	0.58	5.36	4.78	5	30,000	28.00%	8,400	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Kern	Rural	0	0.58	0.58	5	30,000	28.00%	8,400	6	3,000	18,000	6	11%	3,284	547	12	8,716	726
I-5: Los Angeles	Rural	84.76	88.61	3.85	5	35,000	27.00%	9,450	6	3,500	21,000	6	10%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	78.43	84.76	6.33	5	35,000	27.00%	9,450	6	3,500	21,000	6	10%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	69.65	78.43	8.78	5	35,000	18.00%	6,300	6	3,500	21,000	7	10%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	68.1	69.65	1.55	5	35,000	19.00%	6,650	6	3,500	21,000	7	10%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	65.43	68.1	2.67	5	35,000	18.00%	6,300	6	3,500	21,000	7	10%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	59.95	65.43	5.48	5	35,000	18.00%	6,300	6	3,500	21,000	7	10%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	54.16	59.95	5.79	5	40,000	16.00%	6,400	5	4,000	20,000	5	6%	2,433	487	14	17,567	1,255
I-5: Los Angeles	Rural	52.33	54.16	1.83	5	65,000	10.00%	6,500	5	6,500	32,500	5	6%	3,953	791	14	28,547	2,039
I-5: Los Angeles	Urban	46.9	52.33	5.43	5	90,000	10.00%	9,000	6	8,600	51,600	5	6%	5,305	1,061	13	33,095	2,546
I-5: Los Angeles	Urban	46.6	46.9	0.3	5	92,000	9.00%	8,280	6	8,900	53,400	5	6%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.93	46.6	0.67	6	92,000	10.00%	9,200	6	8,900	53,400	5	6%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.1	45.93	0.83	6	100,000	9.00%	9,000	6	8,900	53,400	5	6%	5,895	1,179	13	40,705	3,131
I-5: Los Angeles	Urban	44.01	45.1	1.09	6	115,000	10.00%	11,500	6	9,100	54,600	5	6%	6,779	1,356	13	53,621	4,125
I-5: Los Angeles	Urban	43.9	44.01	0.11	5	115,000	8.00%	9,200	6	8,500	51,000	5	7%	7,618	1,524	13	56,382	4,337
I-5: Los Angeles	Urban	41.6	43.9	2.3	6	120,000	8.00%	9,600	6	9,500	57,000	5	7%	7,949	1,590	13	55,051	4,235
I-5: Los Angeles	Urban	40.27	41.6	1.33	4	117,000	9.00%	10,530	4	4,600	18,400	5	5%	5,710	1,142	15	92,890	6,193
I-5: Los Angeles	Urban	39.81	40.27	0.46	5	65,000	9.00%	5,850	4	4,800	19,200	5	5%	3,172	634	15	42,628	2,842
I-5: Los Angeles	Urban	39.36	39.81	0.45	6	70,000	8.00%	5,600	4	5,000	20,000	5	5%	3,416	683	15	46,584	3,106
I-5: Los Angeles	Urban	36.65	39.36	2.71	6	135,000	8.00%	10,800	5	10,200	51,000	5	4%	5,675	1,135	14	78,325	5,595
I-5: Los Angeles	Urban	36.43	36.65	0.22	7	140,000	8.00%	11,200	5	10,000	50,000	5	4%	5,885	1,177	14	84,115	6,008
I-5: Los Angeles	Urban	36.22	36.43	0.21	5	140,000	8.00%	11,200	5	9,600	48,000	5	4%	5,885	1,177	14	86,115	6,151
I-5: Los Angeles	Urban	35.94	36.22	0.28	5	90,000	8.00%	7,200	5	6,800	34,000	5	4%	3,783	757	14	52,217	3,730
I-5: Los Angeles	Urban	29.16	35.94	6.78	5	90,000	8.00%	7,200	5	7,200	36,000	5	4%	3,783	757	14	50,217	3,587
I-5: Los Angeles	Urban	28.25	29.16	0.91	5	102,000	8.00%	8,160	5	8,200	41,000	5	4%	4,288	858	14	56,712	4,051
I-5: Los Angeles	Urban	22.78	28.25	5.47	6	130,000	7.00%	9,100	5	9,500	47,500	5	4%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	22.28	22.78	0.5	5	130,000	7.00%	9,100	5	9,500	47,500	5	4%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	21.41	22.28	0.87	6	138,000	8.00%	11,040	8	9,900	79,200	5	4%	6,184	1,237	11	52,616	4,783
I-5: Los Angeles	Urban	20.58	21.41	0.83	5	140,000	8.00%	11,200	8	9,600	76,800	5	4%	6,273	1,255	11	56,927	5,175
I-5: Los Angeles	Urban	17.21	20.58	3.37	5	120,000	8.00%	9,600	8	8,000	64,000	5	4%	5,377	1,075	11	50,623	4,602
I-5: Los Angeles	Urban	16.9	17.21	0.31	5	120,000	8.00%	9,600	6	7,900	47,400	5	3%	3,350	670	13	69,250	5,327
I-5: Los Angeles	Urban	14.16	16.9	2.74	5	130,000	8.00%	10,400	6	8,000	48,000	5	3%	3,629	726	13	78,371	6,029
I-5: Los Angeles	Urban	13.78	14.16	0.38	5	128,000	8.00%	10,240	6	8,400	50,400	5	3%	3,574	715	13	74,026	5,694
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	5	110,000	15.00%	16,500	8	8,000	64,000	5	4%	4,929	986	11	41,071	3,734
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	5	88,000	14.00%	12,320	8	7,500	60,000	5	4%	3,943	789	11	24,057	2,187
CA 710: LA	Suburban	4.96	10.18	5.22	4	70,000	15.00%	10,500	8	6,000	48,000	5	4%	3,137	627	11	18,863	1,715

TABLE M2b. SECTION FLOW AND SPEED DATA - CONVENTIONAL LANES WITH ADDED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane (pcphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)		Nighttime Off-Peak Speed (mph)		Daytime Off-Peak Period Speed (mph)	
		Begin	End	Length (mi)							Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	1,167	1,307	192	208	438	473	50	65	50	65	50	65
I-5: Sacramento	Urban	26.94	29.87	2.93	1,225	1,315	157	166	332	350	50	55	50	55	50	55
I-5: Sacramento	Urban	26.69	26.94	0.25	1,225	1,299	157	164	332	347	50	55	50	55	50	55
I-5: Sacramento	Urban	25.53	26.69	1.16	1,625	1,766	177	189	739	787	50	55	50	55	50	55
I-5: Sacramento	Urban	24.51	25.53	1.02	1,460	1,542	145	151	635	664	50	55	50	55	50	55
I-5: Sacramento	Urban	23.1	24.51	1.41	1,183	1,254	127	133	610	640	50	55	50	55	50	55
I-5: Sacramento	Urban	22	23.1	1.1	1,750	1,878	198	209	840	887	50	55	50	55	50	55
I-5: Sacramento	Urban	19.16	22	2.84	1,200	1,305	129	138	585	626	50	55	50	55	50	55
I-5: Sacramento	Urban	18.82	19.16	0.34	900	976	100	107	487	521	50	55	50	55	50	55
I-5: Sacramento	Urban	16.7	18.82	2.12	1,000	1,088	99	106	435	465	50	55	50	55	50	55
I-5: Sacramento	Urban	14.46	16.7	2.24	1,000	1,093	106	113	435	465	50	55	50	55	50	55
I-5: Sacramento	Rural	0	14.46	14.46	1,000	1,188	261	293	509	572	50	65	50	65	50	65
I-5: San Joaquin	Rural	40.45	49.79	9.34	767	905	181	203	358	402	50	65	50	65	50	65
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,000	1,153	108	120	328	366	50	65	50	65	50	65
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,125	1,305	121	135	369	414	50	55	50	55	50	55
I-5: San Joaquin	Urban	24.8	28.34	3.54	1,000	1,150	140	156	317	355	50	55	50	55	50	55
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,000	1,173	149	168	317	359	50	65	50	65	50	65
I-5: San Joaquin	Rural	12.69	14.34	1.65	833	963	141	159	411	464	50	65	50	65	50	65
I-5: San Joaquin	Rural	11.8	12.69	0.89	1,050	1,232	191	215	338	382	50	65	50	65	50	65
I-5: San Joaquin	Rural	0	11.8	11.8	333	398	80	91	129	146	50	65	50	65	50	65
I-5: Stanislaus	Rural	0	28.06	28.06	333	403	130	148	106	121	50	65	50	65	50	65
I-5: Merced	Rural	0	32.45	32.45	500	609	195	223	159	182	50	65	50	65	50	65
I-5: Fresno	Rural	0	66.16	66.16	500	613	193	222	133	153	50	65	50	65	50	65
I-5: Kings	Rural	0	26.72	26.72	500	613	186	213	136	157	50	65	50	65	50	65
I-5: Kern	Rural	15.86	87.03	71.17	567	690	173	198	161	185	50	65	50	65	50	65
I-5: Kern	Rural	15.08	15.86	0.78	600	705	137	156	180	205	50	65	50	65	50	65
I-5: Kern	Rural	10.35	15.08	4.73	600	705	137	156	145	166	50	65	50	65	50	65
I-5: Kern	Rural	9.28	10.35	1.07	600	705	137	156	145	166	50	65	50	65	50	65
I-5: Kern	Rural	7.04	9.28	2.24	600	713	137	157	145	167	50	65	50	65	50	65
I-5: Kern	Rural	6.41	7.04	0.63	600	705	137	156	145	166	50	65	50	65	50	65
I-5: Kern	Rural	5.36	6.41	1.05	600	705	137	156	145	166	50	65	50	65	50	65
I-5: Kern	Rural	0.58	5.36	4.78	600	705	137	156	145	166	50	65	50	65	50	65
I-5: Kern	Rural	0	0.58	0.58	600	705	137	156	145	166	50	65	50	65	50	65
I-5: Los Angeles	Rural	84.76	88.61	3.85	700	818	148	168	174	198	50	65	50	65	50	65
I-5: Los Angeles	Rural	78.43	84.76	6.33	700	818	148	168	174	198	50	65	50	65	50	65
I-5: Los Angeles	Rural	69.65	78.43	8.78	700	779	127	138	190	207	50	65	50	65	50	65
I-5: Los Angeles	Rural	68.1	69.65	1.55	700	783	127	139	190	208	50	65	50	65	50	65
I-5: Los Angeles	Rural	65.43	68.1	2.67	700	779	127	138	190	207	50	65	50	65	50	65
I-5: Los Angeles	Rural	59.95	65.43	5.48	700	779	127	138	190	207	50	65	50	65	50	65
I-5: Los Angeles	Rural	54.16	59.95	5.79	800	880	122	131	251	271	50	65	50	65	50	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	1,300	1,381	198	208	408	428	50	65	50	65	50	65
I-5: Los Angeles	Urban	46.9	52.33	5.43	1,720	1,828	265	279	509	535	50	55	50	55	50	55
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,780	1,880	271	283	510	533	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,483	1,572	217	228	425	447	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,483	1,563	236	246	522	545	50	55	50	55	50	55
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,517	1,608	271	285	687	722	50	55	50	55	50	55
I-5: Los Angeles	Urban	43.9	44.01	0.11	1,700	1,785	381	396	867	902	50	55	50	55	50	55
I-5: Los Angeles	Urban	41.6	43.9	2.3	1,583	1,659	318	331	706	734	50	55	50	55	50	55
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,150	1,219	381	398	1,548	1,618	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.81	40.27	0.46	960	1,014	159	166	568	594	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.36	39.81	0.45	833	873	137	142	518	538	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.65	39.36	2.71	1,700	1,782	227	236	932	970	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.43	36.65	0.22	1,429	1,495	196	204	858	893	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.22	36.43	0.21	1,920	2,016	294	306	1,230	1,279	50	53	50	55	50	55
I-5: Los Angeles	Urban	35.94	36.22	0.28	1,360	1,428	189	197	746	776	50	55	50	55	50	55
I-5: Los Angeles	Urban	29.16	35.94	6.78	1,440	1,512	189	197	717	746	50	55	50	55	50	55
I-5: Los Angeles	Urban	28.25	29.16	0.91	1,640	1,722	214	223	810	843	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.78	28.25	5.47	1,583	1,650	219	226	917	949	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,900	1,983	273	283	1,101	1,139	50	55	50	55	50	55
I-5: Los Angeles	Urban	21.41	22.28	0.87	1,650	1,729	247	257	797	829	50	55	50	55	50	55
I-5: Los Angeles	Urban	20.58	21.41	0.83	1,920	2,016	314	326	1,035	1,076	50	53	50	55	50	55
I-5: Los Angeles	Urban	17.21	20.58	3.37	1,600	1,680	269	280	920	957	50	55	50	55	50	55
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,580	1,659	168	174	1,065	1,108	50	55	50	55	50	55
I-5: Los Angeles	Urban	14.16	16.9	2.74	1,600	1,680	181	189	1,206	1,254	50	55	50	55	50	55
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,680	1,764	179	186	1,139	1,184	50	55	50	55	50	55
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,600	1,750	246	265	747	803	50	65	50	55	50	65
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1,500	1,631	197	211	437	468	50	65	50	55	50	65
CA 710: LA	Suburban	4.96	10.18	5.22	1,500	1,650	209	225	429	461	50	65	50	55	50	65

TABLE M2c. SECTION TRAVEL DATA - CONVENTIONAL LANES WITH ADDED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,297.2	29.4	118.8	261.2	1,054.9	16,061	84,319	1,471	7,722	13,060	68,567
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	9,476	76,666	759	6,143	5,558	44,968
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	662	6,689	53	536	388	3,923
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	357.8	9.6	58.5	133.6	813.1	2,941	19,679	481	3,219	6,682	44,718
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	2,010	20,328	319	3,225	4,372	44,206
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	3,003	27,030	537	4,833	7,740	69,658
I-5: Sacramento	Urban	22	23.1	1.1	50.8	373.8	8.6	63.5	122.0	897.7	2,541	20,559	432	3,495	6,102	49,371
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	7,157	43,963	1,230	7,557	17,457	107,236
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	771	4,737	143	877	2,085	12,807
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	4,452	27,348	706	4,339	9,682	59,473
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	3,763	23,117	597	3,668	8,184	50,271
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,501.6	414.8	957.3	1,103.5	2,546.5	32,535	97,605	20,742	62,226	55,173	165,519
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	20,623	65,305	6,489	20,547	28,929	91,607
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	54,694	183,106	4,410	14,763	50,284	168,343
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	68.4	1.9	5.5	21.8	62.9	1,188	3,762	96	303	1,092	3,459
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	21,240	67,260	2,371	7,510	18,869	59,750
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	54,392	154,808	6,073	17,284	48,319	137,524
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	10,725	30,525	1,509	4,294	14,793	42,104
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	4,859	13,831	794	2,259	4,066	11,572
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	9,204	26,196	2,464	7,013	19,012	54,111
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	31,427	80,813	12,231	31,450	34,910	89,769
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	56,463	138,237	21,974	53,798	62,721	153,558
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	148,860	347,340	53,743	125,401	95,117	221,939
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	60,120	140,280	20,821	48,583	39,299	91,697
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	175,434	429,511	35,667	87,323	139,767	342,188
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	3,276	8,424	717	1,845	2,559	6,579
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	23,839	61,301	4,350	11,185	11,543	29,682
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	5,393	13,867	984	2,530	2,611	6,714
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	12,096	28,224	2,207	5,150	5,857	13,666
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	3,175	8,165	579	1,490	1,537	3,953
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	5,292	13,608	966	2,483	2,562	6,589
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	24,091	61,949	4,396	11,304	11,665	29,996
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	2,923	7,517	533	1,372	1,415	3,640
I-5: Los Angeles	Rural	84.76	88.61	3.85	436.6	908.0	73.8	153.5	217.2	451.8	21,830	59,020	3,691	9,978	10,862	29,369
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	35,891	97,039	6,068	16,405	17,860	48,287
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	33,188	151,192	5,611	25,560	16,515	75,234
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	6,185	26,366	1,046	4,457	3,077	13,120
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	10,093	45,977	1,706	7,773	5,022	22,879
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	20,714	94,366	3,502	15,953	10,308	46,957
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	18,528	97,272	2,254	11,832	16,274	85,440
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	5,948	53,528	723	6,511	5,224	47,016
I-5: Los Angeles	Urban	46.9	52.33	5.43	560.4	4,584.9	57.6	471.4	359.4	2,940.6	28,019	252,169	2,881	25,927	17,970	161,734
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	265.1	2.9	26.9	17.9	164.7	1,442	14,578	146	1,481	896	9,057
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	3,578	32,200	363	3,270	2,223	20,006
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	3,989	40,333	440	4,452	3,041	30,745
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	5,951	53,563	739	6,650	5,845	52,602
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	93.8	1.3	14.0	9.9	103.7	449	5,161	67	771	496	5,706
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	10,488	120,612	1,463	16,821	10,129	116,487
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,044.1	2,202	22,270	683	6,910	11,119	112,425
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	795	8,037	131	1,328	1,765	17,844
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	720	8,280	123	1,414	1,677	19,286
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,311.9	24.6	257.3	339.6	3,550.5	11,057	127,153	1,230	14,149	16,981	195,280
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	880	10,120	104	1,191	1,480	17,025
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	175.0	2.0	20.7	28.9	302.5	806	9,274	99	1,137	1,447	16,637
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	762	8,758	85	975	1,170	13,451
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	19,526	224,554	2,052	23,599	27,238	313,231
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	624.1	6.2	65.3	82.6	863.3	2,985	34,325	312	3,590	4,129	47,479
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	18,188	241,637	2,092	27,800	29,497	391,886
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	401.6	3.8	46.2	53.9	651.3	1,663	22,088	191	2,541	2,696	35,821
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,152.6	8.6	90.0	73.2	765.7	5,512	63,392	430	4,949	3,662	42,114
I-5: Los Angeles	Urban	20.58	21.41	0.83	102.0	1,106.5	8.3	87.1	75.6	790.3	5,100	58,644	417	4,790	3,780	43,469
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,607.7	29.0	303.1	273.0	2,853.7	17,254	198,426	1,450	16,671	13,648	156,951
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	245.8	1.7	17.4	34.3	359.1	1,176	13,518	83	956	1,717	19,750
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,200.0	15.9	166.3	343.6	3,591.9	10,522	120,998	796	9,149	17,179	197,556
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	320.4	2.2	22.7	45.0	470.5	1,532	17,620	109	1,249	2,250	25,880
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	8,628.7	152.5	785.4	1,270.3	5,537.3	98,976	560,864	7,623	43,196	63,516	359,925
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,214.8	30.8	172.0	187.9	888.0	23,436	143,964	1,540	9,461	9,397	57,722
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,276.6	49.1	253.0	295.4	1,287.6	37,584	212,976	2,456	13,917	14,770	83,697
TOTAL					**25,633.1**	**91,721.3**	**5,271.0**	**14,861.6**	**21,765.4**	**87,633.6**	**1,281,653**	**5,586,341**	**263,550**	**912,542**	**1,088,269**	**5,221,226**

TABLE M2d. VEHICLE OPERATING COSTS - CONVENTIONAL LANES WITH ADDED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Los Angeles	Rural	84.76	88.61	3.85	21,830	59,020	3,691	9,978	10,862	29,369	38,551	19,182	6,517	3,243	19,183	9,545
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,948	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Los Angeles	Urban	46.9	52.33	5.43	28,019	252,169	2,881	25,927	17,970	161,734	49,482	81,955	5,087	8,426	31,736	52,564
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,100	58,644	417	4,790	3,780	43,469	9,006	19,059	736	1,557	6,675	14,127
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
TOTAL					**1,281,653**	**5,586,341**	**263,550**	**912,542**	**1,088,269**	**5,221,226**	**2,263,413**	**1,815,561**	**465,431**	**296,576**	**1,921,894**	**1,696,898**

TABLE M2e. TRAVEL TIME COST - CONVENTIONAL LANES WITH ADDED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,297.2	29.4	118.8	261.2	1,054.9	9,082	11,877	832	1,088	7,386	9,658
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	357.8	9.6	58.5	133.6	813.1	1,663	3,276	272	536	3,779	7,444
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: Sacramento	Urban	22	23.1	1.1	50.8	373.8	8.6	63.5	122.0	897.7	1,437	3,422	244	582	3,451	8,218
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,501.6	414.8	957.3	1,103.5	2,546.5	18,398	13,748	11,729	8,765	31,200	23,314
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	68.4	1.9	5.5	21.8	62.9	672	626	54	50	618	576
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Los Angeles	Rural	84.76	88.61	3.85	436.6	908.0	73.8	153.5	217.2	451.8	12,344	8,313	2,087	1,405	6,143	4,137
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Los Angeles	Urban	46.9	52.33	5.43	560.4	4,584.9	57.6	471.4	359.4	2,940.6	15,844	41,977	1,629	4,316	10,162	26,923
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	265.1	2.9	26.9	17.9	164.7	815	2,427	83	246	507	1,508
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	93.8	1.3	14.0	9.9	103.7	254	859	38	128	281	950
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	5,931	20,078	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,044.1	1,245	3,707	386	1,150	6,288	18,715
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,311.9	24.6	257.3	339.6	3,550.5	6,252	21,166	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	175.0	2.0	20.7	28.9	302.5	456	1,602	56	189	818	2,770
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	624.1	6.2	65.3	82.6	863.3	1,688	5,714	177	598	2,335	7,904
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	401.6	3.8	46.2	53.9	651.3	940	3,677	108	423	1,525	5,963
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,152.6	8.6	90.0	73.2	765.7	3,117	10,552	243	824	2,071	7,010
I-5: Los Angeles	Urban	20.58	21.41	0.83	102.0	1,106.5	8.3	87.1	75.6	790.3	2,884	10,131	236	797	2,138	7,236
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,607.7	29.0	303.1	273.0	2,853.7	9,757	33,031	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	245.8	1.7	17.4	34.3	359.1	665	2,250	47	159	971	3,288
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,200.0	15.9	166.3	343.6	3,591.9	5,950	20,142	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	320.4	2.2	22.7	45.0	470.5	866	2,933	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	8,628.7	152.5	785.4	1,270.3	5,537.3	55,970	79,000	4,311	7,191	35,918	50,697
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,214.8	30.8	172.0	187.9	888.0	13,253	20,278	871	1,575	5,314	8,130
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,276.6	49.1	253.0	295.4	1,287.6	21,253	29,999	1,389	2,317	8,352	11,789
TOTAL					**25,633.1**	**91,721.3**	**5,271.0**	**14,861.6**	**21,765.4**	**87,633.6**	**724,759**	**839,757**	**149,034**	**136,066**	**615,403**	**802,331**

TABLE M3. SUMMARY OF DAILY VEHICLE MILES FOR ADDED-CONVENTIONAL-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	1,281,653	5,586,341
	Nighttime Off-Peak	263,550	912,542
	Daytime Off-Peak	1,088,269	5,221,226
TOTAL		**2,633,471**	**11,720,109**
Conventional Lanes including added lane	Peak Period	1,281,653	5,586,341
	Nighttime Off-Peak	263,550	912,542
	Daytime Off-Peak	1,088,269	5,221,226
TOTAL		**2,633,471**	**11,720,109**

TABLE M4. SUMMARY OF DAILY VEHICLE HOURS FOR ADDED-CONVENTIONAL-LANE CONFIGURATION AT BASE VOLUMES

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	25,633	95,243
	Nighttime Off-Peak	5,271	14,675
	Daytime Off-Peak	21,765	87,711
TOTAL		**52,669**	**197,630**
Conventional Lanes including added lane	Peak Period	25,633	91,721
	Nighttime Off-Peak	5,271	14,862
	Daytime Off-Peak	21,765	87,634
TOTAL		**52,669**	**194,217**

TABLE M5. NON-AUTOMATED TRUCK VEHICLE OPERATIONS COSTS PER MILE

Cost Category	Non-Automated	
	Unit Cost (1998 $ per mile)	2001-Equiv. Unit Cost ($ per mile)
Driver Wages & Benefits	0.39	0.41
Other Wages and Benefits	0.40	0.42
Tires	0.02	0.02
Outside Maintenance	0.05	0.05
Fuel	0.10	0.11
Equipment Rents and Purchased Transportation	0.40	0.42
Insurance	0.05	0.05
Depreciation	0.09	0.09
Misc.	0.18	0.19
TOTAL	1.68	1.77

TABLE M6. VEHICLE OPERATING COSTS (ADDED-CONVENTIONAL-LANE CONFIGURATION AND BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Miles		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	2,633,471	11,720,109	1.77	0.325	4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488
Conventional Lanes including added lane	2,633,471	11,720,109	1.77	0.325	4,650,739	3,809,035	1,697,519,582	1,390,297,906	3,087,817,488

TABLE M7. TRAVEL TIME COSTS (ADDED-CONVENTIONAL-LANE CONFIGURATION AND BASE VOLUME/CONDITION CONFIGURATION)

Condition	Daily Vehicle-Hours		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	52,669	197,630	28.27	9.16	1,489,196	1,809,401	543,556,672	660,431,429	1,203,988,101
Conventional Lanes including added lane	52,669	194,217	28.27	9.16	1,489,196	1,778,154	543,556,672	649,026,049	1,192,582,721

APPENDIX N

OVERVIEW OF TRANSFER TERMINAL DESIGN AND OPERATION

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Introduction

The information in this appendix was authored by Professor Randolph Hall of the University of Southern California.

OVERVIEW OF TRANSFER TERMINAL

The transfer terminal is designed to enable trailers to move between automated lanes and the manual roadway system. The underlying concept is that shuttle drivers transfer trailers to and from automated highway entrances/exits over relatively short distances. Automated lanes are used to move trailers over longer distances, between cities.

The tractors driven by shuttle drivers do not need to be automated. Thus, the number of tractors that need to be equipped for automation is limited to those traveling within and between terminals. However, a trucking fleet may elect to purchase automated tractors for their shuttle drivers, which can simplify the transfer process to some degree. However, an operational drawback can be increased waiting time for drivers at terminals, as they may not have the option of returning empty.

The following sections describe the processes followed by tractors as trailers are transferred, terminal functions and driver functions. Conceptual diagrams are also provided for the transfer terminal

Processes for Moving Trailers To, From and Within Transfer Terminal

Process Steps: Shuttle Driver

Check-in	RFID verifies vehicle arrival, checks DB for authorization. Instruction sent to driver on drop-off location if applicable. Instruction sent to driver on pick-up location, if applicable.
Drop-off	Driver positions trailer(s) in specified drop-off location. Tractor is detached from trailer and leaves
Pick-up	If applicable, driver is routed to storage location in yard for trailer(s) pick-up. Tractor is attached to trailer(s) and leaves pick-up area. In some cases driver is first sent to tractor storage area to await arrival of inbound trailer(s).
Check-out	RFID verifies that tractor is authorized to remove trailers. Departure is recorded in DB, and driver leaves terminal.

Process Steps: Yard Driver Inbound

Assignment	Driver is assigned task of retrieving specified automated tractor/trailer combination from inbound area, and transferring trailer(s) to specified storage location(s) to await pick-up. Assignment is made via hand-held RF device.
Positioning	Driver walks to tractor/trailer(s), then drives tractor/trailer(s) to storage location(s), and detaches trailer(s). Driver is then assigned to retrieve an outbound trailer, to drive to tractor storage area and wait, or to drive to tractor storage area and walk to next assignment.

Process Steps: Yard Driver Outbound Trailers

Assignment	Driver is assigned task of attaching retrieving trailer(s) from drop-off area to a specified tractor, and to position tractor/trailer combination for departure. Assignment is made via hand-held RF device.
Positioning	Driver retrieves specified tractor (may already be in tractor at time of assignment) then drives to trailer(s) location. Trailer(s) attached to tractor, then drives trailer/tractor combination to departure lane. Driver steps out of vehicle, then checks hand-held device for next assignment, which may be to retrieve an inbound trailer/tractor, to walk to driver waiting area, or to walk to tractor storage area.

Process Steps: Linehaul Driver

Check-in	RFID verifies platoon arrival, checks DB for authorization. Driver readiness to assume manual control is verified, and control is transferred to driver. Driver is instructed to park platoon in specified location within inbound area.
Drop-off	Driver steps out of vehicle, and walks to driver waiting area for break. After break, driver checks hand-held RF device for next assignment, which could be immediate. Otherwise driver waits to be alerted for next assignment

Pick-up	Upon assignment, driver walks to lead vehicle in platoon and verifies operability of vehicle. Vehicle next verifies that driver is authorized to drive platoon, and verifies driver readiness. Driver engages vehicle and drives platoon to check-out area.
Check-out	Vehicle is checked to verify that it is authorized and ready to enter automated highway, and that automated highway has suitable gap to accept platoon. Upon authorization, automation is engaged, and platoon enters highway.

Process Steps: Same Tractor for Shuttle and Linehaul

Check-in	RFID verifies vehicle arrival, checks DB for authorization. Instruction sent to driver on drop-off location within outbound area.
Pickup:	If shuttle driver will also be platoon driver, driver remains in tractor and awaits platoon departure. Otherwise driver exits vehicle, and receives instruction to either: (a) wait for inbound arrival, or (b) walk to storage area to retrieve tractor/trailer combination for return.
Check-out	RFID verifies that tractor and trailers are authorized for departure.

TERMINAL FUNCTIONS

Manual Check-In: Verify that manual vehicles are authorized for entering terminal, and communicate instructions to drivers.

Drop-off: Detach trailers from manual tractors to await transfer to automated tractors.

Trailer Storage: Store inbound trailers from automated highway to await pick-up by shuttle drivers using manually operated tractors.

Manual Check-Out: Verify that shuttle driver is authorized to remove trailers.

Outbound: Combine tractor/trailer combinations into platoons, and prepare for entry to automated highway.

Inbound: Separate tractor/trailer combinations from platoons, and prepare for trailer storage.

Tractor Storage: Provide a buffer for storage of tractors. When inbound volume exceeds outbound volume, tractors will accumulate in buffer, and some drivers will drop off tractors and walk back to inbound area to retrieve trailers. When outbound volume exceeds inbound volume, number of tractors will decline in buffer, and some drivers will walk from outbound area to tractor storage to retrieve tractors for outbound platoons. When total volume is light, some drivers will wait in tractor storage area for next assignment.

Driver Waiting: Break area for drivers, elevated above the inbound and outbound areas. Some drivers will wait for assignment during periods of light volume.

Automated Check-Out: Verification the driver and platoon are ready to enter automated highway.

Automated Check-Out: Verification that driver and platoon are ready to assume manual control.

DRIVER FUNCTIONS

Shuttle Driver: Manually operates tractors within metropolitan areas, to pick-up and deliver trailers to/from transfer terminal. Round-trip journeys would vary from about 30 minutes to 4 hours.

Yard Driver: Transfers trailers and automated tractors within terminal, while driving tractors in automated mode.

Linehaul Driver: Operates lead tractor in platoon while on automated highway, and while entering and exiting automated highway.

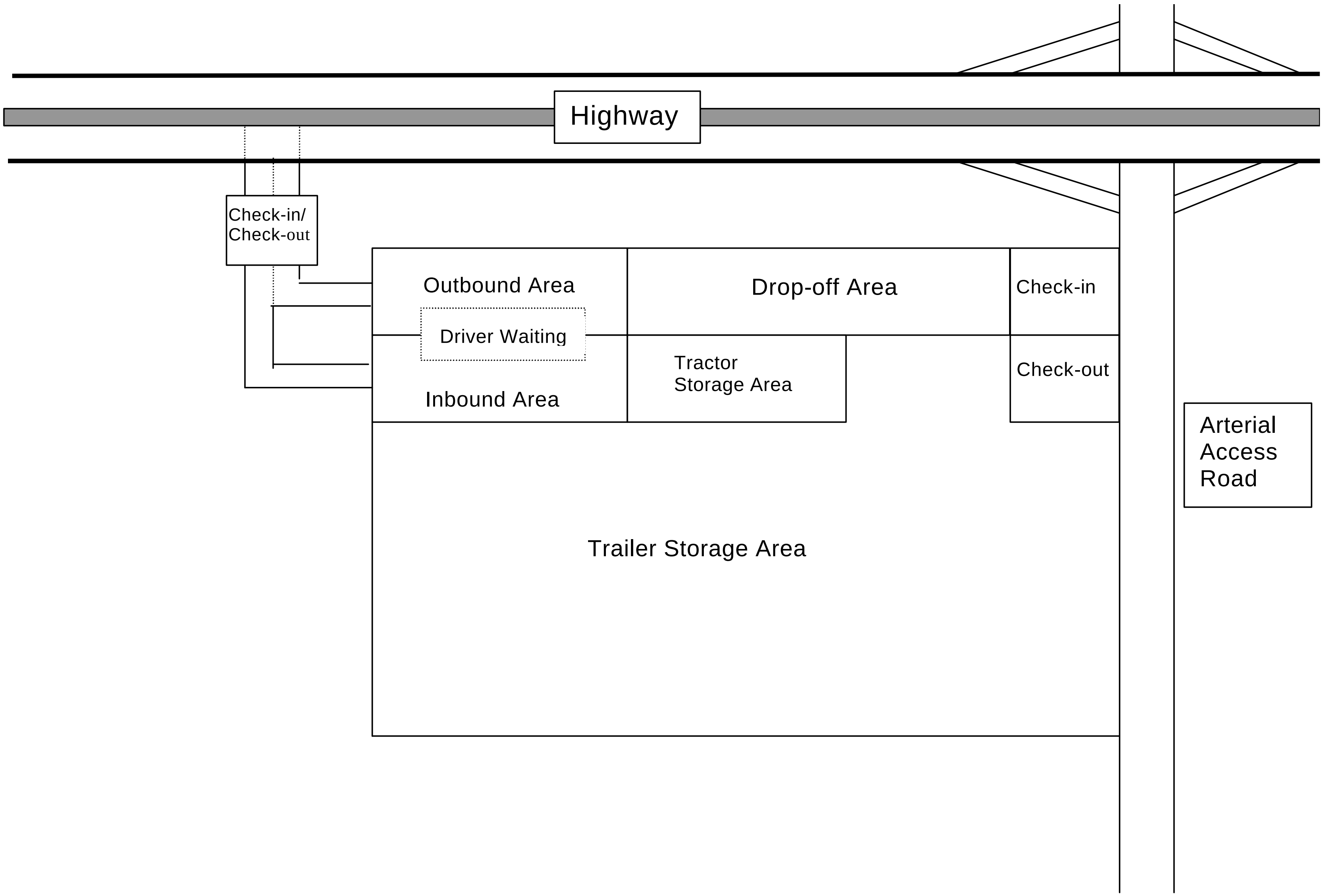

Figure 1. Conceptual Layout for Transfer Terminal

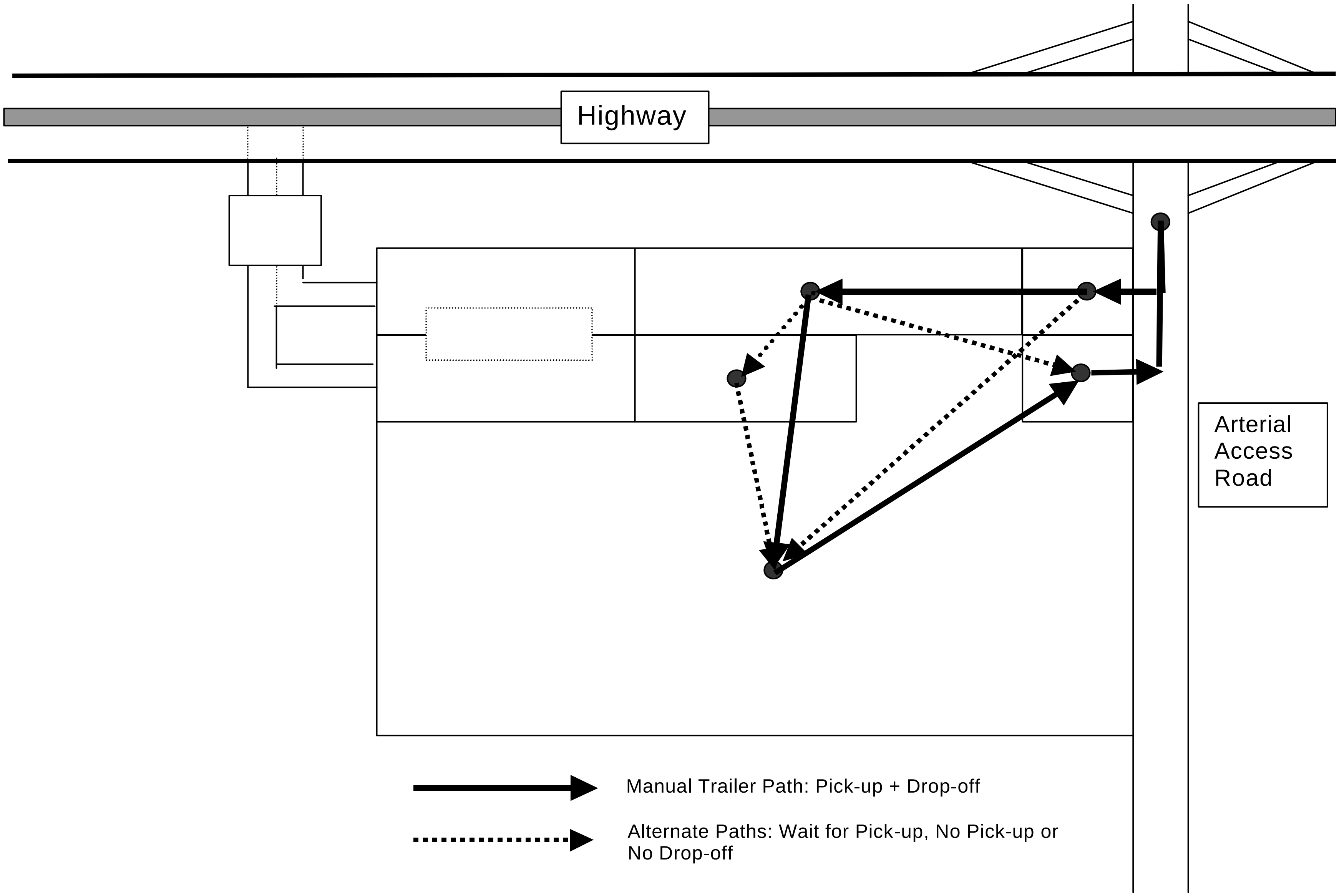

Figure 2. Paths Followed by Manual Tractors

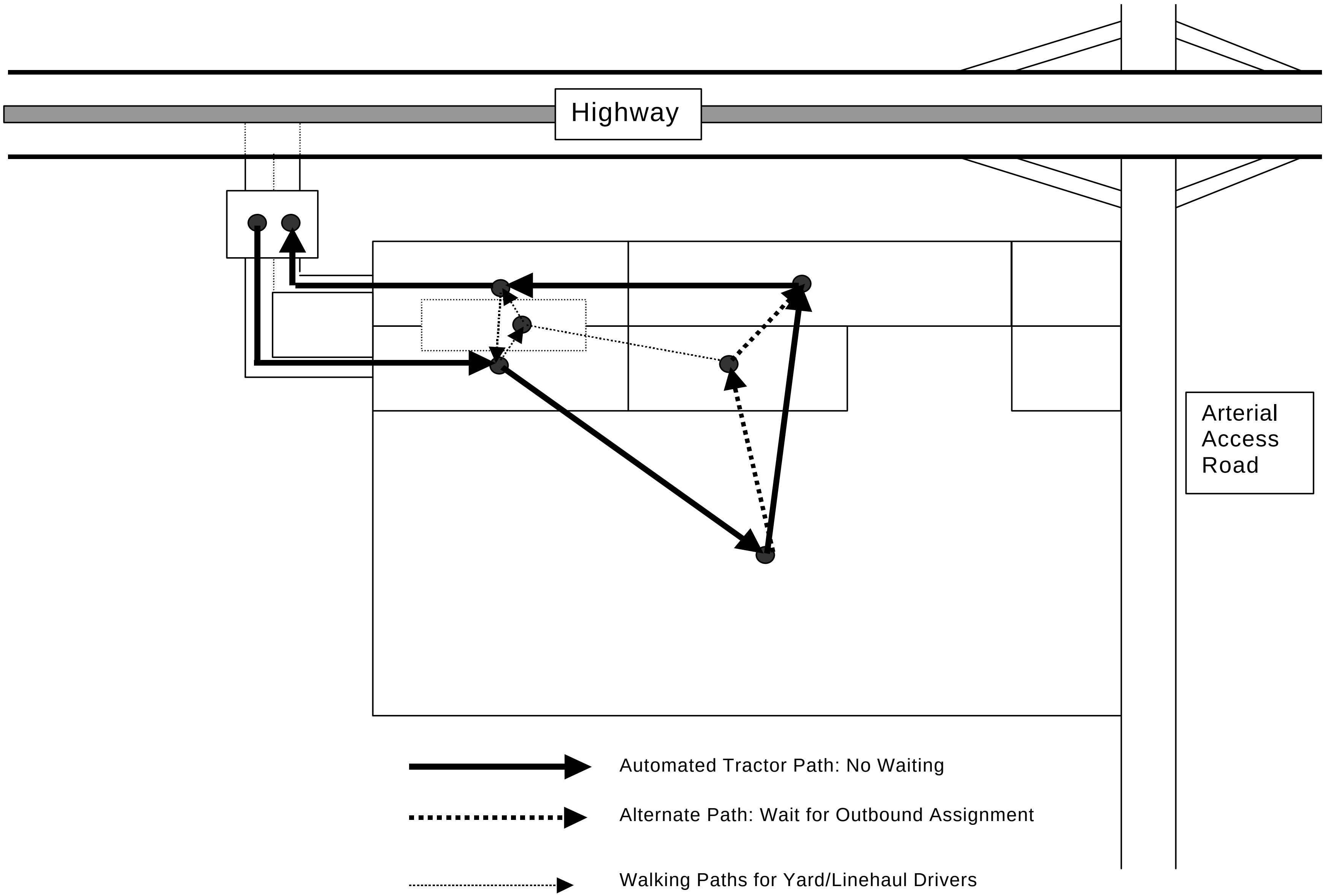

Figure 3. Paths Followed by Automated Tractors

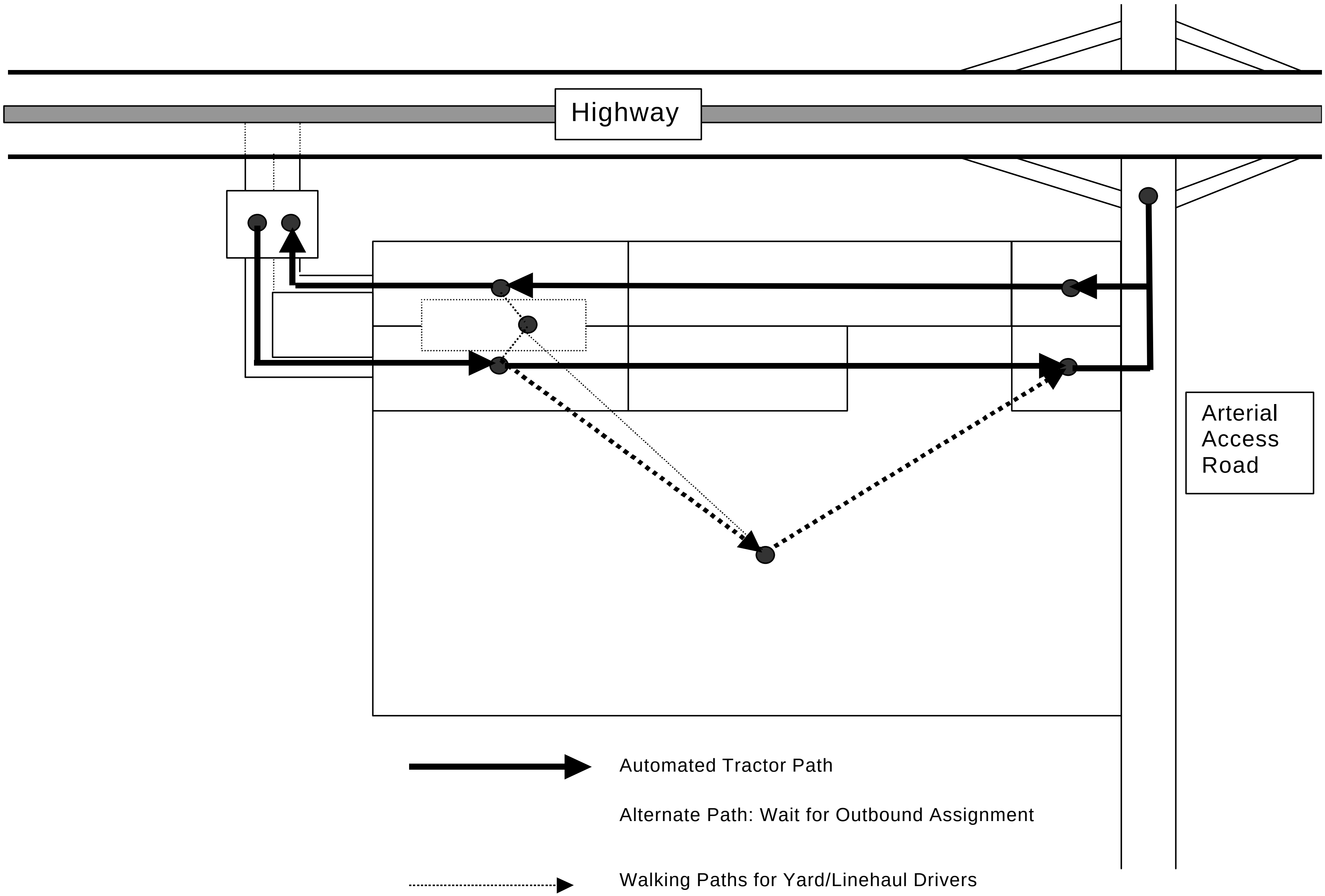

Figure 4. Vehicle Path When Shuttle Tractor is Capable of Automation

APPENDIX O

AHS PLANNING, DESIGN, CONSTRUCTION, REHABILITATION, AND MAINTENANCE COSTS

Methodologies

Costs for incremental planning, design, construction, and rehabilitation of the added AHS lane (having a 48-foot cross section) to the existing freeway configuration were calculated on a segment-by-segment basis, in a similar fashion to those for the added conventional freeway lane. The incremental cost is the cost of building and maintaining the AHS above the no-build option.

The costs for the AHS transfer terminals were allocated to the physical sections with which they are associated geographically.

Calculation methodologies for the costs in the tables presented here are outlined in the main report.

Results

Table O1 shows costs associated with planning, design, and construction of the AHS roadway area, barriers, as well as the magnetic strips used for automation. Table O2 shows costs associated with rehabilitation of the AHS roadway area.

In addition, Table O3 (also Table 10.2 in the main report) shows costs for AHS interchange construction, and Table O4 (also Table 10.3 in the main report) shows transfer terminal construction costs. Rehabilitation costs for AHS interchanges and terminals are shown in Tables O5 and O6 (also Tables 10.4 and 10.5 in the main report), respectively. Table O7 (also Table 10.6 in the main report) summarizes maintenance costs for the travel lanes, interchanges, and staging areas.

TABLE O1. INCREMENTAL CONSTRUCTION COSTS OF AHS LANE FOR ROADWAY SPACE, MAGNETIC STRIPS AND BARRIERS

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AHS Lane Placement	New Freeway Costs ($)			Magnetic Strip Costs ($)			Barrier Costs ($)				Total Construction Costs ($)	
		Begin	End	Length (mi)			2001-Unit Cost	Total Cost	EUAC	2001-Unit Cost per Lane Mile	Total Cost	EUAC	# of Barriers in One Direction	2001-Unit Cost per Lane-Mile	Total Cost	EUAC	Total Cost	EUATC
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	4,181,019	19,985,272	1,451,908	5,000	23,900	1,736	1.5	94,776	679,544	49,368	20,688,716	1,503,013
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	6,394,500	18,735,885	1,361,142	5,000	14,650	1,064	1.5	94,776	416,541	30,261	19,167,076	1,392,467
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Non-Median	23,979,375	5,994,844	435,519	5,000	1,250	91	2.0	94,776	47,388	3,443	6,043,482	439,052
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Non-Median	23,979,375	27,816,075	2,020,808	5,000	5,800	421	2.0	94,776	219,880	15,974	28,041,755	2,037,203
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Non-Median	23,979,375	24,458,963	1,776,917	5,000	5,100	371	2.0	94,776	193,343	14,046	24,657,406	1,791,334
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	23,979,375	33,810,919	2,456,326	5,000	7,050	512	2.0	94,776	267,268	19,417	34,085,237	2,476,255
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	23,979,375	26,377,313	1,916,283	5,000	5,500	400	2.0	94,776	208,507	15,148	26,591,320	1,931,830
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	23,979,375	68,101,425	4,947,494	5,000	14,200	1,032	2.0	94,776	538,328	39,109	68,653,953	4,987,635
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	23,979,375	8,152,988	592,306	5,000	1,700	124	2.0	94,776	64,448	4,682	8,219,135	597,111
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Non-Median	23,979,375	50,836,275	3,693,200	5,000	10,600	770	2.0	94,776	401,850	29,194	51,248,725	3,723,164
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	6,394,500	14,323,680	1,040,600	5,000	11,200	814	1.5	94,776	318,447	23,135	14,653,327	1,064,548
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	4,181,019	60,457,538	4,392,174	5,000	72,300	5,253	1.5	94,776	2,055,691	149,344	62,585,530	4,546,771
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	4,181,019	39,050,720	2,836,992	5,000	46,700	3,393	1.5	94,776	1,327,812	96,464	40,425,231	2,936,849
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	4,181,019	49,712,319	3,611,546	5,000	59,450	4,319	1.5	94,776	1,690,330	122,801	51,462,099	3,738,665
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Non-Median	6,968,365	1,533,040	111,374	5,000	1,100	80	2.0	94,776	41,701	3,030	1,575,842	114,483
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Non-Median	23,979,375	84,886,988	6,166,947	5,000	17,700	1,286	2.0	94,776	671,014	48,748	85,575,702	6,216,982
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	4,181,019	43,733,461	3,177,188	5,000	52,300	3,800	1.5	94,776	1,487,035	108,032	45,272,797	3,289,019
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	4,181,019	6,898,682	501,182	5,000	8,250	599	1.5	94,776	234,571	17,041	7,141,502	518,822
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	4,181,019	3,721,107	270,334	5,000	4,450	323	1.5	94,776	126,526	9,192	3,852,083	279,850
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	4,181,019	49,336,027	3,584,209	5,000	59,000	4,286	1.5	94,776	1,677,535	121,871	51,072,562	3,710,366
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	4,181,019	117,319,400	8,523,127	5,000	140,300	10,193	1.5	94,776	3,989,122	289,805	121,448,821	8,823,125
I-5: Merced	Rural	0	32.45	32.45	2	Median	4,181,019	135,674,074	9,856,574	5,000	162,250	11,787	1.5	94,776	4,613,222	335,146	140,449,546	10,203,507
I-5: Fresno	Rural	0	66.16	66.16	2	Median	4,181,019	276,616,232	20,095,868	5,000	330,800	24,032	1.5	94,776	9,405,570	683,304	286,352,603	20,803,205
I-5: Kings	Rural	0	26.72	26.72	2	Median	4,181,019	111,716,834	8,116,106	5,000	133,600	9,706	1.5	94,776	3,798,622	275,966	115,649,056	8,401,778
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	4,181,019	297,563,139	21,617,638	5,000	355,850	25,852	1.5	94,776	10,117,812	735,048	308,036,801	22,378,538
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	4,181,019	3,261,195	236,922	5,000	3,900	283	1.5	94,776	110,888	8,056	3,375,983	245,261
I-5: Kern	Rural	10.35	15.08	4.73	4	Non-Median	6,968,365	32,960,368	2,394,535	5,000	23,650	1,718	2.0	94,776	896,581	65,136	33,880,599	2,461,389
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	4,181,019	4,473,691	325,009	5,000	5,350	389	1.5	94,776	152,115	11,051	4,631,156	336,448
I-5: Kern	Rural	7.04	9.28	2.24	4	Non-Median	6,968,365	15,609,138	1,133,987	5,000	11,200	814	2.0	94,776	424,596	30,846	16,044,935	1,165,647
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	4,181,019	2,634,042	191,360	5,000	3,150	229	1.5	94,776	89,563	6,507	2,726,755	198,096
I-5: Kern	Rural	5.36	6.41	1.05	4	Non-Median	6,968,365	7,316,784	531,556	5,000	5,250	381	2.0	94,776	199,030	14,459	7,521,063	546,397
I-5: Kern	Rural	0.58	5.36	4.78	4	Non-Median	6,968,365	33,308,787	2,419,847	5,000	23,900	1,736	2.0	94,776	906,059	65,824	34,238,745	2,487,408
I-5: Kern	Rural	0	0.58	0.58	4	Non-Median	6,968,365	4,041,652	293,622	5,000	2,900	211	2.0	94,776	109,940	7,987	4,154,492	301,819
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	Non-Median	6,968,365	13,518,629	982,114	5,000	9,700	705	2.0	94,776	367,731	26,715	13,896,060	1,009,534
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	Non-Median	6,968,365	3,762,917	273,372	5,000	2,700	196	2.0	94,776	102,358	7,436	3,867,975	281,004
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	Non-Median	6,968,365	9,546,661	693,554	5,000	6,850	498	2.0	94,776	259,686	18,866	9,813,197	712,918
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	4,181,019	26,465,852	1,922,715	5,000	31,650	2,299	1.5	94,776	899,898	65,377	27,397,400	1,990,391
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Non-Median	6,968,365	61,182,248	4,444,824	5,000	43,900	3,189	2.0	94,776	1,664,267	120,907	62,890,415	4,568,920
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	4,181,019	6,480,580	470,807	5,000	7,750	563	1.5	94,776	220,354	16,008	6,708,684	487,379
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Non-Median	6,968,365	18,605,536	1,351,672	5,000	13,350	970	2.0	94,776	506,104	36,768	19,124,989	1,389,410
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	4,181,019	22,911,985	1,664,531	5,000	27,400	1,991	1.5	94,776	779,059	56,598	23,718,444	1,723,119
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Non-Median	6,968,365	40,346,836	2,931,154	5,000	28,950	2,103	2.0	94,776	1,097,506	79,733	41,473,292	3,012,989
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Non-Median	6,968,365	12,752,109	926,427	5,000	9,150	665	2.0	94,776	346,880	25,200	13,108,139	952,292
I-5: Los Angeles	Urban	47.13	52.33	5.2	4	Non-Median	23,979,375	124,692,750	9,058,793	5,000	26,000	1,889	2.0	94,776	985,670	71,608	125,704,420	9,132,289
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	Non-Median	23,979,375	5,515,256	400,677	5,000	1,150	84	2.0	94,776	43,597	3,167	5,560,003	403,928
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Non-Median	23,979,375	7,193,812	522,623	5,000	1,500	109	2.0	94,776	56,866	4,131	7,252,178	526,863
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Non-Median	23,979,375	16,066,181	1,167,191	5,000	3,350	243	2.0	94,776	127,000	9,226	16,196,531	1,176,660
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Non-Median	23,979,375	19,902,881	1,445,923	5,000	4,150	301	2.0	94,776	157,328	11,430	20,064,359	1,457,654
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Non-Median	23,979,375	26,137,519	1,898,862	5,000	5,450	396	2.0	94,776	206,612	15,010	26,349,580	1,914,268
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Non-Median	23,979,375	2,637,731	191,628	5,000	550	40	2.0	94,776	20,851	1,515	2,659,132	193,183
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	23,979,375	55,152,562	4,006,774	5,000	11,500	835	2.0	94,776	435,970	31,673	55,600,032	4,039,282
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	23,979,375	31,892,569	2,316,960	5,000	6,650	483	2.0	94,776	252,104	18,315	32,151,323	2,335,759
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	23,979,375	11,030,513	801,355	5,000	2,300	167	2.0	94,776	87,194	6,335	11,120,006	807,856
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	23,979,375	10,790,719	783,934	5,000	2,250	163	2.0	94,776	85,298	6,197	10,878,267	790,294
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	23,979,375	64,984,106	4,721,025	5,000	13,550	984	2.0	94,776	513,686	37,319	65,511,342	4,759,328
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	6,394,500	1,406,790	102,202	5,000	1,100	80	1.5	94,776	31,276	2,272	1,439,166	104,554
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	6,394,500	1,342,845	97,556	5,000	1,050	76	1.5	94,776	29,854	2,169	1,373,749	99,801
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	23,979,375	6,714,225	487,781	5,000	1,400	102	2.0	94,776	53,075	3,856	6,768,700	491,739
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	23,979,375	162,580,163	11,811,272	5,000	33,900	2,463	2.0	94,776	1,285,163	93,366	163,899,225	11,907,100
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	23,979,375	21,821,231	1,585,289	5,000	4,550	331	2.0	94,776	172,492	12,531	21,998,274	1,598,151
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	23,979,375	131,167,181	9,529,153	5,000	27,350	1,987	2.0	94,776	1,036,849	75,326	132,231,381	9,606,466
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	23,979,375	11,989,688	871,038	5,000	2,500	182	2.0	94,776	94,776	6,885	12,086,964	878,105
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	23,979,375	20,862,056	1,515,606	5,000	4,350	316	2.0	94,776	164,910	11,981	21,031,316	1,527,902
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	23,979,375	19,902,881	1,445,923	5,000	4,150	301	2.0	94,776	157,328	11,430	20,064,359	1,457,654
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	23,979,375	80,810,494	5,870,794	5,000	16,850	1,224	2.0	94,776	638,790	46,407	81,466,134	5,918,426
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	6,394,500	1,982,295	144,012	5,000	1,550	113	1.5	94,776	44,071	3,202	2,027,916	147,326
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	23,979,375	65,703,488	4,773,287	5,000	13,700	995	2.0	94,776	519,372	37,732	66,236,560	4,812,014
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	6,394,500	2,429,910	176,530	5,000	1,900	138	1.5	94,776	54,022	3,925	2,485,832	180,593
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	15,473,870	159,535,602	11,590,088	5,000	51,550	3,745	2.0	94,776	1,954,281	141,976	161,541,433	11,735,809
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	15,473,870	43,172,098	3,136,406	5,000	13,950	1,013	2.0	94,776	528,850	38,420	43,714,898	3,175,840
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	15,473,870	80,773,602	5,868,114	5,000	26,100	1,896	2.0	94,776	989,461	71,883	81,789,164	5,941,894
TOTAL								**3,084,183,353**	**224,062,563**		**2,090,050**	**151,840**			**64,451,471**	**4,682,329**	**3,150,724,874**	**228,896,732**

TABLE O2. INCREMENTAL REHABILITATION COSTS OF AHS LANE FOR ROADWAY SPACE

County	City/Suburban/Rural	Post Mile of Segment			AHS Lane Placement	Lane Rehabilitation Costs ($)			Magnetic Strips Rehabilitation Costs ($)			Total Rehabilitation Costs ($)	
		Begin	End	Length (mi)		2001-Unit Cost per Lane Mile	Total Cost	EUAC	Magnetic Strip Replacement Unit Cost per Lane Mile in One Direction	Total Cost of Magnetic Strip Placement per 10-Year Cycle	EUAC	Total Cost per Rehabilitation Cycle	EUATC
I-5: Sacramento	Rural	29.87	34.65	4.78	Median	181,178	866,028	54,749	5,000	23,900	1,511	889,928	56,260
I-5: Sacramento	Urban	26.94	29.87	2.93	Median	399,656	1,170,993	74,029	5,000	14,650	926	1,185,643	74,955
I-5: Sacramento	Urban	26.69	26.94	0.25	Non-Median	1,278,900	319,725	20,213	5,000	1,250	79	320,975	20,292
I-5: Sacramento	Urban	25.53	26.69	1.16	Non-Median	1,278,900	1,483,524	93,787	5,000	5,800	367	1,489,324	94,154
I-5: Sacramento	Urban	24.51	25.53	1.02	Non-Median	1,278,900	1,304,478	82,468	5,000	5,100	322	1,309,578	82,790
I-5: Sacramento	Urban	23.1	24.51	1.41	Non-Median	1,278,900	1,803,249	114,000	5,000	7,050	446	1,810,299	114,445
I-5: Sacramento	Urban	22	23.1	1.1	Non-Median	1,278,900	1,406,790	88,936	5,000	5,500	348	1,412,290	89,284
I-5: Sacramento	Urban	19.16	22	2.84	Non-Median	1,278,900	3,632,076	229,616	5,000	14,200	898	3,646,276	230,514
I-5: Sacramento	Urban	18.82	19.16	0.34	Non-Median	1,278,900	434,826	27,489	5,000	1,700	107	436,526	27,597
I-5: Sacramento	Urban	16.7	18.82	2.12	Non-Median	1,278,900	2,711,268	171,404	5,000	10,600	670	2,721,868	172,074
I-5: Sacramento	Urban	14.46	16.7	2.24	Median	399,656	895,230	56,596	5,000	11,200	708	906,430	57,304
I-5: Sacramento	Rural	0	14.46	14.46	Median	181,178	2,619,827	165,623	5,000	72,300	4,571	2,692,127	170,194
I-5: San Joaquin	Rural	40.45	49.79	9.34	Median	181,178	1,692,198	106,979	5,000	46,700	2,952	1,738,898	109,931
I-5: San Joaquin	Rural	28.56	40.45	11.89	Median	181,178	2,154,200	136,187	5,000	59,450	3,758	2,213,650	139,945
I-5: San Joaquin	Urban	28.34	28.56	0.22	Non-Median	1,278,900	281,358	17,787	5,000	1,100	70	282,458	17,857
I-5: San Joaquin	Urban	24.8	28.34	3.54	Non-Median	1,278,900	4,527,306	286,212	5,000	17,700	1,119	4,545,006	287,331
I-5: San Joaquin	Rural	14.34	24.8	10.46	Median	181,178	1,895,117	119,807	5,000	52,300	3,306	1,947,417	123,114
I-5: San Joaquin	Rural	12.69	14.34	1.65	Median	181,178	298,943	18,899	5,000	8,250	522	307,193	19,420
I-5: San Joaquin	Rural	11.8	12.69	0.89	Median	181,178	161,248	10,194	5,000	4,450	281	165,698	10,475
I-5: San Joaquin	Rural	0	11.8	11.8	Median	181,178	2,137,895	135,156	5,000	59,000	3,730	2,196,895	138,886
I-5: Stanislaus	Rural	0	28.06	28.06	Median	181,178	5,083,841	321,396	5,000	140,300	8,870	5,224,141	330,265
I-5: Merced	Rural	0	32.45	32.45	Median	181,178	5,879,210	371,678	5,000	162,250	10,257	6,041,460	381,935
I-5: Fresno	Rural	0	66.16	66.16	Median	181,178	11,986,703	757,788	5,000	330,800	20,913	12,317,503	778,701
I-5: Kings	Rural	0	26.72	26.72	Median	181,178	4,841,063	306,047	5,000	133,600	8,446	4,974,663	314,493
I-5: Kern	Rural	15.86	87.03	71.17	Median	181,178	12,894,403	815,172	5,000	355,850	22,496	13,250,253	837,668
I-5: Kern	Rural	15.08	15.86	0.78	Median	181,178	141,318	8,934	5,000	3,900	247	145,218	9,181
I-5: Kern	Rural	10.35	15.08	4.73	Non-Median	1,672,408	7,910,488	500,094	5,000	23,650	1,495	7,934,138	501,589
I-5: Kern	Rural	9.28	10.35	1.07	Median	181,178	193,860	12,256	5,000	5,350	338	199,210	12,594
I-5: Kern	Rural	7.04	9.28	2.24	Non-Median	1,672,408	3,746,193	236,831	5,000	11,200	708	3,757,393	237,539
I-5: Kern	Rural	6.41	7.04	0.63	Median	181,178	114,142	7,216	5,000	3,150	199	117,292	7,415
I-5: Kern	Rural	5.36	6.41	1.05	Non-Median	1,672,408	1,756,028	111,014	5,000	5,250	332	1,761,278	111,346
I-5: Kern	Rural	0.58	5.36	4.78	Non-Median	1,672,408	7,994,109	505,380	5,000	23,900	1,511	8,018,009	506,891
I-5: Kern	Rural	0	0.58	0.58	Non-Median	1,672,408	969,996	61,322	5,000	2,900	183	972,896	61,506
I-5: Los Angeles	Rural	86.67	88.61	1.94	Non-Median	1,672,408	3,244,471	205,112	5,000	9,700	613	3,254,171	205,726
I-5: Los Angeles	Rural	86.13	86.67	0.54	Non-Median	1,672,408	903,100	57,093	5,000	2,700	171	905,800	57,264
I-5: Los Angeles	Rural	84.76	86.13	1.37	Non-Median	1,672,408	2,291,199	144,847	5,000	6,850	433	2,298,049	145,280
I-5: Los Angeles	Rural	78.43	84.76	6.33	Median	181,178	1,146,854	72,503	5,000	31,650	2,001	1,178,504	74,504
I-5: Los Angeles	Rural	69.65	78.43	8.78	Non-Median	1,672,408	14,683,740	928,292	5,000	43,900	2,775	14,727,640	931,067
I-5: Los Angeles	Rural	68.1	69.65	1.55	Median	181,178	280,825	17,753	5,000	7,750	490	288,575	18,243
I-5: Los Angeles	Rural	65.43	68.1	2.67	Non-Median	1,672,408	4,465,329	282,294	5,000	13,350	844	4,478,679	283,138
I-5: Los Angeles	Rural	59.95	65.43	5.48	Median	181,178	992,853	62,767	5,000	27,400	1,732	1,020,253	64,499
I-5: Los Angeles	Rural	54.16	59.95	5.79	Non-Median	1,672,408	9,683,241	612,165	5,000	28,950	1,830	9,712,191	613,995
I-5: Los Angeles	Rural	52.33	54.16	1.83	Non-Median	1,672,408	3,060,506	193,482	5,000	9,150	578	3,069,656	194,061
I-5: Los Angeles	Urban	47.13	52.33	5.2	Non-Median	1,278,900	6,650,280	420,424	5,000	26,000	1,644	6,676,280	422,068
I-5: Los Angeles	Urban	46.9	47.13	0.23	Non-Median	1,278,900	294,147	18,596	5,000	1,150	73	295,297	18,668
I-5: Los Angeles	Urban	46.6	46.9	0.3	Non-Median	1,278,900	383,670	24,255	5,000	1,500	95	385,170	24,350
I-5: Los Angeles	Urban	45.93	46.6	0.67	Non-Median	1,278,900	856,863	54,170	5,000	3,350	212	860,213	54,382
I-5: Los Angeles	Urban	45.1	45.93	0.83	Non-Median	1,278,900	1,061,487	67,106	5,000	4,150	262	1,065,637	67,369
I-5: Los Angeles	Urban	44.01	45.1	1.09	Non-Median	1,278,900	1,394,001	88,127	5,000	5,450	345	1,399,451	88,472
I-5: Los Angeles	Urban	43.9	44.01	0.11	Non-Median	1,278,900	140,679	8,894	5,000	550	35	141,229	8,928
I-5: Los Angeles	Urban	41.6	43.9	2.3	Non-Median	1,278,900	2,941,470	185,957	5,000	11,500	727	2,952,970	186,684
I-5: Los Angeles	Urban	40.27	41.6	1.33	Non-Median	1,278,900	1,700,937	107,532	5,000	6,650	420	1,707,587	107,952
I-5: Los Angeles	Urban	39.81	40.27	0.46	Non-Median	1,278,900	588,294	37,191	5,000	2,300	145	590,594	37,337
I-5: Los Angeles	Urban	39.36	39.81	0.45	Non-Median	1,278,900	575,505	36,383	5,000	2,250	142	577,755	36,525
I-5: Los Angeles	Urban	36.65	39.36	2.71	Non-Median	1,278,900	3,465,819	219,106	5,000	13,550	857	3,479,369	219,962
I-5: Los Angeles	Urban	36.43	36.65	0.22	Median	399,656	87,924	5,558	5,000	1,100	70	89,024	5,628
I-5: Los Angeles	Urban	36.22	36.43	0.21	Median	399,656	83,928	5,306	5,000	1,050	66	84,978	5,372
I-5: Los Angeles	Urban	35.94	36.22	0.28	Non-Median	1,278,900	358,092	22,638	5,000	1,400	89	359,492	22,727
I-5: Los Angeles	Urban	29.16	35.94	6.78	Non-Median	1,278,900	8,670,942	548,169	5,000	33,900	2,143	8,704,842	550,312
I-5: Los Angeles	Urban	28.25	29.16	0.91	Non-Median	1,278,900	1,163,799	73,574	5,000	4,550	288	1,168,349	73,862
I-5: Los Angeles	Urban	22.78	28.25	5.47	Non-Median	1,278,900	6,995,583	442,254	5,000	27,350	1,729	7,022,933	443,983
I-5: Los Angeles	Urban	22.28	22.78	0.5	Non-Median	1,278,900	639,450	40,425	5,000	2,500	158	641,950	40,583
I-5: Los Angeles	Urban	21.41	22.28	0.87	Non-Median	1,278,900	1,112,643	70,340	5,000	4,350	275	1,116,993	70,615
I-5: Los Angeles	Urban	20.58	21.41	0.83	Non-Median	1,278,900	1,061,487	67,106	5,000	4,150	262	1,065,637	67,369
I-5: Los Angeles	Urban	17.21	20.58	3.37	Non-Median	1,278,900	4,309,893	272,467	5,000	16,850	1,065	4,326,743	273,533
I-5: Los Angeles	Urban	16.9	17.21	0.31	Median	399,656	123,893	7,832	5,000	1,550	98	125,443	7,930
I-5: Los Angeles	Urban	14.16	16.9	2.74	Non-Median	1,278,900	3,504,186	221,531	5,000	13,700	866	3,517,886	222,397
I-5: Los Angeles	Urban	13.78	14.16	0.38	Median	181,178	68,847	4,352	5,000	1,900	120	70,747	4,473
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	Non-Median	1,475,654	15,213,991	961,814	5,000	51,550	3,259	15,265,541	965,073
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	Non-Median	1,475,654	4,117,074	260,278	5,000	13,950	882	4,131,024	261,159
CA 710: LA	Suburban	4.96	10.18	5.22	Non-Median	1,475,654	7,702,913	486,971	5,000	26,100	1,650	7,729,013	488,621
TOTAL							**211,327,547**	**13,359,926**		**2,090,050**	**132,131**	**213,417,597**	**13,492,057**

TABLE O3. INTERCHANGE CONSTRUCTION COSTS ($) - AHS AND DEDICATED TRUCK LANE*

Interchange	Interchange Type (Urban/Rural)	Unit Cost (1999)	Unit Cost (2001-Equiv.)	EUAC
Long Beach	Suburban**	35,000,000	36,235,500	2,632,470
Commerce	Suburban**	35,000,000	36,235,500	2,632,470
Sylmar	Urban	50,000,000	51,765,000	3,760,671
Wheeler Ridge	Rural	20,000,000	20,706,000	1,504,268
Lost Hills	Rural	20,000,000	20,706,000	1,504,268
Coalinga	Rural	20,000,000	20,706,000	1,504,268
Los Banos	Rural	20,000,000	20,706,000	1,504,268
Vernalis	Rural	20,000,000	20,706,000	1,504,268
Lathrop	Rural	20,000,000	20,706,000	1,504,268
Sacramento	Rural	20,000,000	20,706,000	1,504,268
TOTAL			269,178,000	19,555,489

* Freeway costs in this study are assumed to correspond to the highest values in each range (see Table 10.2 in main report).

**Suburban values are an average of the rural and urban high values.

TABLE O4. AHS TRANSFER TERMINAL CONSTRUCTION COSTS

Interchange	Freeway	Interchange Type (Urban/Rural)	Terminal Square Footage	Land Cost (2001-Equiv. $)	Pavement Unit Cost* (2001-Equiv. $ per Sq. Ft)	Total Pavement Cost ($)	Building Cost ($)	Total One-Time Cost ($)	2001-Equiv. EUATC ($)
Long Beach	SR-710	Suburban	500000	12500000	48	23,844,515	500,000	36,844,515	2,674,912
Commerce	SR-710	Suburban	500000	12500000	48	23,844,515	500,000	36,844,515	2,674,912
Sylmar	I-5	Urban	500000	7500000	58	28,835,227	500,000	36,835,227	2,674,238
Wheeler Ridge	I-5	Rural	500000	5000000	38	18,853,802	500,000	24,353,802	1,768,086
Lost Hills	I-5	Rural	150000	750000	38	5,656,141	500,000	6,906,141	501,386
Coalinga	I-5	Rural	150000	750000	38	5,656,141	500,000	6,906,141	501,386
Los Banos	I-5	Rural	275000	1375000	38	10,369,591	500,000	12,244,591	888,957
Vernalis	I-5	Rural	500000	2500000	38	18,853,802	500,000	21,853,802	1,586,586
Lathrop	I-5	Rural	150000	2250000	38	5,656,141	500,000	8,406,141	610,286
Sacramento	I-5	Rural	275000	4125000	38	10,369,591	500,000	14,994,591	1,088,607
TOTAL			3500000	49250000		151,939,467	5,000,000	206,189,467	14,969,355

TABLE O5. INTERCHANGE REHABILITATION COSTS* - AHS AND DEDICATED TRUCK LANE

Interchange	Interchange Type	Unit Cost (2001-Equiv. $)	Length (mi)	Total Cost ($)	EUAC ($)
Long Beach	Suburban**	1,475,654	2	2,951,308	214,265
Commerce	Suburban**	1,475,654	2	2,951,308	214,265
Sylmar	Urban	1,278,900	2	2,557,800	185,696
Wheeler Ridge	Rural	1,672,408	2	3,344,815	242,834
Lost Hills	Rural	1,672,408	2	3,344,815	242,834
Coalinga	Rural	1,672,408	2	3,344,815	242,834
Los Banos	Rural	1,672,408	2	3,344,815	242,834
Vernalis	Rural	1,672,408	2	3,344,815	242,834
Lathrop	Rural	1,672,408	2	3,344,815	242,834
Sacramento	Rural	1,672,408	2	3,344,815	242,834
TOTAL			20	31,874,123	2,314,061

* Freeway costs in this study are assumed to correspond to the highest values in each range (see Table 10.2 in main report).

**Suburban values are an average of the rural and urban high values.

TABLE O6. AHS TRANSFER TERMINAL REHABILITATION COSTS

Interchange	Interchange Type (Urban/Rural)	Pavement Unit Cost* (2001 $ per Sq. Ft)	Terminal Square Footage	Total Cost ($)	EUAC ($)
Long Beach	Suburban	13	500,000	6,654,283	483,101
Commerce	Suburban	13	500,000	6,654,283	483,101
Sylmar	Urban	12	500,000	5,767,045	418,688
Wheeler Ridge	Rural	15	500,000	7,541,521	547,514
Lost Hills	Rural	15	150,000	2,262,456	164,254
Coalinga	Rural	15	150,000	2,262,456	164,254
Los Banos	Rural	15	275,000	4,147,837	301,133
Vernalis	Rural	15	500,000	7,541,521	547,514
Lathrop	Rural	15	150,000	2,262,456	164,254
Sacramento	Rural	15	275,000	4,147,837	301,133
TOTAL			3,500,000	49,241,696	3,574,947

TABLE O7. SUMMARY OF AHS MAINTENANCE COSTS

Cost Category	EUAC (2001-Equiv. EUAC)
Travel Lane	86,479
Interchange	4,138
Staging Area	11,428
TOTAL	102,045

APPENDIX P

AHS VEHICLE-HOURS AND VEHICLE-MILES, VEHICLE OPERATING COSTS, AND USER COSTS

Introduction

For the calculation of vehicle-miles, vehicle-hours, vehicle operations costs and system user costs for travel on the AHS, similar methodologies were used as for the added conventional lane, with some differences. Like the calculations for the added-conventional-lane scenario, the AHS calculations were carried out for a base condition (i.e. – the existing roadway conditions, without addition of a lane), and also for the added-AHS-lane condition. Unlike the added-conventional-lane scenario, the addition of an AHS lane diverts only truck traffic from the flow on the existing lanes, so analysis must be performed for the following conditions:

- Base condition (i.e. - the existing roadway conditions, without addition of a lane)
- Vehicle-hours and –miles, and operations and user costs, for the added AHS lane
- Vehicle-hours and –miles, and operations and user costs, for the existing freeway lanes, with consideration for the diverted truck traffic due to the presence of the AHS lane.

To this end, calculations were performed for each of these conditions.

Calculations

Vehicle-Revenue-Miles and -Hours

Only those calculations pertinent to the AHS that differ in methodology from those described in Appendix M are discussed here. These calculations pertain to the percentage of trucks diverted onto the AHS lane, and from the regular traffic lanes, in the added-AHS-lane configuration (base condition methodologies are identical to those presented in Appendix M).

Vehicle-miles, vehicle-hours, vehicle operations costs, and vehicle maintenance costs were calculated for both the AHS lane and the existing lanes from which trucks were diverted. Table P2a shows the section volume data for the AHS lane. Truck AADT for each segment was approximated by Professor Randolph Hall of the University of Southern California.

From the Truck AADT recommended by Professor Hall, the percentage of total vehicles using the truck lane was found. (It is noteworthy that all vehicles using the truck lane are trucks.) This calculation was made by dividing the truck AADT in the AHS lane (from Table P2a) by the AADT (from Table P1a). The following sample calculation shows the procedure used to calculate the percentage of total vehicles using the truck lane, as shown in the first line of Table P2a:

> 1.3% = 500/40,000
> where 500 is the estimated truck AADT on the AHS lane, and 40,000 is the one-directional AADT from Table P1a.

The truck proportion diverted (shown in Table P2a) represents the proportion of all trucks using the study system that were assumed to be diverted to the AHS lane, and was calculated by dividing the percentage of total vehicles using the truck lane by the total percentage of trucks on the segment. The following sample calculation shows the procedure used to calculate the truck proportion diverted to the truck lane, as shown in the first line of Table P2a:

> 0.08 = 1.3% / 16%
> where 1.3% is the percentage of total vehicles using the truck lane, and 16% is total truck percentage on the segment (from Table P2a).

For the traffic volumes on the remaining conventional lanes (shown in Table P3a), the one-directional AADT is the difference of the total AADT (from Table P1a) and the AADT on the AHS lane (from Table P2a). The following sample calculation shows the procedure used to calculate the traffic volumes on the conventional lanes, as shown in the first line of Table P3a:

> 39,500 = 40,000 – 500
> where 40,000 is the total one-directional AADT from Table P1a, and 500 is the AHS-lane AADT from Table P2a.

The one-directional truck AADT on the conventional lanes (shown in Table P3a) was calculated by multiplying the total segment AADT (from Table P1a) by the truck percentage on the segment (also from Table P1a), and then multiplying that product by the truck proportion diverted to the AHS lanes (shown in Table P2a). The following sample calculation shows the procedure used to calculate the one-directional truck AADT on the conventional lanes, as shown in the first line of Table P3a:

> 5,900 = 40,000 x 16% x (1 – 0.08)

The "Truck % of Conventional Lanes AADT" column in Table P3a describes the total percentage of all conventional-lane traffic that is comprised of trucks. This value was calculated by dividing the AADT for the conventional lanes by the truck AADT for the conventional lanes (both values appear in Table P3a).

Peak period flows for the conventional lanes (shown in Table P3a) consists of those trucks not diverted to the AHS lane, and of all non-truck vehicles, and were computed for each partition of the study section via the following formula:

> Peak Period Flow (Conv. Lanes) = [Peak Period Flow (Base Condition) x
> (1 – Truck Proportion Diverted)] x [Truck Percentage (Base Condition)] +
> [Peak Period Flow (Base Condition)] x
> [1 – Truck Percentage (Base Condition)]

The following sample calculation shows the procedure used to calculate the peak period flow on the conventional lanes, as shown in the first line of Table P3a:

$$3,456 = [3500 \times (1 - 0.08) \times 16\%] + 3500(1 - 16\%)$$

All other calculations are similar to those described in Appendix M.

Vehicle Operating Costs

Vehicle operating costs for the AHS were calculated in the same manner as were comparable costs for the system featuring an added conventional freeway lane; however, different unit costs for vehicle operations were used. For the AHS configuration, it was assumed for the AHS that a convoy of three trucks would be used and only one driver per convoy was necessary. Thus, the driver cost would amount to one-third of that of trucks not operating on the automated configuration. In addition, it has been estimated that the fuel cost would decrease because of convoy-related decreases in wind drag. The reduction that was used for this report amounts to 15 percent. This percentage is based upon research conducted within the PROMOTE-CHAUFFER project (1). The fuel-consumption reduction of two heavy-duty trucks driving at close spacing amounted to 6 percent for the lead truck and 17 to 21 percent for the trailing truck. Given the assumption that three-truck convoys would be used, a weighted average of these values resulted in a fuel reduction of about 15 percent – the value used for this evaluation. The cost for truck operation on the AHS lane, then, amounted to $1.48 after reductions in costs to account for fewer drivers and fuel savings. Table P4 shows per-mile unit costs for automated truck operations. Unit costs for non-automated truck operations are assumed to be the same, whether the trucks are operating on a dedicated lane or in regular traffic.

User Costs

User cost calculations are discussed in Section 10.4.6 in the main report.

Results

The details for the calculations of vehicle-miles and vehicle-hours of travel, and also for operations and user costs, are shown in Tables P1a through P1e for the existing configuration of the freeway, Tables P2a through P2e for the added AHS lane, and Tables P3a through P3e for the existing conventional lanes with the added AHS lane in operation. Tables P1a through P3a show the flow rates, duration, and volumes for the various periods of the day for which analysis was conducted. The passenger-car equivalents and speeds are shown in Tables P1b through P3b. The vehicle-hours and –miles of travel calculations are presented in Tables P1c through P3c. Tables P1d through P3d show details of vehicle operating costs calculations, and Tables P1e through P3e show user cost calculations. Table P4 shows per-mile unit costs for automated truck operations.

Reference

1. Bonnet, C., Fritz, H. "Fuel Consumption Reduction Experienced by Two Promote-Chauffeur Trucks in Electronic Towbar Operation." ITS World Congress 2000. Torino, Italy.

TABLE P1a. SECTION VOLUME DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AHS Lane Placement	AADT (One Direction)	Truck %	Truck AADT (One Direction)	Peak Period Duration	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)															
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	40,000	16.0%	6,400	6	3,500	21,000	5	4.81%	1,923	385	13	17,077	1,314
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	49,000	11.0%	5,390	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Non-Median	49,000	9.0%	4,410	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Non-Median	67,000	13.0%	8,710	3	6,500	19,500	6	4.76%	3,189	532	15	44,311	2,954
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Non-Median	73,000	9.0%	6,570	3	7,300	21,900	6	4.76%	3,475	579	15	47,625	3,175
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	80,000	10.0%	8,000	3	7,100	21,300	6	4.76%	3,808	635	15	54,892	3,659
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	75,000	11.0%	8,250	3	7,000	21,000	6	4.76%	3,570	595	15	50,430	3,362
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	65,000	14.0%	9,100	3	6,000	18,000	6	4.76%	3,094	516	15	43,906	2,927
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	63,000	14.0%	8,820	3	5,400	16,200	6	4.76%	2,999	500	15	43,801	2,920
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Non-Median	50,000	14.0%	7,000	3	5,000	15,000	6	4.76%	2,380	397	15	32,620	2,175
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	40,000	14.0%	5,600	3	4,000	12,000	6	4.76%	1,904	317	15	26,096	1,740
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	30,000	25.0%	7,500	3	3,000	9,000	11	19.13%	5,738	522	10	15,262	1,526
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	25,000	24.0%	6,000	4	2,300	9,200	8	11.58%	2,895	362	12	12,905	1,075
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	40,000	23.0%	9,200	5	4,000	20,000	5	4.03%	1,613	323	14	18,387	1,313
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Non-Median	45,000	24.0%	10,800	5	4,500	22,500	5	4.03%	1,814	363	14	20,686	1,478
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Non-Median	50,000	24.0%	12,000	5	5,000	25,000	5	5.58%	2,791	558	14	22,209	1,586
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	40,000	26.0%	10,400	5	4,000	20,000	5	5.58%	2,233	447	14	17,767	1,269
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	63,000	26.0%	16,380	5	5,000	25,000	5	5.58%	3,517	703	14	34,483	2,463
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	42,000	26.0%	10,920	5	4,200	21,000	6	8.17%	3,430	572	13	17,570	1,352
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	10,000	26.0%	2,600	3	1,000	3,000	5	8.03%	803	161	16	6,197	387
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	10,000	28.0%	2,800	4	1,000	4,000	6	15.57%	1,557	259	14	4,443	317
I-5: Merced	Rural	0	32.45	32.45	2	Median	15,000	29.0%	4,350	4	1,500	6,000	6	15.57%	2,335	389	14	6,665	476
I-5: Fresno	Rural	0	66.16	66.16	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	18.05%	2,708	387	12	4,792	399
I-5: Kings	Rural	0	26.72	26.72	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	17.32%	2,597	371	12	4,903	409
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	17,000	29.0%	4,930	5	1,700	8,500	5	10.17%	1,728	346	14	6,772	484
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	30,000	28.0%	8,400	5	3,000	15,000	6	10.95%	3,284	547	13	11,716	901
I-5: Kern	Rural	10.35	15.08	4.73	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	7.04	9.28	2.24	4	Non-Median	30,000	30.0%	9,000	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	5.36	6.41	1.05	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0.58	5.36	4.78	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0	0.58	0.58	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Non-Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	35,000	19.0%	6,650	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Non-Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Non-Median	40,000	16.0%	6,400	5	4,000	20,000	5	6.08%	2,433	487	14	17,567	1,255
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Non-Median	65,000	10.0%	6,500	5	6,500	32,500	5	6.08%	3,953	791	14	28,547	2,039
I-5: Los Angeles	Urban	47.13	52.33	5.2	4	Non-Median	90,000	10.0%	9,000	6	8,600	51,600	5	5.89%	5,474	1,095	13	32,926	2,533
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	Non-Median	90,000	10.0%	9,000	6	8,600	51,600	5	5.89%	5,305	1,061	13	33,095	2,546
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Non-Median	92,000	9.0%	8,280	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Non-Median	92,000	10.0%	9,200	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Non-Median	100,000	9.0%	9,000	6	8,900	53,400	5	5.89%	5,895	1,179	13	40,705	3,131
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Non-Median	115,000	10.0%	11,500	6	9,100	54,600	5	5.89%	6,779	1,356	13	53,621	4,125
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Non-Median	115,000	8.0%	9,200	6	8,500	51,000	5	6.62%	7,618	1,524	13	56,382	4,337
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	120,000	8.0%	9,600	6	9,500	57,000	5	6.62%	7,949	1,590	13	55,051	4,235
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	117,000	9.0%	10,530	4	4,600	18,400	5	4.88%	5,710	1,142	15	92,890	6,193
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	65,000	9.0%	5,850	4	4,800	19,200	5	4.88%	3,172	634	15	42,628	2,842
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	70,000	8.0%	5,600	4	5,000	20,000	5	4.88%	3,416	683	15	46,584	3,106
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	135,000	8.0%	10,800	5	10,200	51,000	5	4.20%	5,675	1,135	14	78,325	5,595
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	140,000	8.0%	11,200	5	10,000	50,000	5	4.20%	5,885	1,177	14	84,115	6,008
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	140,000	8.0%	11,200	5	9,600	48,000	5	4.20%	5,885	1,177	14	86,115	6,151
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	90,000	8.0%	7,200	5	6,800	34,000	5	4.20%	3,783	757	14	52,217	3,730
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	90,000	8.0%	7,200	5	7,200	36,000	5	4.20%	3,783	757	14	50,217	3,587
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	102,000	8.0%	8,160	5	8,200	41,000	5	4.20%	4,288	858	14	56,712	4,051
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	138,000	8.0%	11,040	8	9,900	79,200	5	4.48%	6,184	1,237	11	52,616	4,783
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	140,000	8.0%	11,200	8	9,600	80,000	5	4.48%	6,273	1,255	11	53,727	4,884
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	120,000	8.0%	9,600	8	8,000	64,000	5	4.48%	5,377	1,075	11	50,623	4,602
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	120,000	8.0%	9,600	6	7,900	47,400	5	2.79%	3,350	670	13	69,250	5,327
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	130,000	8.0%	10,400	6	8,000	48,000	5	2.79%	3,629	726	13	78,371	6,029
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	128,000	8.0%	10,240	6	8,400	50,400	5	2.79%	3,574	715	13	74,026	5,694
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	110,000	15.0%	16,500	8	8,000	64,000	5	4.48%	4,929	986	11	41,071	3,734
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	88,000	14.0%	12,320	8	7,500	60,000	5	4.48%	3,943	789	11	24,057	2,187
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	70,000	15.0%	10,500	8	6,000	48,000	5	4.48%	3,137	627	11	18,863	1,715

TABLE P1b. SECTION FLOW AND SPEED DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban /Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane (pcphpl)	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)		Nighttime Off-Peak Speed (mph)		Daytime Off-Peak Speed(mph)	
		Begin	End	Length (mi)							Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	1,750	1,890	192	208	657	709	50	63	50	65	50	65
I-5: Sacramento	Urban	26.94	29.87	2.93	1,633	1,723	157	166	442	466	50	55	50	55	50	55
I-5: Sacramento	Urban	26.69	26.94	0.25	1,633	1,707	157	164	442	462	50	55	50	55	50	55
I-5: Sacramento	Urban	25.53	26.69	1.16	2,167	2,308	177	189	985	1,049	50	48	50	55	50	55
I-5: Sacramento	Urban	24.51	25.53	1.02	1,825	1,907	145	151	794	829	50	55	50	55	50	55
I-5: Sacramento	Urban	23.1	24.51	1.41	1,420	1,491	127	133	732	768	50	55	50	55	50	55
I-5: Sacramento	Urban	22	23.1	1.1	2,333	2,462	198	209	1,121	1,182	50	38	50	55	50	55
I-5: Sacramento	Urban	19.16	22	2.84	1,500	1,605	129	138	732	783	50	55	50	55	50	55
I-5: Sacramento	Urban	18.82	19.16	0.34	1,080	1,156	100	107	584	625	50	55	50	55	50	55
I-5: Sacramento	Urban	16.7	18.82	2.12	1,250	1,338	99	106	544	582	50	55	50	55	50	55
I-5: Sacramento	Urban	14.46	16.7	2.24	1,333	1,427	106	113	580	621	50	55	50	55	50	55
I-5: Sacramento	Rural	0	14.46	14.46	1,500	1,688	261	293	763	859	50	64	50	65	50	65
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,150	1,288	181	203	538	602	50	65	50	65	50	65
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,333	1,487	108	120	438	488	50	65	50	65	50	65
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,500	1,680	121	135	493	552	50	65	50	55	50	55
I-5: San Joaquin	Urban	24.8	28.34	3.54	1,250	1,400	140	156	397	444	50	55	50	55	50	55
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,333	1,507	149	168	423	478	50	65	50	65	50	65
I-5: San Joaquin	Rural	12.69	14.34	1.65	1,000	1,130	141	159	493	557	50	65	50	65	50	65
I-5: San Joaquin	Rural	11.8	12.69	0.89	1,400	1,582	191	215	451	509	50	65	50	65	50	65
I-5: San Joaquin	Rural	0	11.8	11.8	500	565	80	91	194	219	50	65	50	65	50	65
I-5: Stanislaus	Rural	0	28.06	28.06	500	570	130	148	159	181	50	65	50	65	50	65
I-5: Merced	Rural	0	32.45	32.45	750	859	195	223	238	273	50	65	50	65	50	65
I-5: Fresno	Rural	0	66.16	66.16	750	863	193	222	200	230	50	65	50	65	50	65
I-5: Kings	Rural	0	26.72	26.72	750	863	186	213	204	235	50	65	50	65	50	65
I-5: Kern	Rural	15.86	87.03	71.17	850	973	173	198	242	277	50	65	50	65	50	65
I-5: Kern	Rural	15.08	15.86	0.78	750	855	137	156	225	257	50	65	50	65	50	65
I-5: Kern	Rural	10.35	15.08	4.73	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	9.28	10.35	1.07	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	7.04	9.28	2.24	750	863	137	157	182	209	50	65	50	65	50	65
I-5: Kern	Rural	6.41	7.04	0.63	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	5.36	6.41	1.05	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	0.58	5.36	4.78	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	0	0.58	0.58	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.67	88.61	1.94	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.13	86.67	0.54	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	84.76	86.13	1.37	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	78.43	84.76	6.33	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	69.65	78.43	8.78	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	68.1	69.65	1.55	875	958	127	139	237	260	50	65	50	65	50	65
I-5: Los Angeles	Rural	65.43	68.1	2.67	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	59.95	65.43	5.48	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	54.16	59.95	5.79	1,000	1,080	122	131	314	339	50	65	50	65	50	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	1,625	1,706	198	208	510	535	50	65	50	65	50	65
I-5: Los Angeles	Urban	47.13	52.33	5.2	2,150	2,258	274	287	633	665	50	50	50	55	50	55
I-5: Los Angeles	Urban	46.9	47.13	0.23	2,150	2,258	265	279	636	668	50	50	50	55	50	55
I-5: Los Angeles	Urban	46.6	46.9	0.3	2,225	2,325	271	283	638	667	50	46	50	55	50	55
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,780	1,869	217	228	510	536	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,780	1,860	236	246	626	654	50	55	50	55	50	55
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,820	1,911	271	285	825	866	50	55	50	55	50	55
I-5: Los Angeles	Urban	43.9	44.01	0.11	2,125	2,210	381	396	1,084	1,128	50	51	50	55	50	55
I-5: Los Angeles	Urban	41.6	43.9	2.3	1,900	1,976	318	331	847	881	50	55	50	55	50	55
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,533	1,602	381	398	2,064	2,157	50	55	50	55	50	53
I-5: Los Angeles	Urban	39.81	40.27	0.46	1,200	1,254	159	166	710	742	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.36	39.81	0.45	1,000	1,040	137	142	621	646	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,040	2,122	227	236	1,119	1,164	50	53	50	55	50	55
I-5: Los Angeles	Urban	36.43	36.65	0.22	1,667	1,733	196	204	1,001	1,041	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.22	36.43	0.21	2,400	2,496	294	306	1,538	1,599	50	32	50	55	50	55
I-5: Los Angeles	Urban	35.94	36.22	0.28	1,700	1,768	189	197	932	970	50	55	50	55	50	55
I-5: Los Angeles	Urban	29.16	35.94	6.78	1,800	1,872	189	197	897	933	50	55	50	55	50	55
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,050	2,132	214	223	1,013	1,053	50	53	50	55	50	55
I-5: Los Angeles	Urban	22.78	28.25	5.47	1,900	1,967	219	226	1,101	1,139	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.28	22.78	0.5	2,375	2,458	273	283	1,376	1,424	50	40	50	55	50	55
I-5: Los Angeles	Urban	21.41	22.28	0.87	1,980	2,059	247	257	957	995	50	54	50	55	50	55
I-5: Los Angeles	Urban	20.58	21.41	0.83	2,400	2,496	314	326	1,221	1,270	50	40	50	55	50	55
I-5: Los Angeles	Urban	17.21	20.58	3.37	2,000	2,080	269	280	1,151	1,197	50	54	50	55	50	55
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,975	2,054	168	174	1,332	1,385	50	54	50	55	50	55
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,000	2,080	181	189	1,507	1,567	50	54	50	55	50	55
I-5: Los Angeles	Urban	13.78	14.16	0.38	2,100	2,184	179	186	1,424	1,481	50	52	50	55	50	55
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	2,000	2,150	246	265	933	1,003	50	59	50	65	50	65
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1,875	2,006	197	211	547	585	50	61	50	65	50	65
CA 710: LA	Suburban	4.96	10.18	5.22	2,000	2,150	209	225	572	614	50	57	50	65	50	65

TABLE P1c. SECTION TRAVEL DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	16,061	84,319	1,471	7,722	13,060	68,567
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	9,476	76,666	759	6,143	5,558	44,968
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	662	6,689	53	536	388	3,923
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	2,941	19,679	481	3,219	6,682	44,718
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	2,010	20,328	319	3,225	4,372	44,206
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	3,003	27,030	537	4,833	7,740	69,658
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	2,541	20,559	432	3,495	6,102	49,371
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	7,157	43,963	1,230	7,557	17,457	107,236
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	771	4,737	143	877	2,085	12,807
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	4,452	27,348	706	4,339	9,682	59,473
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	3,763	23,117	597	3,668	8,184	50,271
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	32,535	97,605	20,742	62,226	55,173	165,519
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	20,623	65,305	6,489	20,547	28,929	91,607
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	54,694	183,106	4,410	14,763	50,284	168,343
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	1,188	3,762	96	303	1,092	3,459
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	21,240	67,260	2,371	7,510	18,869	59,750
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	54,392	154,808	6,073	17,284	48,319	137,524
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	10,725	30,525	1,509	4,294	14,793	42,104
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	4,859	13,831	794	2,259	4,066	11,572
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	9,204	26,196	2,464	7,013	19,012	54,111
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	31,427	80,813	12,231	31,450	34,910	89,769
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	56,463	138,237	21,974	53,798	62,721	153,558
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	148,860	347,340	53,743	125,401	95,117	221,939
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	60,120	140,280	20,821	48,583	39,299	91,697
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	175,434	429,511	35,667	87,323	139,767	342,188
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	3,276	8,424	717	1,845	2,559	6,579
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	23,839	61,301	4,350	11,185	11,543	29,682
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	5,393	13,867	984	2,530	2,611	6,714
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	12,096	28,224	2,207	5,150	5,857	13,666
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	3,175	8,165	579	1,490	1,537	3,953
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	5,292	13,608	966	2,483	2,562	6,589
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	24,091	61,949	4,396	11,304	11,665	29,996
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	2,923	7,517	533	1,372	1,415	3,640
I-5: Los Angeles	Rural	86.67	88.61	1.94	220.0	457.5	37.2	77.4	109.5	227.7	11,000	29,740	1,860	5,028	5,474	14,799
I-5: Los Angeles	Rural	86.13	86.67	0.54	61.2	127.4	10.4	21.5	30.5	63.4	3,062	8,278	518	1,400	1,524	4,119
I-5: Los Angeles	Rural	84.76	86.13	1.37	155.4	323.1	26.3	54.6	77.3	160.8	7,768	21,002	1,313	3,551	3,865	10,451
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	35,891	97,039	6,068	16,405	17,860	48,287
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	33,188	151,192	5,611	25,560	16,515	75,234
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	6,185	26,366	1,046	4,457	3,077	13,120
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	10,093	45,977	1,706	7,773	5,022	22,879
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	20,714	94,366	3,502	15,953	10,308	46,957
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	18,528	97,272	2,254	11,832	16,274	85,440
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	5,948	53,528	723	6,511	5,224	47,016
I-5: Los Angeles	Urban	47.13	52.33	5.2	536.6	4,829.8	56.9	465.8	342.4	2,801.7	26,832	241,488	2,846	25,618	17,122	154,094
I-5: Los Angeles	Urban	46.9	47.13	0.23	23.7	213.6	2.4	20.0	15.2	124.6	1,187	10,681	122	1,098	761	6,851
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	1,442	14,578	146	1,481	896	9,057
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	3,578	32,200	363	3,270	2,223	20,006
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	3,989	40,333	440	4,452	3,041	30,745
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	5,951	53,563	739	6,650	5,845	52,602
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	449	5,161	67	771	496	5,706
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	10,488	120,612	1,463	16,821	10,129	116,487
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	2,202	22,270	683	6,910	11,119	112,425
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	795	8,037	131	1,328	1,765	17,844
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	720	8,280	123	1,414	1,677	19,286
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	11,057	127,153	1,230	14,149	16,981	195,280
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	880	10,120	104	1,191	1,480	17,025
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	806	9,274	99	1,137	1,447	16,637
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	762	8,758	85	975	1,170	13,451
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	19,526	224,554	2,052	23,599	27,238	313,231
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	2,985	34,325	312	3,590	4,129	47,479
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	18,188	241,637	2,092	27,800	29,497	391,886
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	1,663	22,088	191	2,541	2,696	35,821
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	5,512	63,392	430	4,949	3,662	42,114
I-5: Los Angeles	Urban	20.58	21.41	0.83	106.2	1,527.2	8.3	87.1	71.3	745.9	5,312	61,088	417	4,790	3,567	41,026
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	17,254	198,426	1,450	16,671	13,648	156,951
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	1,176	13,518	83	956	1,717	19,750
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	10,522	120,998	796	9,149	17,179	197,556
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	1,532	17,620	109	1,249	2,250	25,880
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	98,976	560,864	7,623	43,196	63,516	359,925
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,360.1	30.8	145.6	187.9	888.0	23,436	143,964	1,540	9,461	9,397	57,722
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,736.4	49.1	214.1	295.4	1,287.6	37,584	212,976	2,456	13,917	14,770	83,697
TOTAL					**25,637.3**	**94,944.0**	**5,272.7**	**14,689.8**	**21,759.4**	**87,651.9**	**1,281,866**	**5,588,784**	**263,637**	**913,331**	**1,087,968**	**5,217,993**

TABLE P1d. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Urban	23	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: Sacramento	Urban	17	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: Sacramento	Urban	14.46	17	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: San Joaquin	Rural	14.34	25	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	0	11.8	11.80	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Los Angeles	Rural	86.67	88.61	1.94	11,000	29,740	1,860	5,028	5,474	14,799	19,426	9,666	3,284	1,634	9,666	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	3,062	8,278	518	1,400	1,524	4,119	5,407	2,690	914	455	2,691	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	7,768	21,002	1,313	3,551	3,865	10,451	13,718	6,826	2,319	1,154	6,826	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,948	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Los Angeles	Urban	47.13	52.33	5.20	26,832	241,488	2,846	25,618	17,122	154,094	47,386	78,484	5,027	8,326	30,237	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	1,187	10,681	122	1,098	761	6,851	2,096	3,471	215	357	1,344	2,226
I-5: Los Angeles	Urban	46.6	46.9	0.30	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	41.6	43.9	2.30	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	22.28	22.78	0.50	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,312	61,088	417	4,790	3,567	41,026	9,381	19,854	736	1,557	6,300	13,333
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
TOTAL					**1,281,866**	**5,588,784**	**263,637**	**913,331**	**1,087,968**	**5,217,993**	**2,263,788**	**1,816,355**	**465,586**	**296,833**	**1,921,364**	**1,695,848**

TABLE P1e . TRAVEL TIME COST - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	9,082	12,254	832	1,088	7,386	9,658
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	1,663	3,754	272	536	3,779	7,444
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	1,437	4,953	244	582	3,451	8,218
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	18,398	13,963	11,729	8,765	31,200	23,314
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	672	530	54	50	618	576
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Los Angeles	Rural	86.67	88.61	1.94	220.0	457.5	37.2	77.4	109.5	227.7	6,220	4,189	1,052	708	3,095	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	61.2	127.4	10.4	21.5	30.5	63.4	1,731	1,166	293	197	862	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	155.4	323.1	26.3	54.6	77.3	160.8	4,393	2,958	743	500	2,186	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Los Angeles	Urban	47.13	52.33	5.2	536.6	4,829.8	56.9	465.8	342.4	2,801.7	15,173	44,219	1,610	4,264	9,682	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	23.7	213.6	2.4	20.0	15.2	124.6	671	1,956	69	183	430	1,140
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	815	2,902	83	246	507	1,508
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	254	927	38	128	281	950
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	5,931	20,078	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	1,245	3,707	386	1,150	6,288	19,421
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	6,252	21,965	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	456	2,653	56	189	818	2,770
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	1,688	5,930	177	598	2,335	7,904
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	940	5,056	108	423	1,525	5,963
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	3,117	10,748	243	824	2,071	7,010
I-5: Los Angeles	Urban	20.58	21.41	0.83	106.2	1,527.2	8.3	87.1	71.3	745.9	3,004	13,982	236	797	2,017	6,829
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	9,757	33,642	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	665	2,292	47	159	971	3,288
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	5,950	20,515	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	866	3,102	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	55,970	87,034	4,311	6,084	35,918	50,697
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,360.1	30.8	145.6	187.9	888.0	13,253	21,608	871	1,333	5,314	8,130
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,736.4	49.1	214.1	295.4	1,287.6	21,253	34,209	1,389	1,960	8,352	11,789
TOTAL					**25,637.3**	**94,944.0**	**5,272.7**	**14,689.8**	**21,759.4**	**87,651.9**	**724,880**	**869,262**	**149,084**	**134,492**	**615,233**	**802,499**

TABLE P2a. SECTION VOLUME DATA - AHS LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Truck Lanes in One Direction	Truck Proportion Diverted	% of Total Veh. Using Truck Lane	Truck AADT in Truck Lane	Peak Period Duration (hours)	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)														
I-5: Sacramento	Rural	29.87	34.65	4.78	1	0.08	1.3%	500	6	44	263	5	4.81%	24	5	13	213	16
I-5: Sacramento	Urban	26.94	29.87	2.93	1	0.09	1.0%	500	6	50	300	5	4.81%	24	5	13	176	14
I-5: Sacramento	Urban	26.69	26.94	0.25	1	0.11	1.0%	500	6	50	300	5	4.81%	24	5	13	176	14
I-5: Sacramento	Urban	25.53	26.69	1.16	1	0.06	0.7%	500	3	49	146	6	4.76%	24	4	15	331	22
I-5: Sacramento	Urban	24.51	25.53	1.02	1	0.08	0.7%	500	3	50	150	6	4.76%	24	4	15	326	22
I-5: Sacramento	Urban	23.1	24.51	1.41	1	0.06	0.6%	500	3	44	133	6	4.76%	24	4	15	343	23
I-5: Sacramento	Urban	22	23.1	1.1	1	0.06	0.7%	500	3	47	140	6	4.76%	24	4	15	336	22
I-5: Sacramento	Urban	19.16	22	2.84	1	0.05	0.8%	500	3	46	138	6	4.76%	24	4	15	338	23
I-5: Sacramento	Urban	18.82	19.16	0.34	1	0.06	0.8%	500	3	43	129	6	4.76%	24	4	15	348	23
I-5: Sacramento	Urban	16.7	18.82	2.12	1	0.07	1.0%	500	3	50	150	6	4.76%	24	4	15	326	22
I-5: Sacramento	Urban	14.46	16.7	2.24	1	0.09	1.3%	500	3	50	150	6	4.76%	24	4	15	326	22
I-5: Sacramento	Rural	0	14.46	14.46	1	0.07	1.7%	500	3	50	150	11	19.13%	96	9	10	254	25
I-5: San Joaquin	Rural	40.45	49.79	9.34	1	0.08	2.0%	500	4	46	184	8	11.58%	58	7	12	258	22
I-5: San Joaquin	Rural	28.56	40.45	11.89	1	0.05	1.3%	500	5	50	250	5	4.03%	20	4	14	230	16
I-5: San Joaquin	Urban	28.34	28.56	0.22	1	0.05	1.1%	500	5	50	250	5	4.03%	20	4	14	230	16
I-5: San Joaquin	Urban	24.8	28.34	3.54	1	0.04	1.0%	500	5	50	250	5	5.58%	28	6	14	222	16
I-5: San Joaquin	Rural	14.34	24.8	10.46	1	0.05	1.3%	500	5	50	250	5	5.58%	28	6	14	222	16
I-5: San Joaquin	Rural	12.69	14.34	1.65	1	0.05	1.2%	750	5	60	298	5	5.58%	42	8	14	411	29
I-5: San Joaquin	Rural	11.8	12.69	0.89	1	0.07	1.8%	750	5	75	375	6	8.17%	61	10	13	314	24
I-5: San Joaquin	Rural	0	11.8	11.8	1	0.29	7.5%	750	3	75	225	5	8.03%	60	12	16	465	29
I-5: Stanislaus	Rural	0	28.06	28.06	1	0.63	17.5%	1,750	4	175	700	6	15.57%	272	45	14	778	56
I-5: Merced	Rural	0	32.45	32.45	1	0.40	11.7%	1,750	4	175	700	6	15.57%	272	45	14	778	56
I-5: Fresno	Rural	0	66.16	66.16	1	0.44	13.3%	2,000	5	200	1,000	7	18.05%	361	52	12	639	53
I-5: Kings	Rural	0	26.72	26.72	1	0.44	13.3%	2,000	5	200	1,000	7	17.32%	346	49	12	654	54
I-5: Kern	Rural	15.86	87.03	71.17	1	0.41	11.8%	2,000	5	200	1,000	5	10.17%	203	41	14	797	57
I-5: Kern	Rural	15.08	15.86	0.78	1	0.24	6.7%	2,000	5	200	1,000	6	10.95%	219	36	13	781	60
I-5: Kern	Rural	10.35	15.08	4.73	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	9.28	10.35	1.07	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	7.04	9.28	2.24	1	0.33	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	6.41	7.04	0.63	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	5.36	6.41	1.05	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	0.58	5.36	4.78	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	0	0.58	0.58	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Los Angeles	Rural	86.67	88.61	1.94	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	86.13	86.67	0.54	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	84.76	86.13	1.37	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	78.43	84.76	6.33	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	69.65	78.43	8.78	1	0.48	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	68.1	69.65	1.55	1	0.45	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	65.43	68.1	2.67	1	0.48	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	59.95	65.43	5.48	1	0.48	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	54.16	59.95	5.79	1	0.47	7.5%	3,000	5	300	1,500	5	6.08%	182	36	14	1,318	94
I-5: Los Angeles	Rural	52.33	54.16	1.83	1	0.46	4.6%	3,000	5	300	1,500	5	6.08%	182	36	14	1,318	94
I-5: Los Angeles	Urban	47.13	52.33	5.2	1	0.33	3.3%	3,000	6	287	1,720	5	6.08%	182	36	13	1,098	84
I-5: Los Angeles	Urban	46.9	47.13	0.23	1	0.33	3.3%	3,000	6	287	1,720	5	5.89%	177	35	13	1,103	85
I-5: Los Angeles	Urban	46.6	46.9	0.3	1	0.36	3.3%	3,000	6	290	1,741	5	5.89%	177	35	13	1,082	83
I-5: Los Angeles	Urban	45.93	46.6	0.67	1	0.33	3.3%	3,000	6	290	1,741	5	5.89%	177	35	13	1,082	83
I-5: Los Angeles	Urban	45.1	45.93	0.83	1	0.33	3.0%	3,000	6	267	1,602	5	5.89%	177	35	13	1,221	94
I-5: Los Angeles	Urban	44.01	45.1	1.09	1	0.26	2.6%	3,000	6	237	1,424	5	5.89%	177	35	13	1,399	108
I-5: Los Angeles	Urban	43.9	44.01	0.11	1	0.33	2.6%	3,000	6	222	1,330	5	6.62%	199	40	13	1,471	113
I-5: Los Angeles	Urban	41.6	43.9	2.3	1	0.21	1.7%	2,000	6	158	950	5	6.62%	132	26	13	918	71
I-5: Los Angeles	Urban	40.27	41.6	1.33	1	0.19	1.7%	2,000	4	79	315	5	4.88%	98	20	15	1,588	106
I-5: Los Angeles	Urban	39.81	40.27	0.46	1	0.34	3.1%	2,000	4	148	591	5	4.88%	98	20	15	1,312	87
I-5: Los Angeles	Urban	39.36	39.81	0.45	1	0.36	2.9%	2,000	4	143	571	5	4.88%	98	20	15	1,331	89
I-5: Los Angeles	Urban	36.65	39.36	2.71	1	0.19	1.5%	2,000	5	151	756	5	4.20%	84	17	14	1,160	83
I-5: Los Angeles	Urban	36.43	36.65	0.22	1	0.18	1.4%	2,000	5	143	714	5	4.20%	84	17	14	1,202	86
I-5: Los Angeles	Urban	36.22	36.43	0.21	1	0.18	1.4%	2,000	5	137	686	5	4.20%	84	17	14	1,230	88
I-5: Los Angeles	Urban	35.94	36.22	0.28	1	0.28	2.2%	2,000	5	151	756	5	4.20%	84	17	14	1,160	83
I-5: Los Angeles	Urban	29.16	35.94	6.78	1	0.28	2.2%	2,000	5	160	800	5	4.20%	84	17	14	1,116	80
I-5: Los Angeles	Rural	28.25	29.16	0.91	1	0.25	2.0%	2,000	5	161	804	5	4.20%	84	17	14	1,112	79
I-5: Los Angeles	Urban	22.78	28.25	5.47	1	0.22	1.5%	2,000	5	146	731	5	4.20%	84	17	14	1,185	85
I-5: Los Angeles	Urban	22.28	22.78	0.5	1	0.22	1.5%	2,000	5	146	731	5	4.20%	84	17	14	1,185	85
I-5: Los Angeles	Urban	21.41	22.28	0.87	1	0.18	1.4%	2,000	8	143	1,148	5	4.48%	90	18	11	763	69
I-5: Los Angeles	Urban	20.58	21.41	0.83	1	0.18	1.4%	2,000	8	137	1,097	5	4.48%	90	18	11	813	74
I-5: Los Angeles	Urban	17.21	20.58	3.37	1	0.21	1.7%	2,000	8	133	1,067	5	4.48%	90	18	11	844	77
I-5: Los Angeles	Urban	16.9	17.21	0.31	1	0.21	1.7%	2,000	6	132	790	5	2.79%	56	11	13	1,154	89
I-5: Los Angeles	Urban	14.16	16.9	2.74	1	0.19	1.5%	2,000	6	123	738	5	2.79%	56	11	13	1,206	93
I-5: Los Angeles	Rural	13.78	14.16	0.38	1	0.20	1.6%	2,000	6	131	788	5	2.79%	56	11	13	1,157	89
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1	0.12	1.8%	2,000	8	145	1,164	5	4.48%	90	18	11	747	68
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1	0.16	2.3%	2,000	8	170	1,364	5	4.48%	90	18	11	547	50
CA 710: LA	Suburban	4.96	10.18	5.22	1	0.10	1.4%	1,000	8	86	686	5	4.48%	45	9	11	269	24

TABLE P2b. SECTION FLOW AND SPEED DATA - AHS LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)	Nighttime Off-Peak Speed (mph)	Daytime Off-Peak Speed(mph)
		Begin	End	Length (mi)							Truck	Truck	Truck
I-5: Sacramento	Rural	29.87	34.65	4.78	44	66	5	7	16	25	70	70	70
I-5: Sacramento	Urban	26.94	29.87	2.93	50	75	5	7	14	20	70	70	70
I-5: Sacramento	Urban	26.69	26.94	0.25	50	75	5	7	14	20	70	70	70
I-5: Sacramento	Urban	25.53	26.69	1.16	49	73	4	6	22	33	70	70	70
I-5: Sacramento	Urban	24.51	25.53	1.02	50	75	4	6	22	33	70	70	70
I-5: Sacramento	Urban	23.1	24.51	1.41	44	67	4	6	23	34	70	70	70
I-5: Sacramento	Urban	22	23.1	1.1	47	70	4	6	22	34	70	70	70
I-5: Sacramento	Urban	19.16	22	2.84	46	69	4	6	23	34	70	70	70
I-5: Sacramento	Urban	18.82	19.16	0.34	43	64	4	6	23	35	70	70	70
I-5: Sacramento	Urban	16.7	18.82	2.12	50	75	4	6	22	33	70	70	70
I-5: Sacramento	Urban	14.46	16.7	2.24	50	75	4	6	22	33	70	70	70
I-5: Sacramento	Rural	0	14.46	14.46	50	75	9	13	25	38	70	70	70
I-5: San Joaquin	Rural	40.45	49.79	9.34	46	69	7	11	22	32	70	70	70
I-5: San Joaquin	Rural	28.56	40.45	11.89	50	75	4	6	16	25	70	70	70
I-5: San Joaquin	Urban	28.34	28.56	0.22	50	75	4	6	16	25	70	70	70
I-5: San Joaquin	Urban	24.8	28.34	3.54	50	75	6	8	16	24	70	70	70
I-5: San Joaquin	Rural	14.34	24.8	10.46	50	75	6	8	16	24	70	70	70
I-5: San Joaquin	Rural	12.69	14.34	1.65	60	89	8	13	29	44	70	70	70
I-5: San Joaquin	Rural	11.8	12.69	0.89	75	113	10	15	24	36	70	70	70
I-5: San Joaquin	Rural	0	11.8	11.8	75	113	12	18	29	44	70	70	70
I-5: Stanislaus	Rural	0	28.06	28.06	175	263	45	68	56	83	70	70	70
I-5: Merced	Rural	0	32.45	32.45	175	263	45	68	56	83	70	70	70
I-5: Fresno	Rural	0	66.16	66.16	200	300	52	77	53	80	70	70	70
I-5: Kings	Rural	0	26.72	26.72	200	300	49	74	54	82	70	70	70
I-5: Kern	Rural	15.86	87.03	71.17	200	300	41	61	57	85	70	70	70
I-5: Kern	Rural	15.08	15.86	0.78	200	300	36	55	60	90	70	70	70
I-5: Kern	Rural	10.35	15.08	4.73	300	450	55	82	73	109	70	70	70
I-5: Kern	Rural	9.28	10.35	1.07	300	450	55	82	73	109	70	70	70
I-5: Kern	Rural	7.04	9.28	2.24	300	450	55	82	73	109	70	70	70
I-5: Kern	Rural	6.41	7.04	0.63	300	450	55	82	73	109	70	70	70
I-5: Kern	Rural	5.36	6.41	1.05	300	450	55	82	73	109	70	70	70
I-5: Kern	Rural	0.58	5.36	4.78	300	450	55	82	73	109	70	70	70
I-5: Kern	Rural	0	0.58	0.58	300	450	55	82	73	109	70	70	70
I-5: Los Angeles	Rural	86.67	88.61	1.94	300	450	51	76	75	112	70	70	70
I-5: Los Angeles	Rural	86.13	86.67	0.54	300	450	51	76	75	112	70	70	70
I-5: Los Angeles	Rural	84.76	86.13	1.37	300	450	51	76	75	112	70	70	70
I-5: Los Angeles	Rural	78.43	84.76	6.33	300	450	51	76	75	112	70	70	70
I-5: Los Angeles	Rural	69.65	78.43	8.78	300	450	43	65	81	122	70	70	70
I-5: Los Angeles	Rural	68.1	69.65	1.55	300	450	43	65	81	122	70	70	70
I-5: Los Angeles	Rural	65.43	68.1	2.67	300	450	43	65	81	122	70	70	70
I-5: Los Angeles	Rural	59.95	65.43	5.48	300	450	43	65	81	122	70	70	70
I-5: Los Angeles	Rural	54.16	59.95	5.79	300	450	36	55	94	141	70	70	70
I-5: Los Angeles	Rural	52.33	54.16	1.83	300	450	36	55	94	141	70	70	70
I-5: Los Angeles	Urban	47.13	52.33	5.2	287	430	36	55	84	127	70	70	70
I-5: Los Angeles	Urban	46.9	47.13	0.23	287	430	35	53	85	127	70	70	70
I-5: Los Angeles	Urban	46.6	46.9	0.3	290	435	35	53	83	125	70	70	70
I-5: Los Angeles	Urban	45.93	46.6	0.67	290	435	35	53	83	125	70	70	70
I-5: Los Angeles	Urban	45.1	45.93	0.83	267	401	35	53	94	141	70	70	70
I-5: Los Angeles	Urban	44.01	45.1	1.09	237	356	35	53	108	161	70	70	70
I-5: Los Angeles	Urban	43.9	44.01	0.11	222	333	40	60	113	170	70	70	70
I-5: Los Angeles	Urban	41.6	43.9	2.3	158	238	26	40	71	106	70	70	70
I-5: Los Angeles	Urban	40.27	41.6	1.33	79	118	20	29	106	159	70	70	70
I-5: Los Angeles	Urban	39.81	40.27	0.46	148	222	20	29	87	131	70	70	70
I-5: Los Angeles	Urban	39.36	39.81	0.45	143	214	20	29	89	133	70	70	70
I-5: Los Angeles	Urban	36.65	39.36	2.71	151	227	17	25	83	124	70	70	70
I-5: Los Angeles	Urban	36.43	36.65	0.22	143	214	17	25	86	129	70	70	70
I-5: Los Angeles	Urban	36.22	36.43	0.21	137	206	17	25	88	132	70	70	70
I-5: Los Angeles	Urban	35.94	36.22	0.28	151	227	17	25	83	124	70	70	70
I-5: Los Angeles	Urban	29.16	35.94	6.78	160	240	17	25	80	120	70	70	70
I-5: Los Angeles	Urban	28.25	29.16	0.91	161	241	17	25	79	119	70	70	70
I-5: Los Angeles	Urban	22.78	28.25	5.47	146	219	17	25	85	127	70	70	70
I-5: Los Angeles	Urban	22.28	22.78	0.5	146	219	17	25	85	127	70	70	70
I-5: Los Angeles	Urban	21.41	22.28	0.87	143	215	18	27	69	104	70	70	70
I-5: Los Angeles	Urban	20.58	21.41	0.83	137	206	18	27	74	111	70	70	70
I-5: Los Angeles	Urban	17.21	20.58	3.37	133	200	18	27	77	115	70	70	70
I-5: Los Angeles	Urban	16.9	17.21	0.31	132	198	11	17	89	133	70	70	70
I-5: Los Angeles	Urban	14.16	16.9	2.74	123	185	11	17	93	139	70	70	70
I-5: Los Angeles	Urban	13.78	14.16	0.38	131	197	11	17	89	133	70	70	70
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	145	218	18	27	68	102	70	70	70
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	170	256	18	27	50	75	70	70	70
CA 710: LA	Suburban	4.96	10.18	5.22	86	129	9	13	24	37	70	70	70

TABLE P2c. SECTION TRAVEL DATA - AHS LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction	Peak Period Vehicle-Miles of Travel, One Direction	Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction	Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction	Daytime Off-Peak Other Vehicle-Hours of Travel, One Direction	Daytime Off-Peak Other Vehicle-Miles of Travel, One Direction
		Begin	End	Length (mi)						
I-5: Sacramento	Rural	29.87	34.65	4.78	17.9	1,255	1.6	115	14.6	1,020
I-5: Sacramento	Urban	26.94	29.87	2.93	12.6	879	1.0	70	7.4	516
I-5: Sacramento	Urban	26.69	26.94	0.25	1.1	75	0.1	6	0.6	44
I-5: Sacramento	Urban	25.53	26.69	1.16	2.4	169	0.4	28	5.5	384
I-5: Sacramento	Urban	24.51	25.53	1.02	2.2	153	0.3	24	4.8	333
I-5: Sacramento	Urban	23.1	24.51	1.41	2.7	188	0.5	34	6.9	484
I-5: Sacramento	Urban	22	23.1	1.1	2.2	154	0.4	26	5.3	370
I-5: Sacramento	Urban	19.16	22	2.84	5.6	393	1.0	68	13.7	959
I-5: Sacramento	Urban	18.82	19.16	0.34	0.6	44	0.1	8	1.7	118
I-5: Sacramento	Urban	16.7	18.82	2.12	4.5	318	0.7	50	9.9	692
I-5: Sacramento	Urban	14.46	16.7	2.24	4.8	336	0.8	53	10.4	731
I-5: Sacramento	Rural	0	14.46	14.46	31.0	2,169	19.8	1,383	52.5	3,678
I-5: San Joaquin	Rural	40.45	49.79	9.34	24.6	1,719	7.7	541	34.4	2,411
I-5: San Joaquin	Rural	28.56	40.45	11.89	42.5	2,973	3.4	240	39.0	2,733
I-5: San Joaquin	Urban	28.34	28.56	0.22	0.8	55	0.1	4	0.7	51
I-5: San Joaquin	Urban	24.8	28.34	3.54	12.6	885	1.4	99	11.2	786
I-5: San Joaquin	Rural	14.34	24.8	10.46	37.4	2,615	4.2	292	33.2	2,323
I-5: San Joaquin	Rural	12.69	14.34	1.65	7.0	491	1.0	69	9.7	677
I-5: San Joaquin	Rural	11.8	12.69	0.89	4.8	334	0.8	55	4.0	279
I-5: San Joaquin	Rural	0	11.8	11.8	37.9	2,655	10.2	711	78.3	5,484
I-5: Stanislaus	Rural	0	28.06	28.06	280.6	19,642	109.2	7,644	311.7	21,819
I-5: Merced	Rural	0	32.45	32.45	324.5	22,715	126.3	8,840	360.5	25,232
I-5: Fresno	Rural	0	66.16	66.16	945.1	66,160	341.2	23,886	603.9	42,274
I-5: Kings	Rural	0	26.72	26.72	381.7	26,720	132.2	9,254	249.5	17,466
I-5: Kern	Rural	15.86	87.03	71.17	1,016.7	71,170	206.7	14,469	810.0	56,701
I-5: Kern	Rural	15.08	15.86	0.78	11.1	780	2.4	171	8.7	609
I-5: Kern	Rural	10.35	15.08	4.73	121.6	8,514	22.2	1,554	58.9	4,122
I-5: Kern	Rural	9.28	10.35	1.07	27.5	1,926	5.0	351	13.3	933
I-5: Kern	Rural	7.04	9.28	2.24	57.6	4,032	10.5	736	27.9	1,952
I-5: Kern	Rural	6.41	7.04	0.63	16.2	1,134	3.0	207	7.8	549
I-5: Kern	Rural	5.36	6.41	1.05	27.0	1,890	4.9	345	13.1	915
I-5: Kern	Rural	0.58	5.36	4.78	122.9	8,604	22.4	1,570	59.5	4,166
I-5: Kern	Rural	0	0.58	0.58	14.9	1,044	2.7	190	7.2	506
I-5: Los Angeles	Rural	86.67	88.61	1.94	49.9	3,492	8.4	590	24.8	1,738
I-5: Los Angeles	Rural	86.13	86.67	0.54	13.9	972	2.3	164	6.9	484
I-5: Los Angeles	Rural	84.76	86.13	1.37	35.2	2,466	6.0	417	17.5	1,227
I-5: Los Angeles	Rural	78.43	84.76	6.33	162.8	11,394	27.5	1,926	81.0	5,670
I-5: Los Angeles	Rural	69.65	78.43	8.78	225.8	15,804	38.2	2,672	112.3	7,864
I-5: Los Angeles	Rural	68.1	69.65	1.55	39.9	2,790	6.7	472	19.8	1,388
I-5: Los Angeles	Rural	65.43	68.1	2.67	68.7	4,806	11.6	813	34.2	2,391
I-5: Los Angeles	Rural	59.95	65.43	5.48	140.9	9,864	23.8	1,668	70.1	4,908
I-5: Los Angeles	Rural	54.16	59.95	5.79	124.1	8,685	15.1	1,056	109.0	7,629
I-5: Los Angeles	Rural	52.33	54.16	1.83	39.2	2,745	4.8	334	34.4	2,411
I-5: Los Angeles	Urban	47.13	52.33	5.2	127.8	8,944	13.6	949	81.5	5,707
I-5: Los Angeles	Urban	46.9	47.13	0.23	5.7	396	0.6	41	3.6	254
I-5: Los Angeles	Urban	46.6	46.9	0.3	7.5	522	0.8	53	4.6	325
I-5: Los Angeles	Urban	45.93	46.6	0.67	16.7	1,167	1.7	118	10.4	725
I-5: Los Angeles	Urban	45.1	45.93	0.83	19.0	1,330	2.1	147	14.5	1,014
I-5: Los Angeles	Urban	44.01	45.1	1.09	22.2	1,553	2.8	193	21.8	1,525
I-5: Los Angeles	Urban	43.9	44.01	0.11	2.1	146	0.3	22	2.3	162
I-5: Los Angeles	Urban	41.6	43.9	2.3	31.2	2,185	4.4	305	30.1	2,110
I-5: Los Angeles	Urban	40.27	41.6	1.33	6.0	418	1.9	130	30.2	2,112
I-5: Los Angeles	Urban	39.81	40.27	0.46	3.9	272	0.6	45	8.6	603
I-5: Los Angeles	Urban	39.36	39.81	0.45	3.7	257	0.6	44	8.6	599
I-5: Los Angeles	Urban	36.65	39.36	2.71	29.3	2,048	3.3	228	44.9	3,145
I-5: Los Angeles	Urban	36.43	36.65	0.22	2.2	157	0.3	18	3.8	264
I-5: Los Angeles	Urban	36.22	36.43	0.21	2.1	144	0.3	18	3.7	258
I-5: Los Angeles	Urban	35.94	36.22	0.28	3.0	212	0.3	24	4.6	325
I-5: Los Angeles	Urban	29.16	35.94	6.78	77.5	5,424	8.1	570	108.1	7,566
I-5: Los Angeles	Urban	28.25	29.16	0.91	10.5	732	1.1	77	14.5	1,012
I-5: Los Angeles	Urban	22.78	28.25	5.47	57.1	3,997	6.6	460	92.6	6,483
I-5: Los Angeles	Urban	22.28	22.78	0.5	5.2	365	0.6	42	8.5	593
I-5: Los Angeles	Urban	21.41	22.28	0.87	14.3	999	1.1	78	9.5	663
I-5: Los Angeles	Urban	20.58	21.41	0.83	13.0	911	1.1	74	9.6	675
I-5: Los Angeles	Urban	17.21	20.58	3.37	51.4	3,595	4.3	302	40.6	2,843
I-5: Los Angeles	Urban	16.9	17.21	0.31	3.5	245	0.2	17	5.1	358
I-5: Los Angeles	Urban	14.16	16.9	2.74	28.9	2,023	2.2	153	47.2	3,304
I-5: Los Angeles	Urban	13.78	14.16	0.38	4.3	299	0.3	21	6.3	440
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	171.4	11,997	13.2	924	110.0	7,699
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	54.4	3,805	3.6	250	21.8	1,525
CA 710: LA	Suburban	4.96	10.18	5.22	51.1	3,579	3.3	234	20.1	1,407
TOTAL					**5,327.5**	**372,928**	**1,267.7**	**88,740**	**4,153.1**	**290,720**

TABLE P2d. VEHICLE OPERATING COSTS - AHS LANE - BASE VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction	Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction	Daytime Off-Peak Other Vehicle-Miles of Travel, One Direction	Vehicle Operating Costs ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Sacramento	Rural	29.87	34.65	4.78	1,255	115	1,020	1,855	170	1,508
I-5: Sacramento	Urban	26.94	29.87	2.93	879	70	516	1,299	104	762
I-5: Sacramento	Urban	26.69	26.94	0.25	75	6	44	111	9	65
I-5: Sacramento	Urban	25.53	26.69	1.16	169	28	384	249	41	567
I-5: Sacramento	Urban	24.51	25.53	1.02	153	24	333	226	36	492
I-5: Sacramento	Urban	23.1	24.51	1.41	188	34	484	277	50	715
I-5: Sacramento	Urban	22	23.1	1.1	154	26	370	228	39	547
I-5: Sacramento	Urban	19.16	22	2.84	393	68	959	581	100	1,418
I-5: Sacramento	Urban	18.82	19.16	0.34	44	8	118	65	12	175
I-5: Sacramento	Urban	16.7	18.82	2.12	318	50	692	470	75	1,022
I-5: Sacramento	Urban	14.46	16.7	2.24	336	53	731	497	79	1,080
I-5: Sacramento	Rural	0	14.46	14.46	2,169	1,383	3,678	3,206	2,044	5,436
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,719	541	2,411	2,540	799	3,563
I-5: San Joaquin	Rural	28.56	40.45	11.89	2,973	240	2,733	4,393	354	4,039
I-5: San Joaquin	Urban	28.34	28.56	0.22	55	4	51	81	7	75
I-5: San Joaquin	Urban	24.8	28.34	3.54	885	99	786	1,308	146	1,162
I-5: San Joaquin	Rural	14.34	24.8	10.46	2,615	292	2,323	3,865	432	3,433
I-5: San Joaquin	Rural	12.69	14.34	1.65	491	69	677	726	102	1,001
I-5: San Joaquin	Rural	11.8	12.69	0.89	334	55	279	493	81	413
I-5: San Joaquin	Rural	0	11.8	11.8	2,655	711	5,484	3,924	1,051	8,106
I-5: Stanislaus	Rural	0	28.06	28.06	19,642	7,644	21,819	29,031	11,298	32,248
I-5: Merced	Rural	0	32.45	32.45	22,715	8,840	25,232	33,573	13,066	37,294
I-5: Fresno	Rural	0	66.16	66.16	66,160	23,886	42,274	97,785	35,303	62,481
I-5: Kings	Rural	0	26.72	26.72	26,720	9,254	17,466	39,492	13,677	25,815
I-5: Kern	Rural	15.86	87.03	71.17	71,170	14,469	56,701	105,189	21,386	83,804
I-5: Kern	Rural	15.08	15.86	0.78	780	171	609	1,153	252	900
I-5: Kern	Rural	10.35	15.08	4.73	8,514	1,554	4,122	12,584	2,296	6,093
I-5: Kern	Rural	9.28	10.35	1.07	1,926	351	933	2,847	519	1,378
I-5: Kern	Rural	7.04	9.28	2.24	4,032	736	1,952	5,959	1,087	2,885
I-5: Kern	Rural	6.41	7.04	0.63	1,134	207	549	1,676	306	812
I-5: Kern	Rural	5.36	6.41	1.05	1,890	345	915	2,793	510	1,353
I-5: Kern	Rural	0.58	5.36	4.78	8,604	1,570	4,166	12,717	2,320	6,157
I-5: Kern	Rural	0	0.58	0.58	1,044	190	506	1,543	282	747
I-5: Los Angeles	Rural	86.67	88.61	1.94	3,492	590	1,738	5,161	873	2,568
I-5: Los Angeles	Rural	86.13	86.67	0.54	972	164	484	1,437	243	715
I-5: Los Angeles	Rural	84.76	86.13	1.37	2,466	417	1,227	3,645	616	1,814
I-5: Los Angeles	Rural	78.43	84.76	6.33	11,394	1,926	5,670	16,840	2,847	8,380
I-5: Los Angeles	Rural	69.65	78.43	8.78	15,804	2,672	7,864	23,358	3,949	11,623
I-5: Los Angeles	Rural	68.1	69.65	1.55	2,790	472	1,388	4,124	697	2,052
I-5: Los Angeles	Rural	65.43	68.1	2.67	4,806	813	2,391	7,103	1,201	3,535
I-5: Los Angeles	Rural	59.95	65.43	5.48	9,864	1,668	4,908	14,579	2,465	7,255
I-5: Los Angeles	Rural	54.16	59.95	5.79	8,685	1,056	7,629	12,836	1,561	11,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	2,745	334	2,411	4,057	494	3,564
I-5: Los Angeles	Urban	47.13	52.33	5.2	8,944	949	5,707	13,219	1,402	8,435
I-5: Los Angeles	Urban	46.9	47.13	0.23	396	41	254	585	60	375
I-5: Los Angeles	Urban	46.6	46.9	0.3	522	53	325	772	78	480
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,167	118	725	1,724	175	1,071
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,330	147	1,014	1,965	217	1,498
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,553	193	1,525	2,295	285	2,254
I-5: Los Angeles	Urban	43.9	44.01	0.11	146	22	162	216	32	239
I-5: Los Angeles	Urban	41.6	43.9	2.3	2,185	305	2,110	3,229	450	3,119
I-5: Los Angeles	Urban	40.27	41.6	1.33	418	130	2,112	618	192	3,121
I-5: Los Angeles	Urban	39.81	40.27	0.46	272	45	603	402	66	892
I-5: Los Angeles	Urban	39.36	39.81	0.45	257	44	599	380	65	885
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,048	228	3,145	3,026	337	4,648
I-5: Los Angeles	Urban	36.43	36.65	0.22	157	18	264	232	27	391
I-5: Los Angeles	Urban	36.22	36.43	0.21	144	18	258	213	26	382
I-5: Los Angeles	Urban	35.94	36.22	0.28	212	24	325	313	35	480
I-5: Los Angeles	Urban	29.16	35.94	6.78	5,424	570	7,566	8,017	842	11,183
I-5: Los Angeles	Urban	28.25	29.16	0.91	732	77	1,012	1,081	113	1,496
I-5: Los Angeles	Urban	22.78	28.25	5.47	3,997	460	6,483	5,908	680	9,582
I-5: Los Angeles	Urban	22.28	22.78	0.5	365	42	593	540	62	876
I-5: Los Angeles	Urban	21.41	22.28	0.87	999	78	663	1,476	115	981
I-5: Los Angeles	Urban	20.58	21.41	0.83	911	74	675	1,346	110	998
I-5: Los Angeles	Urban	17.21	20.58	3.37	3,595	302	2,843	5,313	446	4,202
I-5: Los Angeles	Urban	16.9	17.21	0.31	245	17	358	362	26	529
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,023	153	3,304	2,991	226	4,883
I-5: Los Angeles	Urban	13.78	14.16	0.38	299	21	440	442	31	650
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	11,997	924	7,699	17,732	1,366	11,379
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	3,805	250	1,525	5,623	370	2,255
CA 710: LA	Suburban	4.96	10.18	5.22	3,579	234	1,407	5,290	346	2,079
TOTAL					**372,928**	**88,740**	**290,720**	**551,188**	**131,157**	**429,686**

TABLE P2e. TRAVEL TIME COST - AHS LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction	Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction	Daytime Off-Peak Other Vehicle-Hours of Travel, One Direction	Travel Time Costs ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Sacramento	Rural	29.87	34.65	4.78	17.9	1.6	14.6	507	46	412
I-5: Sacramento	Urban	26.94	29.87	2.93	12.6	1.0	7.4	355	28	208
I-5: Sacramento	Urban	26.69	26.94	0.25	1.1	0.1	0.6	30	2	18
I-5: Sacramento	Urban	25.53	26.69	1.16	2.4	0.4	5.5	68	11	155
I-5: Sacramento	Urban	24.51	25.53	1.02	2.2	0.3	4.8	62	10	134
I-5: Sacramento	Urban	23.1	24.51	1.41	2.7	0.5	6.9	76	14	195
I-5: Sacramento	Urban	22	23.1	1.1	2.2	0.4	5.3	62	11	149
I-5: Sacramento	Urban	19.16	22	2.84	5.6	1.0	13.7	159	27	387
I-5: Sacramento	Urban	18.82	19.16	0.34	0.6	0.1	1.7	18	3	48
I-5: Sacramento	Urban	16.7	18.82	2.12	4.5	0.7	9.9	128	20	279
I-5: Sacramento	Urban	14.46	16.7	2.24	4.8	0.8	10.4	136	22	295
I-5: Sacramento	Rural	0	14.46	14.46	31.0	19.8	52.5	876	559	1,486
I-5: San Joaquin	Rural	40.45	49.79	9.34	24.6	7.7	34.4	694	218	974
I-5: San Joaquin	Rural	28.56	40.45	11.89	42.5	3.4	39.0	1,201	97	1,104
I-5: San Joaquin	Urban	28.34	28.56	0.22	0.8	0.1	0.7	22	2	20
I-5: San Joaquin	Urban	24.8	28.34	3.54	12.6	1.4	11.2	357	40	318
I-5: San Joaquin	Rural	14.34	24.8	10.46	37.4	4.2	33.2	1,056	118	938
I-5: San Joaquin	Rural	12.69	14.34	1.65	7.0	1.0	9.7	198	28	274
I-5: San Joaquin	Rural	11.8	12.69	0.89	4.8	0.8	4.0	135	22	113
I-5: San Joaquin	Rural	0	11.8	11.8	37.9	10.2	78.3	1,072	287	2,215
I-5: Stanislaus	Rural	0	28.06	28.06	280.6	109.2	311.7	7,934	3,088	8,813
I-5: Merced	Rural	0	32.45	32.45	324.5	126.3	360.5	9,175	3,571	10,192
I-5: Fresno	Rural	0	66.16	66.16	945.1	341.2	603.9	26,723	9,648	17,075
I-5: Kings	Rural	0	26.72	26.72	381.7	132.2	249.5	10,793	3,738	7,055
I-5: Kern	Rural	15.86	87.03	71.17	1,016.7	206.7	810.0	28,747	5,844	22,902
I-5: Kern	Rural	15.08	15.86	0.78	11.1	2.4	8.7	315	69	246
I-5: Kern	Rural	10.35	15.08	4.73	121.6	22.2	58.9	3,439	627	1,665
I-5: Kern	Rural	9.28	10.35	1.07	27.5	5.0	13.3	778	142	377
I-5: Kern	Rural	7.04	9.28	2.24	57.6	10.5	27.9	1,629	297	789
I-5: Kern	Rural	6.41	7.04	0.63	16.2	3.0	7.8	458	84	222
I-5: Kern	Rural	5.36	6.41	1.05	27.0	4.9	13.1	763	139	370
I-5: Kern	Rural	0.58	5.36	4.78	122.9	22.4	59.5	3,475	634	1,683
I-5: Kern	Rural	0	0.58	0.58	14.9	2.7	7.2	422	77	204
I-5: Los Angeles	Rural	86.67	88.61	1.94	49.9	8.4	24.8	1,410	238	702
I-5: Los Angeles	Rural	86.13	86.67	0.54	13.9	2.3	6.9	393	66	195
I-5: Los Angeles	Rural	84.76	86.13	1.37	35.2	6.0	17.5	996	168	496
I-5: Los Angeles	Rural	78.43	84.76	6.33	162.8	27.5	81.0	4,602	778	2,290
I-5: Los Angeles	Rural	69.65	78.43	8.78	225.8	38.2	112.3	6,384	1,079	3,176
I-5: Los Angeles	Rural	68.1	69.65	1.55	39.9	6.7	19.8	1,127	191	561
I-5: Los Angeles	Rural	65.43	68.1	2.67	68.7	11.6	34.2	1,941	328	966
I-5: Los Angeles	Rural	59.95	65.43	5.48	140.9	23.8	70.1	3,984	674	1,983
I-5: Los Angeles	Rural	54.16	59.95	5.79	124.1	15.1	109.0	3,508	427	3,081
I-5: Los Angeles	Rural	52.33	54.16	1.83	39.2	4.8	34.4	1,109	135	974
I-5: Los Angeles	Urban	47.13	52.33	5.2	127.8	13.6	81.5	3,613	383	2,305
I-5: Los Angeles	Urban	46.9	47.13	0.23	5.7	0.6	3.6	160	16	102
I-5: Los Angeles	Urban	46.6	46.9	0.3	7.5	0.8	4.6	211	21	131
I-5: Los Angeles	Urban	45.93	46.6	0.67	16.7	1.7	10.4	471	48	293
I-5: Los Angeles	Urban	45.1	45.93	0.83	19.0	2.1	14.5	537	59	409
I-5: Los Angeles	Urban	44.01	45.1	1.09	22.2	2.8	21.8	627	78	616
I-5: Los Angeles	Urban	43.9	44.01	0.11	2.1	0.3	2.3	59	9	65
I-5: Los Angeles	Urban	41.6	43.9	2.3	31.2	4.4	30.1	883	123	852
I-5: Los Angeles	Urban	40.27	41.6	1.33	6.0	1.9	30.2	169	52	853
I-5: Los Angeles	Urban	39.81	40.27	0.46	3.9	0.6	8.6	110	18	244
I-5: Los Angeles	Urban	39.36	39.81	0.45	3.7	0.6	8.6	104	18	242
I-5: Los Angeles	Urban	36.65	39.36	2.71	29.3	3.3	44.9	827	92	1,270
I-5: Los Angeles	Urban	36.43	36.65	0.22	2.2	0.3	3.8	63	7	107
I-5: Los Angeles	Urban	36.22	36.43	0.21	2.1	0.3	3.7	58	7	104
I-5: Los Angeles	Urban	35.94	36.22	0.28	3.0	0.3	4.6	85	10	131
I-5: Los Angeles	Urban	29.16	35.94	6.78	77.5	8.1	108.1	2,191	230	3,056
I-5: Los Angeles	Urban	28.25	29.16	0.91	10.5	1.1	14.5	295	31	409
I-5: Los Angeles	Urban	22.78	28.25	5.47	57.1	6.6	92.6	1,615	186	2,619
I-5: Los Angeles	Urban	22.28	22.78	0.5	5.2	0.6	8.5	148	17	239
I-5: Los Angeles	Urban	21.41	22.28	0.87	14.3	1.1	9.5	403	31	268
I-5: Los Angeles	Urban	20.58	21.41	0.83	13.0	1.1	9.6	368	30	273
I-5: Los Angeles	Urban	17.21	20.58	3.37	51.4	4.3	40.6	1,452	122	1,148
I-5: Los Angeles	Urban	16.9	17.21	0.31	3.5	0.2	5.1	99	7	145
I-5: Los Angeles	Urban	14.16	16.9	2.74	28.9	2.2	47.2	817	62	1,334
I-5: Los Angeles	Urban	13.78	14.16	0.38	4.3	0.3	6.3	121	9	178
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	171.4	13.2	110.0	4,846	373	3,110
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	54.4	3.6	21.8	1,537	101	616
CA 710: LA	Suburban	4.96	10.18	5.22	51.1	3.3	20.1	1,446	94	568
TOTAL					**5,327.5**	**1,267.7**	**4,153.1**	**150,633**	**35,844**	**117,428**

TABLE P3a. SECTION VOLUME DATA - REMAINING CONVENTIONAL LANES - BASE VOLUME - AHS LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AADT (One Direction)	Truck % of Conventional Lanes AADT	Truck AADT (One Direction)	Peak Period Duration (hours)	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)														
I-5: Sacramento	Rural	29.87	34.65	4.78	2	39,500	14.94%	5,900	6	3,456	20,738	5	4.81%	1,899	380	13	16,863	1,297
I-5: Sacramento	Urban	26.94	29.87	2.93	3	48,500	10.08%	4,890	6	4,850	29,100	5	4.81%	2,332	466	13	17,068	1,313
I-5: Sacramento	Urban	26.69	26.94	0.25	3	48,500	8.06%	3,910	6	4,850	29,100	5	4.81%	2,332	466	13	17,068	1,313
I-5: Sacramento	Urban	25.53	26.69	1.16	3	66,500	12.35%	8,210	3	6,451	19,354	6	4.76%	3,166	528	15	43,980	2,932
I-5: Sacramento	Urban	24.51	25.53	1.02	4	72,500	8.37%	6,070	3	7,250	21,750	6	4.76%	3,451	575	15	47,299	3,153
I-5: Sacramento	Urban	23.1	24.51	1.41	5	79,500	9.43%	7,500	3	7,056	21,167	6	4.76%	3,784	631	15	54,549	3,637
I-5: Sacramento	Urban	22	23.1	1.1	3	74,500	10.40%	7,750	3	6,953	20,860	6	4.76%	3,546	591	15	50,094	3,340
I-5: Sacramento	Urban	19.16	22	2.84	4	64,500	13.33%	8,600	3	5,954	17,862	6	4.76%	3,070	512	15	43,568	2,905
I-5: Sacramento	Urban	18.82	19.16	0.34	5	62,500	13.31%	8,320	3	5,357	16,071	6	4.76%	2,975	496	15	43,453	2,897
I-5: Sacramento	Urban	16.7	18.82	2.12	4	49,500	13.13%	6,500	3	4,950	14,850	6	4.76%	2,356	393	15	32,294	2,153
I-5: Sacramento	Urban	14.46	16.7	2.24	3	39,500	12.91%	5,100	3	3,950	11,850	6	4.76%	1,880	313	15	25,770	1,718
I-5: Sacramento	Rural	0	14.46	14.46	2	29,500	23.73%	7,000	3	2,950	8,850	11	19.13%	5,642	513	10	15,008	1,501
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	24,500	22.45%	5,500	4	2,254	9,016	8	11.58%	2,837	355	12	12,647	1,054
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	39,500	22.03%	8,700	5	3,950	19,750	5	4.03%	1,592	318	14	18,158	1,297
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	44,500	23.15%	10,300	5	4,450	22,250	5	4.03%	1,794	359	14	20,456	1,461
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	49,500	23.23%	11,500	5	4,950	24,750	5	5.58%	2,763	553	14	21,987	1,570
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	39,500	25.06%	9,900	5	3,950	19,750	5	5.58%	2,205	441	14	17,545	1,253
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	62,250	25.11%	15,630	5	4,940	24,702	5	5.58%	3,475	695	14	34,072	2,434
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	41,250	24.65%	10,170	5	4,125	20,625	6	8.17%	3,368	561	13	17,257	1,327
I-5: San Joaquin	Rural	0	11.8	11.8	2	9,250	20.00%	1,850	3	925	2,775	5	8.03%	743	149	16	5,732	358
I-5: Stanislaus	Rural	0	28.06	28.06	2	8,250	12.73%	1,050	4	825	3,300	6	15.57%	1,284	214	14	3,666	262
I-5: Merced	Rural	0	32.45	32.45	2	13,250	19.62%	2,600	4	1,325	5,300	6	15.57%	2,063	344	14	5,887	421
I-5: Fresno	Rural	0	66.16	66.16	2	13,000	19.23%	2,500	5	1,300	6,500	7	18.05%	2,347	335	12	4,153	346
I-5: Kings	Rural	0	26.72	26.72	2	13,000	19.23%	2,500	5	1,300	6,500	7	17.32%	2,251	322	12	4,249	354
I-5: Kern	Rural	15.86	87.03	71.17	2	15,000	19.53%	2,930	5	1,500	7,500	5	10.17%	1,525	305	14	5,975	427
I-5: Kern	Rural	15.08	15.86	0.78	4	28,000	22.86%	6,400	5	2,800	14,000	6	10.95%	3,065	511	13	10,935	841
I-5: Kern	Rural	10.35	15.08	4.73	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	9.28	10.35	1.07	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	7.04	9.28	2.24	4	27,000	22.22%	6,000	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	6.41	7.04	0.63	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	5.36	6.41	1.05	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	0.58	5.36	4.78	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	0	0.58	0.58	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	32,000	10.31%	3,300	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	32,000	11.41%	3,650	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	32,000	10.31%	3,300	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	32,000	10.31%	3,300	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	37,000	9.19%	3,400	5	3,700	18,500	5	6.08%	2,250	450	14	16,250	1,161
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	62,000	5.65%	3,500	5	6,200	31,000	5	6.08%	3,771	754	14	27,229	1,945
I-5: Los Angeles	Urban	47.13	52.33	5.2	4	87,000	6.90%	6,000	6	8,313	49,880	5	6.08%	5,291	1,058	13	31,829	2,448
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	87,000	6.90%	6,000	6	8,313	49,880	5	5.89%	5,128	1,026	13	31,992	2,461
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	89,000	5.93%	5,280	6	8,610	51,659	5	5.89%	5,246	1,049	13	32,095	2,469
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	89,000	6.97%	6,200	6	8,610	51,659	5	5.89%	5,246	1,049	13	32,095	2,469
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	97,000	6.19%	6,000	6	8,633	51,798	5	5.89%	5,718	1,144	13	39,484	3,037
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	112,000	7.59%	8,500	6	8,863	53,176	5	5.89%	6,602	1,320	13	52,222	4,017
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	112,000	5.54%	6,200	6	8,278	49,670	5	6.62%	7,419	1,484	13	54,911	4,224
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	118,000	6.44%	7,600	6	9,342	56,050	5	6.62%	7,817	1,563	13	54,133	4,164
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	115,000	7.42%	8,530	4	4,521	18,085	5	4.88%	5,612	1,122	15	91,303	6,087
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	63,000	6.11%	3,850	4	4,652	18,609	5	4.88%	3,074	615	15	41,316	2,754
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	68,000	5.29%	3,600	4	4,857	19,429	5	4.88%	3,318	664	15	45,253	3,017
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	133,000	6.62%	8,800	5	10,049	50,244	5	4.20%	5,591	1,118	14	77,165	5,512
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	138,000	6.67%	9,200	5	9,857	49,286	5	4.20%	5,801	1,160	14	82,913	5,922
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	138,000	6.67%	9,200	5	9,463	47,314	5	4.20%	5,801	1,160	14	84,885	6,063
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	88,000	5.91%	5,200	5	6,649	33,244	5	4.20%	3,699	740	14	51,056	3,647
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	88,000	5.91%	5,200	5	7,040	35,200	5	4.20%	3,699	740	14	49,101	3,507
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	100,000	6.16%	6,160	5	8,039	40,196	5	4.20%	4,204	841	14	55,600	3,971
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	128,000	5.55%	7,100	5	9,354	46,769	5	4.20%	5,381	1,076	14	75,850	5,418
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	128,000	5.55%	7,100	5	9,354	46,769	5	4.20%	5,381	1,076	14	75,850	5,418
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	136,000	6.65%	9,040	8	9,757	78,052	5	4.48%	6,094	1,219	11	51,854	4,714
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	138,000	6.67%	9,200	8	9,463	75,703	5	4.48%	6,184	1,237	11	56,113	5,101
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	118,000	6.44%	7,600	8	7,867	62,933	5	4.48%	5,288	1,058	11	49,779	4,525
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	118,000	6.44%	7,600	6	7,768	46,610	5	2.79%	3,294	659	13	68,096	5,238
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	128,000	6.56%	8,400	6	7,877	47,262	5	2.79%	3,574	715	13	77,165	5,936
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	126,000	6.54%	8,240	6	8,269	49,613	5	2.79%	3,518	704	13	72,870	5,605
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	108,000	13.43%	14,500	8	7,855	62,836	5	4.48%	4,839	968	11	40,324	3,666
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	86,000	12.00%	10,320	8	7,330	58,636	5	4.48%	3,854	771	11	23,510	2,137
CA 710: LA	Suburban	4.96	10.18	5.22	3	69,000	13.77%	9,500	8	5,914	47,314	5	4.48%	3,092	618	11	18,594	1,690

Table P3b. SECTION FLOW AND SPEED DATA - REMAINING CONVENTIONAL LANES - BASE VOLUME - AHS LANE CASE

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane (pcphpl)	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)		Nighttime Off-Peak Speed (mph)		Daytime Off-Peak Speed (mph)	
		Begin	End	Length (mi)							Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	1,728	1,857	190	205	649	697	50	64	50	65	50	65
I-5: Sacramento	Urban	26.94	29.87	2.93	1,617	1,698	155	164	438	460	50	55	50	55	50	55
I-5: Sacramento	Urban	26.69	26.94	0.25	1,617	1,682	155	162	438	455	50	55	50	55	50	55
I-5: Sacramento	Urban	25.53	26.69	1.16	2,150	2,283	176	187	977	1,038	50	48	50	55	50	55
I-5: Sacramento	Urban	24.51	25.53	1.02	1,813	1,888	144	150	788	821	50	55	50	55	50	55
I-5: Sacramento	Urban	23.1	24.51	1.41	1,411	1,478	126	132	727	762	50	55	50	55	50	55
I-5: Sacramento	Urban	22	23.1	1.1	2,318	2,438	197	208	1,113	1,171	50	44	50	55	50	55
I-5: Sacramento	Urban	19.16	22	2.84	1,488	1,588	128	137	726	775	50	55	50	55	50	55
I-5: Sacramento	Urban	18.82	19.16	0.34	1,071	1,143	99	106	579	618	50	55	50	55	50	55
I-5: Sacramento	Urban	16.7	18.82	2.12	1,238	1,319	98	105	538	574	50	55	50	55	50	55
I-5: Sacramento	Urban	14.46	16.7	2.24	1,317	1,402	104	112	573	610	50	55	50	55	50	55
I-5: Sacramento	Rural	0	14.46	14.46	1,475	1,650	256	289	750	839	50	65	50	65	50	65
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,127	1,254	177	199	527	586	50	65	50	65	50	65
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,317	1,462	106	118	432	480	50	65	50	65	50	65
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,483	1,655	120	134	487	543	50	55	50	55	50	55
I-5: San Joaquin	Urban	24.8	28.34	3.54	1,238	1,381	138	155	393	438	50	55	50	55	50	55
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,317	1,482	147	166	418	470	50	65	50	65	50	65
I-5: San Joaquin	Rural	12.69	14.34	1.65	988	1,112	139	157	487	548	50	65	50	65	50	65
I-5: San Joaquin	Rural	11.8	12.69	0.89	1,375	1,545	187	211	442	497	50	65	50	65	50	65
I-5: San Joaquin	Rural	0	11.8	11.8	463	509	74	84	179	197	50	65	50	65	50	65
I-5: Stanislaus	Rural	0	28.06	28.06	413	439	107	122	131	139	50	65	50	65	50	65
I-5: Merced	Rural	0	32.45	32.45	663	728	172	197	210	231	50	65	50	65	50	65
I-5: Fresno	Rural	0	66.16	66.16	650	713	168	193	173	190	50	65	50	65	50	65
I-5: Kings	Rural	0	26.72	26.72	650	713	161	185	177	194	50	65	50	65	50	65
I-5: Kern	Rural	15.86	87.03	71.17	750	823	152	175	213	234	50	65	50	65	50	65
I-5: Kern	Rural	15.08	15.86	0.78	700	780	128	146	210	234	50	65	50	65	50	65
I-5: Kern	Rural	10.35	15.08	4.73	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	9.28	10.35	1.07	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	7.04	9.28	2.24	675	750	123	142	163	182	50	65	50	65	50	65
I-5: Kern	Rural	6.41	7.04	0.63	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	5.36	6.41	1.05	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	0.58	5.36	4.78	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	0	0.58	0.58	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.67	88.61	1.94	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.13	86.67	0.54	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	84.76	86.13	1.37	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	78.43	84.76	6.33	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	69.65	78.43	8.78	800	841	116	126	217	228	50	65	50	65	50	65
I-5: Los Angeles	Rural	68.1	69.65	1.55	800	846	116	127	217	230	50	65	50	65	50	65
I-5: Los Angeles	Rural	65.43	68.1	2.67	800	841	116	126	217	228	50	65	50	65	50	65
I-5: Los Angeles	Rural	59.95	65.43	5.48	800	841	116	126	217	228	50	65	50	65	50	65
I-5: Los Angeles	Rural	54.16	59.95	5.79	925	968	113	122	290	304	50	65	50	65	50	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	1,550	1,594	189	198	486	500	50	65	50	65	50	65
I-5: Los Angeles	Urban	47.13	52.33	5.2	2,078	2,150	265	278	612	633	50	53	50	55	50	55
I-5: Los Angeles	Urban	46.9	47.13	0.23	2,078	2,150	256	269	615	636	50	53	50	55	50	55
I-5: Los Angeles	Urban	46.6	46.9	0.3	2,152	2,216	262	274	617	636	50	52	50	55	50	55
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,722	1,782	210	220	494	511	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,727	1,780	229	239	607	626	50	55	50	55	50	55
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,773	1,840	264	277	803	834	50	55	50	55	50	55
I-5: Los Angeles	Urban	43.9	44.01	0.11	2,070	2,127	371	386	1,056	1,085	50	54	50	55	50	55
I-5: Los Angeles	Urban	41.6	43.9	2.3	1,868	1,929	313	325	833	860	50	55	50	55	50	55
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,507	1,563	374	391	2,029	2,104	50	55	50	55	50	53
I-5: Los Angeles	Urban	39.81	40.27	0.46	1,163	1,199	154	161	689	710	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.36	39.81	0.45	971	997	133	138	603	619	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,010	2,076	224	233	1,102	1,139	50	53	50	55	50	55
I-5: Los Angeles	Urban	36.43	36.65	0.22	1,643	1,698	193	201	987	1,020	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.22	36.43	0.21	2,366	2,445	290	302	1,516	1,566	50	40	50	55	50	55
I-5: Los Angeles	Urban	35.94	36.22	0.28	1,662	1,711	185	192	912	939	50	55	50	55	50	55
I-5: Los Angeles	Urban	29.16	35.94	6.78	1,760	1,812	185	192	877	903	50	55	50	55	50	55
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,010	2,072	210	219	993	1,023	50	53	50	55	50	55
I-5: Los Angeles	Urban	22.78	28.25	5.47	1,871	1,923	215	223	1,084	1,114	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.28	22.78	0.5	2,338	2,403	269	278	1,354	1,392	50	45	50	55	50	55
I-5: Los Angeles	Urban	21.41	22.28	0.87	1,951	2,016	244	254	943	974	50	54	50	55	50	55
I-5: Los Angeles	Urban	20.58	21.41	0.83	2,366	2,445	309	322	1,275	1,318	50	45	50	55	50	55
I-5: Los Angeles	Urban	17.21	20.58	3.37	1,967	2,030	264	275	1,131	1,168	50	54	50	55	50	55
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,942	2,005	165	171	1,310	1,352	50	54	50	55	50	55
I-5: Los Angeles	Urban	14.16	16.9	2.74	1,969	2,034	179	186	1,484	1,533	50	54	50	55	50	55
I-5: Los Angeles	Urban	13.78	14.16	0.38	2,067	2,135	176	183	1,401	1,447	50	53	50	55	50	55
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,964	2,095	242	260	916	978	50	60	50	65	50	65
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1,832	1,942	193	206	534	566	50	63	50	65	50	65
CA 710: LA	Suburban	4.96	10.18	5.22	1,971	2,107	206	222	563	602	50	57	50	65	50	65

TABLE P3c. SECTION TRAVEL DATA - REMAINING CONVENTIONAL LANES -BASE VOLUME - AHS LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	296.1	1,317.5	27.1	118.8	240.8	1,054.9	14,806	84,319	1,356	7,722	12,040	68,567
I-5: Sacramento	Urban	26.94	29.87	2.93	171.9	1,393.9	13.8	111.7	100.8	817.6	8,597	76,666	689	6,143	5,042	44,968
I-5: Sacramento	Urban	26.69	26.94	0.25	11.7	121.6	0.9	9.7	6.9	71.3	587	6,689	47	536	344	3,923
I-5: Sacramento	Urban	25.53	26.69	1.16	55.4	410.0	9.1	58.5	126.0	813.1	2,772	19,679	453	3,219	6,298	44,718
I-5: Sacramento	Urban	24.51	25.53	1.02	37.1	369.6	5.9	58.6	80.8	803.7	1,857	20,328	295	3,225	4,039	44,206
I-5: Sacramento	Urban	23.1	24.51	1.41	56.3	491.4	10.1	87.9	145.1	1,266.5	2,816	27,030	503	4,833	7,256	69,658
I-5: Sacramento	Urban	22	23.1	1.1	47.7	467.3	8.1	63.5	114.6	897.7	2,387	20,559	406	3,495	5,732	49,371
I-5: Sacramento	Urban	19.16	22	2.84	135.3	799.3	23.3	137.4	330.0	1,949.7	6,764	43,963	1,163	7,557	16,498	107,236
I-5: Sacramento	Urban	18.82	19.16	0.34	14.5	86.1	2.7	15.9	39.3	232.9	727	4,737	135	877	1,967	12,807
I-5: Sacramento	Urban	16.7	18.82	2.12	82.7	497.2	13.1	78.9	179.8	1,081.3	4,134	27,348	656	4,339	8,990	59,473
I-5: Sacramento	Urban	14.46	16.7	2.24	68.5	420.3	10.9	66.7	149.1	914.0	3,427	23,117	544	3,668	7,453	50,271
I-5: Sacramento	Rural	0	14.46	14.46	607.3	1,501.6	387.2	957.3	1,029.9	2,546.5	30,366	97,605	19,359	62,226	51,495	165,519
I-5: San Joaquin	Rural	40.45	49.79	9.34	378.1	1,004.7	119.0	316.1	530.4	1,409.3	18,904	65,305	5,948	20,547	26,518	91,607
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,034.4	2,817.0	83.4	227.1	951.0	2,589.9	51,722	183,106	4,170	14,763	47,551	168,343
I-5: San Joaquin	Urban	28.34	28.56	0.22	22.7	68.4	1.8	5.5	20.8	62.9	1,133	3,762	91	303	1,042	3,459
I-5: San Joaquin	Urban	24.8	28.34	3.54	407.1	1,222.9	45.5	136.5	361.6	1,086.4	20,355	67,260	2,273	7,510	18,082	59,750
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,035.5	2,381.7	115.6	265.9	919.9	2,115.7	51,777	154,808	5,781	17,284	45,996	137,524
I-5: San Joaquin	Rural	12.69	14.34	1.65	204.7	469.6	28.8	66.1	282.3	647.7	10,234	30,525	1,440	4,294	14,116	42,104
I-5: San Joaquin	Rural	11.8	12.69	0.89	90.5	212.8	14.8	34.7	75.7	178.0	4,526	13,831	739	2,259	3,787	11,572
I-5: San Joaquin	Rural	0	11.8	11.8	131.0	403.0	35.1	107.9	270.6	832.5	6,549	26,196	1,753	7,013	13,528	54,111
I-5: Stanislaus	Rural	0	28.06	28.06	235.7	1,243.3	91.7	483.8	261.8	1,381.1	11,785	80,813	4,586	31,450	13,091	89,769
I-5: Merced	Rural	0	32.45	32.45	675.0	2,126.7	262.7	827.7	749.8	2,362.4	33,748	138,237	13,134	53,798	37,488	153,558
I-5: Fresno	Rural	0	66.16	66.16	1,654.0	5,343.7	597.1	1,929.2	1,056.9	3,414.4	82,700	347,340	29,857	125,401	52,843	221,939
I-5: Kings	Rural	0	26.72	26.72	668.0	2,158.2	231.3	747.4	436.7	1,410.7	33,400	140,280	11,567	48,583	21,833	91,697
I-5: Kern	Rural	15.86	87.03	71.17	2,085.3	6,607.9	424.0	1,343.4	1,661.3	5,264.4	104,264	429,511	21,198	87,323	83,066	342,188
I-5: Kern	Rural	15.08	15.86	0.78	49.9	129.6	10.9	28.4	39.0	101.2	2,496	8,424	547	1,845	1,949	6,579
I-5: Kern	Rural	10.35	15.08	4.73	306.5	943.1	55.9	172.1	148.4	456.6	15,325	61,301	2,796	11,185	7,420	29,682
I-5: Kern	Rural	9.28	10.35	1.07	69.3	213.3	12.7	38.9	33.6	103.3	3,467	13,867	633	2,530	1,679	6,714
I-5: Kern	Rural	7.04	9.28	2.24	161.3	434.2	29.4	79.2	78.1	210.2	8,064	28,224	1,471	5,150	3,905	13,666
I-5: Kern	Rural	6.41	7.04	0.63	40.8	125.6	7.4	22.9	19.8	60.8	2,041	8,165	372	1,490	988	3,953
I-5: Kern	Rural	5.36	6.41	1.05	68.0	209.4	12.4	38.2	32.9	101.4	3,402	13,608	621	2,483	1,647	6,589
I-5: Kern	Rural	0.58	5.36	4.78	309.7	953.1	56.5	173.9	150.0	461.5	15,487	61,949	2,826	11,304	7,499	29,996
I-5: Kern	Rural	0	0.58	0.58	37.6	115.6	6.9	21.1	18.2	56.0	1,879	7,517	343	1,372	910	3,640
I-5: Los Angeles	Rural	86.67	88.61	1.94	150.2	457.5	25.4	77.4	74.7	227.7	7,508	29,740	1,269	5,028	3,736	14,799
I-5: Los Angeles	Rural	86.13	86.67	0.54	41.8	127.4	7.1	21.5	20.8	63.4	2,090	8,278	353	1,400	1,040	4,119
I-5: Los Angeles	Rural	84.76	86.13	1.37	106.0	323.1	17.9	54.6	52.8	160.8	5,302	21,002	896	3,551	2,638	10,451
I-5: Los Angeles	Rural	78.43	84.76	6.33	489.9	1,492.9	82.8	252.4	243.8	742.9	24,497	97,039	4,141	16,405	12,190	48,287
I-5: Los Angeles	Rural	69.65	78.43	8.78	347.7	2,326.0	58.8	393.2	173.0	1,157.4	17,384	151,192	2,939	25,560	8,651	75,234
I-5: Los Angeles	Rural	68.1	69.65	1.55	67.9	405.6	11.5	68.6	33.8	201.8	3,395	26,366	574	4,457	1,689	13,120
I-5: Los Angeles	Rural	65.43	68.1	2.67	105.7	707.3	17.9	119.6	52.6	352.0	5,287	45,977	894	7,773	2,631	22,879
I-5: Los Angeles	Rural	59.95	65.43	5.48	217.0	1,451.8	36.7	245.4	108.0	722.4	10,850	94,366	1,834	15,953	5,399	46,957
I-5: Los Angeles	Rural	54.16	59.95	5.79	196.9	1,496.5	23.9	182.0	172.9	1,314.5	9,843	97,272	1,197	11,832	8,646	85,440
I-5: Los Angeles	Rural	52.33	54.16	1.83	64.1	823.5	7.8	100.2	56.3	723.3	3,203	53,528	390	6,511	2,813	47,016
I-5: Los Angeles	Urban	47.13	52.33	5.2	357.8	4,556.4	38.0	465.8	228.3	2,801.7	17,888	241,488	1,898	25,618	11,414	154,094
I-5: Los Angeles	Urban	46.9	47.13	0.23	15.8	201.5	1.6	20.0	10.1	124.6	791	10,681	81	1,098	507	6,851
I-5: Los Angeles	Urban	46.6	46.9	0.3	18.4	280.3	1.9	26.9	11.4	164.7	919	14,578	93	1,481	571	9,057
I-5: Los Angeles	Urban	45.93	46.6	0.67	48.2	585.5	4.9	59.5	30.0	363.7	2,411	32,200	245	3,270	1,498	20,006
I-5: Los Angeles	Urban	45.1	45.93	0.83	53.2	733.3	5.9	81.0	40.5	559.0	2,659	40,333	294	4,452	2,027	30,745
I-5: Los Angeles	Urban	44.01	45.1	1.09	88.0	973.9	10.9	120.9	86.4	956.4	4,399	53,563	546	6,650	4,320	52,602
I-5: Los Angeles	Urban	43.9	44.01	0.11	6.0	95.6	0.9	14.0	6.7	103.7	302	5,161	45	771	334	5,706
I-5: Los Angeles	Urban	41.6	43.9	2.3	166.1	2,192.9	23.2	305.8	160.4	2,118.0	8,303	120,612	1,158	16,821	8,019	116,487
I-5: Los Angeles	Urban	40.27	41.6	1.33	35.7	404.9	11.1	125.6	180.1	2,121.2	1,784	22,270	554	6,910	9,007	112,425
I-5: Los Angeles	Urban	39.81	40.27	0.46	10.5	146.1	1.7	24.1	23.2	324.4	523	8,037	86	1,328	1,161	17,844
I-5: Los Angeles	Urban	39.36	39.81	0.45	9.3	150.5	1.6	25.7	21.6	350.7	463	8,280	79	1,414	1,078	19,286
I-5: Los Angeles	Urban	36.65	39.36	2.71	180.2	2,399.1	20.0	257.3	276.7	3,550.5	9,009	127,153	1,002	14,149	13,836	195,280
I-5: Los Angeles	Urban	36.43	36.65	0.22	14.5	184.0	1.7	21.7	24.3	309.5	723	10,120	85	1,191	1,216	17,025
I-5: Los Angeles	Urban	36.22	36.43	0.21	13.2	231.8	1.6	20.7	23.8	302.5	662	9,274	81	1,137	1,188	16,637
I-5: Los Angeles	Urban	35.94	36.22	0.28	11.0	159.2	1.2	17.7	16.9	244.6	550	8,758	61	975	845	13,451
I-5: Los Angeles	Urban	29.16	35.94	6.78	282.0	4,082.8	29.6	429.1	393.4	5,695.1	14,102	224,554	1,482	23,599	19,672	313,231
I-5: Los Angeles	Urban	28.25	29.16	0.91	45.1	647.6	4.7	65.3	62.3	863.3	2,253	34,325	236	3,590	3,117	47,479
I-5: Los Angeles	Urban	22.78	28.25	5.47	283.8	4,393.4	32.7	505.5	460.3	7,125.2	14,190	241,637	1,633	27,800	23,014	391,886
I-5: Los Angeles	Urban	22.28	22.78	0.5	25.9	490.8	3.0	46.2	42.1	651.3	1,297	22,088	149	2,541	2,104	35,821
I-5: Los Angeles	Urban	21.41	22.28	0.87	90.3	1,173.9	7.0	90.0	60.0	765.7	4,514	63,392	352	4,949	2,999	42,114
I-5: Los Angeles	Urban	20.58	21.41	0.83	83.8	1,303.2	6.8	87.1	62.1	790.3	4,189	58,644	342	4,790	3,105	43,469
I-5: Los Angeles	Urban	17.21	20.58	3.37	273.2	3,674.5	23.0	303.1	216.1	2,853.7	13,660	198,426	1,148	16,671	10,805	156,951
I-5: Los Angeles	Urban	16.9	17.21	0.31	18.6	250.3	1.3	17.4	27.2	359.1	931	13,518	66	956	1,360	19,750
I-5: Los Angeles	Urban	14.16	16.9	2.74	170.0	2,240.7	12.9	166.3	277.5	3,591.9	8,498	120,998	643	9,149	13,875	197,556
I-5: Los Angeles	Urban	13.78	14.16	0.38	24.7	332.4	1.7	22.7	36.2	470.5	1,233	17,620	87	1,249	1,811	25,880
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,739.6	9,347.7	134.0	664.6	1,116.3	5,537.3	86,979	560,864	6,699	43,196	55,817	359,925
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	392.6	2,285.1	25.8	145.6	157.4	888.0	19,631	143,964	1,290	9,461	7,871	57,722
CA 710: LA	Suburban	4.96	10.18	5.22	680.1	3,736.4	44.4	214.1	267.3	1,287.6	34,005	212,976	2,222	13,917	13,363	83,697
TOTAL					**18,174.5**	**93,925.7**	**3,498.0**	**14,689.8**	**15,949.2**	**87,696.4**	**908,725**	**5,586,341**	**174,898**	**913,331**	**797,461**	**5,220,436**

TABLE P3d. VEHICLE OPERATING COSTS - REMAINING CONVENTIONAL LANES - BASE VOLUME - AHS LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	14,806	84,319	1,356	7,722	12,040	68,567	26,148	27,404	2,395	2,510	21,263	22,284
I-5: Sacramento	Urban	26.94	29.87	2.93	8,597	76,666	689	6,143	5,042	44,968	15,182	24,917	1,217	1,997	8,905	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	587	6,689	47	536	344	3,923	1,036	2,174	83	174	608	1,275
I-5: Sacramento	Urban	25.53	26.69	1.16	2,772	19,679	453	3,219	6,298	44,718	4,895	6,396	801	1,046	11,123	14,533
I-5: Sacramento	Urban	24.51	25.53	1.02	1,857	20,328	295	3,225	4,039	44,206	3,280	6,606	520	1,048	7,133	14,367
I-5: Sacramento	Urban	23.1	24.51	1.41	2,816	27,030	503	4,833	7,256	69,658	4,972	8,785	889	1,571	12,814	22,639
I-5: Sacramento	Urban	22	23.1	1.1	2,387	20,559	406	3,495	5,732	49,371	4,215	6,682	717	1,136	10,123	16,046
I-5: Sacramento	Urban	19.16	22	2.84	6,764	43,963	1,163	7,557	16,498	107,236	11,945	14,288	2,053	2,456	29,135	34,852
I-5: Sacramento	Urban	18.82	19.16	0.34	727	4,737	135	877	1,967	12,807	1,285	1,539	238	285	3,473	4,162
I-5: Sacramento	Urban	16.7	18.82	2.12	4,134	27,348	656	4,339	8,990	59,473	7,301	8,888	1,158	1,410	15,877	19,329
I-5: Sacramento	Urban	14.46	16.7	2.24	3,427	23,117	544	3,668	7,453	50,271	6,052	7,513	960	1,192	13,162	16,338
I-5: Sacramento	Rural	0	14.46	14.46	30,366	97,605	19,359	62,226	51,495	165,519	53,627	31,722	34,188	20,223	90,941	53,794
I-5: San Joaquin	Rural	40.45	49.79	9.34	18,904	65,305	5,948	20,547	26,518	91,607	33,385	21,224	10,504	6,678	46,831	29,772
I-5: San Joaquin	Rural	28.56	40.45	11.89	51,722	183,106	4,170	14,763	47,551	168,343	91,341	59,509	7,364	4,798	83,976	54,711
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,133	3,762	91	303	1,042	3,459	2,001	1,223	161	99	1,840	1,124
I-5: San Joaquin	Urban	24.8	28.34	3.54	20,355	67,260	2,273	7,510	18,082	59,750	35,947	21,860	4,014	2,441	31,934	19,419
I-5: San Joaquin	Rural	14.34	24.8	10.46	51,777	154,808	5,781	17,284	45,996	137,524	91,439	50,313	10,209	5,617	81,229	44,695
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,234	30,525	1,440	4,294	14,116	42,104	18,073	9,921	2,543	1,396	24,929	13,684
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,526	13,831	739	2,259	3,787	11,572	7,992	4,495	1,305	734	6,687	3,761
I-5: San Joaquin	Rural	0	11.8	11.8	6,549	26,196	1,753	7,013	13,528	54,111	11,566	8,514	3,096	2,279	23,890	17,586
I-5: Stanislaus	Rural	0	28.06	28.06	11,785	80,813	4,586	31,450	13,091	89,769	20,813	26,264	8,100	10,221	23,119	29,175
I-5: Merced	Rural	0	32.45	32.45	33,748	138,237	13,134	53,798	37,488	153,558	59,599	44,927	23,194	17,484	66,205	49,906
I-5: Fresno	Rural	0	66.16	66.16	82,700	347,340	29,857	125,401	52,843	221,939	146,049	112,886	52,728	40,755	93,321	72,130
I-5: Kings	Rural	0	26.72	26.72	33,400	140,280	11,567	48,583	21,833	91,697	58,985	45,591	20,428	15,789	38,557	29,802
I-5: Kern	Rural	15.86	87.03	71.17	104,264	429,511	21,198	87,323	83,066	342,188	184,131	139,591	37,435	28,380	146,696	111,211
I-5: Kern	Rural	15.08	15.86	0.78	2,496	8,424	547	1,845	1,949	6,579	4,408	2,738	965	599	3,443	2,138
I-5: Kern	Rural	10.35	15.08	4.73	15,325	61,301	2,796	11,185	7,420	29,682	27,064	19,923	4,938	3,635	13,105	9,647
I-5: Kern	Rural	9.28	10.35	1.07	3,467	13,867	633	2,530	1,679	6,714	6,122	4,507	1,117	822	2,964	2,182
I-5: Kern	Rural	7.04	9.28	2.24	8,064	28,224	1,471	5,150	3,905	13,666	14,241	9,173	2,599	1,674	6,896	4,441
I-5: Kern	Rural	6.41	7.04	0.63	2,041	8,165	372	1,490	988	3,953	3,605	2,654	658	484	1,745	1,285
I-5: Kern	Rural	5.36	6.41	1.05	3,402	13,608	621	2,483	1,647	6,589	6,008	4,423	1,096	807	2,909	2,141
I-5: Kern	Rural	0.58	5.36	4.78	15,487	61,949	2,826	11,304	7,499	29,996	27,351	20,133	4,991	3,674	13,243	9,749
I-5: Kern	Rural	0	0.58	0.58	1,879	7,517	343	1,372	910	3,640	3,319	2,443	606	446	1,607	1,183
I-5: Los Angeles	Rural	86.67	88.61	1.94	7,508	29,740	1,269	5,028	3,736	14,799	13,259	9,666	2,242	1,634	6,598	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	2,090	8,278	353	1,400	1,040	4,119	3,691	2,690	624	455	1,836	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	5,302	21,002	896	3,551	2,638	10,451	9,363	6,826	1,583	1,154	4,659	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	24,497	97,039	4,141	16,405	12,190	48,287	43,262	31,538	7,314	5,332	21,528	15,693
I-5: Los Angeles	Rural	69.65	78.43	8.78	17,384	151,192	2,939	25,560	8,651	75,234	30,701	49,137	5,190	8,307	15,277	24,451
I-5: Los Angeles	Rural	68.1	69.65	1.55	3,395	26,366	574	4,457	1,689	13,120	5,995	8,569	1,013	1,449	2,983	4,264
I-5: Los Angeles	Rural	65.43	68.1	2.67	5,287	45,977	894	7,773	2,631	22,879	9,336	14,943	1,578	2,526	4,646	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	10,850	94,366	1,834	15,953	5,399	46,957	19,162	30,669	3,240	5,185	9,535	15,261
I-5: Los Angeles	Rural	54.16	59.95	5.79	9,843	97,272	1,197	11,832	8,646	85,440	17,383	31,613	2,114	3,846	15,268	27,768
I-5: Los Angeles	Rural	52.33	54.16	1.83	3,203	53,528	390	6,511	2,813	47,016	5,656	17,396	688	2,116	4,968	15,280
I-5: Los Angeles	Urban	47.13	52.33	5.2	17,888	241,488	1,898	25,618	11,414	154,094	31,590	78,484	3,351	8,326	20,158	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	791	10,681	81	1,098	507	6,851	1,397	3,471	144	357	896	2,226
I-5: Los Angeles	Urban	46.6	46.9	0.3	919	14,578	93	1,481	571	9,057	1,624	4,738	165	481	1,009	2,944
I-5: Los Angeles	Urban	45.93	46.6	0.67	2,411	32,200	245	3,270	1,498	20,006	4,258	10,465	432	1,063	2,645	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	2,659	40,333	294	4,452	2,027	30,745	4,696	13,108	518	1,447	3,580	9,992
I-5: Los Angeles	Urban	44.01	45.1	1.09	4,399	53,563	546	6,650	4,320	52,602	7,768	17,408	965	2,161	7,629	17,096
I-5: Los Angeles	Urban	43.9	44.01	0.11	302	5,161	45	771	334	5,706	534	1,677	80	251	590	1,854
I-5: Los Angeles	Urban	41.6	43.9	2.3	8,303	120,612	1,158	16,821	8,019	116,487	14,663	39,199	2,045	5,467	14,162	37,858
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,784	22,270	554	6,910	9,007	112,425	3,151	7,238	978	2,246	15,907	36,538
I-5: Los Angeles	Urban	39.81	40.27	0.46	523	8,037	86	1,328	1,161	17,844	924	2,612	153	432	2,051	5,799
I-5: Los Angeles	Urban	39.36	39.81	0.45	463	8,280	79	1,414	1,078	19,286	817	2,691	140	460	1,904	6,268
I-5: Los Angeles	Urban	36.65	39.36	2.71	9,009	127,153	1,002	14,149	13,836	195,280	15,910	41,325	1,770	4,598	24,435	63,466
I-5: Los Angeles	Urban	36.43	36.65	0.22	723	10,120	85	1,191	1,216	17,025	1,277	3,289	150	387	2,148	5,533
I-5: Los Angeles	Urban	36.22	36.43	0.21	662	9,274	81	1,137	1,188	16,637	1,170	3,014	143	370	2,099	5,407
I-5: Los Angeles	Urban	35.94	36.22	0.28	550	8,758	61	975	845	13,451	971	2,846	108	317	1,492	4,372
I-5: Los Angeles	Urban	29.16	35.94	6.78	14,102	224,554	1,482	23,599	19,672	313,231	24,905	72,980	2,617	7,670	34,740	101,800
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,253	34,325	236	3,590	3,117	47,479	3,979	11,156	416	1,167	5,504	15,431
I-5: Los Angeles	Urban	22.78	28.25	5.47	14,190	241,637	1,633	27,800	23,014	391,886	25,060	78,532	2,883	9,035	40,643	127,363
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,297	22,088	149	2,541	2,104	35,821	2,291	7,178	264	826	3,715	11,642
I-5: Los Angeles	Urban	21.41	22.28	0.87	4,514	63,392	352	4,949	2,999	42,114	7,971	20,602	622	1,609	5,296	13,687
I-5: Los Angeles	Urban	20.58	21.41	0.83	4,189	58,644	342	4,790	3,105	43,469	7,398	19,059	604	1,557	5,483	14,127
I-5: Los Angeles	Urban	17.21	20.58	3.37	13,660	198,426	1,148	16,671	10,805	156,951	24,123	64,488	2,027	5,418	19,081	51,009
I-5: Los Angeles	Urban	16.9	17.21	0.31	931	13,518	66	956	1,360	19,750	1,643	4,394	116	311	2,401	6,419
I-5: Los Angeles	Urban	14.16	16.9	2.74	8,498	120,998	643	9,149	13,875	197,556	15,008	39,324	1,135	2,973	24,504	64,206
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,233	17,620	87	1,249	1,811	25,880	2,177	5,726	154	406	3,198	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	86,979	560,864	6,699	43,196	55,817	359,925	153,606	182,281	11,830	14,039	98,574	116,976
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	19,631	143,964	1,290	9,461	7,871	57,722	34,669	46,788	2,278	3,075	13,901	18,760
CA 710: LA	Suburban	4.96	10.18	5.22	34,005	212,976	2,222	13,917	13,363	83,697	60,052	69,217	3,924	4,523	23,600	27,201
TOTAL					**908,725**	**5,586,341**	**174,898**	**913,331**	**797,461**	**5,220,436**	**1,604,819**	**1,815,561**	**308,871**	**296,833**	**1,408,324**	**1,696,642**

TABLE P3e. TRAVEL TIME COST - REMAINING CONVENTIONAL LANES - BASE VOLUME - AHS LANE CASE

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	296.1	1,317.5	27.1	118.8	240.8	1,054.9	8,373	12,062	767	1,088	6,809	9,658
I-5: Sacramento	Urban	26.94	29.87	2.93	171.9	1,393.9	13.8	111.7	100.8	817.6	4,861	12,762	390	1,023	2,851	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	11.7	121.6	0.9	9.7	6.9	71.3	332	1,113	27	89	195	653
I-5: Sacramento	Urban	25.53	26.69	1.16	55.4	410.0	9.1	58.5	126.0	813.1	1,567	3,754	256	536	3,562	7,444
I-5: Sacramento	Urban	24.51	25.53	1.02	37.1	369.6	5.9	58.6	80.8	803.7	1,050	3,384	167	537	2,284	7,359
I-5: Sacramento	Urban	23.1	24.51	1.41	56.3	491.4	10.1	87.9	145.1	1,266.5	1,592	4,499	285	804	4,103	11,596
I-5: Sacramento	Urban	22	23.1	1.1	47.7	467.3	8.1	63.5	114.6	897.7	1,350	4,278	229	582	3,241	8,218
I-5: Sacramento	Urban	19.16	22	2.84	135.3	799.3	23.3	137.4	330.0	1,949.7	3,825	7,318	657	1,258	9,329	17,851
I-5: Sacramento	Urban	18.82	19.16	0.34	14.5	86.1	2.7	15.9	39.3	232.9	411	789	76	146	1,112	2,132
I-5: Sacramento	Urban	16.7	18.82	2.12	82.7	497.2	13.1	78.9	179.8	1,081.3	2,338	4,552	371	722	5,084	9,900
I-5: Sacramento	Urban	14.46	16.7	2.24	68.5	420.3	10.9	66.7	149.1	914.0	1,938	3,848	308	611	4,215	8,368
I-5: Sacramento	Rural	0	14.46	14.46	607.3	1,501.6	387.2	957.3	1,029.9	2,546.5	17,172	13,748	10,947	8,765	29,120	23,314
I-5: San Joaquin	Rural	40.45	49.79	9.34	378.1	1,004.7	119.0	316.1	530.4	1,409.3	10,690	9,199	3,363	2,894	14,996	12,903
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,034.4	2,817.0	83.4	227.1	951.0	2,589.9	29,248	25,791	2,358	2,079	26,890	23,712
I-5: San Joaquin	Urban	28.34	28.56	0.22	22.7	68.4	1.8	5.5	20.8	62.9	641	626	52	50	589	576
I-5: San Joaquin	Urban	24.8	28.34	3.54	407.1	1,222.9	45.5	136.5	361.6	1,086.4	11,511	11,196	1,285	1,250	10,225	9,946
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,035.5	2,381.7	115.6	265.9	919.9	2,115.7	29,279	21,805	3,269	2,435	26,010	19,371
I-5: San Joaquin	Rural	12.69	14.34	1.65	204.7	469.6	28.8	66.1	282.3	647.7	5,787	4,300	814	605	7,982	5,930
I-5: San Joaquin	Rural	11.8	12.69	0.89	90.5	212.8	14.8	34.7	75.7	178.0	2,559	1,948	418	318	2,141	1,630
I-5: San Joaquin	Rural	0	11.8	11.8	131.0	403.0	35.1	107.9	270.6	832.5	3,703	3,690	991	988	7,650	7,622
I-5: Stanislaus	Rural	0	28.06	28.06	235.7	1,243.3	91.7	483.8	261.8	1,381.1	6,664	11,383	2,594	4,430	7,403	12,644
I-5: Merced	Rural	0	32.45	32.45	675.0	2,126.7	262.7	827.7	749.8	2,362.4	19,084	19,471	7,427	7,578	21,199	21,629
I-5: Fresno	Rural	0	66.16	66.16	1,654.0	5,343.7	597.1	1,929.2	1,056.9	3,414.4	46,766	48,924	16,884	17,663	29,882	31,261
I-5: Kings	Rural	0	26.72	26.72	668.0	2,158.2	231.3	747.4	436.7	1,410.7	18,887	19,759	6,541	6,843	12,346	12,916
I-5: Kern	Rural	15.86	87.03	71.17	2,085.3	6,607.9	424.0	1,343.4	1,661.3	5,264.4	58,960	60,498	11,987	12,300	46,973	48,199
I-5: Kern	Rural	15.08	15.86	0.78	49.9	129.6	10.9	28.4	39.0	101.2	1,411	1,187	309	260	1,102	927
I-5: Kern	Rural	10.35	15.08	4.73	306.5	943.1	55.9	172.1	148.4	456.6	8,666	8,634	1,581	1,576	4,196	4,181
I-5: Kern	Rural	9.28	10.35	1.07	69.3	213.3	12.7	38.9	33.6	103.3	1,960	1,953	358	356	949	946
I-5: Kern	Rural	7.04	9.28	2.24	161.3	434.2	29.4	79.2	78.1	210.2	4,560	3,975	832	725	2,208	1,925
I-5: Kern	Rural	6.41	7.04	0.63	40.8	125.6	7.4	22.9	19.8	60.8	1,154	1,150	211	210	559	557
I-5: Kern	Rural	5.36	6.41	1.05	68.0	209.4	12.4	38.2	32.9	101.4	1,924	1,917	351	350	931	928
I-5: Kern	Rural	0.58	5.36	4.78	309.7	953.1	56.5	173.9	150.0	461.5	8,758	8,726	1,598	1,592	4,241	4,225
I-5: Kern	Rural	0	0.58	0.58	37.6	115.6	6.9	21.1	18.2	56.0	1,063	1,059	194	193	515	513
I-5: Los Angeles	Rural	86.67	88.61	1.94	150.2	457.5	25.4	77.4	74.7	227.7	4,246	4,189	718	708	2,113	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	41.8	127.4	7.1	21.5	20.8	63.4	1,182	1,166	200	197	588	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	106.0	323.1	17.9	54.6	52.8	160.8	2,998	2,958	507	500	1,492	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	489.9	1,492.9	82.8	252.4	243.8	742.9	13,853	13,668	2,342	2,311	6,893	6,801
I-5: Los Angeles	Rural	69.65	78.43	8.78	347.7	2,326.0	58.8	393.2	173.0	1,157.4	9,831	21,296	1,662	3,600	4,892	10,597
I-5: Los Angeles	Rural	68.1	69.65	1.55	67.9	405.6	11.5	68.6	33.8	201.8	1,920	3,714	325	628	955	1,848
I-5: Los Angeles	Rural	65.43	68.1	2.67	105.7	707.3	17.9	119.6	52.6	352.0	2,990	6,476	505	1,095	1,488	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	217.0	1,451.8	36.7	245.4	108.0	722.4	6,136	13,292	1,037	2,247	3,053	6,614
I-5: Los Angeles	Rural	54.16	59.95	5.79	196.9	1,496.5	23.9	182.0	172.9	1,314.5	5,566	13,701	677	1,667	4,889	12,035
I-5: Los Angeles	Rural	52.33	54.16	1.83	64.1	823.5	7.8	100.2	56.3	723.3	1,811	7,540	220	917	1,591	6,622
I-5: Los Angeles	Urban	47.13	52.33	5.2	357.8	4,556.4	38.0	465.8	228.3	2,801.7	10,115	41,716	1,073	4,264	6,455	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	15.8	201.5	1.6	20.0	10.1	124.6	447	1,845	46	183	287	1,140
I-5: Los Angeles	Urban	46.6	46.9	0.3	18.4	280.3	1.9	26.9	11.4	164.7	520	2,567	53	246	323	1,508
I-5: Los Angeles	Urban	45.93	46.6	0.67	48.2	585.5	4.9	59.5	30.0	363.7	1,363	5,360	138	544	847	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	53.2	733.3	5.9	81.0	40.5	559.0	1,504	6,714	166	741	1,146	5,118
I-5: Los Angeles	Urban	44.01	45.1	1.09	88.0	973.9	10.9	120.9	86.4	956.4	2,488	8,916	309	1,107	2,443	8,756
I-5: Los Angeles	Urban	43.9	44.01	0.11	6.0	95.6	0.9	14.0	6.7	103.7	171	875	26	128	189	950
I-5: Los Angeles	Urban	41.6	43.9	2.3	166.1	2,192.9	23.2	305.8	160.4	2,118.0	4,695	20,078	655	2,800	4,535	19,391
I-5: Los Angeles	Urban	40.27	41.6	1.33	35.7	404.9	11.1	125.6	180.1	2,121.2	1,009	3,707	313	1,150	5,093	19,421
I-5: Los Angeles	Urban	39.81	40.27	0.46	10.5	146.1	1.7	24.1	23.2	324.4	296	1,338	49	221	657	2,970
I-5: Los Angeles	Urban	39.36	39.81	0.45	9.3	150.5	1.6	25.7	21.6	350.7	262	1,378	45	235	610	3,210
I-5: Los Angeles	Urban	36.65	39.36	2.71	180.2	2,399.1	20.0	257.3	276.7	3,550.5	5,095	21,965	567	2,355	7,824	32,507
I-5: Los Angeles	Urban	36.43	36.65	0.22	14.5	184.0	1.7	21.7	24.3	309.5	409	1,685	48	198	688	2,834
I-5: Los Angeles	Urban	36.22	36.43	0.21	13.2	231.8	1.6	20.7	23.8	302.5	375	2,123	46	189	672	2,770
I-5: Los Angeles	Urban	35.94	36.22	0.28	11.0	159.2	1.2	17.7	16.9	244.6	311	1,458	35	162	478	2,239
I-5: Los Angeles	Urban	29.16	35.94	6.78	282.0	4,082.8	29.6	429.1	393.4	5,695.1	7,975	37,380	838	3,928	11,124	52,142
I-5: Los Angeles	Urban	28.25	29.16	0.91	45.1	647.6	4.7	65.3	62.3	863.3	1,274	5,930	133	598	1,762	7,904
I-5: Los Angeles	Urban	22.78	28.25	5.47	283.8	4,393.4	32.7	505.5	460.3	7,125.2	8,025	40,224	923	4,628	13,014	65,235
I-5: Los Angeles	Urban	22.28	22.78	0.5	25.9	490.8	3.0	46.2	42.1	651.3	734	4,494	84	423	1,190	5,963
I-5: Los Angeles	Urban	21.41	22.28	0.87	90.3	1,173.9	7.0	90.0	60.0	765.7	2,552	10,748	199	824	1,696	7,010
I-5: Los Angeles	Urban	20.58	21.41	0.83	83.8	1,303.2	6.8	87.1	62.1	790.3	2,369	11,932	193	797	1,756	7,236
I-5: Los Angeles	Urban	17.21	20.58	3.37	273.2	3,674.5	23.0	303.1	216.1	2,853.7	7,724	33,642	649	2,775	6,110	26,127
I-5: Los Angeles	Urban	16.9	17.21	0.31	18.6	250.3	1.3	17.4	27.2	359.1	526	2,292	37	159	769	3,288
I-5: Los Angeles	Urban	14.16	16.9	2.74	170.0	2,240.7	12.9	166.3	277.5	3,591.9	4,806	20,515	363	1,523	7,846	32,886
I-5: Los Angeles	Urban	13.78	14.16	0.38	24.7	332.4	1.7	22.7	36.2	470.5	697	3,044	49	208	1,024	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,739.6	9,347.7	134.0	664.6	1,116.3	5,537.3	49,186	85,583	3,788	6,084	31,564	50,697
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	392.6	2,285.1	25.8	145.6	157.4	888.0	11,101	20,922	730	1,333	4,451	8,130
CA 710: LA	Suburban	4.96	10.18	5.22	680.1	3,736.4	44.4	214.1	267.3	1,287.6	19,229	34,209	1,257	1,960	7,557	11,789
TOTAL					**18,174.5**	**93,925.7**	**3,498.0**	**14,689.8**	**15,949.2**	**87,696.4**	**513,873**	**859,938**	**98,903**	**134,492**	**450,954**	**802,906**

TABLE P4. AUTOMATED AND NON-AUTOMATED TRUCK VEHICLE OPERATIONS COSTS PER MILE

Cost Category	Non-Automated		Automated
	Unit Cost (1998 $ per mile)	2001-Equiv. Unit Cost ($ per mile)	2001-Equiv. Unit Cost ($ per mile)
Driver Wages & Benefits	0.389	0.408	0.136
Other Wages and Benefits	0.399	0.418	0.418
Tires	0.019	0.020	0.020
Outside Maintenance	0.052	0.055	0.055
Fuel	0.102	0.107	0.091
Equipment Rents and Purchased Transportation	0.404	0.424	0.424
Insurance	0.051	0.053	0.053
Depreciation	0.088	0.092	0.092
Misc.	0.18	0.189	0.189
TOTAL	1.684	1.766	1.478

APPENDIX Q
DEDICATED TRUCK LANE PLANNING, DESIGN, CONSTRUCTION, AND REHABILITATION COSTS

Methodologies

Costs for incremental planning, design, construction, and rehabilitation of the added dedicated-truck lane (having a 48-foot cross section) were calculated on a segment-by-segment basis, in a similar fashion to those for the AHS lane. Cost calculations for the roadway surface are identical to those for the corresponding AHS system, since both systems have the same cross-sectional width. However, the dedicated truck system would not require construction or rehabilitation of the automation-related infrastructure of magnetic strips and transfer terminals. The incremental cost is the cost of building and maintaining the dedicated truck lane above the no-build option.

Calculation methodologies for the costs in the tables presented here are outlined in the main report.

Results

Tables 9.2 and 9.3 (in the main report) show unit costs for urban and rural sections. Table Q1 (in this appendix) shows costs associated with constructing the roadway area and barriers, itemized according to segment. Table Q2 shows costs for rehabilitation of the roadway area.

In addition, Table Q3 (also Table 10.2 in the main report) shows costs for interchange construction, and rehabilitation costs for interchanges are shown in Table Q4 (also Table 10.4 in the main report). Table Q5 (also Table 11.2 in the main report) summarizes maintenance costs for the travel lanes and interchanges.

TABLE Q1. INCREMENTAL CONSTRUCTION COSTS OF DEDICATED TRUCK LANE FOR ROOADWAY SPACE AND BARRIERS

County	City/Suburban/ Rural	Post Mile of Segment			Dedicated Lane Placement	New Freeway Costs ($)			Barrier Costs ($)				Total Construction Costs ($)	
		Begin	End	Length (mi)		2001-Unit Cost per Lane Mile	Total Cost	EUAC	# of Barriers in One Direction	Unit Cost per Lane Mile	Total Cost	EUAC	Total Cost	EUATC
I-5: Sacramento	Rural	29.87	34.65	4.78	Median	4,181,019	19,985,272	1,451,908	1.5	94,776	679,544	49,368	20,664,816	1,501,276
I-5: Sacramento	Urban	26.94	29.87	2.93	Median	6,394,500	18,735,885	1,361,142	1.5	94,776	416,541	30,261	19,152,426	1,391,403
I-5: Sacramento	Urban	26.69	26.94	0.25	Non-Median	23,979,375	5,994,844	435,519	2.0	94,776	47,388	3,443	6,042,232	438,962
I-5: Sacramento	Urban	25.53	26.69	1.16	Non-Median	23,979,375	27,816,075	2,020,808	2.0	94,776	219,880	15,974	28,035,955	2,036,782
I-5: Sacramento	Urban	24.51	25.53	1.02	Non-Median	23,979,375	24,458,963	1,776,917	2.0	94,776	193,343	14,046	24,652,306	1,790,963
I-5: Sacramento	Urban	23.1	24.51	1.41	Non-Median	23,979,375	33,810,919	2,456,326	2.0	94,776	267,268	19,417	34,078,187	2,475,743
I-5: Sacramento	Urban	22	23.1	1.1	Non-Median	23,979,375	26,377,313	1,916,283	2.0	94,776	208,507	15,148	26,585,820	1,931,431
I-5: Sacramento	Urban	19.16	22	2.84	Non-Median	23,979,375	68,101,425	4,947,494	2.0	94,776	538,328	39,109	68,639,753	4,986,603
I-5: Sacramento	Urban	18.82	19.16	0.34	Non-Median	23,979,375	8,152,988	592,306	2.0	94,776	64,448	4,682	8,217,435	596,988
I-5: Sacramento	Urban	16.7	18.82	2.12	Non-Median	23,979,375	50,836,275	3,693,200	2.0	94,776	401,850	29,194	51,238,125	3,722,394
I-5: Sacramento	Urban	14.46	16.7	2.24	Median	6,394,500	14,323,680	1,040,600	1.5	94,776	318,447	23,135	14,642,127	1,063,735
I-5: Sacramento	Rural	0	14.46	14.46	Median	4,181,019	60,457,538	4,392,174	1.5	94,776	2,055,691	149,344	62,513,230	4,541,518
I-5: San Joaquin	Rural	40.45	49.79	9.34	Median	4,181,019	39,050,720	2,836,992	1.5	94,776	1,327,812	96,464	40,378,531	2,933,456
I-5: San Joaquin	Rural	28.56	40.45	11.89	Median	4,181,019	49,712,319	3,611,546	1.5	94,776	1,690,330	122,801	51,402,649	3,734,346
I-5: San Joaquin	Urban	28.34	28.56	0.22	Non-Median	6,968,365	1,533,040	111,374	2.0	94,776	41,701	3,030	1,574,742	114,403
I-5: San Joaquin	Urban	24.8	28.34	3.54	Non-Median	23,979,375	84,886,988	6,166,947	2.0	94,776	671,014	48,748	85,558,002	6,215,696
I-5: San Joaquin	Rural	14.34	24.8	10.46	Median	4,181,019	43,733,461	3,177,188	1.5	94,776	1,487,035	108,032	45,220,497	3,285,220
I-5: San Joaquin	Rural	12.69	14.34	1.65	Median	4,181,019	6,898,682	501,182	1.5	94,776	234,571	17,041	7,133,252	518,223
I-5: San Joaquin	Rural	11.8	12.69	0.89	Median	4,181,019	3,721,107	270,334	1.5	94,776	126,526	9,192	3,847,633	279,526
I-5: San Joaquin	Rural	0	11.8	11.8	Median	4,181,019	49,336,027	3,584,209	1.5	94,776	1,677,535	121,871	51,013,562	3,706,080
I-5: Stanislaus	Rural	0	28.06	28.06	Median	4,181,019	117,319,400	8,523,127	1.5	94,776	3,989,122	289,805	121,308,521	8,812,932
I-5: Merced	Rural	0	32.45	32.45	Median	4,181,019	135,674,074	9,856,574	1.5	94,776	4,613,222	335,146	140,287,296	10,191,719
I-5: Fresno	Rural	0	66.16	66.16	Median	4,181,019	276,616,232	20,095,868	1.5	94,776	9,405,570	683,304	286,021,803	20,779,173
I-5: Kings	Rural	0	26.72	26.72	Median	4,181,019	111,716,834	8,116,106	1.5	94,776	3,798,622	275,966	115,515,456	8,392,072
I-5: Kern	Rural	15.86	87.03	71.17	Median	4,181,019	297,563,139	21,617,638	1.5	94,776	10,117,812	735,048	307,680,951	22,352,686
I-5: Kern	Rural	15.08	15.86	0.78	Median	4,181,019	3,261,195	236,922	1.5	94,776	110,888	8,056	3,372,083	244,978
I-5: Kern	Rural	10.35	15.08	4.73	Non-Median	6,968,365	32,960,368	2,394,535	2.0	94,776	896,581	65,136	33,856,949	2,459,671
I-5: Kern	Rural	9.28	10.35	1.07	Median	4,181,019	4,473,691	325,009	1.5	94,776	152,115	11,051	4,625,806	336,060
I-5: Kern	Rural	7.04	9.28	2.24	Non-Median	6,968,365	15,609,138	1,133,987	2.0	94,776	424,596	30,846	16,033,735	1,164,833
I-5: Kern	Rural	6.41	7.04	0.63	Median	4,181,019	2,634,042	191,360	1.5	94,776	89,563	6,507	2,723,605	197,867
I-5: Kern	Rural	5.36	6.41	1.05	Non-Median	6,968,365	7,316,784	531,556	2.0	94,776	199,030	14,459	7,515,813	546,016
I-5: Kern	Rural	0.58	5.36	4.78	Non-Median	6,968,365	33,308,787	2,419,847	2.0	94,776	906,059	65,824	34,214,845	2,485,671
I-5: Kern	Rural	0	0.58	0.58	Non-Median	6,968,365	4,041,652	293,622	2.0	94,776	109,940	7,987	4,151,592	301,609
I-5: Los Angeles	Rural	86.67	88.61	1.94	Non-Median	6,968,365	13,518,629	982,114	2.0	94,776	367,731	26,715	13,886,360	1,008,829
I-5: Los Angeles	Rural	86.13	86.67	0.54	Non-Median	6,968,365	3,762,917	273,372	2.0	94,776	102,358	7,436	3,865,275	280,808
I-5: Los Angeles	Rural	84.76	86.13	1.37	Non-Median	6,968,365	9,546,661	693,554	2.0	94,776	259,686	18,866	9,806,347	712,420
I-5: Los Angeles	Rural	78.43	84.76	6.33	Median	4,181,019	26,465,852	1,922,715	1.5	94,776	899,898	65,377	27,365,750	1,988,092
I-5: Los Angeles	Rural	69.65	78.43	8.78	Non-Median	6,968,365	61,182,248	4,444,824	2.0	94,776	1,664,267	120,907	62,846,515	4,565,731
I-5: Los Angeles	Rural	68.1	69.65	1.55	Median	4,181,019	6,480,580	470,807	1.5	94,776	220,354	16,008	6,700,934	486,816
I-5: Los Angeles	Rural	65.43	68.1	2.67	Non-Median	6,968,365	18,605,536	1,351,672	2.0	94,776	506,104	36,768	19,111,639	1,388,440
I-5: Los Angeles	Rural	59.95	65.43	5.48	Median	4,181,019	22,911,985	1,664,531	1.5	94,776	779,059	56,598	23,691,044	1,721,129
I-5: Los Angeles	Rural	54.16	59.95	5.79	Non-Median	6,968,365	40,346,836	2,931,154	2.0	94,776	1,097,506	79,733	41,444,342	3,010,886
I-5: Los Angeles	Rural	52.33	54.16	1.83	Non-Median	6,968,365	12,752,109	926,427	2.0	94,776	346,880	25,200	13,098,989	951,627
I-5: Los Angeles	Urban	47.13	52.33	5.2	Non-Median	23,979,375	124,692,750	9,058,793	2.0	94,776	985,670	71,608	125,678,420	9,130,400
I-5: Los Angeles	Urban	46.9	47.13	0.23	Non-Median	23,979,375	5,515,256	400,677	2.0	94,776	43,597	3,167	5,558,853	403,845
I-5: Los Angeles	Urban	46.6	46.9	0.3	Non-Median	23,979,375	7,193,812	522,623	2.0	94,776	56,866	4,131	7,250,678	526,754
I-5: Los Angeles	Urban	45.93	46.6	0.67	Non-Median	23,979,375	16,066,181	1,167,191	2.0	94,776	127,000	9,226	16,193,181	1,176,417
I-5: Los Angeles	Urban	45.1	45.93	0.83	Non-Median	23,979,375	19,902,881	1,445,923	2.0	94,776	157,328	11,430	20,060,209	1,457,352
I-5: Los Angeles	Urban	44.01	45.1	1.09	Non-Median	23,979,375	26,137,519	1,898,862	2.0	94,776	206,612	15,010	26,344,130	1,913,872
I-5: Los Angeles	Urban	43.9	44.01	0.11	Non-Median	23,979,375	2,637,731	191,628	2.0	94,776	20,851	1,515	2,658,582	193,143
I-5: Los Angeles	Urban	41.6	43.9	2.3	Non-Median	23,979,375	55,152,562	4,006,774	2.0	94,776	435,970	31,673	55,588,532	4,038,446
I-5: Los Angeles	Urban	40.27	41.6	1.33	Non-Median	23,979,375	31,892,569	2,316,960	2.0	94,776	252,104	18,315	32,144,673	2,335,275
I-5: Los Angeles	Urban	39.81	40.27	0.46	Non-Median	23,979,375	11,030,513	801,355	2.0	94,776	87,194	6,335	11,117,706	807,689
I-5: Los Angeles	Urban	39.36	39.81	0.45	Non-Median	23,979,375	10,790,719	783,934	2.0	94,776	85,298	6,197	10,876,017	790,131
I-5: Los Angeles	Urban	36.65	39.36	2.71	Non-Median	23,979,375	64,984,106	4,721,025	2.0	94,776	513,686	37,319	65,497,792	4,758,343
I-5: Los Angeles	Urban	36.43	36.65	0.22	Median	6,394,500	1,406,790	102,202	1.5	94,776	31,276	2,272	1,438,066	104,474
I-5: Los Angeles	Urban	36.22	36.43	0.21	Median	6,394,500	1,342,845	97,556	1.5	94,776	29,854	2,169	1,372,699	99,725
I-5: Los Angeles	Urban	35.94	36.22	0.28	Non-Median	23,979,375	6,714,225	487,781	2.0	94,776	53,075	3,856	6,767,300	491,637
I-5: Los Angeles	Urban	29.16	35.94	6.78	Non-Median	23,979,375	162,580,163	11,811,272	2.0	94,776	1,285,163	93,366	163,865,325	11,904,637
I-5: Los Angeles	Urban	28.25	29.16	0.91	Non-Median	23,979,375	21,821,231	1,585,289	2.0	94,776	172,492	12,531	21,993,724	1,597,820
I-5: Los Angeles	Urban	22.78	28.25	5.47	Non-Median	23,979,375	131,167,181	9,529,153	2.0	94,776	1,036,849	75,326	132,204,031	9,604,479
I-5: Los Angeles	Urban	22.28	22.78	0.5	Non-Median	23,979,375	11,989,688	871,038	2.0	94,776	94,776	6,885	12,084,464	877,923
I-5: Los Angeles	Urban	21.41	22.28	0.87	Non-Median	23,979,375	20,862,056	1,515,606	2.0	94,776	164,910	11,981	21,026,966	1,527,586
I-5: Los Angeles	Urban	20.58	21.41	0.83	Non-Median	23,979,375	19,902,881	1,445,923	2.0	94,776	157,328	11,430	20,060,209	1,457,352
I-5: Los Angeles	Urban	17.21	20.58	3.37	Non-Median	23,979,375	80,810,494	5,870,794	2.0	94,776	638,790	46,407	81,449,284	5,917,202
I-5: Los Angeles	Urban	16.9	17.21	0.31	Median	6,394,500	1,982,295	144,012	1.5	94,776	44,071	3,202	2,026,366	147,213
I-5: Los Angeles	Urban	14.16	16.9	2.74	Non-Median	23,979,375	65,703,488	4,773,287	2.0	94,776	519,372	37,732	66,222,860	4,811,019
I-5: Los Angeles	Urban	13.78	14.16	0.38	Median	6,394,500	2,429,910	176,530	1.5	94,776	54,022	3,925	2,483,932	180,455
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	Non-Median	15,473,870	159,535,602	11,590,088	2.0	94,776	1,954,281	141,976	161,489,883	11,732,064
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	Non-Median	15,473,870	43,172,098	3,136,406	2.0	94,776	528,850	38,420	43,700,948	3,174,826
CA 710: LA	Suburban	4.96	10.18	5.22	Non-Median	15,473,870	80,773,602	5,868,114	2.0	94,776	989,461	71,883	81,763,064	5,939,998
TOTAL							**3,084,183,353**	**224,062,563**			**64,451,471**	**4,682,329**	**3,148,634,824**	**228,744,893**

TABLE Q2. INCREMENTAL REHABILITATION OF DEDICATED TRUCK LANE COSTS FOR ROADWAY SPACE

County	City/Suburban/Rural	Post Mile of Segment			Dedicated Lane Placement	Rehabilitation Costs ($)		
		Begin	End	Length (mi)		2001-Unit Cost per Lane Mile	Total Cost	EUAC
I-5: Sacramento	Rural	29.87	34.65	4.78	Median	181,178	866,028	54,749
I-5: Sacramento	Urban	26.94	29.87	2.93	Median	399,656	1,170,993	74,029
I-5: Sacramento	Urban	26.69	26.94	0.25	Non-Median	1,278,900	319,725	20,213
I-5: Sacramento	Urban	25.53	26.69	1.16	Non-Median	1,278,900	1,483,524	93,787
I-5: Sacramento	Urban	24.51	25.53	1.02	Non-Median	1,278,900	1,304,478	82,468
I-5: Sacramento	Urban	23.1	24.51	1.41	Non-Median	1,278,900	1,803,249	114,000
I-5: Sacramento	Urban	22	23.1	1.1	Non-Median	1,278,900	1,406,790	88,936
I-5: Sacramento	Urban	19.16	22	2.84	Non-Median	1,278,900	3,632,076	229,616
I-5: Sacramento	Urban	18.82	19.16	0.34	Non-Median	1,278,900	434,826	27,489
I-5: Sacramento	Urban	16.7	18.82	2.12	Non-Median	1,278,900	2,711,268	171,404
I-5: Sacramento	Urban	14.46	16.7	2.24	Median	399,656	895,230	56,596
I-5: Sacramento	Rural	0	14.46	14.46	Median	181,178	2,619,827	165,623
I-5: San Joaquin	Rural	40.45	49.79	9.34	Median	181,178	1,692,198	106,979
I-5: San Joaquin	Rural	28.56	40.45	11.89	Median	181,178	2,154,200	136,187
I-5: San Joaquin	Urban	28.34	28.56	0.22	Non-Median	1,278,900	281,358	17,787
I-5: San Joaquin	Urban	24.8	28.34	3.54	Non-Median	1,278,900	4,527,306	286,212
I-5: San Joaquin	Rural	14.34	24.8	10.46	Median	181,178	1,895,117	119,807
I-5: San Joaquin	Rural	12.69	14.34	1.65	Median	181,178	298,943	18,899
I-5: San Joaquin	Rural	11.8	12.69	0.89	Median	181,178	161,248	10,194
I-5: San Joaquin	Rural	0	11.8	11.8	Median	181,178	2,137,895	135,156
I-5: Stanislaus	Rural	0	28.06	28.06	Median	181,178	5,083,841	321,396
I-5: Merced	Rural	0	32.45	32.45	Median	181,178	5,879,210	371,678
I-5: Fresno	Rural	0	66.16	66.16	Median	181,178	11,986,703	757,788
I-5: Kings	Rural	0	26.72	26.72	Median	181,178	4,841,063	306,047
I-5: Kern	Rural	15.86	87.03	71.17	Median	181,178	12,894,403	815,172
I-5: Kern	Rural	15.08	15.86	0.78	Median	181,178	141,318	8,934
I-5: Kern	Rural	10.35	15.08	4.73	Non-Median	1,672,408	7,910,488	500,094
I-5: Kern	Rural	9.28	10.35	1.07	Median	181,178	193,860	12,256
I-5: Kern	Rural	7.04	9.28	2.24	Non-Median	1,672,408	3,746,193	236,831
I-5: Kern	Rural	6.41	7.04	0.63	Median	181,178	114,142	7,216
I-5: Kern	Rural	5.36	6.41	1.05	Non-Median	1,672,408	1,756,028	111,014
I-5: Kern	Rural	0.58	5.36	4.78	Non-Median	1,672,408	7,994,109	505,380
I-5: Kern	Rural	0	0.58	0.58	Non-Median	1,672,408	969,996	61,322
I-5: Los Angeles	Rural	86.67	88.61	1.94	Non-Median	1,672,408	3,244,471	205,112
I-5: Los Angeles	Rural	86.13	86.67	0.54	Non-Median	1,672,408	903,100	57,093
I-5: Los Angeles	Rural	84.76	86.13	1.37	Non-Median	1,672,408	2,291,199	144,847
I-5: Los Angeles	Rural	78.43	84.76	6.33	Median	181,178	1,146,854	72,503
I-5: Los Angeles	Rural	69.65	78.43	8.78	Non-Median	1,672,408	14,683,740	928,292
I-5: Los Angeles	Rural	68.1	69.65	1.55	Median	181,178	280,825	17,753
I-5: Los Angeles	Rural	65.43	68.1	2.67	Non-Median	1,672,408	4,465,329	282,294
I-5: Los Angeles	Rural	59.95	65.43	5.48	Median	181,178	992,853	62,767
I-5: Los Angeles	Rural	54.16	59.95	5.79	Non-Median	1,672,408	9,683,241	612,165
I-5: Los Angeles	Rural	52.33	54.16	1.83	Non-Median	1,672,408	3,060,506	193,482
I-5: Los Angeles	Urban	47.13	52.33	5.2	Non-Median	1,278,900	6,650,280	420,424
I-5: Los Angeles	Urban	46.9	47.13	0.23	Non-Median	1,278,900	294,147	18,596
I-5: Los Angeles	Urban	46.6	46.9	0.3	Non-Median	1,278,900	383,670	24,255
I-5: Los Angeles	Urban	45.93	46.6	0.67	Non-Median	1,278,900	856,863	54,170
I-5: Los Angeles	Urban	45.1	45.93	0.83	Non-Median	1,278,900	1,061,487	67,106
I-5: Los Angeles	Urban	44.01	45.1	1.09	Non-Median	1,278,900	1,394,001	88,127
I-5: Los Angeles	Urban	43.9	44.01	0.11	Non-Median	1,278,900	140,679	8,894
I-5: Los Angeles	Urban	41.6	43.9	2.3	Non-Median	1,278,900	2,941,470	185,957
I-5: Los Angeles	Urban	40.27	41.6	1.33	Non-Median	1,278,900	1,700,937	107,532
I-5: Los Angeles	Urban	39.81	40.27	0.46	Non-Median	1,278,900	588,294	37,191
I-5: Los Angeles	Urban	39.36	39.81	0.45	Non-Median	1,278,900	575,505	36,383
I-5: Los Angeles	Urban	36.65	39.36	2.71	Non-Median	1,278,900	3,465,819	219,106
I-5: Los Angeles	Urban	36.43	36.65	0.22	Median	399,656	87,924	5,558
I-5: Los Angeles	Urban	36.22	36.43	0.21	Median	399,656	83,928	5,306
I-5: Los Angeles	Urban	35.94	36.22	0.28	Non-Median	1,278,900	358,092	22,638
I-5: Los Angeles	Urban	29.16	35.94	6.78	Non-Median	1,278,900	8,670,942	548,169
I-5: Los Angeles	Urban	28.25	29.16	0.91	Non-Median	1,278,900	1,163,799	73,574
I-5: Los Angeles	Urban	22.78	28.25	5.47	Non-Median	1,278,900	6,995,583	442,254
I-5: Los Angeles	Urban	22.28	22.78	0.5	Non-Median	1,278,900	639,450	40,425
I-5: Los Angeles	Urban	21.41	22.28	0.87	Non-Median	1,278,900	1,112,643	70,340
I-5: Los Angeles	Urban	20.58	21.41	0.83	Non-Median	1,278,900	1,061,487	67,106
I-5: Los Angeles	Urban	17.21	20.58	3.37	Non-Median	1,278,900	4,309,893	272,467
I-5: Los Angeles	Urban	16.9	17.21	0.31	Median	399,656	123,893	7,832
I-5: Los Angeles	Urban	14.16	16.9	2.74	Non-Median	1,278,900	3,504,186	221,531
I-5: Los Angeles	Urban	13.78	14.16	0.38	Median	181,178	68,847	4,352
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	Non-Median	1,475,654	15,213,991	961,814
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	Non-Median	1,475,654	4,117,074	260,278
CA 710: LA	Suburban	4.96	10.18	5.22	Non-Median	1,475,654	7,702,913	486,971
TOTAL							**211,327,547**	**13,359,926**

TABLE Q3. DEDICATED LANE INTERCHANGE CONSTRUCTION COSTS* ($)

Interchange	Interchange Type	Unit Cost	Unit Cost	EUAC
Long Beach	Suburban**	35,000,000	36,235,500	2,632,470
Commerce	Suburban**	35,000,000	36,235,500	2,632,470
Sylmar	Urban	50,000,000	51,765,000	3,760,671
Wheeler Ridge	Rural	20,000,000	20,706,000	1,504,268
Lost Hills	Rural	20,000,000	20,706,000	1,504,268
Coalinga	Rural	20,000,000	20,706,000	1,504,268
Los Banos	Rural	20,000,000	20,706,000	1,504,268
Vernalis	Rural	20,000,000	20,706,000	1,504,268
Lathrop	Rural	20,000,000	20,706,000	1,504,268
Sacramento	Rural	20,000,000	20,706,000	1,504,268
TOTAL			269,178,000	19,555,489

* Freeway costs in this study are assumed to correspond to the highest values in each range (see Table 10.2 in main report).

**Suburban values are an average of the rural and urban high values.

TABLE Q4. DEDICATED LANE INTERCHANGE REHABILITATION COSTS ($)

Interchange	Interchange Type (Urban/Rural)	Unit Cost (2001)	Length (mi)	Total Cost	EUAC
Long Beach	Suburban**	1,475,654	2	2,951,308	214,265
Commerce	Suburban**	1,475,654	2	2,951,308	214,265
Sylmar	Urban	1,278,900	2	2,557,800	185,696
Wheeler Ridge	Rural	1,672,408	2	3,344,815	242,834
Lost Hills	Rural	1,672,408	2	3,344,815	242,834
Coalinga	Rural	1,672,408	2	3,344,815	242,834
Los Banos	Rural	1,672,408	2	3,344,815	242,834
Vernalis	Rural	1,672,408	2	3,344,815	242,834
Lathrop	Rural	1,672,408	2	3,344,815	242,834
Sacramento	Rural	1,672,408	2	3,344,815	242,834
TOTAL			20	31,874,123	2,314,061

TABLE Q5. SUMMARY OF DEDICATED-TRUCK-LANE MAINTENANCE COSTS ($)

Cost Category	EUAC
Travel Lane	86,479
Interchange	4,138
TOTAL	90,617

APPENDIX R

DEDICATED TRUCK LANE VEHICLE-HOURS AND VEHICLE-MILES, VEHICLE OPERATING COSTS, AND USER COSTS

Methodologies

The calculation procedures for determining vehicle-revenue-miles, vehicle-revenue-hours, vehicle operating costs, and user travel-time costs for the dedicated-truck-lane option are similar to those presented in Appendix P, for the AHS lane. There is one notable exception: for the AHS lane, truck operations unit costs were reduced because the convoying ability of AHS vehicles would reduce costs related to drivers and fuel (see Appendix P). For the dedicated-truck-lane option, however, convoying capability is not available. Thus, unit costs for vehicle operations for trucks operating on the dedicated truck lane were assumed to be equal to those for trucks operating on the conventional freeway lanes (see Appendix M), or $1.77 per vehicle-mile.

Results

The details for the calculations of vehicle-miles and vehicle-hours of travel, and also for operations and user costs, are shown in Tables R1a through R1e for the existing configuration of the freeway, Tables R2a through R2e for the added dedicated truck lane, and Tables R3a through R3e for the existing conventional lanes with the added dedicated truck lane in operation. Tables R1a through R3a show the flow rates, duration, and volumes for the various periods of the day for which analysis was conducted. The passenger-car equivalents and speeds are shown in Tables R1b through R3b. The vehicle-hours and –miles of travel calculations are presented in Tables R1c through R3c. Tables R1d through R3d show details of vehicle operating costs calculations, and Tables R1e through R3e show user cost calculations.

Table R1a. SECTION VOLUME DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	Dedicated Lane Placement	AADT (One Direction)	Truck %	Truck AADT (One Direction)	Peak Period Duration	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration (hours)	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)															
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	40,000	16.0%	6,400	6	3,500	21,000	5	4.81%	1,923	385	13	17,077	1,314
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	49,000	11.0%	5,390	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Non-Median	49,000	9.0%	4,410	6	4,900	29,400	5	4.81%	2,356	471	13	17,244	1,326
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Non-Median	67,000	13.0%	8,710	3	6,500	19,500	6	4.76%	3,189	532	15	44,311	2,954
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Non-Median	73,000	9.0%	6,570	3	7,300	21,900	6	4.76%	3,475	579	15	47,625	3,175
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	80,000	10.0%	8,000	3	7,100	21,300	6	4.76%	3,808	635	15	54,892	3,659
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	75,000	11.0%	8,250	3	7,000	21,000	6	4.76%	3,570	595	15	50,430	3,362
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	65,000	14.0%	9,100	3	6,000	18,000	6	4.76%	3,094	516	15	43,906	2,927
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	63,000	14.0%	8,820	3	5,400	16,200	6	4.76%	2,999	500	15	43,801	2,920
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Non-Median	50,000	14.0%	7,000	3	5,000	15,000	6	4.76%	2,380	397	15	32,620	2,175
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	40,000	14.0%	5,600	3	4,000	12,000	6	4.76%	1,904	317	15	26,096	1,740
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	30,000	25.0%	7,500	3	3,000	9,000	11	19.13%	5,738	522	10	15,262	1,526
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	25,000	24.0%	6,000	4	2,300	9,200	8	11.58%	2,895	362	12	12,905	1,075
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	40,000	23.0%	9,200	5	4,000	20,000	5	4.03%	1,613	323	14	18,387	1,313
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Non-Median	45,000	24.0%	10,800	5	4,500	22,500	5	4.03%	1,814	363	14	20,686	1,478
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Non-Median	50,000	24.0%	12,000	5	5,000	25,000	5	5.58%	2,791	558	14	22,209	1,586
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	40,000	26.0%	10,400	5	4,000	20,000	5	5.58%	2,233	447	14	17,767	1,269
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	63,000	26.0%	16,380	5	5,000	25,000	5	5.58%	3,517	703	14	34,483	2,463
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	42,000	26.0%	10,920	5	4,200	21,000	6	8.17%	3,430	572	13	17,570	1,352
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	10,000	26.0%	2,600	3	1,000	3,000	5	8.03%	803	161	16	6,197	387
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	10,000	28.0%	2,800	4	1,000	4,000	6	15.57%	1,557	259	14	4,443	317
I-5: Merced	Rural	0	32.45	32.45	2	Median	15,000	29.0%	4,350	4	1,500	6,000	6	15.57%	2,335	389	14	6,665	476
I-5: Fresno	Rural	0	66.16	66.16	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	18.05%	2,708	387	12	4,792	399
I-5: Kings	Rural	0	26.72	26.72	2	Median	15,000	30.0%	4,500	5	1,500	7,500	7	17.32%	2,597	371	12	4,903	409
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	17,000	29.0%	4,930	5	1,700	8,500	5	10.17%	1,728	346	14	6,772	484
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	30,000	28.0%	8,400	5	3,000	15,000	6	10.95%	3,284	547	13	11,716	901
I-5: Kern	Rural	10.35	15.08	4.73	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	7.04	9.28	2.24	4	Non-Median	30,000	30.0%	9,000	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	5.36	6.41	1.05	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0.58	5.36	4.78	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Kern	Rural	0	0.58	0.58	4	Non-Median	30,000	28.0%	8,400	6	3,000	18,000	6	10.95%	3,284	547	12	8,716	726
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	Non-Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	35,000	27.0%	9,450	6	3,500	21,000	6	10.14%	3,550	592	12	10,450	871
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Non-Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	35,000	19.0%	6,650	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Non-Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	35,000	18.0%	6,300	6	3,500	21,000	7	10.14%	3,550	507	11	10,450	950
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Non-Median	40,000	16.0%	6,400	5	4,000	20,000	5	6.08%	2,433	487	14	17,567	1,255
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Non-Median	65,000	10.0%	6,500	5	6,500	32,500	5	6.08%	3,953	791	14	28,547	2,039
I-5: Los Angeles	Urban	47.13	52.33	5.2	4	Non-Median	90,000	10.0%	9,000	6	8,600	51,600	5	5.89%	5,474	1,095	13	32,926	2,533
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	Non-Median	90,000	10.0%	9,000	6	8,600	51,600	5	5.89%	5,305	1,061	13	33,095	2,546
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Non-Median	92,000	9.0%	8,280	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Non-Median	92,000	10.0%	9,200	6	8,900	53,400	5	5.89%	5,423	1,085	13	33,177	2,552
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Non-Median	100,000	9.0%	9,000	6	8,900	53,400	5	5.89%	5,895	1,179	13	40,705	3,131
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Non-Median	115,000	10.0%	11,500	6	9,100	54,600	5	5.89%	6,779	1,356	13	53,621	4,125
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Non-Median	115,000	8.0%	9,200	6	8,500	51,000	5	6.62%	7,618	1,524	13	56,382	4,337
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	120,000	8.0%	9,600	6	9,500	57,000	5	6.62%	7,949	1,590	13	55,051	4,235
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	117,000	9.0%	10,530	4	4,600	18,400	5	4.88%	5,710	1,142	15	92,890	6,193
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	65,000	9.0%	5,850	4	4,800	19,200	5	4.88%	3,172	634	15	42,628	2,842
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	70,000	8.0%	5,600	4	5,000	20,000	5	4.88%	3,416	683	15	46,584	3,106
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	135,000	8.0%	10,800	5	10,200	51,000	5	4.20%	5,675	1,135	14	78,325	5,595
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	140,000	8.0%	11,200	5	10,000	50,000	5	4.20%	5,885	1,177	14	84,115	6,008
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	140,000	8.0%	11,200	5	9,600	48,000	5	4.20%	5,885	1,177	14	86,115	6,151
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	90,000	8.0%	7,200	5	6,800	34,000	5	4.20%	3,783	757	14	52,217	3,730
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	90,000	8.0%	7,200	5	7,200	36,000	5	4.20%	3,783	757	14	50,217	3,587
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	102,000	8.0%	8,160	5	8,200	41,000	5	4.20%	4,288	858	14	56,712	4,051
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	130,000	7.0%	9,100	5	9,500	47,500	5	4.20%	5,465	1,093	14	77,035	5,503
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	138,000	8.0%	11,040	8	9,900	79,200	5	4.48%	6,184	1,237	11	52,616	4,783
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	140,000	8.0%	11,200	8	9,600	80,000	5	4.48%	6,273	1,255	11	53,727	4,884
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	120,000	8.0%	9,600	8	8,000	64,000	5	4.48%	5,377	1,075	11	50,623	4,602
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	120,000	8.0%	9,600	6	7,900	47,400	5	2.79%	3,350	670	13	69,250	5,327
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	130,000	8.0%	10,400	6	8,000	48,000	5	2.79%	3,629	726	13	78,371	6,029
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	128,000	8.0%	10,240	6	8,400	50,400	5	2.79%	3,574	715	13	74,026	5,694
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	110,000	15.0%	16,500	8	8,000	64,000	5	4.48%	4,929	986	11	41,071	3,734
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	88,000	14.0%	12,320	8	7,500	60,000	5	4.48%	3,943	789	11	24,057	2,187
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	70,000	15.0%	10,500	8	6,000	48,000	5	4.48%	3,137	627	11	18,863	1,715

TABLE R1b. SECTION FLOW AND SPEED DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban /Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane (pcphpl)	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)		Nighttime Off-Peak Speed (mph)		Daytime Off-Peak Speed(mph)	
		Begin	End	Length (mi)							Truck	Other Vehicle	Truck	Other Vehicle	Truck	Other Vehicle
I-5: Sacramento	Rural	29.87	34.65	4.78	1,750	1,890	192	208	657	709	50	63	50	65	50	65
I-5: Sacramento	Urban	26.94	29.87	2.93	1,633	1,723	157	166	442	466	50	55	50	55	50	55
I-5: Sacramento	Urban	26.69	26.94	0.25	1,633	1,707	157	164	442	462	50	55	50	55	50	55
I-5: Sacramento	Urban	25.53	26.69	1.16	2,167	2,308	177	189	985	1,049	50	48	50	55	50	55
I-5: Sacramento	Urban	24.51	25.53	1.02	1,825	1,907	145	151	794	829	50	55	50	55	50	55
I-5: Sacramento	Urban	23.1	24.51	1.41	1,420	1,491	127	133	732	768	50	55	50	55	50	55
I-5: Sacramento	Urban	22	23.1	1.1	2,333	2,462	198	209	1,121	1,182	50	38	50	55	50	55
I-5: Sacramento	Urban	19.16	22	2.84	1,500	1,605	129	138	732	783	50	55	50	55	50	55
I-5: Sacramento	Urban	18.82	19.16	0.34	1,080	1,156	100	107	584	625	50	55	50	55	50	55
I-5: Sacramento	Urban	16.7	18.82	2.12	1,250	1,338	99	106	544	582	50	55	50	55	50	55
I-5: Sacramento	Urban	14.46	16.7	2.24	1,333	1,427	106	113	580	621	50	55	50	55	50	55
I-5: Sacramento	Rural	0	14.46	14.46	1,500	1,688	261	293	763	859	50	64	50	65	50	65
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,150	1,288	181	203	538	602	50	65	50	65	50	65
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,333	1,487	108	120	438	488	50	65	50	65	50	65
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,500	1,680	121	135	493	552	50	65	50	55	50	55
I-5: San Joaquin	Urban	24.8	28.34	3.54	1,250	1,400	140	156	397	444	50	55	50	55	50	55
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,333	1,507	149	168	423	478	50	65	50	65	50	65
I-5: San Joaquin	Rural	12.69	14.34	1.65	1,000	1,130	141	159	493	557	50	65	50	65	50	65
I-5: San Joaquin	Rural	11.8	12.69	0.89	1,400	1,582	191	215	451	509	50	65	50	65	50	65
I-5: San Joaquin	Rural	0	11.8	11.8	500	565	80	91	194	219	50	65	50	65	50	65
I-5: Stanislaus	Rural	0	28.06	28.06	500	570	130	148	159	181	50	65	50	65	50	65
I-5: Merced	Rural	0	32.45	32.45	750	859	195	223	238	273	50	65	50	65	50	65
I-5: Fresno	Rural	0	66.16	66.16	750	863	193	222	200	230	50	65	50	65	50	65
I-5: Kings	Rural	0	26.72	26.72	750	863	186	213	204	235	50	65	50	65	50	65
I-5: Kern	Rural	15.86	87.03	71.17	850	973	173	198	242	277	50	65	50	65	50	65
I-5: Kern	Rural	15.08	15.86	0.78	750	855	137	156	225	257	50	65	50	65	50	65
I-5: Kern	Rural	10.35	15.08	4.73	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	9.28	10.35	1.07	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	7.04	9.28	2.24	750	863	137	157	182	209	50	65	50	65	50	65
I-5: Kern	Rural	6.41	7.04	0.63	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	5.36	6.41	1.05	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	0.58	5.36	4.78	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Kern	Rural	0	0.58	0.58	750	855	137	156	182	207	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.67	88.61	1.94	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.13	86.67	0.54	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	84.76	86.13	1.37	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	78.43	84.76	6.33	875	993	148	168	218	247	50	65	50	65	50	65
I-5: Los Angeles	Rural	69.65	78.43	8.78	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	68.1	69.65	1.55	875	958	127	139	237	260	50	65	50	65	50	65
I-5: Los Angeles	Rural	65.43	68.1	2.67	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	59.95	65.43	5.48	875	954	127	138	237	259	50	65	50	65	50	65
I-5: Los Angeles	Rural	54.16	59.95	5.79	1,000	1,080	122	131	314	339	50	65	50	65	50	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	1,625	1,706	198	208	510	535	50	65	50	65	50	65
I-5: Los Angeles	Urban	47.13	52.33	5.2	2,150	2,258	274	287	633	665	50	50	50	55	50	55
I-5: Los Angeles	Urban	46.9	47.13	0.23	2,150	2,258	265	279	636	668	50	50	50	55	50	55
I-5: Los Angeles	Urban	46.6	46.9	0.3	2,225	2,325	271	283	638	667	50	46	50	55	50	55
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,780	1,869	217	228	510	536	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,780	1,860	236	246	626	654	50	55	50	55	50	55
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,820	1,911	271	285	825	866	50	55	50	55	50	55
I-5: Los Angeles	Urban	43.9	44.01	0.11	2,125	2,210	381	396	1,084	1,128	50	51	50	55	50	55
I-5: Los Angeles	Urban	41.6	43.9	2.3	1,900	1,976	318	331	847	881	50	55	50	55	50	55
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,533	1,602	381	398	2,064	2,157	50	55	50	55	50	53
I-5: Los Angeles	Urban	39.81	40.27	0.46	1,200	1,254	159	166	710	742	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.36	39.81	0.45	1,000	1,040	137	142	621	646	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,040	2,122	227	236	1,119	1,164	50	53	50	55	50	55
I-5: Los Angeles	Urban	36.43	36.65	0.22	1,667	1,733	196	204	1,001	1,041	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.22	36.43	0.21	2,400	2,496	294	306	1,538	1,599	50	32	50	55	50	55
I-5: Los Angeles	Urban	35.94	36.22	0.28	1,700	1,768	189	197	932	970	50	55	50	55	50	55
I-5: Los Angeles	Urban	29.16	35.94	6.78	1,800	1,872	189	197	897	933	50	55	50	55	50	55
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,050	2,132	214	223	1,013	1,053	50	53	50	55	50	55
I-5: Los Angeles	Urban	22.78	28.25	5.47	1,900	1,967	219	226	1,101	1,139	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.28	22.78	0.5	2,375	2,458	273	283	1,376	1,424	50	40	50	55	50	55
I-5: Los Angeles	Urban	21.41	22.28	0.87	1,980	2,059	247	257	957	995	50	54	50	55	50	55
I-5: Los Angeles	Urban	20.58	21.41	0.83	2,400	2,496	314	326	1,221	1,270	50	40	50	55	50	55
I-5: Los Angeles	Urban	17.21	20.58	3.37	2,000	2,080	269	280	1,151	1,197	50	54	50	55	50	55
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,975	2,054	168	174	1,332	1,385	50	54	50	55	50	55
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,000	2,080	181	189	1,507	1,567	50	54	50	55	50	55
I-5: Los Angeles	Urban	13.78	14.16	0.38	2,100	2,184	179	186	1,424	1,481	50	52	50	55	50	55
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	2,000	2,150	246	265	933	1,003	50	59	50	65	50	65
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1,875	2,006	197	211	547	585	50	61	50	65	50	65
CA 710: LA	Suburban	4.96	10.18	5.22	2,000	2,150	209	225	572	614	50	57	50	65	50	65

TABLE R1c. SECTION TRAVEL DATA - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	16,061	84,319	1,471	7,722	13,060	68,567
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	9,476	76,666	759	6,143	5,558	44,968
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	662	6,689	53	536	388	3,923
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	2,941	19,679	481	3,219	6,682	44,718
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	2,010	20,328	319	3,225	4,372	44,206
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	3,003	27,030	537	4,833	7,740	69,658
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	2,541	20,559	432	3,495	6,102	49,371
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	7,157	43,963	1,230	7,557	17,457	107,236
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	771	4,737	143	877	2,085	12,807
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	4,452	27,348	706	4,339	9,682	59,473
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	3,763	23,117	597	3,668	8,184	50,271
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	32,535	97,605	20,742	62,226	55,173	165,519
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	20,623	65,305	6,489	20,547	28,929	91,607
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	54,694	183,106	4,410	14,763	50,284	168,343
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	1,188	3,762	96	303	1,092	3,459
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	21,240	67,260	2,371	7,510	18,869	59,750
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	54,392	154,808	6,073	17,284	48,319	137,524
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	10,725	30,525	1,509	4,294	14,793	42,104
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	4,859	13,831	794	2,259	4,066	11,572
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	9,204	26,196	2,464	7,013	19,012	54,111
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	31,427	80,813	12,231	31,450	34,910	89,769
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	56,463	138,237	21,974	53,798	62,721	153,558
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	148,860	347,340	53,743	125,401	95,117	221,939
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	60,120	140,280	20,821	48,583	39,299	91,697
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	175,434	429,511	35,667	87,323	139,767	342,188
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	3,276	8,424	717	1,845	2,559	6,579
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	23,839	61,301	4,350	11,185	11,543	29,682
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	5,393	13,867	984	2,530	2,611	6,714
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	12,096	28,224	2,207	5,150	5,857	13,666
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	3,175	8,165	579	1,490	1,537	3,953
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	5,292	13,608	966	2,483	2,562	6,589
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	24,091	61,949	4,396	11,304	11,665	29,996
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	2,923	7,517	533	1,372	1,415	3,640
I-5: Los Angeles	Rural	86.67	88.61	1.94	220.0	457.5	37.2	77.4	109.5	227.7	11,000	29,740	1,860	5,028	5,474	14,799
I-5: Los Angeles	Rural	86.13	86.67	0.54	61.2	127.4	10.4	21.5	30.5	63.4	3,062	8,278	518	1,400	1,524	4,119
I-5: Los Angeles	Rural	84.76	86.13	1.37	155.4	323.1	26.3	54.6	77.3	160.8	7,768	21,002	1,313	3,551	3,865	10,451
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	35,891	97,039	6,068	16,405	17,860	48,287
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	33,188	151,192	5,611	25,560	16,515	75,234
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	6,185	26,366	1,046	4,457	3,077	13,120
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	10,093	45,977	1,706	7,773	5,022	22,879
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	20,714	94,366	3,502	15,953	10,308	46,957
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	18,528	97,272	2,254	11,832	16,274	85,440
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	5,948	53,528	723	6,511	5,224	47,016
I-5: Los Angeles	Urban	47.13	52.33	5.2	536.6	4,829.8	56.9	465.8	342.4	2,801.7	26,832	241,488	2,846	25,618	17,122	154,094
I-5: Los Angeles	Urban	46.9	47.13	0.23	23.7	213.6	2.4	20.0	15.2	124.6	1,187	10,681	122	1,098	761	6,851
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	1,442	14,578	146	1,481	896	9,057
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	3,578	32,200	363	3,270	2,223	20,006
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	3,989	40,333	440	4,452	3,041	30,745
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	5,951	53,563	739	6,650	5,845	52,602
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	449	5,161	67	771	496	5,706
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	10,488	120,612	1,463	16,821	10,129	116,487
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	2,202	22,270	683	6,910	11,119	112,425
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	795	8,037	131	1,328	1,765	17,844
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	720	8,280	123	1,414	1,677	19,286
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	11,057	127,153	1,230	14,149	16,981	195,280
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	880	10,120	104	1,191	1,480	17,025
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	806	9,274	99	1,137	1,447	16,637
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	762	8,758	85	975	1,170	13,451
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	19,526	224,554	2,052	23,599	27,238	313,231
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	2,985	34,325	312	3,590	4,129	47,479
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	18,188	241,637	2,092	27,800	29,497	391,886
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	1,663	22,088	191	2,541	2,696	35,821
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	5,512	63,392	430	4,949	3,662	42,114
I-5: Los Angeles	Urban	20.58	21.41	0.83	106.2	1,527.2	8.3	87.1	71.3	745.9	5,312	61,088	417	4,790	3,567	41,026
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	17,254	198,426	1,450	16,671	13,648	156,951
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	1,176	13,518	83	956	1,717	19,750
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	10,522	120,998	796	9,149	17,179	197,556
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	1,532	17,620	109	1,249	2,250	25,880
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	98,976	560,864	7,623	43,196	63,516	359,925
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,360.1	30.8	145.6	187.9	888.0	23,436	143,964	1,540	9,461	9,397	57,722
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,736.4	49.1	214.1	295.4	1,287.6	37,584	212,976	2,456	13,917	14,770	83,697
TOTAL					**25,637.3**	**94,944.0**	**5,272.7**	**14,689.8**	**21,759.4**	**87,651.9**	**1,281,866**	**5,588,784**	**263,637**	**913,331**	**1,087,968**	**5,217,993**

TABLE R1d. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT. BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Los Angeles	Rural	86.67	88.61	1.94	11,000	29,740	1,860	5,028	5,474	14,799	19,426	9,666	3,284	1,634	9,666	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	3,062	8,278	518	1,400	1,524	4,119	5,407	2,690	914	455	2,691	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	7,768	21,002	1,313	3,551	3,865	10,451	13,718	6,826	2,319	1,154	6,826	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,948	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Los Angeles	Urban	47.13	52.33	5.2	26,832	241,488	2,846	25,618	17,122	154,094	47,386	78,484	5,027	8,326	30,237	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	1,187	10,681	122	1,098	761	6,851	2,096	3,471	215	357	1,344	2,226
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,312	61,088	417	4,790	3,567	41,026	9,381	19,854	736	1,557	6,300	13,333
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
TOTAL					**1,281,866**	**5,588,784**	**263,637**	**913,331**	**1,087,968**	**5,217,993**	**2,263,788**	**1,816,355**	**465,586**	**296,833**	**1,921,364**	**1,695,848**

TABLE R1e. TRAVEL TIME COST - BASE CONDITION - BASE VOLUME - SEGMENTATION 48 FT.BASIS

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	321	1,338	29	119	261	1,055	9,082	12,254	832	1,088	7,386	9,658
I-5: Sacramento	Urban	26.94	29.87	2.93	190	1,394	15	112	111	818	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13	122	1	10	8	71	374	1,113	30	89	219	653
I-5: Sacramento	Urban	25.53	26.69	1.16	59	410	10	59	134	813	1,663	3,754	272	536	3,779	7,444
I-5: Sacramento	Urban	24.51	25.53	1.02	40	370	6	59	87	804	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Urban	23.1	24.51	1.41	60	491	11	88	155	1,267	1,698	4,499	304	804	4,377	11,596
I-5: Sacramento	Urban	22	23.1	1.1	51	541	9	64	122	898	1,437	4,953	244	582	3,451	8,218
I-5: Sacramento	Urban	19.16	22	2.84	143	799	25	137	349	1,950	4,047	7,318	696	1,258	9,872	17,851
I-5: Sacramento	Urban	18.82	19.16	0.34	15	86	3	16	42	233	436	789	81	146	1,179	2,132
I-5: Sacramento	Urban	16.7	18.82	2.12	89	497	14	79	194	1,081	2,518	4,552	399	722	5,475	9,900
I-5: Sacramento	Urban	14.46	16.7	2.24	75	420	12	67	164	914	2,128	3,848	338	611	4,628	8,368
I-5: Sacramento	Rural	0	14.46	14.46	651	1,525	415	957	1,103	2,546	18,398	13,963	11,729	8,765	31,200	23,314
I-5: San Joaquin	Rural	40.45	49.79	9.34	412	1,005	130	316	579	1,409	11,662	9,199	3,669	2,894	16,359	12,903
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,094	2,817	88	227	1,006	2,590	30,929	25,791	2,494	2,079	28,435	23,712
I-5: San Joaquin	Urban	28.34	28.56	0.22	24	58	2	6	22	63	672	530	54	50	618	576
I-5: San Joaquin	Urban	24.8	28.34	3.54	425	1,223	47	137	377	1,086	12,011	11,196	1,341	1,250	10,670	9,946
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,088	2,382	121	266	966	2,116	30,758	21,805	3,434	2,435	27,324	19,371
I-5: San Joaquin	Rural	12.69	14.34	1.65	215	470	30	66	296	648	6,065	4,300	853	605	8,365	5,930
I-5: San Joaquin	Rural	11.8	12.69	0.89	97	213	16	35	81	178	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	0	11.8	11.8	184	403	49	108	380	832	5,205	3,690	1,393	988	10,751	7,622
I-5: Stanislaus	Rural	0	28.06	28.06	629	1,243	245	484	698	1,381	17,772	11,383	6,916	4,430	19,741	12,644
I-5: Merced	Rural	0	32.45	32.45	1,129	2,127	439	828	1,254	2,362	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Fresno	Rural	0	66.16	66.16	2,977	5,344	1,075	1,929	1,902	3,414	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202	2,158	416	747	786	1,411	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	15.86	87.03	71.17	3,509	6,608	713	1,343	2,795	5,264	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Kern	Rural	15.08	15.86	0.78	66	130	14	28	51	101	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	477	943	87	172	231	457	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	108	213	20	39	52	103	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	7.04	9.28	2.24	242	434	44	79	117	210	6,840	3,975	1,248	725	3,312	1,925
I-5: Kern	Rural	6.41	7.04	0.63	64	126	12	23	31	61	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	106	209	19	38	51	101	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	482	953	88	174	233	461	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58	116	11	21	28	56	1,653	1,059	302	193	800	513
I-5: Los Angeles	Rural	86.67	88.61	1.94	220	458	37	77	109	228	6,220	4,189	1,052	708	3,095	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	61	127	10	22	30	63	1,731	1,166	293	197	862	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	155	323	26	55	77	161	4,393	2,958	743	500	2,186	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	718	1,493	121	252	357	743	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Los Angeles	Rural	69.65	78.43	8.78	664	2,326	112	393	330	1,157	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	68.1	69.65	1.55	124	406	21	69	62	202	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	65.43	68.1	2.67	202	707	34	120	100	352	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414	1,452	70	245	206	722	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Los Angeles	Rural	54.16	59.95	5.79	371	1,496	45	182	325	1,314	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Rural	52.33	54.16	1.83	119	824	14	100	104	723	3,363	7,540	409	917	2,954	6,622
I-5: Los Angeles	Urban	47.13	52.33	5.2	537	4,830	57	466	342	2,802	15,173	44,219	1,610	4,264	9,682	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	24	214	2	20	15	125	671	1,956	69	183	430	1,140
I-5: Los Angeles	Urban	46.6	46.9	0.3	29	317	3	27	18	165	815	2,902	83	246	507	1,508
I-5: Los Angeles	Urban	45.93	46.6	0.67	72	585	7	59	44	364	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	80	733	9	81	61	559	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	44.01	45.1	1.09	119	974	15	121	117	956	3,365	8,916	418	1,107	3,305	8,756
I-5: Los Angeles	Urban	43.9	44.01	0.11	9	101	1	14	10	104	254	927	38	128	281	950
I-5: Los Angeles	Urban	41.6	43.9	2.3	210	2,193	29	306	203	2,118	5,931	20,078	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	40.27	41.6	1.33	44	405	14	126	222	2,121	1,245	3,707	386	1,150	6,288	19,421
I-5: Los Angeles	Urban	39.81	40.27	0.46	16	146	3	24	35	324	449	1,338	74	221	998	2,970
I-5: Los Angeles	Urban	39.36	39.81	0.45	14	151	2	26	34	351	407	1,378	70	235	948	3,210
I-5: Los Angeles	Urban	36.65	39.36	2.71	221	2,399	25	257	340	3,551	6,252	21,965	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	36.43	36.65	0.22	18	184	2	22	30	310	498	1,685	59	198	837	2,834
I-5: Los Angeles	Urban	36.22	36.43	0.21	16	290	2	21	29	302	456	2,653	56	189	818	2,770
I-5: Los Angeles	Urban	35.94	36.22	0.28	15	159	2	18	23	245	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	29.16	35.94	6.78	391	4,083	41	429	545	5,695	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	28.25	29.16	0.91	60	648	6	65	83	863	1,688	5,930	177	598	2,335	7,904
I-5: Los Angeles	Urban	22.78	28.25	5.47	364	4,393	42	505	590	7,125	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	22.28	22.78	0.5	33	552	4	46	54	651	940	5,056	108	423	1,525	5,963
I-5: Los Angeles	Urban	21.41	22.28	0.87	110	1,174	9	90	73	766	3,117	10,748	243	824	2,071	7,010
I-5: Los Angeles	Urban	20.58	21.41	0.83	106	1,527	8	87	71	746	3,004	13,982	236	797	2,017	6,829
I-5: Los Angeles	Urban	17.21	20.58	3.37	345	3,675	29	303	273	2,854	9,757	33,642	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	16.9	17.21	0.31	24	250	2	17	34	359	665	2,292	47	159	971	3,288
I-5: Los Angeles	Urban	14.16	16.9	2.74	210	2,241	16	166	344	3,592	5,950	20,515	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	13.78	14.16	0.38	31	339	2	23	45	471	866	3,102	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,980	9,506	152	665	1,270	5,537	55,970	87,034	4,311	6,084	35,918	50,697
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	469	2,360	31	146	188	888	13,253	21,608	871	1,333	5,314	8,130
CA 710: LA	Suburban	4.96	10.18	5.22	752	3,736	49	214	295	1,288	21,253	34,209	1,389	1,960	8,352	11,789
TOTAL					**25,637**	**94,944**	**5,273**	**14,690**	**21,759**	**87,652**	**724,880**	**869,262**	**149,084**	**134,492**	**615,233**	**802,499**

TABLE R2a. SECTION VOLUME DATA - DEDICATED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Truck Lanes in One Direction	Truck Proportion Diverted	% of Total Veh. Using Truck Lane	Truck AADT in Truck Lane	Peak Period Duration	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction (vph)	Daytime Off-Peak Period Duration	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)														
I-5: Sacramento	Rural	29.87	34.65	4.78	1	0.08	1.3%	500	6	44	263	5	4.81%	24	5	13	213	16
I-5: Sacramento	Urban	26.94	29.87	2.93	1	0.09	1.0%	500	6	50	300	5	4.81%	24	5	13	176	14
I-5: Sacramento	Urban	26.69	26.94	0.25	1	0.11	1.0%	500	6	50	300	5	4.81%	24	5	13	176	14
I-5: Sacramento	Urban	25.53	26.69	1.16	1	0.06	0.7%	500	3	49	146	6	4.76%	24	4	15	331	22
I-5: Sacramento	Urban	24.51	25.53	1.02	1	0.08	0.7%	500	3	50	150	6	4.76%	24	4	15	326	22
I-5: Sacramento	Urban	23.1	24.51	1.41	1	0.06	0.6%	500	3	44	133	6	4.76%	24	4	15	343	23
I-5: Sacramento	Urban	22	23.1	1.1	1	0.06	0.7%	500	3	47	140	6	4.76%	24	4	15	336	22
I-5: Sacramento	Urban	19.16	22	2.84	1	0.05	0.8%	500	3	46	138	6	4.76%	24	4	15	338	23
I-5: Sacramento	Urban	18.82	19.16	0.34	1	0.06	0.8%	500	3	43	129	6	4.76%	24	4	15	348	23
I-5: Sacramento	Urban	16.7	18.82	2.12	1	0.07	1.0%	500	3	50	150	6	4.76%	24	4	15	326	22
I-5: Sacramento	Urban	14.46	16.7	2.24	1	0.09	1.3%	500	3	50	150	6	4.76%	24	4	15	326	22
I-5: Sacramento	Rural	0	14.46	14.46	1	0.07	1.7%	500	3	50	150	11	19.13%	96	9	10	254	25
I-5: San Joaquin	Rural	40.45	49.79	9.34	1	0.08	2.0%	500	4	46	184	8	11.58%	58	7	12	258	22
I-5: San Joaquin	Rural	28.56	40.45	11.89	1	0.05	1.3%	500	5	50	250	5	4.03%	20	4	14	230	16
I-5: San Joaquin	Urban	28.34	28.56	0.22	1	0.05	1.1%	500	5	50	250	5	4.03%	20	4	14	230	16
I-5: San Joaquin	Urban	24.8	28.34	3.54	1	0.04	1.0%	500	5	50	250	5	5.58%	28	6	14	222	16
I-5: San Joaquin	Rural	14.34	24.8	10.46	1	0.05	1.3%	500	5	50	250	5	5.58%	28	6	14	222	16
I-5: San Joaquin	Rural	12.69	14.34	1.65	1	0.05	1.2%	750	5	60	298	5	5.58%	42	8	14	411	29
I-5: San Joaquin	Rural	11.8	12.69	0.89	1	0.07	1.8%	750	5	75	375	6	8.17%	61	10	13	314	24
I-5: San Joaquin	Rural	0	11.8	11.8	1	0.29	7.5%	750	3	75	225	5	8.03%	60	12	16	465	29
I-5: Stanislaus	Rural	0	28.06	28.06	1	0.63	17.5%	1,750	4	175	700	6	15.57%	272	45	14	778	56
I-5: Merced	Rural	0	32.45	32.45	1	0.40	11.7%	1,750	4	175	700	6	15.57%	272	45	14	778	56
I-5: Fresno	Rural	0	66.16	66.16	1	0.44	13.3%	2,000	5	200	1,000	7	18.05%	361	52	12	639	53
I-5: Kings	Rural	0	26.72	26.72	1	0.44	13.3%	2,000	5	200	1,000	7	17.32%	346	49	12	654	54
I-5: Kern	Rural	15.86	87.03	71.17	1	0.41	11.8%	2,000	5	200	1,000	5	10.17%	203	41	14	797	57
I-5: Kern	Rural	15.08	15.86	0.78	1	0.24	6.7%	2,000	5	200	1,000	6	10.95%	219	36	13	781	60
I-5: Kern	Rural	10.35	15.08	4.73	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	9.28	10.35	1.07	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	7.04	9.28	2.24	1	0.33	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	6.41	7.04	0.63	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	5.36	6.41	1.05	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	0.58	5.36	4.78	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Kern	Rural	0	0.58	0.58	1	0.36	10.0%	3,000	6	300	1,800	6	10.95%	328	55	12	872	73
I-5: Los Angeles	Rural	86.67	88.61	1.94	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	86.13	86.67	0.54	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	84.76	86.13	1.37	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	78.43	84.76	6.33	1	0.32	8.6%	3,000	6	300	1,800	6	10.14%	304	51	12	896	75
I-5: Los Angeles	Rural	69.65	78.43	8.78	1	0.48	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	68.1	69.65	1.55	1	0.45	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	65.43	68.1	2.67	1	0.48	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	59.95	65.43	5.48	1	0.48	8.6%	3,000	6	300	1,800	7	10.14%	304	43	11	896	81
I-5: Los Angeles	Rural	54.16	59.95	5.79	1	0.47	7.5%	3,000	5	300	1,500	5	6.08%	182	36	14	1,318	94
I-5: Los Angeles	Rural	52.33	54.16	1.83	1	0.46	4.6%	3,000	5	300	1,500	5	6.08%	182	36	14	1,318	94
I-5: Los Angeles	Urban	47.13	52.33	5.2	1	0.33	3.3%	3,000	6	287	1,720	5	6.08%	182	36	13	1,098	84
I-5: Los Angeles	Urban	46.9	47.13	0.23	1	0.33	3.3%	3,000	6	287	1,720	5	5.89%	177	35	13	1,103	85
I-5: Los Angeles	Urban	46.6	46.9	0.3	1	0.36	3.3%	3,000	6	290	1,741	5	5.89%	177	35	13	1,082	83
I-5: Los Angeles	Urban	45.93	46.6	0.67	1	0.33	3.3%	3,000	6	290	1,741	5	5.89%	177	35	13	1,082	83
I-5: Los Angeles	Urban	45.1	45.93	0.83	1	0.33	3.0%	3,000	6	267	1,602	5	5.89%	177	35	13	1,221	94
I-5: Los Angeles	Urban	44.01	45.1	1.09	1	0.26	2.6%	3,000	6	237	1,424	5	5.89%	177	35	13	1,399	108
I-5: Los Angeles	Urban	43.9	44.01	0.11	1	0.33	2.6%	3,000	6	222	1,330	5	6.62%	199	40	13	1,471	113
I-5: Los Angeles	Urban	41.6	43.9	2.3	1	0.21	1.7%	2,000	6	158	950	5	6.62%	132	26	13	918	71
I-5: Los Angeles	Urban	40.27	41.6	1.33	1	0.19	1.7%	2,000	4	79	315	5	4.88%	98	20	15	1,588	106
I-5: Los Angeles	Urban	39.81	40.27	0.46	1	0.34	3.1%	2,000	4	148	591	5	4.88%	98	20	15	1,312	87
I-5: Los Angeles	Urban	39.36	39.81	0.45	1	0.36	2.9%	2,000	4	143	571	5	4.88%	98	20	15	1,331	89
I-5: Los Angeles	Urban	36.65	39.36	2.71	1	0.19	1.5%	2,000	5	151	756	5	4.20%	84	17	14	1,160	83
I-5: Los Angeles	Urban	36.43	36.65	0.22	1	0.18	1.4%	2,000	5	143	714	5	4.20%	84	17	14	1,202	86
I-5: Los Angeles	Urban	36.22	36.43	0.21	1	0.18	1.4%	2,000	5	137	686	5	4.20%	84	17	14	1,230	88
I-5: Los Angeles	Urban	35.94	36.22	0.28	1	0.28	2.2%	2,000	5	151	756	5	4.20%	84	17	14	1,160	83
I-5: Los Angeles	Urban	29.16	35.94	6.78	1	0.28	2.2%	2,000	5	160	800	5	4.20%	84	17	14	1,116	80
I-5: Los Angeles	Rural	28.25	29.16	0.91	1	0.25	2.0%	2,000	5	161	804	5	4.20%	84	17	14	1,112	79
I-5: Los Angeles	Urban	22.78	28.25	5.47	1	0.22	1.5%	2,000	5	146	731	5	4.20%	84	17	14	1,185	85
I-5: Los Angeles	Urban	22.28	22.78	0.5	1	0.22	1.5%	2,000	5	146	731	5	4.20%	84	17	14	1,185	85
I-5: Los Angeles	Urban	21.41	22.28	0.87	1	0.18	1.4%	2,000	8	143	1,148	5	4.48%	90	18	11	763	69
I-5: Los Angeles	Urban	20.58	21.41	0.83	1	0.18	1.4%	2,000	8	137	1,097	5	4.48%	90	18	11	813	74
I-5: Los Angeles	Urban	17.21	20.58	3.37	1	0.21	1.7%	2,000	8	133	1,067	5	4.48%	90	18	11	844	77
I-5: Los Angeles	Urban	16.9	17.21	0.31	1	0.21	1.7%	2,000	6	132	790	5	2.79%	56	11	13	1,154	89
I-5: Los Angeles	Urban	14.16	16.9	2.74	1	0.19	1.5%	2,000	6	123	738	5	2.79%	56	11	13	1,206	93
I-5: Los Angeles	Rural	13.78	14.16	0.38	1	0.20	1.6%	2,000	6	131	788	5	2.79%	56	11	13	1,157	89
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1	0.12	1.8%	2,000	8	145	1,164	5	4.48%	90	18	11	747	68
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1	0.16	2.3%	2,000	8	170	1,364	5	4.48%	90	18	11	547	50
CA 710: LA	Suburban	4.96	10.18	5.22	1	0.10	1.4%	1,000	8	86	686	5	4.48%	45	9	11	269	24

TABLE R2b. SECTION FLOW AND SPEED DATA - DEDICATED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One Direction per Lane (pcphpl)	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)	Nighttime Off-Peak Speed (mph)	Daytime Off-Peak Speed(mph)
		Begin	End	Length (mi)							Truck	Truck	Truck
I-5: Sacramento	Rural	29.87	34.65	4.78	44	66	5	7	16	25	50	50	50
I-5: Sacramento	Urban	26.94	29.87	2.93	50	75	5	7	14	20	50	50	50
I-5: Sacramento	Urban	26.69	26.94	0.25	50	75	5	7	14	20	50	50	50
I-5: Sacramento	Urban	25.53	26.69	1.16	49	73	4	6	22	33	50	50	50
I-5: Sacramento	Urban	24.51	25.53	1.02	50	75	4	6	22	33	50	50	50
I-5: Sacramento	Urban	23.1	24.51	1.41	44	67	4	6	23	34	50	50	50
I-5: Sacramento	Urban	22	23.1	1.1	47	70	4	6	22	34	50	50	50
I-5: Sacramento	Urban	19.16	22	2.84	46	69	4	6	23	34	50	50	50
I-5: Sacramento	Urban	18.82	19.16	0.34	43	64	4	6	23	35	50	50	50
I-5: Sacramento	Urban	16.7	18.82	2.12	50	75	4	6	22	33	50	50	50
I-5: Sacramento	Urban	14.46	16.7	2.24	50	75	4	6	22	33	50	50	50
I-5: Sacramento	Rural	0	14.46	14.46	50	75	9	13	25	38	50	50	50
I-5: San Joaquin	Rural	40.45	49.79	9.34	46	69	7	11	22	32	50	50	50
I-5: San Joaquin	Rural	28.56	40.45	11.89	50	75	4	6	16	25	50	50	50
I-5: San Joaquin	Urban	28.34	28.56	0.22	50	75	4	6	16	25	50	50	50
I-5: San Joaquin	Urban	24.8	28.34	3.54	50	75	6	8	16	24	50	50	50
I-5: San Joaquin	Rural	14.34	24.8	10.46	50	75	6	8	16	24	50	50	50
I-5: San Joaquin	Rural	12.69	14.34	1.65	60	89	8	13	29	44	50	50	50
I-5: San Joaquin	Rural	11.8	12.69	0.89	75	113	10	15	24	36	50	50	50
I-5: San Joaquin	Rural	0	11.8	11.8	75	113	12	18	29	44	50	50	50
I-5: Stanislaus	Rural	0	28.06	28.06	175	263	45	68	56	83	50	50	50
I-5: Merced	Rural	0	32.45	32.45	175	263	45	68	56	83	50	50	50
I-5: Fresno	Rural	0	66.16	66.16	200	300	52	77	53	80	50	50	50
I-5: Kings	Rural	0	26.72	26.72	200	300	49	74	54	82	50	50	50
I-5: Kern	Rural	15.86	87.03	71.17	200	300	41	61	57	85	50	50	50
I-5: Kern	Rural	15.08	15.86	0.78	200	300	36	55	60	90	50	50	50
I-5: Kern	Rural	10.35	15.08	4.73	300	450	55	82	73	109	50	50	50
I-5: Kern	Rural	9.28	10.35	1.07	300	450	55	82	73	109	50	50	50
I-5: Kern	Rural	7.04	9.28	2.24	300	450	55	82	73	109	50	50	50
I-5: Kern	Rural	6.41	7.04	0.63	300	450	55	82	73	109	50	50	50
I-5: Kern	Rural	5.36	6.41	1.05	300	450	55	82	73	109	50	50	50
I-5: Kern	Rural	0.58	5.36	4.78	300	450	55	82	73	109	50	50	50
I-5: Kern	Rural	0	0.58	0.58	300	450	55	82	73	109	50	50	50
I-5: Los Angeles	Rural	86.67	88.61	1.94	300	450	51	76	75	112	50	50	50
I-5: Los Angeles	Rural	86.13	86.67	0.54	300	450	51	76	75	112	50	50	50
I-5: Los Angeles	Rural	84.76	86.13	1.37	300	450	51	76	75	112	50	50	50
I-5: Los Angeles	Rural	78.43	84.76	6.33	300	450	51	76	75	112	50	50	50
I-5: Los Angeles	Rural	69.65	78.43	8.78	300	450	43	65	81	122	50	50	50
I-5: Los Angeles	Rural	68.1	69.65	1.55	300	450	43	65	81	122	50	50	50
I-5: Los Angeles	Rural	65.43	68.1	2.67	300	450	43	65	81	122	50	50	50
I-5: Los Angeles	Rural	59.95	65.43	5.48	300	450	43	65	81	122	50	50	50
I-5: Los Angeles	Rural	54.16	59.95	5.79	300	450	36	55	94	141	50	50	50
I-5: Los Angeles	Rural	52.33	54.16	1.83	300	450	36	55	94	141	50	50	50
I-5: Los Angeles	Urban	47.13	52.33	5.2	287	430	36	55	84	127	50	50	50
I-5: Los Angeles	Urban	46.9	47.13	0.23	287	430	35	53	85	127	50	50	50
I-5: Los Angeles	Urban	46.6	46.9	0.3	290	435	35	53	83	125	50	50	50
I-5: Los Angeles	Urban	45.93	46.6	0.67	290	435	35	53	83	125	50	50	50
I-5: Los Angeles	Urban	45.1	45.93	0.83	267	401	35	53	94	141	50	50	50
I-5: Los Angeles	Urban	44.01	45.1	1.09	237	356	35	53	108	161	50	50	50
I-5: Los Angeles	Urban	43.9	44.01	0.11	222	333	40	60	113	170	50	50	50
I-5: Los Angeles	Urban	41.6	43.9	2.3	158	238	26	40	71	106	50	50	50
I-5: Los Angeles	Urban	40.27	41.6	1.33	79	118	20	29	106	159	50	50	50
I-5: Los Angeles	Urban	39.81	40.27	0.46	148	222	20	29	87	131	50	50	50
I-5: Los Angeles	Urban	39.36	39.81	0.45	143	214	20	29	89	133	50	50	50
I-5: Los Angeles	Urban	36.65	39.36	2.71	151	227	17	25	83	124	50	50	50
I-5: Los Angeles	Urban	36.43	36.65	0.22	143	214	17	25	86	129	50	50	50
I-5: Los Angeles	Urban	36.22	36.43	0.21	137	206	17	25	88	132	50	50	50
I-5: Los Angeles	Urban	35.94	36.22	0.28	151	227	17	25	83	124	50	50	50
I-5: Los Angeles	Urban	29.16	35.94	6.78	160	240	17	25	80	120	50	50	50
I-5: Los Angeles	Urban	28.25	29.16	0.91	161	241	17	25	79	119	50	50	50
I-5: Los Angeles	Urban	22.78	28.25	5.47	146	219	17	25	85	127	50	50	50
I-5: Los Angeles	Urban	22.28	22.78	0.5	146	219	17	25	85	127	50	50	50
I-5: Los Angeles	Urban	21.41	22.28	0.87	143	215	18	27	69	104	50	50	50
I-5: Los Angeles	Urban	20.58	21.41	0.83	137	206	18	27	74	111	50	50	50
I-5: Los Angeles	Urban	17.21	20.58	3.37	133	200	18	27	77	115	50	50	50
I-5: Los Angeles	Urban	16.9	17.21	0.31	132	198	11	17	89	133	50	50	50
I-5: Los Angeles	Urban	14.16	16.9	2.74	123	185	11	17	93	139	50	50	50
I-5: Los Angeles	Urban	13.78	14.16	0.38	131	197	11	17	89	133	50	50	50
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	145	218	18	27	68	102	50	50	50
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	170	256	18	27	50	75	50	50	50
CA 710: LA	Suburban	4.96	10.18	5.22	86	129	9	13	24	37	50	50	50

TABLE R2c. SECTION TRAVEL DATA - DEDICATED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction	Peak Period Vehicle-Miles of Travel, One Direction	Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction	Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction	Daytime Off-Peak Other Vehicle-Hours of Travel, One Direction	Daytime Off-Peak Other Vehicle-Miles of Travel, One Direction
		Begin	End	Length (mi)						
I-5: Sacramento	Rural	29.87	34.65	4.78	25.1	1,255	2.3	115	20.4	1,020
I-5: Sacramento	Urban	26.94	29.87	2.93	17.6	879	1.4	70	10.3	516
I-5: Sacramento	Urban	26.69	26.94	0.25	1.5	75	0.1	6	0.9	44
I-5: Sacramento	Urban	25.53	26.69	1.16	3.4	169	0.6	28	7.7	384
I-5: Sacramento	Urban	24.51	25.53	1.02	3.1	153	0.5	24	6.7	333
I-5: Sacramento	Urban	23.1	24.51	1.41	3.8	188	0.7	34	9.7	484
I-5: Sacramento	Urban	22	23.1	1.1	3.1	154	0.5	26	7.4	370
I-5: Sacramento	Urban	19.16	22	2.84	7.9	393	1.4	68	19.2	959
I-5: Sacramento	Urban	18.82	19.16	0.34	0.9	44	0.2	8	2.4	118
I-5: Sacramento	Urban	16.7	18.82	2.12	6.4	318	1.0	50	13.8	692
I-5: Sacramento	Urban	14.46	16.7	2.24	6.7	336	1.1	53	14.6	731
I-5: Sacramento	Rural	0	14.46	14.46	43.4	2,169	27.7	1,383	73.6	3,678
I-5: San Joaquin	Rural	40.45	49.79	9.34	34.4	1,719	10.8	541	48.2	2,411
I-5: San Joaquin	Rural	28.56	40.45	11.89	59.5	2,973	4.8	240	54.7	2,733
I-5: San Joaquin	Urban	28.34	28.56	0.22	1.1	55	0.1	4	1.0	51
I-5: San Joaquin	Urban	24.8	28.34	3.54	17.7	885	2.0	99	15.7	786
I-5: San Joaquin	Rural	14.34	24.8	10.46	52.3	2,615	5.8	292	46.5	2,323
I-5: San Joaquin	Rural	12.69	14.34	1.65	9.8	491	1.4	69	13.5	677
I-5: San Joaquin	Rural	11.8	12.69	0.89	6.7	334	1.1	55	5.6	279
I-5: San Joaquin	Rural	0	11.8	11.8	53.1	2,655	14.2	711	109.7	5,484
I-5: Stanislaus	Rural	0	28.06	28.06	392.8	19,642	152.9	7,644	436.4	21,819
I-5: Merced	Rural	0	32.45	32.45	454.3	22,715	176.8	8,840	504.6	25,232
I-5: Fresno	Rural	0	66.16	66.16	1,323.2	66,160	477.7	23,886	845.5	42,274
I-5: Kings	Rural	0	26.72	26.72	534.4	26,720	185.1	9,254	349.3	17,466
I-5: Kern	Rural	15.86	87.03	71.17	1,423.4	71,170	289.4	14,469	1,134.0	56,701
I-5: Kern	Rural	15.08	15.86	0.78	15.6	780	3.4	171	12.2	609
I-5: Kern	Rural	10.35	15.08	4.73	170.3	8,514	31.1	1,554	82.4	4,122
I-5: Kern	Rural	9.28	10.35	1.07	38.5	1,926	7.0	351	18.7	933
I-5: Kern	Rural	7.04	9.28	2.24	80.6	4,032	14.7	736	39.0	1,952
I-5: Kern	Rural	6.41	7.04	0.63	22.7	1,134	4.1	207	11.0	549
I-5: Kern	Rural	5.36	6.41	1.05	37.8	1,890	6.9	345	18.3	915
I-5: Kern	Rural	0.58	5.36	4.78	172.1	8,604	31.4	1,570	83.3	4,166
I-5: Kern	Rural	0	0.58	0.58	20.9	1,044	3.8	190	10.1	506
I-5: Los Angeles	Rural	86.67	88.61	1.94	69.8	3,492	11.8	590	34.8	1,738
I-5: Los Angeles	Rural	86.13	86.67	0.54	19.4	972	3.3	164	9.7	484
I-5: Los Angeles	Rural	84.76	86.13	1.37	49.3	2,466	8.3	417	24.5	1,227
I-5: Los Angeles	Rural	78.43	84.76	6.33	227.9	11,394	38.5	1,926	113.4	5,670
I-5: Los Angeles	Rural	69.65	78.43	8.78	316.1	15,804	53.4	2,672	157.3	7,864
I-5: Los Angeles	Rural	68.1	69.65	1.55	55.8	2,790	9.4	472	27.8	1,388
I-5: Los Angeles	Rural	65.43	68.1	2.67	96.1	4,806	16.3	813	47.8	2,391
I-5: Los Angeles	Rural	59.95	65.43	5.48	197.3	9,864	33.4	1,668	98.2	4,908
I-5: Los Angeles	Rural	54.16	59.95	5.79	173.7	8,685	21.1	1,056	152.6	7,629
I-5: Los Angeles	Rural	52.33	54.16	1.83	54.9	2,745	6.7	334	48.2	2,411
I-5: Los Angeles	Urban	47.13	52.33	5.2	178.9	8,944	19.0	949	114.1	5,707
I-5: Los Angeles	Urban	46.9	47.13	0.23	7.9	396	0.8	41	5.1	254
I-5: Los Angeles	Urban	46.6	46.9	0.3	10.4	522	1.1	53	6.5	325
I-5: Los Angeles	Urban	45.93	46.6	0.67	23.3	1,167	2.4	118	14.5	725
I-5: Los Angeles	Urban	45.1	45.93	0.83	26.6	1,330	2.9	147	20.3	1,014
I-5: Los Angeles	Urban	44.01	45.1	1.09	31.1	1,553	3.9	193	30.5	1,525
I-5: Los Angeles	Urban	43.9	44.01	0.11	2.9	146	0.4	22	3.2	162
I-5: Los Angeles	Urban	41.6	43.9	2.3	43.7	2,185	6.1	305	42.2	2,110
I-5: Los Angeles	Urban	40.27	41.6	1.33	8.4	418	2.6	130	42.2	2,112
I-5: Los Angeles	Urban	39.81	40.27	0.46	5.4	272	0.9	45	12.1	603
I-5: Los Angeles	Urban	39.36	39.81	0.45	5.1	257	0.9	44	12.0	599
I-5: Los Angeles	Urban	36.65	39.36	2.71	41.0	2,048	4.6	228	62.9	3,145
I-5: Los Angeles	Urban	36.43	36.65	0.22	3.1	157	0.4	18	5.3	264
I-5: Los Angeles	Urban	36.22	36.43	0.21	2.9	144	0.4	18	5.2	258
I-5: Los Angeles	Urban	35.94	36.22	0.28	4.2	212	0.5	24	6.5	325
I-5: Los Angeles	Urban	29.16	35.94	6.78	108.5	5,424	11.4	570	151.3	7,566
I-5: Los Angeles	Urban	28.25	29.16	0.91	14.6	732	1.5	77	20.2	1,012
I-5: Los Angeles	Urban	22.78	28.25	5.47	79.9	3,997	9.2	460	129.7	6,483
I-5: Los Angeles	Urban	22.28	22.78	0.5	7.3	365	0.8	42	11.9	593
I-5: Los Angeles	Urban	21.41	22.28	0.87	20.0	999	1.6	78	13.3	663
I-5: Los Angeles	Urban	20.58	21.41	0.83	18.2	911	1.5	74	13.5	675
I-5: Los Angeles	Urban	17.21	20.58	3.37	71.9	3,595	6.0	302	56.9	2,843
I-5: Los Angeles	Urban	16.9	17.21	0.31	4.9	245	0.3	17	7.2	358
I-5: Los Angeles	Urban	14.16	16.9	2.74	40.5	2,023	3.1	153	66.1	3,304
I-5: Los Angeles	Urban	13.78	14.16	0.38	6.0	299	0.4	21	8.8	440
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	239.9	11,997	18.5	924	154.0	7,699
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	76.1	3,805	5.0	250	30.5	1,525
CA 710: LA	Suburban	4.96	10.18	5.22	71.6	3,579	4.7	234	28.1	1,407
Total					**7,458.6**	**372,928**	**1,774.8**	**88,740**	**5,814.4**	**290,720**

TABLE R2d. VEHICLE OPERATING COSTS - DEDICATED LANE - BASE VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction	Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction	Daytime Off-Peak Other Vehicle-Miles of Travel, One Direction	Vehicle Operating Costs ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Sacramento	Rural	29.87	34.65	4.78	1,255	115	1,020	2,216	203	1,802
I-5: Sacramento	Urban	26.94	29.87	2.93	879	70	516	1,552	124	910
I-5: Sacramento	Urban	26.69	26.94	0.25	75	6	44	132	11	78
I-5: Sacramento	Urban	25.53	26.69	1.16	169	28	384	298	49	677
I-5: Sacramento	Urban	24.51	25.53	1.02	153	24	333	270	43	588
I-5: Sacramento	Urban	23.1	24.51	1.41	188	34	484	331	59	854
I-5: Sacramento	Urban	22	23.1	1.1	154	26	370	272	46	653
I-5: Sacramento	Urban	19.16	22	2.84	393	68	959	694	119	1,694
I-5: Sacramento	Urban	18.82	19.16	0.34	44	8	118	77	14	209
I-5: Sacramento	Urban	16.7	18.82	2.12	318	50	692	562	89	1,221
I-5: Sacramento	Urban	14.46	16.7	2.24	336	53	731	593	94	1,290
I-5: Sacramento	Rural	0	14.46	14.46	2,169	1,383	3,678	3,830	2,442	6,496
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,719	541	2,411	3,035	955	4,257
I-5: San Joaquin	Rural	28.56	40.45	11.89	2,973	240	2,733	5,249	423	4,826
I-5: San Joaquin	Urban	28.34	28.56	0.22	55	4	51	97	8	89
I-5: San Joaquin	Urban	24.8	28.34	3.54	885	99	786	1,563	175	1,388
I-5: San Joaquin	Rural	14.34	24.8	10.46	2,615	292	2,323	4,618	516	4,102
I-5: San Joaquin	Rural	12.69	14.34	1.65	491	69	677	867	122	1,196
I-5: San Joaquin	Rural	11.8	12.69	0.89	334	55	279	589	96	493
I-5: San Joaquin	Rural	0	11.8	11.8	2,655	711	5,484	4,689	1,255	9,685
I-5: Stanislaus	Rural	0	28.06	28.06	19,642	7,644	21,819	34,688	13,500	38,532
I-5: Merced	Rural	0	32.45	32.45	22,715	8,840	25,232	40,115	15,612	44,561
I-5: Fresno	Rural	0	66.16	66.16	66,160	23,886	42,274	116,839	42,183	74,657
I-5: Kings	Rural	0	26.72	26.72	26,720	9,254	17,466	47,188	16,342	30,845
I-5: Kern	Rural	15.86	87.03	71.17	71,170	14,469	56,701	125,687	25,553	100,134
I-5: Kern	Rural	15.08	15.86	0.78	780	171	609	1,377	302	1,076
I-5: Kern	Rural	10.35	15.08	4.73	8,514	1,554	4,122	15,036	2,744	7,280
I-5: Kern	Rural	9.28	10.35	1.07	1,926	351	933	3,401	621	1,647
I-5: Kern	Rural	7.04	9.28	2.24	4,032	736	1,952	7,121	1,299	3,448
I-5: Kern	Rural	6.41	7.04	0.63	1,134	207	549	2,003	365	970
I-5: Kern	Rural	5.36	6.41	1.05	1,890	345	915	3,338	609	1,616
I-5: Kern	Rural	0.58	5.36	4.78	8,604	1,570	4,166	15,195	2,773	7,357
I-5: Kern	Rural	0	0.58	0.58	1,044	190	506	1,844	336	893
I-5: Los Angeles	Rural	86.67	88.61	1.94	3,492	590	1,738	6,167	1,043	3,069
I-5: Los Angeles	Rural	86.13	86.67	0.54	972	164	484	1,717	290	854
I-5: Los Angeles	Rural	84.76	86.13	1.37	2,466	417	1,227	4,355	736	2,167
I-5: Los Angeles	Rural	78.43	84.76	6.33	11,394	1,926	5,670	20,122	3,402	10,013
I-5: Los Angeles	Rural	69.65	78.43	8.78	15,804	2,672	7,864	27,910	4,718	13,888
I-5: Los Angeles	Rural	68.1	69.65	1.55	2,790	472	1,388	4,927	833	2,452
I-5: Los Angeles	Rural	65.43	68.1	2.67	4,806	813	2,391	8,487	1,435	4,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	9,864	1,668	4,908	17,420	2,945	8,668
I-5: Los Angeles	Rural	54.16	59.95	5.79	8,685	1,056	7,629	15,338	1,866	13,472
I-5: Los Angeles	Rural	52.33	54.16	1.83	2,745	334	2,411	4,848	590	4,258
I-5: Los Angeles	Urban	47.13	52.33	5.2	8,944	949	5,707	15,795	1,676	10,079
I-5: Los Angeles	Urban	46.9	47.13	0.23	396	41	254	699	72	448
I-5: Los Angeles	Urban	46.6	46.9	0.3	522	53	325	923	94	573
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,167	118	725	2,060	209	1,280
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,330	147	1,014	2,348	259	1,790
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,553	193	1,525	2,742	340	2,693
I-5: Los Angeles	Urban	43.9	44.01	0.11	146	22	162	258	39	286
I-5: Los Angeles	Urban	41.6	43.9	2.3	2,185	305	2,110	3,859	538	3,727
I-5: Los Angeles	Urban	40.27	41.6	1.33	418	130	2,112	739	229	3,730
I-5: Los Angeles	Urban	39.81	40.27	0.46	272	45	603	480	79	1,066
I-5: Los Angeles	Urban	39.36	39.81	0.45	257	44	599	454	78	1,058
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,048	228	3,145	3,616	402	5,553
I-5: Los Angeles	Urban	36.43	36.65	0.22	157	18	264	278	33	467
I-5: Los Angeles	Urban	36.22	36.43	0.21	144	18	258	254	31	456
I-5: Los Angeles	Urban	35.94	36.22	0.28	212	24	325	374	42	574
I-5: Los Angeles	Urban	29.16	35.94	6.78	5,424	570	7,566	9,579	1,007	13,362
I-5: Los Angeles	Urban	28.25	29.16	0.91	732	77	1,012	1,292	135	1,787
I-5: Los Angeles	Urban	22.78	28.25	5.47	3,997	460	6,483	7,059	812	11,449
I-5: Los Angeles	Urban	22.28	22.78	0.5	365	42	593	645	74	1,046
I-5: Los Angeles	Urban	21.41	22.28	0.87	999	78	663	1,764	138	1,172
I-5: Los Angeles	Urban	20.58	21.41	0.83	911	74	675	1,608	131	1,192
I-5: Los Angeles	Urban	17.21	20.58	3.37	3,595	302	2,843	6,348	533	5,021
I-5: Los Angeles	Urban	16.9	17.21	0.31	245	17	358	432	31	632
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,023	153	3,304	3,573	270	5,834
I-5: Los Angeles	Urban	13.78	14.16	0.38	299	21	440	528	37	776
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	11,997	924	7,699	21,187	1,632	13,596
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	3,805	250	1,525	6,719	442	2,694
CA 710: LA	Suburban	4.96	10.18	5.22	3,579	234	1,407	6,321	413	2,484
TOTAL					**372,928**	**88,740**	**290,720**	**658,594**	**156,715**	**513,415**

TABLE R2e. TRAVEL TIME COST - DEDICATED LANE - BASE VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction	Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction	Daytime Off-Peak Other Vehicle-Hours of Travel, One Direction	Travel Time Costs ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Sacramento	Rural	29.87	34.65	4.78	25.1	2.3	20.4	710	65	577
I-5: Sacramento	Urban	26.94	29.87	2.93	17.6	1.4	10.3	497	40	292
I-5: Sacramento	Urban	26.69	26.94	0.25	1.5	0.1	0.9	42	3	25
I-5: Sacramento	Urban	25.53	26.69	1.16	3.4	0.6	7.7	95	16	217
I-5: Sacramento	Urban	24.51	25.53	1.02	3.1	0.5	6.7	87	14	188
I-5: Sacramento	Urban	23.1	24.51	1.41	3.8	0.7	9.7	106	19	274
I-5: Sacramento	Urban	22	23.1	1.1	3.1	0.5	7.4	87	15	209
I-5: Sacramento	Urban	19.16	22	2.84	7.9	1.4	19.2	222	38	542
I-5: Sacramento	Urban	18.82	19.16	0.34	0.9	0.2	2.4	25	5	67
I-5: Sacramento	Urban	16.7	18.82	2.12	6.4	1.0	13.8	180	29	391
I-5: Sacramento	Urban	14.46	16.7	2.24	6.7	1.1	14.6	190	30	413
I-5: Sacramento	Rural	0	14.46	14.46	43.4	27.7	73.6	1,227	782	2,080
I-5: San Joaquin	Rural	40.45	49.79	9.34	34.4	10.8	48.2	972	306	1,363
I-5: San Joaquin	Rural	28.56	40.45	11.89	59.5	4.8	54.7	1,681	136	1,545
I-5: San Joaquin	Urban	28.34	28.56	0.22	1.1	0.1	1.0	31	3	29
I-5: San Joaquin	Urban	24.8	28.34	3.54	17.7	2.0	15.7	500	56	445
I-5: San Joaquin	Rural	14.34	24.8	10.46	52.3	5.8	46.5	1,479	165	1,314
I-5: San Joaquin	Rural	12.69	14.34	1.65	9.8	1.4	13.5	278	39	383
I-5: San Joaquin	Rural	11.8	12.69	0.89	6.7	1.1	5.6	189	31	158
I-5: San Joaquin	Rural	0	11.8	11.8	53.1	14.2	109.7	1,501	402	3,101
I-5: Stanislaus	Rural	0	28.06	28.06	392.8	152.9	436.4	11,107	4,323	12,338
I-5: Merced	Rural	0	32.45	32.45	454.3	176.8	504.6	12,845	4,999	14,269
I-5: Fresno	Rural	0	66.16	66.16	1,323.2	477.7	845.5	37,413	13,507	23,906
I-5: Kings	Rural	0	26.72	26.72	534.4	185.1	349.3	15,110	5,233	9,877
I-5: Kern	Rural	15.86	87.03	71.17	1,423.4	289.4	1,134.0	40,246	8,182	32,063
I-5: Kern	Rural	15.08	15.86	0.78	15.6	3.4	12.2	441	97	345
I-5: Kern	Rural	10.35	15.08	4.73	170.3	31.1	82.4	4,815	878	2,331
I-5: Kern	Rural	9.28	10.35	1.07	38.5	7.0	18.7	1,089	199	527
I-5: Kern	Rural	7.04	9.28	2.24	80.6	14.7	39.0	2,280	416	1,104
I-5: Kern	Rural	6.41	7.04	0.63	22.7	4.1	11.0	641	117	310
I-5: Kern	Rural	5.36	6.41	1.05	37.8	6.9	18.3	1,069	195	517
I-5: Kern	Rural	0.58	5.36	4.78	172.1	31.4	83.3	4,865	888	2,356
I-5: Kern	Rural	0	0.58	0.58	20.9	3.8	10.1	590	108	286
I-5: Los Angeles	Rural	86.67	88.61	1.94	69.8	11.8	34.8	1,975	334	983
I-5: Los Angeles	Rural	86.13	86.67	0.54	19.4	3.3	9.7	550	93	274
I-5: Los Angeles	Rural	84.76	86.13	1.37	49.3	8.3	24.5	1,394	236	694
I-5: Los Angeles	Rural	78.43	84.76	6.33	227.9	38.5	113.4	6,443	1,089	3,206
I-5: Los Angeles	Rural	69.65	78.43	8.78	316.1	53.4	157.3	8,937	1,511	4,447
I-5: Los Angeles	Rural	68.1	69.65	1.55	55.8	9.4	27.8	1,578	267	785
I-5: Los Angeles	Rural	65.43	68.1	2.67	96.1	16.3	47.8	2,718	459	1,352
I-5: Los Angeles	Rural	59.95	65.43	5.48	197.3	33.4	98.2	5,578	943	2,776
I-5: Los Angeles	Rural	54.16	59.95	5.79	173.7	21.1	152.6	4,911	597	4,314
I-5: Los Angeles	Rural	52.33	54.16	1.83	54.9	6.7	48.2	1,552	189	1,363
I-5: Los Angeles	Urban	47.13	52.33	5.2	178.9	19.0	114.1	5,058	537	3,227
I-5: Los Angeles	Urban	46.9	47.13	0.23	7.9	0.8	5.1	224	23	143
I-5: Los Angeles	Urban	46.6	46.9	0.3	10.4	1.1	6.5	295	30	184
I-5: Los Angeles	Urban	45.93	46.6	0.67	23.3	2.4	14.5	660	67	410
I-5: Los Angeles	Urban	45.1	45.93	0.83	26.6	2.9	20.3	752	83	573
I-5: Los Angeles	Urban	44.01	45.1	1.09	31.1	3.9	30.5	878	109	862
I-5: Los Angeles	Urban	43.9	44.01	0.11	2.9	0.4	3.2	83	12	91
I-5: Los Angeles	Urban	41.6	43.9	2.3	43.7	6.1	42.2	1,236	172	1,193
I-5: Los Angeles	Urban	40.27	41.6	1.33	8.4	2.6	42.2	237	73	1,194
I-5: Los Angeles	Urban	39.81	40.27	0.46	5.4	0.9	12.1	154	25	341
I-5: Los Angeles	Urban	39.36	39.81	0.45	5.1	0.9	12.0	145	25	339
I-5: Los Angeles	Urban	36.65	39.36	2.71	41.0	4.6	62.9	1,158	129	1,778
I-5: Los Angeles	Urban	36.43	36.65	0.22	3.1	0.4	5.3	89	10	149
I-5: Los Angeles	Urban	36.22	36.43	0.21	2.9	0.4	5.2	81	10	146
I-5: Los Angeles	Urban	35.94	36.22	0.28	4.2	0.5	6.5	120	13	184
I-5: Los Angeles	Urban	29.16	35.94	6.78	108.5	11.4	151.3	3,067	322	4,278
I-5: Los Angeles	Urban	28.25	29.16	0.91	14.6	1.5	20.2	414	43	572
I-5: Los Angeles	Urban	22.78	28.25	5.47	79.9	9.2	129.7	2,260	260	3,666
I-5: Los Angeles	Urban	22.28	22.78	0.5	7.3	0.8	11.9	207	24	335
I-5: Los Angeles	Urban	21.41	22.28	0.87	20.0	1.6	13.3	565	44	375
I-5: Los Angeles	Urban	20.58	21.41	0.83	18.2	1.5	13.5	515	42	382
I-5: Los Angeles	Urban	17.21	20.58	3.37	71.9	6.0	56.9	2,033	171	1,608
I-5: Los Angeles	Urban	16.9	17.21	0.31	4.9	0.3	7.2	138	10	202
I-5: Los Angeles	Urban	14.16	16.9	2.74	40.5	3.1	66.1	1,144	87	1,868
I-5: Los Angeles	Urban	13.78	14.16	0.38	6.0	0.4	8.8	169	12	249
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	239.9	18.5	154.0	6,784	522	4,354
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	76.1	5.0	30.5	2,151	141	863
CA 710: LA	Suburban	4.96	10.18	5.22	71.6	4.7	28.1	2,024	132	795
TOTAL					**7,458.6**	**1,774.8**	**5,814.4**	**210,886**	**50,181**	**164,399**

TABLE R3a. SECTION VOLUME DATA - REMAINING CONVENTIONAL LANES - BASE VOLUME - DEDICATED LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AADT (One Direction)	Truck % of Conventional Lanes	Truck AADT (One Direction)	Peak Period Duration	Peak Period Flow, One Direction (vph)	Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Duration (hours)	Nighttime Off-Peak Period % AADT	Nighttime Off-Peak Period Volume, One Direction (veh)	Nighttime Off-Peak Period Flow, One Direction	Daytime Off-Peak Period Duration	Daytime Off-Peak Period Volume, One Direction (veh)	Daytime Off-Peak Period Flow, One Direction (vph)
		Begin	End	Length (mi)														
I-5: Sacramento	Rural	29.87	34.65	4.78	2	39,500	14.94%	5,900	6	3,456	20,738	5	4.81%	1,899	380	13	16,863	1,297
I-5: Sacramento	Urban	26.94	29.87	2.93	3	48,500	10.08%	4,890	6	4,850	29,100	5	4.81%	2,332	466	13	17,068	1,313
I-5: Sacramento	Urban	26.69	26.94	0.25	3	48,500	8.06%	3,910	6	4,850	29,100	5	4.81%	2,332	466	13	17,068	1,313
I-5: Sacramento	Urban	25.53	26.69	1.16	3	66,500	12.35%	8,210	3	6,451	19,354	6	4.76%	3,166	528	15	43,980	2,932
I-5: Sacramento	Urban	24.51	25.53	1.02	4	72,500	8.37%	6,070	3	7,250	21,750	6	4.76%	3,451	575	15	47,299	3,153
I-5: Sacramento	Urban	23.10	24.51	1.41	5	79,500	9.43%	7,500	3	7,056	21,167	6	4.76%	3,784	631	15	54,549	3,637
I-5: Sacramento	Urban	22	23.10	1.10	3	74,500	10.40%	7,750	3	6,953	20,860	6	4.76%	3,546	591	15	50,094	3,340
I-5: Sacramento	Urban	19.16	22	2.84	4	64,500	13.33%	8,600	3	5,954	17,862	6	4.76%	3,070	512	15	43,568	2,905
I-5: Sacramento	Urban	18.82	19.16	0.34	5	62,500	13.31%	8,320	3	5,357	16,071	6	4.76%	2,975	496	15	43,453	2,897
I-5: Sacramento	Urban	16.70	18.82	2.12	4	49,500	13.13%	6,500	3	4,950	14,850	6	4.76%	2,356	393	15	32,294	2,153
I-5: Sacramento	Urban	14.46	16.70	2.24	3	39,500	12.91%	5,100	3	3,950	11,850	6	4.76%	1,880	313	15	25,770	1,718
I-5: Sacramento	Rural	0	14.46	14.46	2	29,500	23.73%	7,000	3	2,950	8,850	11	19.13%	5,642	513	10	15,008	1,501
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	24,500	22.45%	5,500	4	2,254	9,016	8	11.58%	2,837	355	12	12,647	1,054
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	39,500	22.03%	8,700	5	3,950	19,750	5	4.03%	1,592	318	14	18,158	1,297
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	44,500	23.15%	10,300	5	4,450	22,250	5	4.03%	1,794	359	14	20,456	1,461
I-5: San Joaquin	Urban	24.80	28.34	3.54	4	49,500	23.23%	11,500	5	4,950	24,750	5	5.58%	2,763	553	14	21,987	1,570
I-5: San Joaquin	Rural	14.34	24.80	10.46	3	39,500	25.06%	9,900	5	3,950	19,750	5	5.58%	2,205	441	14	17,545	1,253
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	62,250	25.11%	15,630	5	4,940	24,702	5	5.58%	3,475	695	14	34,072	2,434
I-5: San Joaquin	Rural	11.80	12.69	0.89	3	41,250	24.65%	10,170	5	4,125	20,625	6	8.17%	3,368	561	13	17,257	1,327
I-5: San Joaquin	Rural	0	11.80	11.80	2	9,250	20.00%	1,850	3	925	2,775	5	8.03%	743	149	16	5,732	358
I-5: Stanislaus	Rural	0	28.06	28.06	2	8,250	12.73%	1,050	4	825	3,300	6	15.57%	1,284	214	14	3,666	262
I-5: Merced	Rural	0	32.45	32.45	2	13,250	19.62%	2,600	4	1,325	5,300	6	15.57%	2,063	344	14	5,887	421
I-5: Fresno	Rural	0	66.16	66.16	2	13,000	19.23%	2,500	5	1,300	6,500	7	18.05%	2,347	335	12	4,153	346
I-5: Kings	Rural	0	26.72	26.72	2	13,000	19.23%	2,500	5	1,300	6,500	7	17.32%	2,251	322	12	4,249	354
I-5: Kern	Rural	15.86	87.03	71.17	2	15,000	19.53%	2,930	5	1,500	7,500	5	10.17%	1,525	305	14	5,975	427
I-5: Kern	Rural	15.08	15.86	0.78	4	28,000	22.86%	6,400	5	2,800	14,000	6	10.95%	3,065	511	13	10,935	841
I-5: Kern	Rural	10.35	15.08	4.73	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	9.28	10.35	1.07	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	7.04	9.28	2.24	4	27,000	22.22%	6,000	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	6.41	7.04	0.63	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	5.36	6.41	1.05	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	0.58	5.36	4.78	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Kern	Rural	0	0.58	0.58	4	27,000	20.00%	5,400	6	2,700	16,200	6	10.95%	2,956	493	12	7,844	654
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	32,000	20.16%	6,450	6	3,200	19,200	6	10.14%	3,246	541	12	9,554	796
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	32,000	10.31%	3,300	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	68.10	69.65	1.55	4	32,000	11.41%	3,650	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	65.43	68.10	2.67	4	32,000	10.31%	3,300	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	32,000	10.31%	3,300	6	3,200	19,200	7	10.14%	3,246	464	11	9,554	869
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	37,000	9.19%	3,400	5	3,700	18,500	5	6.08%	2,250	450	14	16,250	1,161
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	62,000	5.65%	3,500	5	6,200	31,000	5	6.08%	3,771	754	14	27,229	1,945
I-5: Los Angeles	Urban	47.13	52.33	5.20	4	87,000	6.90%	6,000	6	8,313	49,880	5	6.08%	5,291	1,058	13	31,829	2,448
I-5: Los Angeles	Urban	46.90	47.13	0.23	4	87,000	6.90%	6,000	6	8,313	49,880	5	5.89%	5,128	1,026	13	31,992	2,461
I-5: Los Angeles	Urban	46.60	46.90	0.30	4	89,000	5.93%	5,280	6	8,610	51,659	5	5.89%	5,246	1,049	13	32,095	2,469
I-5: Los Angeles	Urban	45.93	46.60	0.67	5	89,000	6.97%	6,200	6	8,610	51,659	5	5.89%	5,246	1,049	13	32,095	2,469
I-5: Los Angeles	Urban	45.10	45.93	0.83	5	97,000	6.19%	6,000	6	8,633	51,798	5	5.89%	5,718	1,144	13	39,484	3,037
I-5: Los Angeles	Urban	44.01	45.10	1.09	5	112,000	7.59%	8,500	6	8,863	53,176	5	5.89%	6,602	1,320	13	52,222	4,017
I-5: Los Angeles	Urban	43.90	44.01	0.11	4	112,000	5.54%	6,200	6	8,278	49,670	5	6.62%	7,419	1,484	13	54,911	4,224
I-5: Los Angeles	Urban	41.60	43.90	2.30	5	118,000	6.44%	7,600	6	9,342	56,050	5	6.62%	7,817	1,563	13	54,133	4,164
I-5: Los Angeles	Urban	40.27	41.60	1.33	3	115,000	7.42%	8,530	4	4,521	18,085	5	4.88%	5,612	1,122	15	91,303	6,087
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	63,000	6.11%	3,850	4	4,652	18,609	5	4.88%	3,074	615	15	41,316	2,754
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	68,000	5.29%	3,600	4	4,857	19,429	5	4.88%	3,318	664	15	45,253	3,017
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	133,000	6.62%	8,800	5	10,049	50,244	5	4.20%	5,591	1,118	14	77,165	5,512
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	138,000	6.67%	9,200	5	9,857	49,286	5	4.20%	5,801	1,160	14	82,913	5,922
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	138,000	6.67%	9,200	5	9,463	47,314	5	4.20%	5,801	1,160	14	84,885	6,063
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	88,000	5.91%	5,200	5	6,649	33,244	5	4.20%	3,699	740	14	51,056	3,647
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	88,000	5.91%	5,200	5	7,040	35,200	5	4.20%	3,699	740	14	49,101	3,507
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	100,000	6.16%	6,160	5	8,039	40,196	5	4.20%	4,204	841	14	55,600	3,971
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	128,000	5.55%	7,100	5	9,354	46,769	5	4.20%	5,381	1,076	14	75,850	5,418
I-5: Los Angeles	Urban	22.28	22.78	0.50	4	128,000	5.55%	7,100	5	9,354	46,769	5	4.20%	5,381	1,076	14	75,850	5,418
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	136,000	6.65%	9,040	8	9,757	78,052	5	4.48%	6,094	1,219	11	51,854	4,714
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	138,000	6.67%	9,200	8	9,463	75,703	5	4.48%	6,184	1,237	11	56,113	5,101
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	118,000	6.44%	7,600	8	7,867	62,933	5	4.48%	5,288	1,058	11	49,779	4,525
I-5: Los Angeles	Urban	16.90	17.21	0.31	4	118,000	6.44%	7,600	6	7,768	46,610	5	2.79%	3,294	659	13	68,096	5,238
I-5: Los Angeles	Urban	14.16	16.90	2.74	4	128,000	6.56%	8,400	6	7,877	47,262	5	2.79%	3,574	715	13	77,165	5,936
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	126,000	6.54%	8,240	6	8,269	49,613	5	2.79%	3,518	704	13	72,870	5,605
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	108,000	13.43%	14,500	8	7,855	62,836	5	4.48%	4,839	968	11	40,324	3,666
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	86,000	12.00%	10,320	8	7,330	58,636	5	4.48%	3,854	771	11	23,510	2,137
CA 710: LA	Suburban	4.96	10.18	5.22	3	69,000	13.77%	9,500	8	5,914	47,314	5	4.48%	3,092	618	11	18,594	1,690

Table R3b. SECTION FLOW AND SPEED DATA - REMAINING CONVENTIONAL LANES - BASE VOLUME - DEDICATED LANE CASE

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Flow, One Direction per Lane (vphpl)	Peak Period Passenger Car Equivalent Flow, One Direction (pcphpl)	Nighttime Off-Peak Period Flow, One Direction per Lane (vphpl)	Nighttime Off-Peak Period Passenger Car Equivalent Flow, One	Daytime Off-Peak Flow, One Direction per Lane (vphpl)	Daytime Off-Peak Passenger Car Equivalent Flow, One Direction (pcphpl)	Peak Period Speed (mph)		Nighttime Off-Peak Speed (mph)		Daytime Off-Peak Speed(mph)	
		Begin	End	Length (mi)							Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	1,728	1,857	190	205	649	697	50	64	50	65	50	65
I-5: Sacramento	Urban	26.94	29.87	2.93	1,617	1,698	155	164	438	460	50	55	50	55	50	55
I-5: Sacramento	Urban	26.69	26.94	0.25	1,617	1,682	155	162	438	455	50	55	50	55	50	55
I-5: Sacramento	Urban	25.53	26.69	1.16	2,150	2,283	176	187	977	1,038	50	48	50	55	50	55
I-5: Sacramento	Urban	24.51	25.53	1.02	1,813	1,888	144	150	788	821	50	55	50	55	50	55
I-5: Sacramento	Urban	23.1	24.51	1.41	1,411	1,478	126	132	727	762	50	55	50	55	50	55
I-5: Sacramento	Urban	22	23.1	1.1	2,318	2,438	197	208	1,113	1,171	50	44	50	55	50	55
I-5: Sacramento	Urban	19.16	22	2.84	1,488	1,588	128	137	726	775	50	55	50	55	50	55
I-5: Sacramento	Urban	18.82	19.16	0.34	1,071	1,143	99	106	579	618	50	55	50	55	50	55
I-5: Sacramento	Urban	16.7	18.82	2.12	1,238	1,319	98	105	538	574	50	55	50	55	50	55
I-5: Sacramento	Urban	14.46	16.7	2.24	1,317	1,402	104	112	573	610	50	55	50	55	50	55
I-5: Sacramento	Rural	0	14.46	14.46	1,475	1,650	256	289	750	839	50	65	50	65	50	65
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,127	1,254	177	199	527	586	50	65	50	65	50	65
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,317	1,462	106	118	432	480	50	65	50	65	50	65
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,483	1,655	120	134	487	543	50	55	50	55	50	55
I-5: San Joaquin	Urban	24.8	28.34	3.54	1,238	1,381	138	155	393	438	50	55	50	55	50	55
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,317	1,482	147	166	418	470	50	65	50	65	50	65
I-5: San Joaquin	Rural	12.69	14.34	1.65	988	1,112	139	157	487	548	50	65	50	65	50	65
I-5: San Joaquin	Rural	11.8	12.69	0.89	1,375	1,545	187	211	442	497	50	65	50	65	50	65
I-5: San Joaquin	Rural	0	11.8	11.8	463	509	74	84	179	197	50	65	50	65	50	65
I-5: Stanislaus	Rural	0	28.06	28.06	413	439	107	122	131	139	50	65	50	65	50	65
I-5: Merced	Rural	0	32.45	32.45	663	728	172	197	210	231	50	65	50	65	50	65
I-5: Fresno	Rural	0	66.16	66.16	650	713	168	193	173	190	50	65	50	65	50	65
I-5: Kings	Rural	0	26.72	26.72	650	713	161	185	177	194	50	65	50	65	50	65
I-5: Kern	Rural	15.86	87.03	71.17	750	823	152	175	213	234	50	65	50	65	50	65
I-5: Kern	Rural	15.08	15.86	0.78	700	780	128	146	210	234	50	65	50	65	50	65
I-5: Kern	Rural	10.35	15.08	4.73	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	9.28	10.35	1.07	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	7.04	9.28	2.24	675	750	123	142	163	182	50	65	50	65	50	65
I-5: Kern	Rural	6.41	7.04	0.63	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	5.36	6.41	1.05	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	0.58	5.36	4.78	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Kern	Rural	0	0.58	0.58	675	743	123	140	163	180	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.67	88.61	1.94	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	86.13	86.67	0.54	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	84.76	86.13	1.37	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	78.43	84.76	6.33	800	881	135	154	199	219	50	65	50	65	50	65
I-5: Los Angeles	Rural	69.65	78.43	8.78	800	841	116	126	217	228	50	65	50	65	50	65
I-5: Los Angeles	Rural	68.1	69.65	1.55	800	846	116	127	217	230	50	65	50	65	50	65
I-5: Los Angeles	Rural	65.43	68.1	2.67	800	841	116	126	217	228	50	65	50	65	50	65
I-5: Los Angeles	Rural	59.95	65.43	5.48	800	841	116	126	217	228	50	65	50	65	50	65
I-5: Los Angeles	Rural	54.16	59.95	5.79	925	968	113	122	290	304	50	65	50	65	50	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	1,550	1,594	189	198	486	500	50	65	50	65	50	65
I-5: Los Angeles	Urban	47.13	52.33	5.2	2,078	2,150	265	278	612	633	50	53	50	55	50	55
I-5: Los Angeles	Urban	46.9	47.13	0.23	2,078	2,150	256	269	615	636	50	53	50	55	50	55
I-5: Los Angeles	Urban	46.6	46.9	0.3	2,152	2,216	262	274	617	636	50	52	50	55	50	55
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,722	1,782	210	220	494	511	50	55	50	55	50	55
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,727	1,780	229	239	607	626	50	55	50	55	50	55
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,773	1,840	264	277	803	834	50	55	50	55	50	55
I-5: Los Angeles	Urban	43.9	44.01	0.11	2,070	2,127	371	386	1,056	1,085	50	54	50	55	50	55
I-5: Los Angeles	Urban	41.6	43.9	2.3	1,868	1,929	313	325	833	860	50	55	50	55	50	55
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,507	1,563	374	391	2,029	2,104	50	55	50	55	50	53
I-5: Los Angeles	Urban	39.81	40.27	0.46	1,163	1,199	154	161	689	710	50	55	50	55	50	55
I-5: Los Angeles	Urban	39.36	39.81	0.45	971	997	133	138	603	619	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,010	2,076	224	233	1,102	1,139	50	53	50	55	50	55
I-5: Los Angeles	Urban	36.43	36.65	0.22	1,643	1,698	193	201	987	1,020	50	55	50	55	50	55
I-5: Los Angeles	Urban	36.22	36.43	0.21	2,366	2,445	290	302	1,516	1,566	50	40	50	55	50	55
I-5: Los Angeles	Urban	35.94	36.22	0.28	1,662	1,711	185	192	912	939	50	55	50	55	50	55
I-5: Los Angeles	Urban	29.16	35.94	6.78	1,760	1,812	185	192	877	903	50	55	50	55	50	55
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,010	2,072	210	219	993	1,023	50	53	50	55	50	55
I-5: Los Angeles	Urban	22.78	28.25	5.47	1,871	1,923	215	223	1,084	1,114	50	55	50	55	50	55
I-5: Los Angeles	Urban	22.28	22.78	0.5	2,338	2,403	269	278	1,354	1,392	50	45	50	55	50	55
I-5: Los Angeles	Urban	21.41	22.28	0.87	1,951	2,016	244	254	943	974	50	54	50	55	50	55
I-5: Los Angeles	Urban	20.58	21.41	0.83	2,366	2,445	309	322	1,275	1,318	50	45	50	55	50	55
I-5: Los Angeles	Urban	17.21	20.58	3.37	1,967	2,030	264	275	1,131	1,168	50	54	50	55	50	55
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,942	2,005	165	171	1,310	1,352	50	54	50	55	50	55
I-5: Los Angeles	Urban	14.16	16.9	2.74	1,969	2,034	179	186	1,484	1,533	50	54	50	55	50	55
I-5: Los Angeles	Urban	13.78	14.16	0.38	2,067	2,135	176	183	1,401	1,447	50	53	50	55	50	55
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,964	2,095	242	260	916	978	50	60	50	65	50	65
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	1,832	1,942	193	206	534	566	50	63	50	65	50	65
CA 710: LA	Suburban	4.96	10.18	5.22	1,971	2,107	206	222	563	602	50	57	50	65	50	65

TABLE R3c. SECTION TRAVEL DATA - REMAINING CONVENTIONAL LANES - BASE VOLUME - DEDICATED LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	296.1	1,317.5	27.1	118.8	240.8	1,054.9	14,806	84,319	1,356	7,722	12,040	68,567
I-5: Sacramento	Urban	26.94	29.87	2.93	171.9	1,393.9	13.8	111.7	100.8	817.6	8,597	76,666	689	6,143	5,042	44,968
I-5: Sacramento	Urban	26.69	26.94	0.25	11.7	121.6	0.9	9.7	6.9	71.3	587	6,689	47	536	344	3,923
I-5: Sacramento	Urban	25.53	26.69	1.16	55.4	410.0	9.1	58.5	126.0	813.1	2,772	19,679	453	3,219	6,298	44,718
I-5: Sacramento	Urban	24.51	25.53	1.02	37.1	369.6	5.9	58.6	80.8	803.7	1,857	20,328	295	3,225	4,039	44,206
I-5: Sacramento	Urban	23.1	24.51	1.41	56.3	491.4	10.1	87.9	145.1	1,266.5	2,816	27,030	503	4,833	7,256	69,658
I-5: Sacramento	Urban	22	23.1	1.1	47.7	467.3	8.1	63.5	114.6	897.7	2,387	20,559	406	3,495	5,732	49,371
I-5: Sacramento	Urban	19.16	22	2.84	135.3	799.3	23.3	137.4	330.0	1,949.7	6,764	43,963	1,163	7,557	16,498	107,236
I-5: Sacramento	Urban	18.82	19.16	0.34	14.5	86.1	2.7	15.9	39.3	232.9	727	4,737	135	877	1,967	12,807
I-5: Sacramento	Urban	16.7	18.82	2.12	82.7	497.2	13.1	78.9	179.8	1,081.3	4,134	27,348	656	4,339	8,990	59,473
I-5: Sacramento	Urban	14.46	16.7	2.24	68.5	420.3	10.9	66.7	149.1	914.0	3,427	23,117	544	3,668	7,453	50,271
I-5: Sacramento	Rural	0	14.46	14.46	607.3	1,501.6	387.2	957.3	1,029.9	2,546.5	30,366	97,605	19,359	62,226	51,495	165,519
I-5: San Joaquin	Rural	40.45	49.79	9.34	378.1	1,004.7	119.0	316.1	530.4	1,409.3	18,904	65,305	5,948	20,547	26,518	91,607
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,034.4	2,817.0	83.4	227.1	951.0	2,589.9	51,722	183,106	4,170	14,763	47,551	168,343
I-5: San Joaquin	Urban	28.34	28.56	0.22	22.7	68.4	1.8	5.5	20.8	62.9	1,133	3,762	91	303	1,042	3,459
I-5: San Joaquin	Urban	24.8	28.34	3.54	407.1	1,222.9	45.5	136.5	361.6	1,086.4	20,355	67,260	2,273	7,510	18,082	59,750
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,035.5	2,381.7	115.6	265.9	919.9	2,115.7	51,777	154,808	5,781	17,284	45,996	137,524
I-5: San Joaquin	Rural	12.69	14.34	1.65	204.7	469.6	28.8	66.1	282.3	647.7	10,234	30,525	1,440	4,294	14,116	42,104
I-5: San Joaquin	Rural	11.8	12.69	0.89	90.5	212.8	14.8	34.7	75.7	178.0	4,526	13,831	739	2,259	3,787	11,572
I-5: San Joaquin	Rural	0	11.8	11.8	131.0	403.0	35.1	107.9	270.6	832.5	6,549	26,196	1,753	7,013	13,528	54,111
I-5: Stanislaus	Rural	0	28.06	28.06	235.7	1,243.3	91.7	483.8	261.8	1,381.1	11,785	80,813	4,586	31,450	13,091	89,769
I-5: Merced	Rural	0	32.45	32.45	675.0	2,126.7	262.7	827.7	749.8	2,362.4	33,748	138,237	13,134	53,798	37,488	153,558
I-5: Fresno	Rural	0	66.16	66.16	1,654.0	5,343.7	597.1	1,929.2	1,056.9	3,414.4	82,700	347,340	29,857	125,401	52,843	221,939
I-5: Kings	Rural	0	26.72	26.72	668.0	2,158.2	231.3	747.4	436.7	1,410.7	33,400	140,280	11,567	48,583	21,833	91,697
I-5: Kern	Rural	15.86	87.03	71.17	2,085.3	6,607.9	424.0	1,343.4	1,661.3	5,264.4	104,264	429,511	21,198	87,323	83,066	342,188
I-5: Kern	Rural	15.08	15.86	0.78	49.9	129.6	10.9	28.4	39.0	101.2	2,496	8,424	547	1,845	1,949	6,579
I-5: Kern	Rural	10.35	15.08	4.73	306.5	943.1	55.9	172.1	148.4	456.6	15,325	61,301	2,796	11,185	7,420	29,682
I-5: Kern	Rural	9.28	10.35	1.07	69.3	213.3	12.7	38.9	33.6	103.3	3,467	13,867	633	2,530	1,679	6,714
I-5: Kern	Rural	7.04	9.28	2.24	161.3	434.2	29.4	79.2	78.1	210.2	8,064	28,224	1,471	5,150	3,905	13,666
I-5: Kern	Rural	6.41	7.04	0.63	40.8	125.6	7.4	22.9	19.8	60.8	2,041	8,165	372	1,490	988	3,953
I-5: Kern	Rural	5.36	6.41	1.05	68.0	209.4	12.4	38.2	32.9	101.4	3,402	13,608	621	2,483	1,647	6,589
I-5: Kern	Rural	0.58	5.36	4.78	309.7	953.1	56.5	173.9	150.0	461.5	15,487	61,949	2,826	11,304	7,499	29,996
I-5: Kern	Rural	0	0.58	0.58	37.6	115.6	6.9	21.1	18.2	56.0	1,879	7,517	343	1,372	910	3,640
I-5: Los Angeles	Rural	86.67	88.61	1.94	150.2	457.5	25.4	77.4	74.7	227.7	7,508	29,740	1,269	5,028	3,736	14,799
I-5: Los Angeles	Rural	86.13	86.67	0.54	41.8	127.4	7.1	21.5	20.8	63.4	2,090	8,278	353	1,400	1,040	4,119
I-5: Los Angeles	Rural	84.76	86.13	1.37	106.0	323.1	17.9	54.6	52.8	160.8	5,302	21,002	896	3,551	2,638	10,451
I-5: Los Angeles	Rural	78.43	84.76	6.33	489.9	1,492.9	82.8	252.4	243.8	742.9	24,497	97,039	4,141	16,405	12,190	48,287
I-5: Los Angeles	Rural	69.65	78.43	8.78	347.7	2,326.0	58.8	393.2	173.0	1,157.4	17,384	151,192	2,939	25,560	8,651	75,234
I-5: Los Angeles	Rural	68.1	69.65	1.55	67.9	405.6	11.5	68.6	33.8	201.8	3,395	26,366	574	4,457	1,689	13,120
I-5: Los Angeles	Rural	65.43	68.1	2.67	105.7	707.3	17.9	119.6	52.6	352.0	5,287	45,977	894	7,773	2,631	22,879
I-5: Los Angeles	Rural	59.95	65.43	5.48	217.0	1,451.8	36.7	245.4	108.0	722.4	10,850	94,366	1,834	15,953	5,399	46,957
I-5: Los Angeles	Rural	54.16	59.95	5.79	196.9	1,496.5	23.9	182.0	172.9	1,314.5	9,843	97,272	1,197	11,832	8,646	85,440
I-5: Los Angeles	Rural	52.33	54.16	1.83	64.1	823.5	7.8	100.2	56.3	723.3	3,203	53,528	390	6,511	2,813	47,016
I-5: Los Angeles	Urban	47.13	52.33	5.2	357.8	4,556.4	38.0	465.8	228.3	2,801.7	17,888	241,488	1,898	25,618	11,414	154,094
I-5: Los Angeles	Urban	46.9	47.13	0.23	15.8	201.5	1.6	20.0	10.1	124.6	791	10,681	81	1,098	507	6,851
I-5: Los Angeles	Urban	46.6	46.9	0.3	18.4	280.3	1.9	26.9	11.4	164.7	919	14,578	93	1,481	571	9,057
I-5: Los Angeles	Urban	45.93	46.6	0.67	48.2	585.5	4.9	59.5	30.0	363.7	2,411	32,200	245	3,270	1,498	20,006
I-5: Los Angeles	Urban	45.1	45.93	0.83	53.2	733.3	5.9	81.0	40.5	559.0	2,659	40,333	294	4,452	2,027	30,745
I-5: Los Angeles	Urban	44.01	45.1	1.09	88.0	973.9	10.9	120.9	86.4	956.4	4,399	53,563	546	6,650	4,320	52,602
I-5: Los Angeles	Urban	43.9	44.01	0.11	6.0	95.6	0.9	14.0	6.7	103.7	302	5,161	45	771	334	5,706
I-5: Los Angeles	Urban	41.6	43.9	2.3	166.1	2,192.9	23.2	305.8	160.4	2,118.0	8,303	120,612	1,158	16,821	8,019	116,487
I-5: Los Angeles	Urban	40.27	41.6	1.33	35.7	404.9	11.1	125.6	180.1	2,121.2	1,784	22,270	554	6,910	9,007	112,425
I-5: Los Angeles	Urban	39.81	40.27	0.46	10.5	146.1	1.7	24.1	23.2	324.4	523	8,037	86	1,328	1,161	17,844
I-5: Los Angeles	Urban	39.36	39.81	0.45	9.3	150.5	1.6	25.7	21.6	350.7	463	8,280	79	1,414	1,078	19,286
I-5: Los Angeles	Urban	36.65	39.36	2.71	180.2	2,399.1	20.0	257.3	276.7	3,550.5	9,009	127,153	1,002	14,149	13,836	195,280
I-5: Los Angeles	Urban	36.43	36.65	0.22	14.5	184.0	1.7	21.7	24.3	309.5	723	10,120	85	1,191	1,216	17,025
I-5: Los Angeles	Urban	36.22	36.43	0.21	13.2	231.8	1.6	20.7	23.8	302.5	662	9,274	81	1,137	1,188	16,637
I-5: Los Angeles	Urban	35.94	36.22	0.28	11.0	159.2	1.2	17.7	16.9	244.6	550	8,758	61	975	845	13,451
I-5: Los Angeles	Urban	29.16	35.94	6.78	282.0	4,082.8	29.6	429.1	393.4	5,695.1	14,102	224,554	1,482	23,599	19,672	313,231
I-5: Los Angeles	Urban	28.25	29.16	0.91	45.1	647.6	4.7	65.3	62.3	863.3	2,253	34,325	236	3,590	3,117	47,479
I-5: Los Angeles	Urban	22.78	28.25	5.47	283.8	4,393.4	32.7	505.5	460.3	7,125.2	14,190	241,637	1,633	27,800	23,014	391,886
I-5: Los Angeles	Urban	22.28	22.78	0.5	25.9	490.8	3.0	46.2	42.1	651.3	1,297	22,088	149	2,541	2,104	35,821
I-5: Los Angeles	Urban	21.41	22.28	0.87	90.3	1,173.9	7.0	90.0	60.0	765.7	4,514	63,392	352	4,949	2,999	42,114
I-5: Los Angeles	Urban	20.58	21.41	0.83	83.8	1,303.2	6.8	87.1	62.1	790.3	4,189	58,644	342	4,790	3,105	43,469
I-5: Los Angeles	Urban	17.21	20.58	3.37	273.2	3,674.5	23.0	303.1	216.1	2,853.7	13,660	198,426	1,148	16,671	10,805	156,951
I-5: Los Angeles	Urban	16.9	17.21	0.31	18.6	250.3	1.3	17.4	27.2	359.1	931	13,518	66	956	1,360	19,750
I-5: Los Angeles	Urban	14.16	16.9	2.74	170.0	2,240.7	12.9	166.3	277.5	3,591.9	8,498	120,998	643	9,149	13,875	197,556
I-5: Los Angeles	Urban	13.78	14.16	0.38	24.7	332.4	1.7	22.7	36.2	470.5	1,233	17,620	87	1,249	1,811	25,880
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,739.6	9,347.7	134.0	664.6	1,116.3	5,537.3	86,979	560,864	6,699	43,196	55,817	359,925
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	392.6	2,285.1	25.8	145.6	157.4	888.0	19,631	143,964	1,290	9,461	7,871	57,722
CA 710: LA	Suburban	4.96	10.18	5.22	680.1	3,736.4	44.4	214.1	267.3	1,287.6	34,005	212,976	2,222	13,917	13,363	83,697
TOTAL					**18,174.5**	**93,925.7**	**3,498.0**	**14,689.8**	**15,949.2**	**87,696.4**	**908,725**	**5,586,341**	**174,898**	**913,331**	**797,461**	**5,220,436**

TABLE R3d. VEHICLE OPERATING COSTS - REMAINING CONVENTIONAL LANES - BASE VOLUME - DEDICATED LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	14,806	84,319	1,356	7,722	12,040	68,567	26,148	27,404	2,395	2,510	21,263	22,284
I-5: Sacramento	Urban	26.94	29.87	2.93	8,597	76,666	689	6,143	5,042	44,968	15,182	24,917	1,217	1,997	8,905	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	587	6,689	47	536	344	3,923	1,036	2,174	83	174	608	1,275
I-5: Sacramento	Urban	25.53	26.69	1.16	2,772	19,679	453	3,219	6,298	44,718	4,895	6,396	801	1,046	11,123	14,533
I-5: Sacramento	Urban	24.51	25.53	1.02	1,857	20,328	295	3,225	4,039	44,206	3,280	6,606	520	1,048	7,133	14,367
I-5: Sacramento	Urban	23.1	24.51	1.41	2,816	27,030	503	4,833	7,256	69,658	4,972	8,785	889	1,571	12,814	22,639
I-5: Sacramento	Urban	22	23.1	1.1	2,387	20,559	406	3,495	5,732	49,371	4,215	6,682	717	1,136	10,123	16,046
I-5: Sacramento	Urban	19.16	22	2.84	6,764	43,963	1,163	7,557	16,498	107,236	11,945	14,288	2,053	2,456	29,135	34,852
I-5: Sacramento	Urban	18.82	19.16	0.34	727	4,737	135	877	1,967	12,807	1,285	1,539	238	285	3,473	4,162
I-5: Sacramento	Urban	16.7	18.82	2.12	4,134	27,348	656	4,339	8,990	59,473	7,301	8,888	1,158	1,410	15,877	19,329
I-5: Sacramento	Urban	14.46	16.7	2.24	3,427	23,117	544	3,668	7,453	50,271	6,052	7,513	960	1,192	13,162	16,338
I-5: Sacramento	Rural	0	14.46	14.46	30,366	97,605	19,359	62,226	51,495	165,519	53,627	31,722	34,188	20,223	90,941	53,794
I-5: San Joaquin	Rural	40.45	49.79	9.34	18,904	65,305	5,948	20,547	26,518	91,607	33,385	21,224	10,504	6,678	46,831	29,772
I-5: San Joaquin	Rural	28.56	40.45	11.89	51,722	183,106	4,170	14,763	47,551	168,343	91,341	59,509	7,364	4,798	83,976	54,711
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,133	3,762	91	303	1,042	3,459	2,001	1,223	161	99	1,840	1,124
I-5: San Joaquin	Urban	24.8	28.34	3.54	20,355	67,260	2,273	7,510	18,082	59,750	35,947	21,860	4,014	2,441	31,934	19,419
I-5: San Joaquin	Rural	14.34	24.8	10.46	51,777	154,808	5,781	17,284	45,996	137,524	91,439	50,313	10,209	5,617	81,229	44,695
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,234	30,525	1,440	4,294	14,116	42,104	18,073	9,921	2,543	1,396	24,929	13,684
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,526	13,831	739	2,259	3,787	11,572	7,992	4,495	1,305	734	6,687	3,761
I-5: San Joaquin	Rural	0	11.8	11.8	6,549	26,196	1,753	7,013	13,528	54,111	11,566	8,514	3,096	2,279	23,890	17,586
I-5: Stanislaus	Rural	0	28.06	28.06	11,785	80,813	4,586	31,450	13,091	89,769	20,813	26,264	8,100	10,221	23,119	29,175
I-5: Merced	Rural	0	32.45	32.45	33,748	138,237	13,134	53,798	37,488	153,558	59,599	44,927	23,194	17,484	66,205	49,906
I-5: Fresno	Rural	0	66.16	66.16	82,700	347,340	29,857	125,401	52,843	221,939	146,049	112,886	52,728	40,755	93,321	72,130
I-5: Kings	Rural	0	26.72	26.72	33,400	140,280	11,567	48,583	21,833	91,697	58,985	45,591	20,428	15,789	38,557	29,802
I-5: Kern	Rural	15.86	87.03	71.17	104,264	429,511	21,198	87,323	83,066	342,188	184,131	139,591	37,435	28,380	146,696	111,211
I-5: Kern	Rural	15.08	15.86	0.78	2,496	8,424	547	1,845	1,949	6,579	4,408	2,738	965	599	3,443	2,138
I-5: Kern	Rural	10.35	15.08	4.73	15,325	61,301	2,796	11,185	7,420	29,682	27,064	19,923	4,938	3,635	13,105	9,647
I-5: Kern	Rural	9.28	10.35	1.07	3,467	13,867	633	2,530	1,679	6,714	6,122	4,507	1,117	822	2,964	2,182
I-5: Kern	Rural	7.04	9.28	2.24	8,064	28,224	1,471	5,150	3,905	13,666	14,241	9,173	2,599	1,674	6,896	4,441
I-5: Kern	Rural	6.41	7.04	0.63	2,041	8,165	372	1,490	988	3,953	3,605	2,654	658	484	1,745	1,285
I-5: Kern	Rural	5.36	6.41	1.05	3,402	13,608	621	2,483	1,647	6,589	6,008	4,423	1,096	807	2,909	2,141
I-5: Kern	Rural	0.58	5.36	4.78	15,487	61,949	2,826	11,304	7,499	29,996	27,351	20,133	4,991	3,674	13,243	9,749
I-5: Kern	Rural	0	0.58	0.58	1,879	7,517	343	1,372	910	3,640	3,319	2,443	606	446	1,607	1,183
I-5: Los Angeles	Rural	86.67	88.61	1.94	7,508	29,740	1,269	5,028	3,736	14,799	13,259	9,666	2,242	1,634	6,598	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	2,090	8,278	353	1,400	1,040	4,119	3,691	2,690	624	455	1,836	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	5,302	21,002	896	3,551	2,638	10,451	9,363	6,826	1,583	1,154	4,659	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	24,497	97,039	4,141	16,405	12,190	48,287	43,262	31,538	7,314	5,332	21,528	15,693
I-5: Los Angeles	Rural	69.65	78.43	8.78	17,384	151,192	2,939	25,560	8,651	75,234	30,701	49,137	5,190	8,307	15,277	24,451
I-5: Los Angeles	Rural	68.1	69.65	1.55	3,395	26,366	574	4,457	1,689	13,120	5,995	8,569	1,013	1,449	2,983	4,264
I-5: Los Angeles	Rural	65.43	68.1	2.67	5,287	45,977	894	7,773	2,631	22,879	9,336	14,943	1,578	2,526	4,646	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	10,850	94,366	1,834	15,953	5,399	46,957	19,162	30,669	3,240	5,185	9,535	15,261
I-5: Los Angeles	Rural	54.16	59.95	5.79	9,843	97,272	1,197	11,832	8,646	85,440	17,383	31,613	2,114	3,846	15,268	27,768
I-5: Los Angeles	Rural	52.33	54.16	1.83	3,203	53,528	390	6,511	2,813	47,016	5,656	17,396	688	2,116	4,968	15,280
I-5: Los Angeles	Urban	47.13	52.33	5.2	17,888	241,488	1,898	25,618	11,414	154,094	31,590	78,484	3,351	8,326	20,158	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	791	10,681	81	1,098	507	6,851	1,397	3,471	144	357	896	2,226
I-5: Los Angeles	Urban	46.6	46.9	0.3	919	14,578	93	1,481	571	9,057	1,624	4,738	165	481	1,009	2,944
I-5: Los Angeles	Urban	45.93	46.6	0.67	2,411	32,200	245	3,270	1,498	20,006	4,258	10,465	432	1,063	2,645	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	2,659	40,333	294	4,452	2,027	30,745	4,696	13,108	518	1,447	3,580	9,992
I-5: Los Angeles	Urban	44.01	45.1	1.09	4,399	53,563	546	6,650	4,320	52,602	7,768	17,408	965	2,161	7,629	17,096
I-5: Los Angeles	Urban	43.9	44.01	0.11	302	5,161	45	771	334	5,706	534	1,677	80	251	590	1,854
I-5: Los Angeles	Urban	41.6	43.9	2.3	8,303	120,612	1,158	16,821	8,019	116,487	14,663	39,199	2,045	5,467	14,162	37,858
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,784	22,270	554	6,910	9,007	112,425	3,151	7,238	978	2,246	15,907	36,538
I-5: Los Angeles	Urban	39.81	40.27	0.46	523	8,037	86	1,328	1,161	17,844	924	2,612	153	432	2,051	5,799
I-5: Los Angeles	Urban	39.36	39.81	0.45	463	8,280	79	1,414	1,078	19,286	817	2,691	140	460	1,904	6,268
I-5: Los Angeles	Urban	36.65	39.36	2.71	9,009	127,153	1,002	14,149	13,836	195,280	15,910	41,325	1,770	4,598	24,435	63,466
I-5: Los Angeles	Urban	36.43	36.65	0.22	723	10,120	85	1,191	1,216	17,025	1,277	3,289	150	387	2,148	5,533
I-5: Los Angeles	Urban	36.22	36.43	0.21	662	9,274	81	1,137	1,188	16,637	1,170	3,014	143	370	2,099	5,407
I-5: Los Angeles	Urban	35.94	36.22	0.28	550	8,758	61	975	845	13,451	971	2,846	108	317	1,492	4,372
I-5: Los Angeles	Urban	29.16	35.94	6.78	14,102	224,554	1,482	23,599	19,672	313,231	24,905	72,980	2,617	7,670	34,740	101,800
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,253	34,325	236	3,590	3,117	47,479	3,979	11,156	416	1,167	5,504	15,431
I-5: Los Angeles	Urban	22.78	28.25	5.47	14,190	241,637	1,633	27,800	23,014	391,886	25,060	78,532	2,883	9,035	40,643	127,363
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,297	22,088	149	2,541	2,104	35,821	2,291	7,178	264	826	3,715	11,642
I-5: Los Angeles	Urban	21.41	22.28	0.87	4,514	63,392	352	4,949	2,999	42,114	7,971	20,602	622	1,609	5,296	13,687
I-5: Los Angeles	Urban	20.58	21.41	0.83	4,189	58,644	342	4,790	3,105	43,469	7,398	19,059	604	1,557	5,483	14,127
I-5: Los Angeles	Urban	17.21	20.58	3.37	13,660	198,426	1,148	16,671	10,805	156,951	24,123	64,488	2,027	5,418	19,081	51,009
I-5: Los Angeles	Urban	16.9	17.21	0.31	931	13,518	66	956	1,360	19,750	1,643	4,394	116	311	2,401	6,419
I-5: Los Angeles	Urban	14.16	16.9	2.74	8,498	120,998	643	9,149	13,875	197,556	15,008	39,324	1,135	2,973	24,504	64,206
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,233	17,620	87	1,249	1,811	25,880	2,177	5,726	154	406	3,198	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	86,979	560,864	6,699	43,196	55,817	359,925	153,606	182,281	11,830	14,039	98,574	116,976
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	19,631	143,964	1,290	9,461	7,871	57,722	34,669	46,788	2,278	3,075	13,901	18,760
CA 710: LA	Suburban	4.96	10.18	5.22	34,005	212,976	2,222	13,917	13,363	83,697	60,052	69,217	3,924	4,523	23,600	27,201
TOTAL					**908,725**	**5,586,341**	**174,898**	**913,331**	**797,461**	**5,220,436**	**1,604,819**	**1,815,561**	**308,871**	**296,833**	**1,408,324**	**1,696,642**

TABLE R3e. TRAVEL TIME COST - REMAINING CONVENTIONAL LANES - BASE VOLUME - DEDICATED LANE CASE

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Sacramento	Rural	29.87	34.65	4.78	296.1	1,317.5	27.1	118.8	240.8	1,054.9	8,373	12,062	767	1,088	6,809	9,658
I-5: Sacramento	Urban	26.94	29.87	2.93	171.9	1,393.9	13.8	111.7	100.8	817.6	4,861	12,762	390	1,023	2,851	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	11.7	121.6	0.9	9.7	6.9	71.3	332	1,113	27	89	195	653
I-5: Sacramento	Urban	25.53	26.69	1.16	55.4	410.0	9.1	58.5	126.0	813.1	1,567	3,754	256	536	3,562	7,444
I-5: Sacramento	Urban	24.51	25.53	1.02	37.1	369.6	5.9	58.6	80.8	803.7	1,050	3,384	167	537	2,284	7,359
I-5: Sacramento	Urban	23.1	24.51	1.41	56.3	491.4	10.1	87.9	145.1	1,266.5	1,592	4,499	285	804	4,103	11,596
I-5: Sacramento	Urban	22	23.1	1.1	47.7	467.3	8.1	63.5	114.6	897.7	1,350	4,278	229	582	3,241	8,218
I-5: Sacramento	Urban	19.16	22	2.84	135.3	799.3	23.3	137.4	330.0	1,949.7	3,825	7,318	657	1,258	9,329	17,851
I-5: Sacramento	Urban	18.82	19.16	0.34	14.5	86.1	2.7	15.9	39.3	232.9	411	789	76	146	1,112	2,132
I-5: Sacramento	Urban	16.7	18.82	2.12	82.7	497.2	13.1	78.9	179.8	1,081.3	2,338	4,552	371	722	5,084	9,900
I-5: Sacramento	Urban	14.46	16.7	2.24	68.5	420.3	10.9	66.7	149.1	914.0	1,938	3,848	308	611	4,215	8,368
I-5: Sacramento	Rural	0	14.46	14.46	607.3	1,501.6	387.2	957.3	1,029.9	2,546.5	17,172	13,748	10,947	8,765	29,120	23,314
I-5: San Joaquin	Rural	40.45	49.79	9.34	378.1	1,004.7	119.0	316.1	530.4	1,409.3	10,690	9,199	3,363	2,894	14,996	12,903
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,034.4	2,817.0	83.4	227.1	951.0	2,589.9	29,248	25,791	2,358	2,079	26,890	23,712
I-5: San Joaquin	Urban	28.34	28.56	0.22	22.7	68.4	1.8	5.5	20.8	62.9	641	626	52	50	589	576
I-5: San Joaquin	Urban	24.8	28.34	3.54	407.1	1,222.9	45.5	136.5	361.6	1,086.4	11,511	11,196	1,285	1,250	10,225	9,946
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,035.5	2,381.7	115.6	265.9	919.9	2,115.7	29,279	21,805	3,269	2,435	26,010	19,371
I-5: San Joaquin	Rural	12.69	14.34	1.65	204.7	469.6	28.8	66.1	282.3	647.7	5,787	4,300	814	605	7,982	5,930
I-5: San Joaquin	Rural	11.8	12.69	0.89	90.5	212.8	14.8	34.7	75.7	178.0	2,559	1,948	418	318	2,141	1,630
I-5: San Joaquin	Rural	0	11.8	11.8	131.0	403.0	35.1	107.9	270.6	832.5	3,703	3,690	991	988	7,650	7,622
I-5: Stanislaus	Rural	0	28.06	28.06	235.7	1,243.3	91.7	483.8	261.8	1,381.1	6,664	11,383	2,594	4,430	7,403	12,644
I-5: Merced	Rural	0	32.45	32.45	675.0	2,126.7	262.7	827.7	749.8	2,362.4	19,084	19,471	7,427	7,578	21,199	21,629
I-5: Fresno	Rural	0	66.16	66.16	1,654.0	5,343.7	597.1	1,929.2	1,056.9	3,414.4	46,766	48,924	16,884	17,663	29,882	31,261
I-5: Kings	Rural	0	26.72	26.72	668.0	2,158.2	231.3	747.4	436.7	1,410.7	18,887	19,759	6,541	6,843	12,346	12,916
I-5: Kern	Rural	15.86	87.03	71.17	2,085.3	6,607.9	424.0	1,343.4	1,661.3	5,264.4	58,960	60,498	11,987	12,300	46,973	48,199
I-5: Kern	Rural	15.08	15.86	0.78	49.9	129.6	10.9	28.4	39.0	101.2	1,411	1,187	309	260	1,102	927
I-5: Kern	Rural	10.35	15.08	4.73	306.5	943.1	55.9	172.1	148.4	456.6	8,666	8,634	1,581	1,576	4,196	4,181
I-5: Kern	Rural	9.28	10.35	1.07	69.3	213.3	12.7	38.9	33.6	103.3	1,960	1,953	358	356	949	946
I-5: Kern	Rural	7.04	9.28	2.24	161.3	434.2	29.4	79.2	78.1	210.2	4,560	3,975	832	725	2,208	1,925
I-5: Kern	Rural	6.41	7.04	0.63	40.8	125.6	7.4	22.9	19.8	60.8	1,154	1,150	211	210	559	557
I-5: Kern	Rural	5.36	6.41	1.05	68.0	209.4	12.4	38.2	32.9	101.4	1,924	1,917	351	350	931	928
I-5: Kern	Rural	0.58	5.36	4.78	309.7	953.1	56.5	173.9	150.0	461.5	8,758	8,726	1,598	1,592	4,241	4,225
I-5: Kern	Rural	0	0.58	0.58	37.6	115.6	6.9	21.1	18.2	56.0	1,063	1,059	194	193	515	513
I-5: Los Angeles	Rural	86.67	88.61	1.94	150.2	457.5	25.4	77.4	74.7	227.7	4,246	4,189	718	708	2,113	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	41.8	127.4	7.1	21.5	20.8	63.4	1,182	1,166	200	197	588	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	106.0	323.1	17.9	54.6	52.8	160.8	2,998	2,958	507	500	1,492	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	489.9	1,492.9	82.8	252.4	243.8	742.9	13,853	13,668	2,342	2,311	6,893	6,801
I-5: Los Angeles	Rural	69.65	78.43	8.78	347.7	2,326.0	58.8	393.2	173.0	1,157.4	9,831	21,296	1,662	3,600	4,892	10,597
I-5: Los Angeles	Rural	68.1	69.65	1.55	67.9	405.6	11.5	68.6	33.8	201.8	1,920	3,714	325	628	955	1,848
I-5: Los Angeles	Rural	65.43	68.1	2.67	105.7	707.3	17.9	119.6	52.6	352.0	2,990	6,476	505	1,095	1,488	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	217.0	1,451.8	36.7	245.4	108.0	722.4	6,136	13,292	1,037	2,247	3,053	6,614
I-5: Los Angeles	Rural	54.16	59.95	5.79	196.9	1,496.5	23.9	182.0	172.9	1,314.5	5,566	13,701	677	1,667	4,889	12,035
I-5: Los Angeles	Rural	52.33	54.16	1.83	64.1	823.5	7.8	100.2	56.3	723.3	1,811	7,540	220	917	1,591	6,622
I-5: Los Angeles	Urban	47.13	52.33	5.2	357.8	4,556.4	38.0	465.8	228.3	2,801.7	10,115	41,716	1,073	4,264	6,455	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	15.8	201.5	1.6	20.0	10.1	124.6	447	1,845	46	183	287	1,140
I-5: Los Angeles	Urban	46.6	46.9	0.3	18.4	280.3	1.9	26.9	11.4	164.7	520	2,567	53	246	323	1,508
I-5: Los Angeles	Urban	45.93	46.6	0.67	48.2	585.5	4.9	59.5	30.0	363.7	1,363	5,360	138	544	847	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	53.2	733.3	5.9	81.0	40.5	559.0	1,504	6,714	166	741	1,146	5,118
I-5: Los Angeles	Urban	44.01	45.1	1.09	88.0	973.9	10.9	120.9	86.4	956.4	2,488	8,916	309	1,107	2,443	8,756
I-5: Los Angeles	Urban	43.9	44.01	0.11	6.0	95.6	0.9	14.0	6.7	103.7	171	875	26	128	189	950
I-5: Los Angeles	Urban	41.6	43.9	2.3	166.1	2,192.9	23.2	305.8	160.4	2,118.0	4,695	20,078	655	2,800	4,535	19,391
I-5: Los Angeles	Urban	40.27	41.6	1.33	35.7	404.9	11.1	125.6	180.1	2,121.2	1,009	3,707	313	1,150	5,093	19,421
I-5: Los Angeles	Urban	39.81	40.27	0.46	10.5	146.1	1.7	24.1	23.2	324.4	296	1,338	49	221	657	2,970
I-5: Los Angeles	Urban	39.36	39.81	0.45	9.3	150.5	1.6	25.7	21.6	350.7	262	1,378	45	235	610	3,210
I-5: Los Angeles	Urban	36.65	39.36	2.71	180.2	2,399.1	20.0	257.3	276.7	3,550.5	5,095	21,965	567	2,355	7,824	32,507
I-5: Los Angeles	Urban	36.43	36.65	0.22	14.5	184.0	1.7	21.7	24.3	309.5	409	1,685	48	198	688	2,834
I-5: Los Angeles	Urban	36.22	36.43	0.21	13.2	231.8	1.6	20.7	23.8	302.5	375	2,123	46	189	672	2,770
I-5: Los Angeles	Urban	35.94	36.22	0.28	11.0	159.2	1.2	17.7	16.9	244.6	311	1,458	35	162	478	2,239
I-5: Los Angeles	Urban	29.16	35.94	6.78	282.0	4,082.8	29.6	429.1	393.4	5,695.1	7,975	37,380	838	3,928	11,124	52,142
I-5: Los Angeles	Urban	28.25	29.16	0.91	45.1	647.6	4.7	65.3	62.3	863.3	1,274	5,930	133	598	1,762	7,904
I-5: Los Angeles	Urban	22.78	28.25	5.47	283.8	4,393.4	32.7	505.5	460.3	7,125.2	8,025	40,224	923	4,628	13,014	65,235
I-5: Los Angeles	Urban	22.28	22.78	0.5	25.9	490.8	3.0	46.2	42.1	651.3	734	4,494	84	423	1,190	5,963
I-5: Los Angeles	Urban	21.41	22.28	0.87	90.3	1,173.9	7.0	90.0	60.0	765.7	2,552	10,748	199	824	1,696	7,010
I-5: Los Angeles	Urban	20.58	21.41	0.83	83.8	1,303.2	6.8	87.1	62.1	790.3	2,369	11,932	193	797	1,756	7,236
I-5: Los Angeles	Urban	17.21	20.58	3.37	273.2	3,674.5	23.0	303.1	216.1	2,853.7	7,724	33,642	649	2,775	6,110	26,127
I-5: Los Angeles	Urban	16.9	17.21	0.31	18.6	250.3	1.3	17.4	27.2	359.1	526	2,292	37	159	769	3,288
I-5: Los Angeles	Urban	14.16	16.9	2.74	170.0	2,240.7	12.9	166.3	277.5	3,591.9	4,806	20,515	363	1,523	7,846	32,886
I-5: Los Angeles	Urban	13.78	14.16	0.38	24.7	332.4	1.7	22.7	36.2	470.5	697	3,044	49	208	1,024	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,739.6	9,347.7	134.0	664.6	1,116.3	5,537.3	49,186	85,583	3,788	6,084	31,564	50,697
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	392.6	2,285.1	25.8	145.6	157.4	888.0	11,101	20,922	730	1,333	4,451	8,130
CA 710: LA	Suburban	4.96	10.18	5.22	680.1	3,736.4	44.4	214.1	267.3	1,287.6	19,229	34,209	1,257	1,960	7,557	11,789
TOTAL					**18,174.5**	**93,925.7**	**3,498.0**	**14,689.8**	**15,949.2**	**87,696.4**	**513,873**	**859,938**	**98,903**	**134,492**	**450,954**	**802,906**

APPENDIX S

ADDED CONVENTIONAL FREEWAY LANE PLANNING, DESIGN, CONSTRUCTION, AND REHABILITATION COSTS AT VARIOUS VOLUMES

Introduction

This appendix shows supporting tables for the calculation of incremental planning, design, construction, and rehabilitation costs for the added-conventional-freeway-lane system for low-, medium-, and high-volume traffic conditions. The incremental cost is the cost of building and maintaining the added conventional freeway lane above the no-build option.

Methodologies

In order to determine the effect of various volume levels on the relative costs associated with building and operating the added conventional freeway lane under study here, the road sections were sorted according to the passenger car per hour per lane (pcphpl) flow rates. The sections were then divided at a flow rate of 1000 and 2000 pcphpl, respectively. This resulted in having sections of road that represented flow rates designated as follows:

> "low" – flow rates between zero and 1000
> "medium" – flow rates between 1000 and 2000
> "high" – flow rates between 2000 and 2500.

Although the sections of roadway in each of the categories were not contiguous, the result could be thought of as a simulated road section that is based on existing roadway conditions. The sections were sorted according to the existing roadway and base (existing) volumes and grouped together using the categories shown above. All ensuing calculations were based on these same sections – even though flow rates for individual sections may have changed after addition of extra lanes. The AHS transfer terminals were allocated to the physical sections with which they are associated geographically.

The procedures followed to calculate the costs were identical to the methodologies outlined in Chapters 9 through 11 of the main report.

Results

Details of the calculations are shown in S1 and S2 in this appendix.

TABLE S1. INCREMENTAL CONSTRUCTION COSTS OF CONVENTIONAL FREEWAY FOR ROADWAY SPACE AND BARRIERS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in	AHS Lane Placement	New Freeway Costs ($)			Barrier Costs ($)				Total Construction Costs ($)	
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC	# of Barriers in One Direction	2001-Unit Cost per Lane Mile	Total Cost	EUAC	Total Cost	EUATC
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	3,654,000	767,340	55,746	0.5	94,776	9,951	723	777,291	56,469
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	13,702,500	11,373,075	826,242	0.0	94,776	0	0	11,373,075	826,242
I-5: Sacramento	Urban	22.00	23.10	1.10	3	Non-Median	13,702,500	15,072,750	1,095,019	0.0	94,776	0	0	15,072,750	1,095,019
I-5: Los Angeles	Urban	22.28	22.78	0.50	4	Non-Median	13,702,500	6,851,250	497,736	0.0	94,776	0	0	6,851,250	497,736
I-5: Los Angeles	Urban	46.60	46.90	0.30	4	Median	3,654,000	1,096,200	79,638	0.5	94,776	14,216	1,033	1,110,416	80,671
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Median	3,654,000	4,238,640	307,933	0.5	94,776	54,970	3,994	4,293,610	311,926
I-5: Los Angeles	Urban	46.90	52.33	5.43	4	Median	3,654,000	19,841,220	1,441,443	0.5	94,776	257,317	18,694	20,098,537	1,460,137
I-5: Los Angeles	Urban	43.90	44.01	0.11	4	Median	3,654,000	401,940	29,201	0.5	94,776	5,213	379	407,153	29,579
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	3,654,000	1,388,520	100,874	0.5	94,776	18,007	1,308	1,406,527	102,183
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	8,842,212	91,163,201	6,622,907	0.0	94,776	0	0	91,163,201	6,622,907
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	8,842,212	46,156,344	3,353,208	0.0	94,776	0	0	46,156,344	3,353,208
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	13,702,500	12,469,275	905,879	0.0	94,776	0	0	12,469,275	905,879
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	13,702,500	37,133,775	2,697,728	0.0	94,776	0	0	37,133,775	2,697,728
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	13,702,500	46,177,425	3,354,740	0.0	94,776	0	0	46,177,425	3,354,740
I-5: Los Angeles	Urban	14.16	16.90	2.74	4	Non-Median	13,702,500	37,544,850	2,727,592	0.0	94,776	0	0	37,544,850	2,727,592
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	13,702,500	11,921,175	866,060	0.0	94,776	0	0	11,921,175	866,060
I-5: Los Angeles	Urban	16.90	17.21	0.31	4	Median	3,654,000	1,132,740	82,292	0.5	94,776	14,690	1,067	1,147,430	83,360
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	8,842,212	24,669,770	1,792,232	0.0	94,776	0	0	24,669,770	1,792,232
TOTAL				**39.25**				**369,399,490**	**26,836,471**			**374,365**	**27,197**	**369,773,856**	**26,863,668**
I-5: Los Angeles	Urban	41.60	43.90	2.30	5	Non-Median	13,702,500	31,515,750	2,289,585	0.0	94,776	0	0	31,515,750	2,289,585
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	13,702,500	74,952,675	5,445,230	0.0	94,776	0	0	74,952,675	5,445,230
I-5: Los Angeles	Urban	44.01	45.10	1.09	5	Median	3,654,000	3,982,860	289,350	0.5	94,776	51,653	3,753	4,034,513	293,103
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Median	3,654,000	3,727,080	270,768	0.5	94,776	48,336	3,512	3,775,416	274,280
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	2,389,154	11,420,155	829,662	0.5	94,776	226,515	16,456	11,646,670	846,118
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	13,702,500	92,902,950	6,749,298	0.0	94,776	0	0	92,902,950	6,749,298
I-5: Los Angeles	Urban	45.93	46.60	0.67	5	Median	3,654,000	2,448,180	177,858	0.5	94,776	31,750	2,307	2,479,930	180,164
I-5: Los Angeles	Urban	45.10	45.93	0.83	5	Median	3,654,000	3,032,820	220,331	0.5	94,776	39,332	2,857	3,072,152	223,189
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	13,702,500	3,836,700	278,732	0.0	94,776	0	0	3,836,700	278,732
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	3,654,000	803,880	58,401	0.5	94,776	10,425	757	814,305	59,158
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	3,654,000	10,706,220	777,795	0.5	94,776	138,847	10,087	10,845,067	787,882
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Median	3,654,000	913,500	66,365	0.5	94,776	11,847	861	925,347	67,225
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Median	2,389,154	4,372,152	317,632	0.5	94,776	86,720	6,300	4,458,872	323,932
I-5: Sacramento	Rural	0.00	14.46	14.46	2	Median	2,389,154	34,547,165	2,509,814	0.5	94,776	685,230	49,781	35,232,395	2,559,595
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Median	3,654,000	803,880	58,401	0.5	94,776	10,425	757	814,305	59,158
I-5: Sacramento	Urban	19.16	22.00	2.84	4	Non-Median	13,702,500	38,915,100	2,827,140	0.0	94,776	0	0	38,915,100	2,827,140
I-5: Los Angeles	Urban	40.27	41.60	1.33	3	Non-Median	13,702,500	18,224,325	1,323,977	0.0	94,776	0	0	18,224,325	1,323,977
I-5: San Joaquin	Rural	11.80	12.69	0.89	3	Median	2,389,154	2,126,347	154,477	0.5	94,776	42,175	3,064	2,168,522	157,541
I-5: San Joaquin	Rural	14.34	24.80	10.46	3	Median	2,389,154	24,990,549	1,815,536	0.5	94,776	495,678	36,011	25,486,228	1,851,547
I-5: Sacramento	Urban	23.10	24.51	1.41	5	Non-Median	13,702,500	19,320,525	1,403,615	0.0	94,776	0	0	19,320,525	1,403,615
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	2,389,154	28,407,039	2,063,740	0.5	94,776	563,443	40,934	28,970,483	2,104,674
I-5: Sacramento	Urban	14.46	16.70	2.24	3	Median	3,654,000	8,184,960	594,628	0.5	94,776	106,149	7,712	8,291,109	602,340
I-5: San Joaquin	Urban	24.80	28.34	3.54	4	Median	3,654,000	12,935,160	939,725	0.5	94,776	167,754	12,187	13,102,914	951,912
I-5: Sacramento	Urban	16.70	18.82	2.12	4	Median	3,654,000	7,746,480	562,773	0.5	94,776	100,463	7,298	7,846,943	570,072
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	2,389,154	22,314,697	1,621,138	0.5	94,776	442,604	32,155	22,757,301	1,653,293
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	13,702,500	6,303,150	457,917	0.0	94,776	0	0	6,303,150	457,917
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	13,702,500	4,658,850	338,460	0.0	94,776	0	0	4,658,850	338,460
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	2,389,154	3,942,104	286,390	0.5	94,776	78,190	5,680	4,020,294	292,070
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Median	2,389,154	13,833,201	1,004,967	0.5	94,776	274,377	19,933	14,107,577	1,024,900
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	13,702,500	6,166,125	447,962	0.0	94,776	0	0	6,166,125	447,962
TOTAL				**97.88**				**498,034,578**	**36,181,670**			**3,611,913**	**262,402**	**501,646,492**	**36,444,072**
I-5: Los Angeles	Rural	84.76	88.61	3.85	4	Non-Median	3,981,923	15,330,404	1,113,737	0.0	94,776	0	0	15,330,404	1,113,737
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	2,389,154	15,123,344	1,098,694	0.5	94,776	299,966	21,792	15,423,310	1,120,487
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	2,389,154	170,036,079	12,352,936	0.5	94,776	3,372,604	245,016	173,408,683	12,597,952
I-5: Los Angeles	Rural	68.10	69.65	1.55	4	Median	2,389,154	3,703,188	269,033	0.5	94,776	73,451	5,336	3,776,640	274,369
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Median	2,389,154	20,976,771	1,523,940	0.5	94,776	416,067	30,227	21,392,837	1,554,166
I-5: Los Angeles	Rural	65.43	68.10	2.67	4	Median	2,389,154	6,379,041	463,430	0.5	94,776	126,526	9,192	6,505,567	472,622
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	2,389,154	13,092,563	951,160	0.5	94,776	259,686	18,866	13,352,249	970,026
I-5: Fresno	Rural	0.00	66.16	66.16	2	Median	2,389,154	158,066,418	11,483,353	0.5	94,776	3,135,190	227,768	161,201,609	11,711,121
I-5: Kings	Rural	0.00	26.72	26.72	2	Median	2,389,154	63,838,191	4,637,775	0.5	94,776	1,266,207	91,989	65,104,398	4,729,764
I-5: Kern	Rural	7.04	9.28	2.24	4	Median	2,389,154	5,351,705	388,796	0.5	94,776	106,149	7,712	5,457,854	396,507
I-5: Merced	Rural	0.00	32.45	32.45	2	Median	2,389,154	77,528,042	5,632,328	0.5	94,776	1,537,741	111,715	79,065,783	5,744,043
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	2,389,154	1,863,540	135,384	0.5	94,776	36,963	2,685	1,900,503	138,069
I-5: Kern	Rural	10.35	15.08	4.73	4	Median	2,389,154	11,300,698	820,983	0.5	94,776	224,145	16,284	11,524,843	837,267
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	2,389,154	2,556,395	185,719	0.5	94,776	50,705	3,684	2,607,100	189,403
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	2,389,154	1,505,167	109,349	0.5	94,776	29,854	2,169	1,535,021	111,518
I-5: Kern	Rural	5.36	6.41	1.05	4	Median	2,389,154	2,508,612	182,248	0.5	94,776	49,757	3,615	2,558,369	185,863
I-5: Kern	Rural	0.58	5.36	4.78	4	Median	2,389,154	11,420,155	829,662	0.5	94,776	226,515	16,456	11,646,670	846,118
I-5: Kern	Rural	0.00	0.58	0.58	4	Median	2,389,154	1,385,709	100,670	0.5	94,776	27,485	1,997	1,413,194	102,667
I-5: Stanislaus	Rural	0.00	28.06	28.06	2	Median	2,389,154	67,039,657	4,870,358	0.5	94,776	1,329,707	96,602	68,369,364	4,966,960
I-5: San Joaquin	Rural	0.00	11.80	11.80	2	Median	2,389,154	28,192,015	2,048,119	0.5	94,776	559,178	40,624	28,751,194	2,088,743
TOTAL				**280.88**				**677,197,694**	**49,197,675**			**13,127,898**	**953,727**	**690,325,591**	**50,151,403**

TABLE S2. INCREMENTAL REHABILITATION COSTS FOR ADDED CONVENTIONAL LANE - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	Added Lane Placement	Rehabilitation Costs ($)		
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	228,375	47,959	3,032
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	730,800	606,564	38,346
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	730,800	803,880	50,821
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	730,800	365,400	23,100
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Median	228,375	68,512	4,331
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Median	228,375	264,915	16,748
I-5: Los Angeles	Urban	46.9	52.33	5.43	4	Median	228,375	1,240,076	78,396
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Median	228,375	25,121	1,588
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	228,375	86,783	5,486
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	843,231	8,693,709	549,608
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	843,231	4,401,665	278,269
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	730,800	665,028	42,042
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	730,800	1,980,468	125,203
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	730,800	2,462,796	155,696
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	730,800	2,002,392	126,589
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	730,800	635,796	40,194
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	228,375	70,796	4,476
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	843,231	2,352,614	148,730
TOTAL				**39.25**			**9,974,717**	**26,774,474**	**1,692,657**
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	730,800	1,680,840	106,261
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	730,800	3,997,476	252,717
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Median	228,375	248,929	15,737
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Median	228,375	232,943	14,726
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	103,530	494,873	31,285
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	730,800	4,954,824	313,239
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Median	228,375	153,011	9,673
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Median	228,375	189,551	11,983
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	730,800	204,624	12,936
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	228,375	50,242	3,176
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	228,375	669,139	42,302
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Median	228,375	57,094	3,609
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Median	103,530	189,460	11,977
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	103,530	1,497,044	94,642
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Median	228,375	50,242	3,176
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	730,800	2,075,472	131,209
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	730,800	971,964	61,447
I-5: San Joaquin	Rural	11.8	12.7	0.89	3	Median	103,530	92,142	5,825
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	103,530	1,082,924	68,461
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	730,800	1,030,428	65,143
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	103,530	1,230,972	77,821
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	228,375	511,560	32,340
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Median	228,375	808,448	51,109
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Median	228,375	484,155	30,608
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	103,530	966,970	61,131
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	730,800	336,168	21,252
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	730,800	248,472	15,708
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	103,530	170,825	10,799
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Median	103,530	599,439	37,896
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	730,800	328,860	20,790
TOTAL				**97.88**				**25,609,089**	**1,618,982**
I-5: Los Angeles	Rural	84.76	88.61	3.85	4	Non-Median	955,662	3,679,297	232,602
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	103,530	655,345	41,430
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	103,530	7,368,230	465,812
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	103,530	160,472	10,145
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Median	103,530	908,993	57,466
I-5: Los Angeles	Rural	65.4	68.10	2.67	4	Median	103,530	276,425	17,475
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	103,530	567,344	35,867
I-5: Fresno	Rural	0	66.16	66.16	2	Median	103,530	6,849,545	433,022
I-5: Kings	Rural	0	26.72	26.72	2	Median	103,530	2,766,322	174,884
I-5: Kern	Rural	7.04	9.28	2.24	4	Median	103,530	231,907	14,661
I-5: Merced	Rural	0	32.45	32.45	2	Median	103,530	3,359,549	212,387
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	103,530	80,753	5,105
I-5: Kern	Rural	10.35	15.08	4.73	4	Median	103,530	489,697	30,958
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	103,530	110,777	7,003
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	103,530	65,224	4,123
I-5: Kern	Rural	5.36	6.41	1.05	4	Median	103,530	108,707	6,872
I-5: Kern	Rural	0.58	5.36	4.78	4	Median	103,530	494,873	31,285
I-5: Kern	Rural	0	0.58	0.58	4	Median	103,530	60,047	3,796
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	103,530	2,905,052	183,655
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	103,530	1,221,654	77,232
TOTAL				**280.88**			**2,922,732**	**32,360,213**	**2,045,782**

APPENDIX T

ADDED CONVENTIONAL FREEWAY LANE VEHICLE-HOURS AND VEHICLE-MILES, VEHICLE OPERATING COSTS, AND USER COSTS AT VARIOUS VOLUMES

Introduction

This appendix shows supporting tables for the calculation of vehicle-miles, vehicle-hours, vehicle operating costs, and user travel time costs for low-, medium-, and high-volume traffic conditions for the added-conventional-lane configuration (these traffic conditions are described in Appendix S).

Methodologies

Sorting methodologies for the tables in this appendix are identical to those presented in Appendix S. Calculation methodologies for the tables shown here are identical to those for calculation of the corresponding values for the added-conventional-freeway-lane scenario at base volumes, which is presented in Appendix M. Values were summed for the low-, medium-, and high-volume conditions to determine a total cost for each type of segment.

Results

The vehicle-miles of travel and vehicle operating costs are shown in Table T1a for the existing freeway conditions (sorted by volume), and in Table T2a for the existing configuration plus an added conventional lane. Table T1b shows vehicle-hours of travel and user travel-time costs for the existing configuration (sorted by volume), and Table T2b shows vehicle-hours of travel and user travel-time costs for the existing configuration plus the added conventional lane, again sorted by volume.

TABLE T1a. VEHICLE OPERATING COSTS - BASE CONDITION - SEGMENTATION 26 FT. BASIS - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,100	58,644	417	4,790	3,780	43,469	9,006	19,059	736	1,557	6,675	14,127
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Los Angeles	Urban	46.9	52.33	5.43	28,019	252,169	2,881	25,927	17,970	161,734	49,482	81,955	5,087	8,426	31,736	52,564
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
TOTAL					**252,993**	**1,895,389**	**20,743**	**160,649**	**187,318**	**1,552,868**	**446,788**	**616,001**	**36,632**	**52,211**	**330,806**	**504,682**
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,947	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
TOTAL					**339,166**	**1,851,561**	**59,552**	**280,841**	**406,731**	**2,378,430**	**598,970**	**601,757**	**105,169**	**91,273**	**718,291**	**772,990**
I-5: Los Angeles	Rural	84.76	88.61	3.85	21,830	59,020	3,691	9,978	10,862	29,369	38,551	19,182	6,517	3,243	19,183	9,545
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
TOTAL					**689,494**	**1,839,391**	**183,255**	**471,053**	**494,219**	**1,289,927**	**1,217,654**	**597,802**	**323,631**	**153,092**	**872,797**	**419,226**

TABLE T1b. TRAVEL TIME COST - BASE CONDITION - SEGMENTATION 26 FT. BASIS - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	456	2,653	56	189	818	2,770
I-5: Los Angeles	Urban	20.58	21.41	0.83	102.0	1,832.6	8.3	87.1	75.6	790.3	2,884	16,779	236	797	2,138	7,236
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	1,437	4,953	244	582	3,451	8,218
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	940	5,056	108	423	1,525	5,963
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	815	2,902	83	246	507	1,508
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	1,663	3,754	272	536	3,779	7,444
I-5: Los Angeles	Urban	46.9	52.33	5.43	560.4	5,043.4	57.6	471.4	359.4	2,940.6	15,844	46,175	1,629	4,316	10,162	26,923
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	254	927	38	128	281	950
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	866	3,102	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	55,970	87,034	4,311	6,084	35,918	50,697
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,609.8	49.1	214.1	295.4	1,287.6	21,253	33,049	1,389	1,960	8,352	11,789
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	1,688	5,930	177	598	2,335	7,904
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	6,252	21,965	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	9,757	33,642	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	5,950	20,515	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	3,117	10,748	243	824	2,071	7,010
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	665	2,292	47	159	971	3,288
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,440.1	30.8	145.6	187.9	888.0	13,253	22,340	871	1,333	5,314	8,130
TOTAL					**5,059.9**	**35,368.3**	**414.9**	**2,734.7**	**3,746.4**	**26,831.6**	**143,065**	**323,815**	**11,730**	**25,037**	**105,926**	**245,657**
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,233.6	29.3	305.8	202.6	2,118.0	5,931	20,449	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	9,082	12,254	832	1,088	7,386	9,658
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	18,398	13,963	11,729	8,765	31,200	23,314
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	672	530	54	50	618	576
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	1,245	3,707	386	1,150	6,288	19,421
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
TOTAL					**6,783.3**	**31,576.8**	**1,191.0**	**4,693.8**	**8,134.6**	**41,034.1**	**191,794**	**289,102**	**33,676**	**42,974**	**230,001**	**375,688**
I-5: Los Angeles	Rural	84.76	88.61	3.85	436.6	908.0	73.8	153.5	217.2	451.8	12,344	8,313	2,087	1,405	6,143	4,137
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
TOTAL					**13,789.9**	**28,298.3**	**3,665.1**	**7,247.0**	**9,884.4**	**19,845.0**	**389,901**	**259,086**	**103,629**	**66,350**	**279,475**	**181,692**

TABLE T2a. VEHICLE OPERATING COSTS - CONVENTIONAL LANES WITH ADDED LANE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other	Truck	Other	Truck	Other	Truck	Other	Truck	Other	Truck	Other
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,100	58,644	417	4,790	3,780	43,469	9,006	19,059	736	1,557	6,675	14,127
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Los Angeles	Urban	46.9	52.33	5.43	28,019	252,169	2,881	25,927	17,970	161,734	49,482	81,955	5,087	8,426	31,736	52,564
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
TOTAL					**252,993**	**1,895,389**	**20,743**	**160,649**	**187,318**	**1,552,868**	**446,788**	**616,001**	**36,632**	**52,211**	**330,806**	**504,682**
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,947	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
TOTAL					**339,166**	**1,851,561**	**59,552**	**280,841**	**406,731**	**2,378,430**	**598,970**	**601,757**	**105,169**	**91,273**	**718,291**	**772,990**
I-5: Los Angeles	Rural	84.76	88.61	3.85	21,830	59,020	3,691	9,978	10,862	29,369	38,551	19,182	6,517	3,243	19,183	9,545
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
TOTAL					**689,494**	**1,839,391**	**183,255**	**471,053**	**494,219**	**1,289,927**	**1,217,654**	**597,802**	**323,631**	**153,092**	**872,797**	**419,226**

TABLE T2b. TRAVEL TIME COST - CONVENTIONAL LANES WITH ADDED LANE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	175.0	2.0	20.7	28.9	302.5	456	1,602	56	189	818	2,770
I-5: Los Angeles	Urban	20.58	21.41	0.83	102.0	1,106.5	8.3	87.1	75.6	790.3	2,884	10,131	236	797	2,138	7,236
I-5: Sacramento	Urban	22	23.1	1.1	50.8	373.8	8.6	63.5	122.0	897.7	1,437	3,422	244	582	3,451	8,218
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	401.6	3.8	46.2	53.9	651.3	940	3,677	108	423	1,525	5,963
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	265.1	2.9	26.9	17.9	164.7	815	2,427	83	246	507	1,508
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	357.8	9.6	58.5	133.6	813.1	1,663	3,276	272	536	3,779	7,444
I-5: Los Angeles	Urban	46.9	52.33	5.43	560.4	4,584.9	57.6	471.4	359.4	2,940.6	15,844	41,977	1,629	4,316	10,162	26,923
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	93.8	1.3	14.0	9.9	103.7	254	859	38	128	281	950
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	320.4	2.2	22.7	45.0	470.5	866	2,933	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	8,628.7	152.5	785.4	1,270.3	5,537.3	55,970	79,000	4,311	7,191	35,918	50,697
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,276.6	49.1	253.0	295.4	1,287.6	21,253	29,999	1,389	2,317	8,352	11,789
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	624.1	6.2	65.3	82.6	863.3	1,688	5,714	177	598	2,335	7,904
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,311.9	24.6	257.3	339.6	3,550.5	6,252	21,166	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,607.7	29.0	303.1	273.0	2,853.7	9,757	33,031	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,200.0	15.9	166.3	343.6	3,591.9	5,950	20,142	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,152.6	8.6	90.0	73.2	765.7	3,117	10,552	243	824	2,071	7,010
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	245.8	1.7	17.4	34.3	359.1	665	2,250	47	159	971	3,288
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,214.8	30.8	172.0	187.9	888.0	13,253	20,278	871	1,575	5,314	8,130
TOTAL					**5,059.9**	**31,940.9**	**414.9**	**2,920.9**	**3,746.4**	**26,831.6**	**143,065**	**292,436**	**11,730**	**26,742**	**105,926**	**245,657**
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	5,931	20,078	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,297.2	29.4	118.8	261.2	1,054.9	9,082	11,877	832	1,088	7,386	9,658
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,501.6	414.8	957.3	1,103.5	2,546.5	18,398	13,748	11,729	8,765	31,200	23,314
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	68.4	1.9	5.5	21.8	62.9	672	626	54	50	618	576
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,044.1	1,245	3,707	386	1,150	6,288	18,715
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
TOTAL					**6,783.3**	**31,482.1**	**1,191.0**	**4,693.8**	**8,134.6**	**40,956.9**	**191,794**	**288,235**	**33,676**	**42,974**	**230,001**	**374,982**
I-5: Los Angeles	Rural	84.76	88.61	3.85	436.6	908.0	73.8	153.5	217.2	451.8	12,344	8,313	2,087	1,405	6,143	4,137
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
TOTAL					**13,789.9**	**28,298.3**	**3,665.1**	**7,247.0**	**9,884.4**	**19,845.0**	**389,901**	**259,086**	**103,629**	**66,350**	**279,475**	**181,692**

APPENDIX U

AHS PLANNING, DESIGN, CONSTRUCTION, AND REHABILITATION COSTS AT VARIOUS VOLUMES

Introduction

This appendix shows supporting tables for the calculation of incremental planning, design, construction, and rehabilitation costs for the AHS system for low-, medium-, and high-volume traffic conditions (these traffic conditions are described in Appendix S). The incremental cost is the cost of building and maintaining the AHS above the no-build option.

Methodologies

Sorting methodologies for the tables in this appendix are identical to those presented in Appendix S. Calculation methodologies for the tables shown here are identical to those for calculation of the corresponding costs for the added-conventional-freeway-lane scenario at base volumes, which is presented in the main report. Values were summed for the low-, medium-, and high-volume conditions to determine a total cost for each type of segment.

Results

The costs at low, medium, and high volume levels are shown in Table U1 and U2 for the AHS incremental construction costs (these include planning and design costs, implicitly) and rehabilitation costs, respectively.

TABLE U1. INCREMENTAL CONSTRUCTION COSTS OF AHS LANE FOR ROADWAY SPACE, MAGNETIC STRIPS AND BARRIERS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	AHS Lane Placement	New Freeway Costs ($)			Magnetic Strip Costs ($)			Barrier Costs ($)				Total Construction Costs ($)	
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC	2001-Unit Cost per Lane Mile	Total Cost	EUAC	# of Barriers in One Direction	2001-Unit Cost per Lane Mile	Total Cost	EUAC	Total Cost	EUAC
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	6,394,500	1,342,845	97,556	5,000	1,050	76	1.5	94,776	29,854	2,169	1,373,749	99,801
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	23,979,375	19,902,881	1,445,923	5,000	4,150	301	2.0	94,776	157,328	11,430	20,064,359	1,457,654
I-5: Sacramento	Urban	22	23.1	1.10	3	Non-Median	23,979,375	26,377,313	1,916,283	5,000	5,500	400	2.0	94,776	208,507	15,148	26,591,320	1,931,830
I-5: Los Angeles	Urban	22.28	22.78	0.50	4	Non-Median	23,979,375	11,989,688	871,038	5,000	2,500	182	2.0	94,776	94,776	6,885	12,086,964	878,105
I-5: Los Angeles	Urban	46.6	46.9	0.30	4	Non-Median	23,979,375	7,193,812	522,623	5,000	1,500	109	2.0	94,776	56,866	4,131	7,252,178	526,863
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Non-Median	23,979,375	27,816,075	2,020,808	5,000	5,800	421	2.0	94,776	219,880	15,974	28,041,755	2,037,203
I-5: Los Angeles	Urban	47.13	52.33	5.20	4	Non-Median	23,979,375	124,692,750	9,058,793	5,000	26,000	1,889	2.0	94,776	985,670	71,608	125,704,420	9,132,289
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	Non-Median	23,979,375	5,515,256	400,677	5,000	1,150	84	2.0	94,776	43,597	3,167	5,560,003	403,928
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Non-Median	23,979,375	2,637,731	191,628	5,000	550	40	2.0	94,776	20,851	1,515	2,659,132	193,183
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	6,394,500	2,429,910	176,530	5,000	1,900	138	1.5	94,776	54,022	3,925	2,485,832	180,593
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	15,473,870	159,535,602	11,590,088	5,000	51,550	3,745	2.0	94,776	1,954,281	141,976	161,541,433	11,735,809
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	15,473,870	80,773,602	5,868,114	5,000	26,100	1,896	2.0	94,776	989,461	71,883	81,789,164	5,941,894
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	23,979,375	21,821,231	1,585,289	5,000	4,550	331	2.0	94,776	172,492	12,531	21,998,274	1,598,151
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	23,979,375	64,984,106	4,721,025	5,000	13,550	984	2.0	94,776	513,686	37,319	65,511,342	4,759,328
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	23,979,375	80,810,494	5,870,794	5,000	16,850	1,224	2.0	94,776	638,790	46,407	81,466,134	5,918,426
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	23,979,375	65,703,488	4,773,287	5,000	13,700	995	2.0	94,776	519,372	37,732	66,236,560	4,812,014
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	23,979,375	20,862,056	1,515,606	5,000	4,350	316	2.0	94,776	164,910	11,981	21,031,316	1,527,902
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	6,394,500	1,982,295	144,012	5,000	1,550	113	1.5	94,776	44,071	3,202	2,027,916	147,326
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	15,473,870	43,172,098	3,136,406	5,000	13,950	1,013	2.0	94,776	528,850	38,420	43,714,898	3,175,840
TOTAL				**39.25**				**769,543,233**	**55,906,478**		**196,250**	**14,257**			**7,397,267**	**537,403**	**777,136,750**	**56,458,139**
I-5: Los Angeles	Urban	41.6	43.9	2.30	5	Non-Median	23,979,375	55,152,562	4,006,774	5,000	11,500	835	2.0	94,776	435,970	31,673	55,600,032	4,039,282
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	23,979,375	131,167,181	9,529,153	5,000	27,350	1,987	2.0	94,776	1,036,849	75,326	132,231,381	9,606,466
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Non-Median	23,979,375	26,137,519	1,898,862	5,000	5,450	396	2.0	94,776	206,612	15,010	26,349,580	1,914,268
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Non-Median	23,979,375	24,458,963	1,776,917	5,000	5,100	371	2.0	94,776	193,343	14,046	24,657,406	1,791,334
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	4,181,019	19,985,272	1,451,908	5,000	23,900	1,736	1.5	94,776	679,544	49,368	20,688,716	1,503,013
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	23,979,375	162,580,163	11,811,272	5,000	33,900	2,463	2.0	94,776	1,285,163	93,366	163,899,225	11,907,100
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Non-Median	23,979,375	16,066,181	1,167,191	5,000	3,350	243	2.0	94,776	127,000	9,226	16,196,531	1,176,660
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Non-Median	23,979,375	19,902,881	1,445,923	5,000	4,150	301	2.0	94,776	157,328	11,430	20,064,359	1,457,654
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	23,979,375	6,714,225	487,781	5,000	1,400	102	2.0	94,776	53,075	3,856	6,768,700	491,739
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	6,394,500	1,406,790	102,202	5,000	1,100	80	1.5	94,776	31,276	2,272	1,439,166	104,554
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	6,394,500	18,735,885	1,361,142	5,000	14,650	1,064	1.5	94,776	416,541	30,261	19,167,076	1,392,467
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Non-Median	23,979,375	5,994,844	435,519	5,000	1,250	91	2.0	94,776	47,388	3,443	6,043,482	439,052
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Non-Median	6,968,365	12,752,109	926,427	5,000	9,150	665	2.0	94,776	346,880	25,200	13,108,139	952,292
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	4,181,019	60,457,538	4,392,174	5,000	72,300	5,253	1.5	94,776	2,055,691	149,344	62,585,530	4,546,771
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Non-Median	6,968,365	1,533,040	111,374	5,000	1,100	80	2.0	94,776	41,701	3,030	1,575,842	114,483
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	23,979,375	68,101,425	4,947,494	5,000	14,200	1,032	2.0	94,776	538,328	39,109	68,653,953	4,987,635
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	23,979,375	31,892,569	2,316,960	5,000	6,650	483	2.0	94,776	252,104	18,315	32,151,323	2,335,759
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	4,181,019	3,721,107	270,334	5,000	4,450	323	1.5	94,776	126,526	9,192	3,852,083	279,850
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	4,181,019	43,733,461	3,177,188	5,000	52,300	3,800	1.5	94,776	1,487,035	108,032	45,272,797	3,289,019
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	23,979,375	33,810,919	2,456,326	5,000	7,050	512	2.0	94,776	267,268	19,417	34,085,237	2,476,255
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	4,181,019	49,712,319	3,611,546	5,000	59,450	4,319	1.5	94,776	1,690,330	122,801	51,462,099	3,738,665
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	6,394,500	14,323,680	1,040,600	5,000	11,200	814	1.5	94,776	318,447	23,135	14,653,327	1,064,548
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Non-Median	23,979,375	84,886,988	6,166,947	5,000	17,700	1,286	2.0	94,776	671,014	48,748	85,575,702	6,216,982
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Non-Median	23,979,375	50,836,275	3,693,200	5,000	10,600	770	2.0	94,776	401,850	29,194	51,248,725	3,723,164
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	4,181,019	39,050,720	2,836,992	5,000	46,700	3,393	1.5	94,776	1,327,812	96,464	40,425,231	2,936,849
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	23,979,375	11,030,513	801,355	5,000	2,300	167	2.0	94,776	87,194	6,335	11,120,006	807,856
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	23,979,375	8,152,988	592,306	5,000	1,700	124	2.0	94,776	64,448	4,682	8,219,135	597,111
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	4,181,019	6,898,682	501,182	5,000	8,250	599	1.5	94,776	234,571	17,041	7,141,502	518,822
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Non-Median	6,968,365	40,346,836	2,931,154	5,000	28,950	2,103	2.0	94,776	1,097,506	79,733	41,473,292	3,012,989
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	23,979,375	10,790,719	783,934	5,000	2,250	163	2.0	94,776	85,298	6,197	10,878,267	790,294
TOTAL				**97.88**				**1,060,334,350**	**77,032,136**		**489,400**	**35,554**			**15,764,092**	**1,145,244**	**1,076,587,842**	**78,212,935**
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	Non-Median	6,968,365	13,518,629	982,114	5,000	9,700	705	2.0	94,776	367,731	26,715	13,896,060	1,009,534
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	Non-Median	6,968,365	3,762,917	273,372	5,000	2,700	196	2.0	94,776	102,358	7,436	3,867,975	281,004
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	Non-Median	6,968,365	9,546,661	693,554	5,000	6,850	498	2.0	94,776	259,686	18,866	9,813,197	712,918
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	4,181,019	26,465,852	1,922,715	5,000	31,650	2,299	1.5	94,776	899,898	65,377	27,397,400	1,990,391
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	4,181,019	297,563,139	21,617,638	5,000	355,850	25,852	1.5	94,776	10,117,812	735,048	308,036,801	22,378,538
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	4,181,019	6,480,580	470,807	5,000	7,750	563	1.5	94,776	220,354	16,008	6,708,684	487,379
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Non-Median	6,968,365	61,182,248	4,444,824	5,000	43,900	3,189	2.0	94,776	1,664,267	120,907	62,890,415	4,568,920
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Non-Median	6,968,365	18,605,536	1,351,672	5,000	13,350	970	2.0	94,776	506,104	36,768	19,124,989	1,389,410
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	4,181,019	22,911,985	1,664,531	5,000	27,400	1,991	1.5	94,776	779,059	56,598	23,718,444	1,723,119
I-5: Fresno	Rural	0	66.16	66.16	2	Median	4,181,019	276,616,232	20,095,868	5,000	330,800	24,032	1.5	94,776	9,405,570	683,304	286,352,603	20,803,205
I-5: Kings	Rural	0	26.72	26.72	2	Median	4,181,019	111,716,834	8,116,106	5,000	133,600	9,706	1.5	94,776	3,798,622	275,966	115,649,056	8,401,778
I-5: Kern	Rural	7.04	9.28	2.24	4	Non-Median	6,968,365	15,609,138	1,133,987	5,000	11,200	814	2.0	94,776	424,596	30,846	16,044,935	1,165,647
I-5: Merced	Rural	0	32.45	32.45	2	Median	4,181,019	135,674,074	9,856,574	5,000	162,250	11,787	1.5	94,776	4,613,222	335,146	140,449,546	10,203,507
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	4,181,019	3,261,195	236,922	5,000	3,900	283	1.5	94,776	110,888	8,056	3,375,983	245,261
I-5: Kern	Rural	10.35	15.08	4.73	4	Non-Median	6,968,365	32,960,368	2,394,535	5,000	23,650	1,718	2.0	94,776	896,581	65,136	33,880,599	2,461,389
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	4,181,019	4,473,691	325,009	5,000	5,350	389	1.5	94,776	152,115	11,051	4,631,156	336,448
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	4,181,019	2,634,042	191,360	5,000	3,150	229	1.5	94,776	89,563	6,507	2,726,755	198,096
I-5: Kern	Rural	5.36	6.41	1.05	4	Non-Median	6,968,365	7,316,784	531,556	5,000	5,250	381	2.0	94,776	199,030	14,459	7,521,063	546,397
I-5: Kern	Rural	0.58	5.36	4.78	4	Non-Median	6,968,365	33,308,787	2,419,847	5,000	23,900	1,736	2.0	94,776	906,059	65,824	34,238,745	2,487,408
I-5: Kern	Rural	0	0.58	0.58	4	Non-Median	6,968,365	4,041,652	293,622	5,000	2,900	211	2.0	94,776	109,940	7,987	4,154,492	301,819
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	4,181,019	117,319,400	8,523,127	5,000	140,300	10,193	1.5	94,776	3,989,122	289,805	121,448,821	8,823,125
I-5: San Joaquin	Rural	0	11.8	11.80	2	Median	4,181,019	49,336,027	3,584,209	5,000	59,000	4,286	1.5	94,776	1,677,535	121,871	51,072,562	3,710,366
TOTAL				**280.88**				**1,254,305,769**	**91,123,949**		**1,404,400**	**102,028**			**41,290,112**	**2,999,682**	**1,297,000,281**	**94,225,659**

TABLE U2. INCREMENTAL REHABILITATION COSTS OF AHS LANE FOR ROADWAY SPACE - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			AHS Lane Placement	Lane Rehabilitation cost ($)			Magnetic Strips Rehabilitation Costs ($)			Total Rehabilitation Costs ($)	
		Begin	End	Length (mi)		2001-Unit Cost per Lane Mile	Total Cost	EUAC	Magnetic Strip Replacement Unit Cost per Lane Mile in	Total Cost of Magnetic Strip Placement per 10-Year Cycle	EUAC	Total Cost per Rehabilitation Cycle	EUATC
I-5: Los Angeles	Urban	36.22	36.43	0.21	Median	399,656	83,928	5,306	5,000	1,050	66	84,978	5,372
I-5: Los Angeles	Urban	20.58	21.41	0.83	Non-Median	1,278,900	1,061,487	67,106	5,000	4,150	262	1,065,637	67,369
I-5: Sacramento	Urban	22	23.1	1.1	Non-Median	1,278,900	1,406,790	88,936	5,000	5,500	348	1,412,290	89,284
I-5: Los Angeles	Urban	22.28	22.78	0.5	Non-Median	1,278,900	639,450	40,425	5,000	2,500	158	641,950	40,583
I-5: Los Angeles	Urban	46.6	46.9	0.3	Non-Median	1,278,900	383,670	24,255	5,000	1,500	95	385,170	24,350
I-5: Sacramento	Urban	25.53	26.69	1.16	Non-Median	1,278,900	1,483,524	93,787	5,000	5,800	367	1,489,324	94,154
I-5: Los Angeles	Urban	47.13	52.33	5.2	Non-Median	1,278,900	6,650,280	420,424	5,000	26,000	1,644	6,676,280	422,068
I-5: Los Angeles	Urban	46.9	47.13	0.23	Non-Median	1,278,900	294,147	18,596	5,000	1,150	73	295,297	18,668
I-5: Los Angeles	Urban	43.9	44.01	0.11	Non-Median	1,278,900	140,679	8,894	5,000	550	35	141,229	8,928
I-5: Los Angeles	Urban	13.78	14.16	0.38	Median	181,178	68,847	4,352	5,000	1,900	120	70,747	4,473
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	Non-Median	1,475,654	15,213,991	961,814	5,000	51,550	3,259	15,265,541	965,073
CA 710: LA	Suburban	4.96	10.18	5.22	Non-Median	1,475,654	7,702,913	486,971	5,000	26,100	1,650	7,729,013	488,621
I-5: Los Angeles	Urban	28.25	29.16	0.91	Non-Median	1,278,900	1,163,799	73,574	5,000	4,550	288	1,168,349	73,862
I-5: Los Angeles	Urban	36.65	39.36	2.71	Non-Median	1,278,900	3,465,819	219,106	5,000	13,550	857	3,479,369	219,962
I-5: Los Angeles	Urban	17.21	20.58	3.37	Non-Median	1,278,900	4,309,893	272,467	5,000	16,850	1,065	4,326,743	273,533
I-5: Los Angeles	Urban	14.16	16.9	2.74	Non-Median	1,278,900	3,504,186	221,531	5,000	13,700	866	3,517,886	222,397
I-5: Los Angeles	Urban	21.41	22.28	0.87	Non-Median	1,278,900	1,112,643	70,340	5,000	4,350	275	1,116,993	70,615
I-5: Los Angeles	Urban	16.9	17.21	0.31	Median	399,656	123,893	7,832	5,000	1,550	98	125,443	7,930
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	Non-Median	1,475,654	4,117,074	260,278	5,000	13,950	882	4,131,024	261,159
TOTAL				**39.25**			**52,927,014**	**3,345,995**		**196,250**	**12,407**	**53,123,264**	**3,358,402**
I-5: Los Angeles	Urban	41.6	43.9	2.3	Non-Median	1,278,900	2,941,470	185,957	5,000	11,500	727	2,952,970	186,684
I-5: Los Angeles	Urban	22.78	28.25	5.47	Non-Median	1,278,900	6,995,583	442,254	5,000	27,350	1,729	7,022,933	443,983
I-5: Los Angeles	Urban	44.01	45.1	1.09	Non-Median	1,278,900	1,394,001	88,127	5,000	5,450	345	1,399,451	88,472
I-5: Sacramento	Urban	24.51	25.53	1.02	Non-Median	1,278,900	1,304,478	82,468	5,000	5,100	322	1,309,578	82,790
I-5: Sacramento	Rural	29.87	34.65	4.78	Median	181,178	866,028	54,749	5,000	23,900	1,511	889,928	56,260
I-5: Los Angeles	Urban	29.16	35.94	6.78	Non-Median	1,278,900	8,670,942	548,169	5,000	33,900	2,143	8,704,842	550,312
I-5: Los Angeles	Urban	45.93	46.6	0.67	Non-Median	1,278,900	856,863	54,170	5,000	3,350	212	860,213	54,382
I-5: Los Angeles	Urban	45.1	45.93	0.83	Non-Median	1,278,900	1,061,487	67,106	5,000	4,150	262	1,065,637	67,369
I-5: Los Angeles	Urban	35.94	36.22	0.28	Non-Median	1,278,900	358,092	22,638	5,000	1,400	89	359,492	22,727
I-5: Los Angeles	Urban	36.43	36.65	0.22	Median	399,656	87,924	5,558	5,000	1,100	70	89,024	5,628
I-5: Sacramento	Urban	26.94	29.87	2.93	Median	399,656	1,170,993	74,029	5,000	14,650	926	1,185,643	74,955
I-5: Sacramento	Urban	26.69	26.94	0.25	Non-Median	1,278,900	319,725	20,213	5,000	1,250	79	320,975	20,292
I-5: Los Angeles	Rural	52.33	54.16	1.83	Non-Median	1,672,408	3,060,506	193,482	5,000	9,150	578	3,069,656	194,061
I-5: Sacramento	Rural	0	14.46	14.46	Median	181,178	2,619,827	165,623	5,000	72,300	4,571	2,692,127	170,194
I-5: San Joaquin	Urban	28.34	28.56	0.22	Non-Median	1,278,900	281,358	17,787	5,000	1,100	70	282,458	17,857
I-5: Sacramento	Urban	19.16	22	2.84	Non-Median	1,278,900	3,632,076	229,616	5,000	14,200	898	3,646,276	230,514
I-5: Los Angeles	Urban	40.27	41.6	1.33	Non-Median	1,278,900	1,700,937	107,532	5,000	6,650	420	1,707,587	107,952
I-5: San Joaquin	Rural	11.8	12.69	0.89	Median	181,178	161,248	10,194	5,000	4,450	281	165,698	10,475
I-5: San Joaquin	Rural	14.34	24.8	10.46	Median	181,178	1,895,117	119,807	5,000	52,300	3,306	1,947,417	123,114
I-5: Sacramento	Urban	23.1	24.51	1.41	Non-Median	1,278,900	1,803,249	114,000	5,000	7,050	446	1,810,299	114,445
I-5: San Joaquin	Rural	28.56	40.45	11.89	Median	181,178	2,154,200	136,187	5,000	59,450	3,758	2,213,650	139,945
I-5: Sacramento	Urban	14.46	16.7	2.24	Median	399,656	895,230	56,596	5,000	11,200	708	906,430	57,304
I-5: San Joaquin	Urban	24.8	28.34	3.54	Non-Median	1,278,900	4,527,306	286,212	5,000	17,700	1,119	4,545,006	287,331
I-5: Sacramento	Urban	16.7	18.82	2.12	Non-Median	1,278,900	2,711,268	171,404	5,000	10,600	670	2,721,868	172,074
I-5: San Joaquin	Rural	40.45	49.79	9.34	Median	181,178	1,692,198	106,979	5,000	46,700	2,952	1,738,898	109,931
I-5: Los Angeles	Urban	39.81	40.27	0.46	Non-Median	1,278,900	588,294	37,191	5,000	2,300	145	590,594	37,337
I-5: Sacramento	Urban	18.82	19.16	0.34	Non-Median	1,278,900	434,826	27,489	5,000	1,700	107	436,526	27,597
I-5: San Joaquin	Rural	12.69	14.34	1.65	Median	181,178	298,943	18,899	5,000	8,250	522	307,193	19,420
I-5: Los Angeles	Rural	54.16	59.95	5.79	Non-Median	1,672,408	9,683,241	612,165	5,000	28,950	1,830	9,712,191	613,995
I-5: Los Angeles	Urban	39.36	39.81	0.45	Non-Median	1,278,900	575,505	36,383	5,000	2,250	142	577,755	36,525
TOTAL				**97.88**			**64,742,915**	**4,092,985**		**489,400**	**30,939**	**65,232,315**	**4,123,925**
I-5: Los Angeles	Rural	86.67	88.61	1.94	Non-Median	1,672,408	3,244,471	205,112	5,000	9,700	613	3,254,171	205,726
I-5: Los Angeles	Rural	86.13	86.67	0.54	Non-Median	1,672,408	903,100	57,093	5,000	2,700	171	905,800	57,264
I-5: Los Angeles	Rural	84.76	86.13	1.37	Non-Median	1,672,408	2,291,199	144,847	5,000	6,850	433	2,298,049	145,280
I-5: Los Angeles	Rural	78.43	84.76	6.33	Median	181,178	1,146,854	72,503	5,000	31,650	2,001	1,178,504	74,504
I-5: Kern	Rural	15.86	87.03	71.17	Median	181,178	12,894,403	815,172	5,000	355,850	22,496	13,250,253	837,668
I-5: Los Angeles	Rural	68.1	69.65	1.55	Median	181,178	280,825	17,753	5,000	7,750	490	288,575	18,243
I-5: Los Angeles	Rural	69.65	78.43	8.78	Non-Median	1,672,408	14,683,740	928,292	5,000	43,900	2,775	14,727,640	931,067
I-5: Los Angeles	Rural	65.43	68.1	2.67	Non-Median	1,672,408	4,465,329	282,294	5,000	13,350	844	4,478,679	283,138
I-5: Los Angeles	Rural	59.95	65.43	5.48	Median	181,178	992,853	62,767	5,000	27,400	1,732	1,020,253	64,499
I-5: Fresno	Rural	0	66.16	66.16	Median	181,178	11,986,703	757,788	5,000	330,800	20,913	12,317,503	778,701
I-5: Kings	Rural	0	26.72	26.72	Median	181,178	4,841,063	306,047	5,000	133,600	8,446	4,974,663	314,493
I-5: Kern	Rural	7.04	9.28	2.24	Non-Median	1,672,408	3,746,193	236,831	5,000	11,200	708	3,757,393	237,539
I-5: Merced	Rural	0	32.45	32.45	Median	181,178	5,879,210	371,678	5,000	162,250	10,257	6,041,460	381,935
I-5: Kern	Rural	15.08	15.86	0.78	Median	181,178	141,318	8,934	5,000	3,900	247	145,218	9,181
I-5: Kern	Rural	10.35	15.08	4.73	Non-Median	1,672,408	7,910,488	500,094	5,000	23,650	1,495	7,934,138	501,589
I-5: Kern	Rural	9.28	10.35	1.07	Median	181,178	193,860	12,256	5,000	5,350	338	199,210	12,594
I-5: Kern	Rural	6.41	7.04	0.63	Median	181,178	114,142	7,216	5,000	3,150	199	117,292	7,415
I-5: Kern	Rural	5.36	6.41	1.05	Non-Median	1,672,408	1,756,028	111,014	5,000	5,250	332	1,761,278	111,346
I-5: Kern	Rural	0.58	5.36	4.78	Non-Median	1,672,408	7,994,109	505,380	5,000	23,900	1,511	8,018,009	506,891
I-5: Kern	Rural	0	0.58	0.58	Non-Median	1,672,408	969,996	61,322	5,000	2,900	183	972,896	61,506
I-5: Stanislaus	Rural	0	28.06	28.06	Median	181,178	5,083,841	321,396	5,000	140,300	8,870	5,224,141	330,265
I-5: San Joaquin	Rural	0	11.8	11.8	Median	181,178	2,137,895	135,156	5,000	59,000	3,730	2,196,895	138,886
TOTAL				**280.88**			**93,657,618**	**5,920,945**		**1,404,400**	**88,785**	**95,062,018**	**6,009,730**

APPENDIX V

AHS VEHICLE-HOURS AND VEHICLE-MILES, VEHICLE OPERATING COSTS, AND USER COSTS AT VARIOUS VOLUMES

Introduction

This appendix shows supporting tables for the calculation of vehicle-miles, vehicle-hours, vehicle operating costs, and user travel time costs for low-, medium-, and high-volume traffic conditions for the added-AHS-lane configuration (these traffic conditions are described in Appendix S).

Methodologies

Sorting methodologies for the tables in this appendix are identical to those presented in Appendix S. Calculation methodologies for the tables shown here are identical to those for calculation of the corresponding values for the added-conventional-freeway-lane scenario at base volumes, which is presented in Appendix M. Values were summed for the low-, medium-, and high-volume conditions to determine a total cost for each type of segment.

Results

The vehicle-miles of travel and vehicle operating costs are shown in Table V1a for the existing freeway conditions (sorted by volume), in Table V2a for the AHS lane, and Table V3a for the traffic remaining in the conventional lanes. Tables V1b, V2b, and V3b show vehicle-hours of travel and user travel-time costs for the existing configuration (sorted by volume), for the AHS lane, and for the traffic remaining on the conventional lanes, respectively.

TABLE V1a. VEHICLE OPERATING COSTS - BASE CONDITION - SEGMENTATION 48 FT. BASIS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,312	61,088	417	4,790	3,567	41,026	9,381	19,854	736	1,557	6,300	13,333
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Los Angeles	Urban	47.13	52.33	5.2	26,832	241,488	2,846	25,618	17,122	154,094	47,386	78,484	5,027	8,326	30,237	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	1,187	10,681	122	1,098	761	6,851	2,096	3,471	215	357	1,344	2,226
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
TOTAL					**253,206**	**1,897,833**	**20,830**	**161,438**	**187,018**	**1,549,636**	**447,164**	**616,796**	**36,787**	**52,467**	**330,276**	**503,632**
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,947	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
TOTAL					**339,166**	**1,851,561**	**59,552**	**280,841**	**406,731**	**2,378,430**	**598,970**	**601,757**	**105,169**	**91,273**	**718,291**	**772,990**
I-5: Los Angeles	Rural	86.67	88.61	1.94	11,000	29,740	1,860	5,028	5,474	14,799	19,426	9,666	3,284	1,634	9,666	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	3,062	8,278	518	1,400	1,524	4,119	5,407	2,690	914	455	2,691	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	7,768	21,002	1,313	3,551	3,865	10,451	13,718	6,826	2,319	1,154	6,826	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
TOTAL					**689,494**	**1,839,391**	**183,255**	**471,053**	**494,219**	**1,289,927**	**1,217,654**	**597,802**	**323,631**	**153,092**	**872,797**	**419,226**

TABLE V1b. TRAVEL TIME COST - BASE CONDITION - SEGMENTATION 48 FT. BASIS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	456	2,653	56	189	818	2,770
I-5: Los Angeles	Urban	20.58	21.41	0.83	106.2	1,527.2	8.3	87.1	71.3	745.9	3,004	13,982	236	797	2,017	6,829
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	1,437	4,953	244	582	3,451	8,218
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	940	5,056	108	423	1,525	5,963
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	815	2,902	83	246	507	1,508
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	1,663	3,754	272	536	3,779	7,444
I-5: Los Angeles	Urban	47.13	52.33	5.2	536.6	4,829.8	56.9	465.8	342.4	2,801.7	15,173	44,219	1,610	4,264	9,682	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	23.7	213.6	2.4	20.0	15.2	124.6	671	1,956	69	183	430	1,140
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	254	927	38	128	281	950
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	866	3,102	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	55,970	87,034	4,311	6,084	35,918	50,697
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,736.4	49.1	214.1	295.4	1,287.6	21,253	34,209	1,389	1,960	8,352	11,789
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	1,688	5,930	177	598	2,335	7,904
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	6,252	21,965	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	9,757	33,642	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	5,950	20,515	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	3,117	10,748	243	824	2,071	7,010
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	665	2,292	47	159	971	3,288
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,360.1	30.8	145.6	187.9	888.0	13,253	21,608	871	1,333	5,314	8,130
TOTAL					**5,064.1**	**35,109.5**	**416.6**	**2,749.0**	**3,740.4**	**26,772.8**	**143,185**	**321,446**	**11,779**	**25,169**	**105,756**	**245,119**
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	5,931	20,078	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	9,082	12,254	832	1,088	7,386	9,658
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	18,398	13,963	11,729	8,765	31,200	23,314
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	672	530	54	50	618	576
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	1,245	3,707	386	1,150	6,288	19,421
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
TOTAL					**6,783.3**	**31,536.2**	**1,191.0**	**4,693.8**	**8,134.6**	**41,034.1**	**191,794**	**288,730**	**33,676**	**42,974**	**230,001**	**375,688**
I-5: Los Angeles	Rural	86.67	88.61	1.94	220.0	457.5	37.2	77.4	109.5	227.7	6,220	4,189	1,052	708	3,095	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	61.2	127.4	10.4	21.5	30.5	63.4	1,731	1,166	293	197	862	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	155.4	323.1	26.3	54.6	77.3	160.8	4,393	2,958	743	500	2,186	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
TOTAL					**13,789.9**	**28,298.3**	**3,665.1**	**7,247.0**	**9,884.4**	**19,845.0**	**389,901**	**259,086**	**103,629**	**66,350**	**279,475**	**181,692**

TABLE V2a. VEHICLE OPERATING COSTS - AHS LANE - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction	Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction	Daytime Off-Peak Other Vehicle-Miles of Travel, One Direction	Vehicle Operating Costs ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime off-Peak Truck	Daytime off-Peak Truck
I-5: Los Angeles	Urban	36.22	36.43	0.21	144	18	258	213	26	382
I-5: Los Angeles	Urban	20.58	21.41	0.83	911	74	675	1,346	110	998
I-5: Sacramento	Urban	22	23.1	1.1	154	26	370	228	39	547
I-5: Los Angeles	Urban	22.28	22.78	0.5	365	42	593	540	62	876
I-5: Los Angeles	Urban	46.6	46.9	0.3	522	53	325	772	78	480
I-5: Sacramento	Urban	25.53	26.69	1.16	169	28	384	249	41	567
I-5: Los Angeles	Urban	47.13	52.33	5.2	8,944	949	5,707	13,219	1,402	8,435
I-5: Los Angeles	Urban	46.9	47.13	0.23	396	41	254	585	60	375
I-5: Los Angeles	Urban	43.9	44.01	0.11	146	22	162	216	32	239
I-5: Los Angeles	Urban	13.78	14.16	0.38	299	21	440	442	31	650
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	11,997	924	7,699	17,732	1,366	11,379
CA 710: LA	Suburban	4.96	10.18	5.22	3,579	234	1,407	5,290	346	2,079
I-5: Los Angeles	Urban	28.25	29.16	0.91	732	77	1,012	1,081	113	1,496
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,048	228	3,145	3,026	337	4,648
I-5: Los Angeles	Urban	17.21	20.58	3.37	3,595	302	2,843	5,313	446	4,202
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,023	153	3,304	2,991	226	4,883
I-5: Los Angeles	Urban	21.41	22.28	0.87	999	78	663	1,476	115	981
I-5: Los Angeles	Urban	16.9	17.21	0.31	245	17	358	362	26	529
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	3,805	250	1,525	5,623	370	2,255
TOTAL					**41,072**	**3,536**	**31,122**	**60,705**	**5,226**	**45,998**
I-5: Los Angeles	Urban	41.6	43.9	2.3	2,185	305	2,110	3,229	450	3,119
I-5: Los Angeles	Urban	22.78	28.25	5.47	3,997	460	6,483	5,908	680	9,582
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,553	193	1,525	2,295	285	2,254
I-5: Sacramento	Urban	24.51	25.53	1.02	153	24	333	226	36	492
I-5: Sacramento	Rural	29.87	34.65	4.78	1,255	115	1,020	1,855	170	1,508
I-5: Los Angeles	Urban	29.16	35.94	6.78	5,424	570	7,566	8,017	842	11,183
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,167	118	725	1,724	175	1,071
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,330	147	1,014	1,965	217	1,498
I-5: Los Angeles	Urban	35.94	36.22	0.28	212	24	325	313	35	480
I-5: Los Angeles	Urban	36.43	36.65	0.22	157	18	264	232	27	391
I-5: Sacramento	Urban	26.94	29.87	2.93	879	70	516	1,299	104	762
I-5: Sacramento	Urban	26.69	26.94	0.25	75	6	44	111	9	65
I-5: Los Angeles	Rural	52.33	54.16	1.83	2,745	334	2,411	4,057	494	3,564
I-5: Sacramento	Rural	0	14.46	14.46	2,169	1,383	3,678	3,206	2,044	5,436
I-5: San Joaquin	Urban	28.34	28.56	0.22	55	4	51	81	7	75
I-5: Sacramento	Urban	19.16	22	2.84	393	68	959	581	100	1,418
I-5: Los Angeles	Urban	40.27	41.6	1.33	418	130	2,112	618	192	3,121
I-5: San Joaquin	Rural	11.8	12.69	0.89	334	55	279	493	81	413
I-5: San Joaquin	Rural	14.34	24.8	10.46	2,615	292	2,323	3,865	432	3,433
I-5: Sacramento	Urban	23.1	24.51	1.41	188	34	484	277	50	715
I-5: San Joaquin	Rural	28.56	40.45	11.89	2,973	240	2,733	4,393	354	4,039
I-5: Sacramento	Urban	14.46	16.7	2.24	336	53	731	497	79	1,080
I-5: San Joaquin	Urban	24.8	28.34	3.54	885	99	786	1,308	146	1,162
I-5: Sacramento	Urban	16.7	18.82	2.12	318	50	692	470	75	1,022
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,719	541	2,411	2,540	799	3,563
I-5: Los Angeles	Urban	39.81	40.27	0.46	272	45	603	402	66	892
I-5: Sacramento	Urban	18.82	19.16	0.34	44	8	118	65	12	175
I-5: San Joaquin	Rural	12.69	14.34	1.65	491	69	677	726	102	1,001
I-5: Los Angeles	Rural	54.16	59.95	5.79	8,685	1,056	7,629	12,836	1,561	11,275
I-5: Los Angeles	Urban	39.36	39.81	0.45	257	44	599	380	65	885
TOTAL					**43,281**	**6,554**	**51,199**	**63,970**	**9,687**	**75,673**
I-5: Los Angeles	Rural	86.67	88.61	1.94	3,492	590	1,738	5,161	873	2,568
I-5: Los Angeles	Rural	86.13	86.67	0.54	972	164	484	1,437	243	715
I-5: Los Angeles	Rural	84.76	86.13	1.37	2,466	417	1,227	3,645	616	1,814
I-5: Los Angeles	Rural	78.43	84.76	6.33	11,394	1,926	5,670	16,840	2,847	8,380
I-5: Kern	Rural	15.86	87.03	71.17	71,170	14,469	56,701	105,189	21,386	83,804
I-5: Los Angeles	Rural	68.1	69.65	1.55	2,790	472	1,388	4,124	697	2,052
I-5: Los Angeles	Rural	69.65	78.43	8.78	15,804	2,672	7,864	23,358	3,949	11,623
I-5: Los Angeles	Rural	65.43	68.1	2.67	4,806	813	2,391	7,103	1,201	3,535
I-5: Los Angeles	Rural	59.95	65.43	5.48	9,864	1,668	4,908	14,579	2,465	7,255
I-5: Fresno	Rural	0	66.16	66.16	66,160	23,886	42,274	97,785	35,303	62,481
I-5: Kings	Rural	0	26.72	26.72	26,720	9,254	17,466	39,492	13,677	25,815
I-5: Kern	Rural	7.04	9.28	2.24	4,032	736	1,952	5,959	1,087	2,885
I-5: Merced	Rural	0	32.45	32.45	22,715	8,840	25,232	33,573	13,066	37,294
I-5: Kern	Rural	15.08	15.86	0.78	780	171	609	1,153	252	900
I-5: Kern	Rural	10.35	15.08	4.73	8,514	1,554	4,122	12,584	2,296	6,093
I-5: Kern	Rural	9.28	10.35	1.07	1,926	351	933	2,847	519	1,378
I-5: Kern	Rural	6.41	7.04	0.63	1,134	207	549	1,676	306	812
I-5: Kern	Rural	5.36	6.41	1.05	1,890	345	915	2,793	510	1,353
I-5: Kern	Rural	0.58	5.36	4.78	8,604	1,570	4,166	12,717	2,320	6,157
I-5: Kern	Rural	0	0.58	0.58	1,044	190	506	1,543	282	747
I-5: Stanislaus	Rural	0	28.06	28.06	19,642	7,644	21,819	29,031	11,298	32,248
I-5: San Joaquin	Rural	0	11.8	11.8	2,655	711	5,484	3,924	1,051	8,106
TOTAL					**288,574**	**78,649**	**208,399**	**426,513**	**116,244**	**308,015**

TABLE V2b. TRAVEL TIME COST - AHS LANE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction	Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction	Daytime Off-Peak Other Vehicle-Hours of Travel, One Direction	Travel Time Costs ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Los Angeles	Urban	36.22	36.43	0.21	2.1	0.3	3.7	58	7	104
I-5: Los Angeles	Urban	20.58	21.41	0.83	13.0	1.1	9.6	368	30	273
I-5: Sacramento	Urban	22	23.1	1.1	2.2	0.4	5.3	62	11	149
I-5: Los Angeles	Urban	22.28	22.78	0.5	5.2	0.6	8.5	148	17	239
I-5: Los Angeles	Urban	46.6	46.9	0.3	7.5	0.8	4.6	211	21	131
I-5: Sacramento	Urban	25.53	26.69	1.16	2.4	0.4	5.5	68	11	155
I-5: Los Angeles	Urban	47.13	52.33	5.2	127.8	13.6	81.5	3,613	383	2,305
I-5: Los Angeles	Urban	46.9	47.13	0.23	5.7	0.6	3.6	160	16	102
I-5: Los Angeles	Urban	43.9	44.01	0.11	2.1	0.3	2.3	59	9	65
I-5: Los Angeles	Urban	13.78	14.16	0.38	4.3	0.3	6.3	121	9	178
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	171.4	13.2	110.0	4,846	373	3,110
CA 710: LA	Suburban	4.96	10.18	5.22	51.1	3.3	20.1	1,446	94	568
I-5: Los Angeles	Urban	28.25	29.16	0.91	10.5	1.1	14.5	295	31	409
I-5: Los Angeles	Urban	36.65	39.36	2.71	29.3	3.3	44.9	827	92	1,270
I-5: Los Angeles	Urban	17.21	20.58	3.37	51.4	4.3	40.6	1,452	122	1,148
I-5: Los Angeles	Urban	14.16	16.9	2.74	28.9	2.2	47.2	817	62	1,334
I-5: Los Angeles	Urban	21.41	22.28	0.87	14.3	1.1	9.5	403	31	268
I-5: Los Angeles	Urban	16.9	17.21	0.31	3.5	0.2	5.1	99	7	145
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	54.4	3.6	21.8	1,537	101	616
TOTAL					**586.7**	**50.5**	**444.6**	**16,590**	**1,428**	**12,571**
I-5: Los Angeles	Urban	41.6	43.9	2.3	31.2	4.4	30.1	883	123	852
I-5: Los Angeles	Urban	22.78	28.25	5.47	57.1	6.6	92.6	1,615	186	2,619
I-5: Los Angeles	Urban	44.01	45.1	1.09	22.2	2.8	21.8	627	78	616
I-5: Sacramento	Urban	24.51	25.53	1.02	2.2	0.3	4.8	62	10	134
I-5: Sacramento	Rural	29.87	34.65	4.78	17.9	1.6	14.6	507	46	412
I-5: Los Angeles	Urban	29.16	35.94	6.78	77.5	8.1	108.1	2,191	230	3,056
I-5: Los Angeles	Urban	45.93	46.6	0.67	16.7	1.7	10.4	471	48	293
I-5: Los Angeles	Urban	45.1	45.93	0.83	19.0	2.1	14.5	537	59	409
I-5: Los Angeles	Urban	35.94	36.22	0.28	3.0	0.3	4.6	85	10	131
I-5: Los Angeles	Urban	36.43	36.65	0.22	2.2	0.3	3.8	63	7	107
I-5: Sacramento	Urban	26.94	29.87	2.93	12.6	1.0	7.4	355	28	208
I-5: Sacramento	Urban	26.69	26.94	0.25	1.1	0.1	0.6	30	2	18
I-5: Los Angeles	Rural	52.33	54.16	1.83	39.2	4.8	34.4	1,109	135	974
I-5: Sacramento	Rural	0	14.46	14.46	31.0	19.8	52.5	876	559	1,486
I-5: San Joaquin	Urban	28.34	28.56	0.22	0.8	0.1	0.7	22	2	20
I-5: Sacramento	Urban	19.16	22	2.84	5.6	1.0	13.7	159	27	387
I-5: Los Angeles	Urban	40.27	41.6	1.33	6.0	1.9	30.2	169	52	853
I-5: San Joaquin	Rural	11.8	12.69	0.89	4.8	0.8	4.0	135	22	113
I-5: San Joaquin	Rural	14.34	24.8	10.46	37.4	4.2	33.2	1,056	118	938
I-5: Sacramento	Urban	23.1	24.51	1.41	2.7	0.5	6.9	76	14	195
I-5: San Joaquin	Rural	28.56	40.45	11.89	42.5	3.4	39.0	1,201	97	1,104
I-5: Sacramento	Urban	14.46	16.7	2.24	4.8	0.8	10.4	136	22	295
I-5: San Joaquin	Urban	24.8	28.34	3.54	12.6	1.4	11.2	357	40	318
I-5: Sacramento	Urban	16.7	18.82	2.12	4.5	0.7	9.9	128	20	279
I-5: San Joaquin	Rural	40.45	49.79	9.34	24.6	7.7	34.4	694	218	974
I-5: Los Angeles	Urban	39.81	40.27	0.46	3.9	0.6	8.6	110	18	244
I-5: Sacramento	Urban	18.82	19.16	0.34	0.6	0.1	1.7	18	3	48
I-5: San Joaquin	Rural	12.69	14.34	1.65	7.0	1.0	9.7	198	28	274
I-5: Los Angeles	Rural	54.16	59.95	5.79	124.1	15.1	109.0	3,508	427	3,081
I-5: Los Angeles	Urban	39.36	39.81	0.45	3.7	0.6	8.6	104	18	242
TOTAL					**618.3**	**93.6**	**731.4**	**17,482**	**2,647**	**20,680**
I-5: Los Angeles	Rural	86.67	88.61	1.94	49.9	8.4	24.8	1,410	238	702
I-5: Los Angeles	Rural	86.13	86.67	0.54	13.9	2.3	6.9	393	66	195
I-5: Los Angeles	Rural	84.76	86.13	1.37	35.2	6.0	17.5	996	168	496
I-5: Los Angeles	Rural	78.43	84.76	6.33	162.8	27.5	81.0	4,602	778	2,290
I-5: Kern	Rural	15.86	87.03	71.17	1,016.7	206.7	810.0	28,747	5,844	22,902
I-5: Los Angeles	Rural	68.1	69.65	1.55	39.9	6.7	19.8	1,127	191	561
I-5: Los Angeles	Rural	69.65	78.43	8.78	225.8	38.2	112.3	6,384	1,079	3,176
I-5: Los Angeles	Rural	65.43	68.1	2.67	68.7	11.6	34.2	1,941	328	966
I-5: Los Angeles	Rural	59.95	65.43	5.48	140.9	23.8	70.1	3,984	674	1,983
I-5: Fresno	Rural	0	66.16	66.16	945.1	341.2	603.9	26,723	9,648	17,075
I-5: Kings	Rural	0	26.72	26.72	381.7	132.2	249.5	10,793	3,738	7,055
I-5: Kern	Rural	7.04	9.28	2.24	57.6	10.5	27.9	1,629	297	789
I-5: Merced	Rural	0	32.45	32.45	324.5	126.3	360.5	9,175	3,571	10,192
I-5: Kern	Rural	15.08	15.86	0.78	11.1	2.4	8.7	315	69	246
I-5: Kern	Rural	10.35	15.08	4.73	121.6	22.2	58.9	3,439	627	1,665
I-5: Kern	Rural	9.28	10.35	1.07	27.5	5.0	13.3	778	142	377
I-5: Kern	Rural	6.41	7.04	0.63	16.2	3.0	7.8	458	84	222
I-5: Kern	Rural	5.36	6.41	1.05	27.0	4.9	13.1	763	139	370
I-5: Kern	Rural	0.58	5.36	4.78	122.9	22.4	59.5	3,475	634	1,683
I-5: Kern	Rural	0	0.58	0.58	14.9	2.7	7.2	422	77	204
I-5: Stanislaus	Rural	0	28.06	28.06	280.6	109.2	311.7	7,934	3,088	8,813
I-5: San Joaquin	Rural	0	11.8	11.8	37.9	10.2	78.3	1,072	287	2,215
TOTAL					**4,122.5**	**1,123.6**	**2,977.1**	**116,561**	**31,768**	**84,177**

TABLE V3a . VEHICLE OPERATING COSTS - REMAINING CONVENTIONAL LANES - AHS LANE CASE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	662	9,274	81	1,137	1,188	16,637	1,170	3,014	143	370	2,099	5,407
I-5: Los Angeles	Urban	20.58	21.41	0.83	4,189	58,644	342	4,790	3,105	43,469	7,398	19,059	604	1,557	5,483	14,127
I-5: Sacramento	Urban	22	23.1	1.1	2,387	20,559	406	3,495	5,732	49,371	4,215	6,682	717	1,136	10,123	16,046
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,297	22,088	149	2,541	2,104	35,821	2,291	7,178	264	826	3,715	11,642
I-5: Los Angeles	Urban	46.6	46.9	0.3	919	14,578	93	1,481	571	9,057	1,624	4,738	165	481	1,009	2,944
I-5: Sacramento	Urban	25.53	26.69	1.16	2,772	19,679	453	3,219	6,298	44,718	4,895	6,396	801	1,046	11,123	14,533
I-5: Los Angeles	Urban	47.13	52.33	5.2	17,888	241,488	1,898	25,618	11,414	154,094	31,590	78,484	3,351	8,326	20,158	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	791	10,681	81	1,098	507	6,851	1,397	3,471	144	357	896	2,226
I-5: Los Angeles	Urban	43.9	44.01	0.11	302	5,161	45	771	334	5,706	534	1,677	80	251	590	1,854
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,233	17,620	87	1,249	1,811	25,880	2,177	5,726	154	406	3,198	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	86,979	560,864	6,699	43,196	55,817	359,925	153,606	182,281	11,830	14,039	98,574	116,976
CA 710: LA	Suburban	4.96	10.18	5.22	34,005	212,976	2,222	13,917	13,363	83,697	60,052	69,217	3,924	4,523	23,600	27,201
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,253	34,325	236	3,590	3,117	47,479	3,979	11,156	416	1,167	5,504	15,431
I-5: Los Angeles	Urban	36.65	39.36	2.71	9,009	127,153	1,002	14,149	13,836	195,280	15,910	41,325	1,770	4,598	24,435	63,466
I-5: Los Angeles	Urban	17.21	20.58	3.37	13,660	198,426	1,148	16,671	10,805	156,951	24,123	64,488	2,027	5,418	19,081	51,009
I-5: Los Angeles	Urban	14.16	16.9	2.74	8,498	120,998	643	9,149	13,875	197,556	15,008	39,324	1,135	2,973	24,504	64,206
I-5: Los Angeles	Urban	21.41	22.28	0.87	4,514	63,392	352	4,949	2,999	42,114	7,971	20,602	622	1,609	5,296	13,687
I-5: Los Angeles	Urban	16.9	17.21	0.31	931	13,518	66	956	1,360	19,750	1,643	4,394	116	311	2,401	6,419
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	19,631	143,964	1,290	9,461	7,871	57,722	34,669	46,788	2,278	3,075	13,901	18,760
TOTAL					**211,921**	**1,895,389**	**17,294**	**161,438**	**156,109**	**1,552,079**	**374,255**	**616,001**	**30,542**	**52,467**	**275,690**	**504,426**
I-5: Los Angeles	Urban	41.6	43.9	2.3	8,303	120,612	1,158	16,821	8,019	116,487	14,663	39,199	2,045	5,467	14,162	37,858
I-5: Los Angeles	Urban	22.78	28.25	5.47	14,190	241,637	1,633	27,800	23,014	391,886	25,060	78,532	2,883	9,035	40,643	127,363
I-5: Los Angeles	Urban	44.01	45.1	1.09	4,399	53,563	546	6,650	4,320	52,602	7,768	17,408	965	2,161	7,629	17,096
I-5: Sacramento	Urban	24.51	25.53	1.02	1,857	20,328	295	3,225	4,039	44,206	3,280	6,606	520	1,048	7,133	14,367
I-5: Sacramento	Rural	29.87	34.65	4.78	14,806	84,319	1,356	7,722	12,040	68,567	26,148	27,404	2,395	2,510	21,263	22,284
I-5: Los Angeles	Urban	29.16	35.94	6.78	14,102	224,554	1,482	23,599	19,672	313,231	24,905	72,980	2,617	7,670	34,740	101,800
I-5: Los Angeles	Urban	45.93	46.6	0.67	2,411	32,200	245	3,270	1,498	20,006	4,258	10,465	432	1,063	2,645	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	2,659	40,333	294	4,452	2,027	30,745	4,696	13,108	518	1,447	3,580	9,992
I-5: Los Angeles	Urban	35.94	36.22	0.28	550	8,758	61	975	845	13,451	971	2,846	108	317	1,492	4,372
I-5: Los Angeles	Urban	36.43	36.65	0.22	723	10,120	85	1,191	1,216	17,025	1,277	3,289	150	387	2,148	5,533
I-5: Sacramento	Urban	26.94	29.87	2.93	8,597	76,666	689	6,143	5,042	44,968	15,182	24,917	1,217	1,997	8,905	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	587	6,689	47	536	344	3,923	1,036	2,174	83	174	608	1,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	3,203	53,528	390	6,511	2,813	47,016	5,656	17,396	688	2,116	4,968	15,280
I-5: Sacramento	Rural	0	14.46	14.46	30,366	97,605	19,359	62,226	51,495	165,519	53,627	31,722	34,188	20,223	90,941	53,794
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,133	3,762	91	303	1,042	3,459	2,001	1,223	161	99	1,840	1,124
I-5: Sacramento	Urban	19.16	22	2.84	6,764	43,963	1,163	7,557	16,498	107,236	11,945	14,288	2,053	2,456	29,135	34,852
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,784	22,270	554	6,910	9,007	112,425	3,151	7,238	978	2,246	15,907	36,538
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,526	13,831	739	2,259	3,787	11,572	7,992	4,495	1,305	734	6,687	3,761
I-5: San Joaquin	Rural	14.34	24.8	10.46	51,777	154,808	5,781	17,284	45,996	137,524	91,439	50,313	10,209	5,617	81,229	44,695
I-5: Sacramento	Urban	23.1	24.51	1.41	2,816	27,030	503	4,833	7,256	69,658	4,972	8,785	889	1,571	12,814	22,639
I-5: San Joaquin	Rural	28.56	40.45	11.89	51,722	183,106	4,170	14,763	47,551	168,343	91,341	59,509	7,364	4,798	83,976	54,711
I-5: Sacramento	Urban	14.46	16.7	2.24	3,427	23,117	544	3,668	7,453	50,271	6,052	7,513	960	1,192	13,162	16,338
I-5: San Joaquin	Urban	24.8	28.34	3.54	20,355	67,260	2,273	7,510	18,082	59,750	35,947	21,860	4,014	2,441	31,934	19,419
I-5: Sacramento	Urban	16.7	18.82	2.12	4,134	27,348	656	4,339	8,990	59,473	7,301	8,888	1,158	1,410	15,877	19,329
I-5: San Joaquin	Rural	40.45	49.79	9.34	18,904	65,305	5,948	20,547	26,518	91,607	33,385	21,224	10,504	6,678	46,831	29,772
I-5: Los Angeles	Urban	39.81	40.27	0.46	523	8,037	86	1,328	1,161	17,844	924	2,612	153	432	2,051	5,799
I-5: Sacramento	Urban	18.82	19.16	0.34	727	4,737	135	877	1,967	12,807	1,285	1,539	238	285	3,473	4,162
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,234	30,525	1,440	4,294	14,116	42,104	18,073	9,921	2,543	1,396	24,929	13,684
I-5: Los Angeles	Rural	54.16	59.95	5.79	9,843	97,272	1,197	11,832	8,646	85,440	17,383	31,613	2,114	3,846	15,268	27,768
I-5: Los Angeles	Urban	39.36	39.81	0.45	463	8,280	79	1,414	1,078	19,286	817	2,691	140	460	1,904	6,268
TOTAL					**295,884**	**1,851,561**	**52,997**	**280,841**	**355,532**	**2,378,430**	**522,535**	**601,757**	**93,594**	**91,273**	**627,873**	**772,990**
I-5: Los Angeles	Rural	86.67	88.61	1.94	7,508	29,740	1,269	5,028	3,736	14,799	13,259	9,666	2,242	1,634	6,598	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	2,090	8,278	353	1,400	1,040	4,119	3,691	2,690	624	455	1,836	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	5,302	21,002	896	3,551	2,638	10,451	9,363	6,826	1,583	1,154	4,659	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	24,497	97,039	4,141	16,405	12,190	48,287	43,262	31,538	7,314	5,332	21,528	15,693
I-5: Kern	Rural	15.86	87.03	71.17	104,264	429,511	21,198	87,323	83,066	342,188	184,131	139,591	37,435	28,380	146,696	111,211
I-5: Los Angeles	Rural	68.1	69.65	1.55	3,395	26,366	574	4,457	1,689	13,120	5,995	8,569	1,013	1,449	2,983	4,264
I-5: Los Angeles	Rural	69.65	78.43	8.78	17,384	151,192	2,939	25,560	8,651	75,234	30,701	49,137	5,190	8,307	15,277	24,451
I-5: Los Angeles	Rural	65.43	68.1	2.67	5,287	45,977	894	7,773	2,631	22,879	9,336	14,943	1,578	2,526	4,646	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	10,850	94,366	1,834	15,953	5,399	46,957	19,162	30,669	3,240	5,185	9,535	15,261
I-5: Fresno	Rural	0	66.16	66.16	82,700	347,340	29,857	125,401	52,843	221,939	146,049	112,886	52,728	40,755	93,321	72,130
I-5: Kings	Rural	0	26.72	26.72	33,400	140,280	11,567	48,583	21,833	91,697	58,985	45,591	20,428	15,789	38,557	29,802
I-5: Kern	Rural	7.04	9.28	2.24	8,064	28,224	1,471	5,150	3,905	13,666	14,241	9,173	2,599	1,674	6,896	4,441
I-5: Merced	Rural	0	32.45	32.45	33,748	138,237	13,134	53,798	37,488	153,558	59,599	44,927	23,194	17,484	66,205	49,906
I-5: Kern	Rural	15.08	15.86	0.78	2,496	8,424	547	1,845	1,949	6,579	4,408	2,738	965	599	3,443	2,138
I-5: Kern	Rural	10.35	15.08	4.73	15,325	61,301	2,796	11,185	7,420	29,682	27,064	19,923	4,938	3,635	13,105	9,647
I-5: Kern	Rural	9.28	10.35	1.07	3,467	13,867	633	2,530	1,679	6,714	6,122	4,507	1,117	822	2,964	2,182
I-5: Kern	Rural	6.41	7.04	0.63	2,041	8,165	372	1,490	988	3,953	3,605	2,654	658	484	1,745	1,285
I-5: Kern	Rural	5.36	6.41	1.05	3,402	13,608	621	2,483	1,647	6,589	6,008	4,423	1,096	807	2,909	2,141
I-5: Kern	Rural	0.58	5.36	4.78	15,487	61,949	2,826	11,304	7,499	29,996	27,351	20,133	4,991	3,674	13,243	9,749
I-5: Kern	Rural	0	0.58	0.58	1,879	7,517	343	1,372	910	3,640	3,319	2,443	606	446	1,607	1,183
I-5: Stanislaus	Rural	0	28.06	28.06	11,785	80,813	4,586	31,450	13,091	89,769	20,813	26,264	8,100	10,221	23,119	29,175
I-5: San Joaquin	Rural	0	11.8	11.8	6,549	26,196	1,753	7,013	13,528	54,111	11,566	8,514	3,096	2,279	23,890	17,586
TOTAL					**400,920**	**1,839,391**	**104,606**	**471,053**	**285,820**	**1,289,927**	**708,030**	**597,802**	**184,735**	**153,092**	**504,762**	**419,226**

TABLE V3b. TRAVEL TIME COST - REMAINING CONVENTIONAL LANES - AHS LANE CASE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	13.2	231.8	1.6	20.7	23.8	302.5	375	2,123	46	189	672	2,770
I-5: Los Angeles	Urban	20.58	21.41	0.83	83.8	1,303.2	6.8	87.1	62.1	790.3	2,369	11,932	193	797	1,756	7,236
I-5: Sacramento	Urban	22	23.1	1.1	47.7	467.3	8.1	63.5	114.6	897.7	1,350	4,278	229	582	3,241	8,218
I-5: Los Angeles	Urban	22.28	22.78	0.5	25.9	490.8	3.0	46.2	42.1	651.3	734	4,494	84	423	1,190	5,963
I-5: Los Angeles	Urban	46.6	46.9	0.3	18.4	280.3	1.9	26.9	11.4	164.7	520	2,567	53	246	323	1,508
I-5: Sacramento	Urban	25.53	26.69	1.16	55.4	410.0	9.1	58.5	126.0	813.1	1,567	3,754	256	536	3,562	7,444
I-5: Los Angeles	Urban	47.13	52.33	5.2	357.8	4,556.4	38.0	465.8	228.3	2,801.7	10,115	41,716	1,073	4,264	6,455	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	15.8	201.5	1.6	20.0	10.1	124.6	447	1,845	46	183	287	1,140
I-5: Los Angeles	Urban	43.9	44.01	0.11	6.0	95.6	0.9	14.0	6.7	103.7	171	875	26	128	189	950
I-5: Los Angeles	Urban	13.78	14.16	0.38	24.7	332.4	1.7	22.7	36.2	470.5	697	3,044	49	208	1,024	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,739.6	9,347.7	134.0	664.6	1,116.3	5,537.3	49,186	85,583	3,788	6,084	31,564	50,697
CA 710: LA	Suburban	4.96	10.18	5.22	680.1	3,736.4	44.4	214.1	267.3	1,287.6	19,229	34,209	1,257	1,960	7,557	11,789
I-5: Los Angeles	Urban	28.25	29.16	0.91	45.1	647.6	4.7	65.3	62.3	863.3	1,274	5,930	133	598	1,762	7,904
I-5: Los Angeles	Urban	36.65	39.36	2.71	180.2	2,399.1	20.0	257.3	276.7	3,550.5	5,095	21,965	567	2,355	7,824	32,507
I-5: Los Angeles	Urban	17.21	20.58	3.37	273.2	3,674.5	23.0	303.1	216.1	2,853.7	7,724	33,642	649	2,775	6,110	26,127
I-5: Los Angeles	Urban	14.16	16.9	2.74	170.0	2,240.7	12.9	166.3	277.5	3,591.9	4,806	20,515	363	1,523	7,846	32,886
I-5: Los Angeles	Urban	21.41	22.28	0.87	90.3	1,173.9	7.0	90.0	60.0	765.7	2,552	10,748	199	824	1,696	7,010
I-5: Los Angeles	Urban	16.9	17.21	0.31	18.6	250.3	1.3	17.4	27.2	359.1	526	2,292	37	159	769	3,288
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	392.6	2,285.1	25.8	145.6	157.4	888.0	11,101	20,922	730	1,333	4,451	8,130
TOTAL					**4,238.4**	**34,125.0**	**345.9**	**2,749.0**	**3,122.2**	**26,817.3**	**119,839**	**312,432**	**9,780**	**25,169**	**88,278**	**245,526**
I-5: Los Angeles	Urban	41.6	43.9	2.3	166.1	2,192.9	23.2	305.8	160.4	2,118.0	4,695	20,078	655	2,800	4,535	19,391
I-5: Los Angeles	Urban	22.78	28.25	5.47	283.8	4,393.4	32.7	505.5	460.3	7,125.2	8,025	40,224	923	4,628	13,014	65,235
I-5: Los Angeles	Urban	44.01	45.1	1.09	88.0	973.9	10.9	120.9	86.4	956.4	2,488	8,916	309	1,107	2,443	8,756
I-5: Sacramento	Urban	24.51	25.53	1.02	37.1	369.6	5.9	58.6	80.8	803.7	1,050	3,384	167	537	2,284	7,359
I-5: Sacramento	Rural	29.87	34.65	4.78	296.1	1,317.5	27.1	118.8	240.8	1,054.9	8,373	12,062	767	1,088	6,809	9,658
I-5: Los Angeles	Urban	29.16	35.94	6.78	282.0	4,082.8	29.6	429.1	393.4	5,695.1	7,975	37,380	838	3,928	11,124	52,142
I-5: Los Angeles	Urban	45.93	46.6	0.67	48.2	585.5	4.9	59.5	30.0	363.7	1,363	5,360	138	544	847	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	53.2	733.3	5.9	81.0	40.5	559.0	1,504	6,714	166	741	1,146	5,118
I-5: Los Angeles	Urban	35.94	36.22	0.28	11.0	159.2	1.2	17.7	16.9	244.6	311	1,458	35	162	478	2,239
I-5: Los Angeles	Urban	36.43	36.65	0.22	14.5	184.0	1.7	21.7	24.3	309.5	409	1,685	48	198	688	2,834
I-5: Sacramento	Urban	26.94	29.87	2.93	171.9	1,393.9	13.8	111.7	100.8	817.6	4,861	12,762	390	1,023	2,851	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	11.7	121.6	0.9	9.7	6.9	71.3	332	1,113	27	89	195	653
I-5: Los Angeles	Rural	52.33	54.16	1.83	64.0	823.5	7.8	100.2	56.3	723.3	1,811	7,540	220	917	1,591	6,622
I-5: Sacramento	Rural	0	14.46	14.46	607.3	1,501.6	387.2	957.3	1,029.9	2,546.5	17,172	13,748	10,947	8,765	29,120	23,314
I-5: San Joaquin	Urban	28.34	28.56	0.22	22.7	68.4	1.8	5.5	20.8	62.9	641	626	52	50	589	576
I-5: Sacramento	Urban	19.16	22	2.84	135.3	799.3	23.3	137.4	330.0	1,949.7	3,825	7,318	657	1,258	9,329	17,851
I-5: Los Angeles	Urban	40.27	41.6	1.33	35.7	404.9	11.1	125.6	180.1	2,121.2	1,009	3,707	313	1,150	5,093	19,421
I-5: San Joaquin	Rural	11.8	12.69	0.89	90.5	212.8	14.8	34.7	75.7	178.0	2,559	1,948	418	318	2,141	1,630
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,035.5	2,381.7	115.6	265.9	919.9	2,115.7	29,279	21,805	3,269	2,435	26,010	19,371
I-5: Sacramento	Urban	23.1	24.51	1.41	56.3	491.4	10.1	87.9	145.1	1,266.5	1,592	4,499	285	804	4,103	11,596
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,034.4	2,817.0	83.4	227.1	951.0	2,589.9	29,248	25,791	2,358	2,079	26,890	23,712
I-5: Sacramento	Urban	14.46	16.7	2.24	68.5	420.3	10.9	66.7	149.1	914.0	1,938	3,848	308	611	4,215	8,368
I-5: San Joaquin	Urban	24.8	28.34	3.54	407.1	1,222.9	45.5	136.5	361.6	1,086.4	11,511	11,196	1,285	1,250	10,225	9,946
I-5: Sacramento	Urban	16.7	18.82	2.12	82.7	497.2	13.1	78.9	179.8	1,081.3	2,338	4,552	371	722	5,084	9,900
I-5: San Joaquin	Rural	40.45	49.79	9.34	378.1	1,004.7	119.0	316.1	530.4	1,409.3	10,690	9,199	3,363	2,894	14,996	12,903
I-5: Los Angeles	Urban	39.81	40.27	0.46	10.5	146.1	1.7	24.1	23.2	324.4	296	1,338	49	221	657	2,970
I-5: Sacramento	Urban	18.82	19.16	0.34	14.5	86.1	2.7	15.9	39.3	232.9	411	789	76	146	1,112	2,132
I-5: San Joaquin	Rural	12.69	14.34	1.65	204.7	469.6	28.8	66.1	282.3	647.7	5,787	4,300	814	605	7,982	5,930
I-5: Los Angeles	Rural	54.16	59.95	5.79	196.9	1,496.5	23.9	182.0	172.9	1,314.5	5,566	13,701	677	1,667	4,889	12,035
I-5: Los Angeles	Urban	39.36	39.81	0.45	9.3	150.5	1.6	25.7	21.6	350.7	262	1,378	45	235	610	3,210
TOTAL					**5,917.7**	**31,502.4**	**1,059.9**	**4,693.8**	**7,110.6**	**41,034.1**	**167,319**	**288,421**	**29,969**	**42,974**	**201,049**	**375,688**
I-5: Los Angeles	Rural	86.67	88.61	1.94	150.2	457.5	25.4	77.4	74.7	227.7	4,246	4,189	718	708	2,113	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	41.8	127.4	7.1	21.5	20.8	63.4	1,182	1,166	200	197	588	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	106.0	323.1	17.9	54.6	52.8	160.8	2,998	2,958	507	500	1,492	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	489.9	1,492.9	82.8	252.4	243.8	742.9	13,853	13,668	2,342	2,311	6,893	6,801
I-5: Kern	Rural	15.86	87.03	71.17	2,085.3	6,607.9	424.0	1,343.4	1,661.3	5,264.4	58,960	60,498	11,987	12,300	46,973	48,199
I-5: Los Angeles	Rural	68.1	69.65	1.55	67.9	405.6	11.5	68.6	33.8	201.8	1,920	3,714	325	628	955	1,848
I-5: Los Angeles	Rural	69.65	78.43	8.78	347.7	2,326.0	58.8	393.2	173.0	1,157.4	9,831	21,296	1,662	3,600	4,892	10,597
I-5: Los Angeles	Rural	65.43	68.1	2.67	105.7	707.3	17.9	119.6	52.6	352.0	2,990	6,476	505	1,095	1,488	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	217.0	1,451.8	36.7	245.4	108.0	722.4	6,136	13,292	1,037	2,247	3,053	6,614
I-5: Fresno	Rural	0	66.16	66.16	1,654.0	5,343.7	597.1	1,929.2	1,056.9	3,414.4	46,766	48,924	16,884	17,663	29,882	31,261
I-5: Kings	Rural	0	26.72	26.72	668.0	2,158.2	231.3	747.4	436.7	1,410.7	18,887	19,759	6,541	6,843	12,346	12,916
I-5: Kern	Rural	7.04	9.28	2.24	161.3	434.2	29.4	79.2	78.1	210.2	4,560	3,975	832	725	2,208	1,925
I-5: Merced	Rural	0	32.45	32.45	675.0	2,126.7	262.7	827.7	749.8	2,362.4	19,084	19,471	7,427	7,578	21,199	21,629
I-5: Kern	Rural	15.08	15.86	0.78	49.9	129.6	10.9	28.4	39.0	101.2	1,411	1,187	309	260	1,102	927
I-5: Kern	Rural	10.35	15.08	4.73	306.5	943.1	55.9	172.1	148.4	456.6	8,666	8,634	1,581	1,576	4,196	4,181
I-5: Kern	Rural	9.28	10.35	1.07	69.3	213.3	12.7	38.9	33.6	103.3	1,960	1,953	358	356	949	946
I-5: Kern	Rural	6.41	7.04	0.63	40.8	125.6	7.4	22.9	19.8	60.8	1,154	1,150	211	210	559	557
I-5: Kern	Rural	5.36	6.41	1.05	68.0	209.4	12.4	38.2	32.9	101.4	1,924	1,917	351	350	931	928
I-5: Kern	Rural	0.58	5.36	4.78	309.7	953.1	56.5	173.9	150.0	461.5	8,758	8,726	1,598	1,592	4,241	4,225
I-5: Kern	Rural	0	0.58	0.58	37.6	115.6	6.9	21.1	18.2	56.0	1,063	1,059	194	193	515	513
I-5: Stanislaus	Rural	0	28.06	28.06	235.7	1,243.3	91.7	483.8	261.8	1,381.1	6,664	11,383	2,594	4,430	7,403	12,644
I-5: San Joaquin	Rural	0	11.8	11.8	131.0	403.0	35.1	107.9	270.6	832.5	3,703	3,690	991	988	7,650	7,622
TOTAL					**8,018.4**	**28,298.3**	**2,092.1**	**7,247.0**	**5,716.4**	**19,845.0**	**226,716**	**259,086**	**59,153**	**66,350**	**161,628**	**181,692**

APPENDIX W

DEDICATED TRUCK LANE PLANNING, DESIGN, CONSTRUCTION, AND REHABILITATION COSTS AT VARIOUS VOLUMES

Introduction

This appendix shows supporting tables for the calculation of incremental planning, design, construction, and rehabilitation costs for the dedicated-truck-lane system for low-, medium-, and high-volume traffic conditions (these traffic conditions are described in Appendix S). The incremental cost is the cost of building and maintaining the dedicated truck lane above the no-build option.

Methodologies

Sorting methodologies for the tables in this appendix are identical to those presented in Appendix S. Calculation methodologies for the tables shown here are identical to those for calculation of the corresponding costs for the dedicated-truck-lane scenario at base volumes, which is presented in the main report. Values were summed for the low-, medium-, and high-volume conditions to determine a total cost for each type of segment.

Results

The costs at low, medium, and high volume levels are shown in Table W1 and W2 for the dedicated-truck-lane incremental construction costs (these include planning and design costs, implicitly) and rehabilitation costs, respectively.

TABLE W1. INCREMENTAL CONSTRUCTION COSTS OF DEDICATED TRUCK LANE FOR ROOADWAY SPACE AND BARRIERS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	Dedicated Lane Placement	New Freeway Costs ($)			Barrier Costs ($)				Total Construction Costs ($)	
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC	# of Barriers in One Direction	2001-Unit Cost per Lane Mile	Total Cost	EUAC	Total Cost	EUATC
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	6,394,500	1,342,845	97,556	1.5	94,776	29,854	2,169	1,372,699	99,725
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	23,979,375	19,902,881	1,445,923	2.0	94,776	157,328	11,430	20,060,209	1,457,352
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	23,979,375	26,377,313	1,916,283	2	94,776	208,507	15,148	26,585,820	1,931,431
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	23,979,375	11,989,688	871,038	2.0	94,776	94,776	6,885	12,084,464	877,923
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Non-Median	23,979,375	7,193,812	522,623	2.0	94,776	56,866	4,131	7,250,678	526,754
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Non-Median	23,979,375	27,816,075	2,020,808	2	94,776	219,880	15,974	28,035,955	2,036,782
I-5: Los Angeles	Urban	47.13	52.33	5.2	4	Non-Median	23,979,375	124,692,750	9,058,793	2	94,776	985,670	71,608	125,678,420	9,130,400
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	Non-Median	23,979,375	5,515,256	400,677	2	94,776	43,597	3,167	5,558,853	403,845
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Non-Median	23,979,375	2,637,731	191,628	2	94,776	20,851	1,515	2,658,582	193,143
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	6,394,500	2,429,910	176,530	2	94,776	54,022	3,925	2,483,932	180,455
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	15,473,870	159,535,602	11,590,088	2.0	94,776	1,954,281	141,976	161,489,883	11,732,064
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	15,473,870	80,773,602	5,868,114	2	94,776	989,461	71,883	81,763,064	5,939,998
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	23,979,375	21,821,231	1,585,289	2	94,776	172,492	12,531	21,993,724	1,597,820
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	23,979,375	64,984,106	4,721,025	2	94,776	513,686	37,319	65,497,792	4,758,343
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	23,979,375	80,810,494	5,870,794	2	94,776	638,790	46,407	81,449,284	5,917,202
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	23,979,375	65,703,488	4,773,287	2.0	94,776	519,372	37,732	66,222,860	4,811,019
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	23,979,375	20,862,056	1,515,606	2.0	94,776	164,910	11,981	21,026,966	1,527,586
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	6,394,500	1,982,295	144,012	1.5	94,776	44,071	3,202	2,026,366	147,213
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	15,473,870	43,172,098	3,136,406	2.0	94,776	528,850	38,420	43,700,948	3,174,826
TOTAL				**39.25**				**769,543,233**	**55,906,478**			**7,397,267**	**537,403**	**776,940,500**	**56,443,882**
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	23,979,375	55,152,562	4,006,774	2	94,776	435,970	31,673	55,588,532	4,038,446
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	23,979,375	131,167,181	9,529,153	2	94,776	1,036,849	75,326	132,204,031	9,604,479
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Non-Median	23,979,375	26,137,519	1,898,862	2.0	94,776	206,612	15,010	26,344,130	1,913,872
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Non-Median	23,979,375	24,458,963	1,776,917	2	94,776	193,343	14,046	24,652,306	1,790,963
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	4,181,019	19,985,272	1,451,908	1.5	94,776	679,544	49,368	20,664,816	1,501,276
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	23,979,375	162,580,163	11,811,272	2.0	94,776	1,285,163	93,366	163,865,325	11,904,637
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Non-Median	23,979,375	16,066,181	1,167,191	2	94,776	127,000	9,226	16,193,181	1,176,417
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Non-Median	23,979,375	19,902,881	1,445,923	2	94,776	157,328	11,430	20,060,209	1,457,352
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	23,979,375	6,714,225	487,781	2.0	94,776	53,075	3,856	6,767,300	491,637
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	6,394,500	1,406,790	102,202	2	94,776	31,276	2,272	1,438,066	104,474
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	6,394,500	18,735,885	1,361,142	2	94,776	416,541	30,261	19,152,426	1,391,403
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Non-Median	23,979,375	5,994,844	435,519	2	94,776	47,388	3,443	6,042,232	438,962
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Non-Median	6,968,365	12,752,109	926,427	2.0	94,776	346,880	25,200	13,098,989	951,627
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	4,181,019	60,457,538	4,392,174	2	94,776	2,055,691	149,344	62,513,230	4,541,518
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Non-Median	6,968,365	1,533,040	111,374	2	94,776	41,701	3,030	1,574,742	114,403
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	23,979,375	68,101,425	4,947,494	2	94,776	538,328	39,109	68,639,753	4,986,603
I-5: Los Angeles	Urban	40.27	41.6	1.33	3	Non-Median	23,979,375	31,892,569	2,316,960	2	94,776	252,104	18,315	32,144,673	2,335,275
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	4,181,019	3,721,107	270,334	2	94,776	126,526	9,192	3,847,633	279,526
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	4,181,019	43,733,461	3,177,188	2	94,776	1,487,035	108,032	45,220,497	3,285,220
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	23,979,375	33,810,919	2,456,326	2	94,776	267,268	19,417	34,078,187	2,475,743
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	4,181,019	49,712,319	3,611,546	2	94,776	1,690,330	122,801	51,402,649	3,734,346
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	6,394,500	14,323,680	1,040,600	2	94,776	318,447	23,135	14,642,127	1,063,735
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Non-Median	23,979,375	84,886,988	6,166,947	2	94,776	671,014	48,748	85,558,002	6,215,696
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Non-Median	23,979,375	50,836,275	3,693,200	2.0	94,776	401,850	29,194	51,238,125	3,722,394
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	4,181,019	39,050,720	2,836,992	2	94,776	1,327,812	96,464	40,378,531	2,933,456
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	23,979,375	11,030,513	801,355	2	94,776	87,194	6,335	11,117,706	807,689
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	23,979,375	8,152,988	592,306	2	94,776	64,448	4,682	8,217,435	596,988
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	4,181,019	6,898,682	501,182	1.5	94,776	234,571	17,041	7,133,252	518,223
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Non-Median	6,968,365	40,346,836	2,931,154	2.0	94,776	1,097,506	79,733	41,444,342	3,010,886
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	23,979,375	10,790,719	783,934	2	94,776	85,298	6,197	10,876,017	790,131
TOTAL				**97.88**				**1,060,334,350**	**77,032,136**			**15,764,092**	**1,145,244**	**1,076,098,442**	**78,177,381**
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	Non-Median	6,968,365	13,518,629	982,114	2	94,776	367,731	26,715	13,886,360	1,008,829
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	Non-Median	6,968,365	3,762,917	273,372	2.0	94,776	102,358	7,436	3,865,275	280,808
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	Non-Median	6,968,365	9,546,661	693,554	2	94,776	259,686	18,866	9,806,347	712,420
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	4,181,019	26,465,852	1,922,715	2	94,776	899,898	65,377	27,365,750	1,988,092
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	4,181,019	297,563,139	21,617,638	2	94,776	10,117,812	735,048	307,680,951	22,352,686
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	4,181,019	6,480,580	470,807	1.5	94,776	220,354	16,008	6,700,934	486,816
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Non-Median	6,968,365	61,182,248	4,444,824	2	94,776	1,664,267	120,907	62,846,515	4,565,731
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Non-Median	6,968,365	18,605,536	1,351,672	2.0	94,776	506,104	36,768	19,111,639	1,388,440
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	4,181,019	22,911,985	1,664,531	2	94,776	779,059	56,598	23,691,044	1,721,129
I-5: Fresno	Rural	0	66.16	66.16	2	Median	4,181,019	276,616,232	20,095,868	2	94,776	9,405,570	683,304	286,021,803	20,779,173
I-5: Kings	Rural	0	26.72	26.72	2	Median	4,181,019	111,716,834	8,116,106	2	94,776	3,798,622	275,966	115,515,456	8,392,072
I-5: Kern	Rural	7.04	9.28	2.24	4	Non-Median	6,968,365	15,609,138	1,133,987	2	94,776	424,596	30,846	16,033,735	1,164,833
I-5: Merced	Rural	0	32.45	32.45	2	Median	4,181,019	135,674,074	9,856,574	2	94,776	4,613,222	335,146	140,287,296	10,191,719
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	4,181,019	3,261,195	236,922	1.5	94,776	110,888	8,056	3,372,083	244,978
I-5: Kern	Rural	10.35	15.08	4.73	4	Non-Median	6,968,365	32,960,368	2,394,535	2	94,776	896,581	65,136	33,856,949	2,459,671
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	4,181,019	4,473,691	325,009	2	94,776	152,115	11,051	4,625,806	336,060
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	4,181,019	2,634,042	191,360	2	94,776	89,563	6,507	2,723,605	197,867
I-5: Kern	Rural	5.36	6.41	1.05	4	Non-Median	6,968,365	7,316,784	531,556	2.0	94,776	199,030	14,459	7,515,813	546,016
I-5: Kern	Rural	0.58	5.36	4.78	4	Non-Median	6,968,365	33,308,787	2,419,847	2.0	94,776	906,059	65,824	34,214,845	2,485,671
I-5: Kern	Rural	0	0.58	0.58	4	Non-Median	6,968,365	4,041,652	293,622	2	94,776	109,940	7,987	4,151,592	301,609
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	4,181,019	117,319,400	8,523,127	2	94,776	3,989,122	289,805	121,308,521	8,812,932
I-5: San Joaquin	Rural	0	11.8	11.8	2	Median	4,181,019	49,336,027	3,584,209	2	94,776	1,677,535	121,871	51,013,562	3,706,080
TOTAL				**280.88**				**1,254,305,769**	**91,123,949**			**41,290,112**	**2,999,682**	**1,295,595,881**	**94,123,631**

TABLE W2. INCREMENTAL REHABILITATION OF DEDICATED TRUCK LANE COSTS FOR ROADWAY SPACE - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Conventional Freeway Lanes in One Direction	Dedicated Lane Placement	Rehabilitation Costs ($)		
		Begin	End	Length (mi)			2001-Unit Cost per Lane Mile	Total Cost	EUAC
I-5: Los Angeles	Urban	36.22	36.43	0.21	4	Median	399,656	83,928	5,306
I-5: Los Angeles	Urban	20.58	21.41	0.83	4	Non-Median	1,278,900	1,061,487	67,106
I-5: Sacramento	Urban	22	23.1	1.1	3	Non-Median	1,278,900	1,406,790	88,936
I-5: Los Angeles	Urban	22.28	22.78	0.5	4	Non-Median	1,278,900	639,450	40,425
I-5: Los Angeles	Urban	46.6	46.9	0.3	4	Non-Median	1,278,900	383,670	24,255
I-5: Sacramento	Urban	25.53	26.69	1.16	3	Non-Median	1,278,900	1,483,524	93,787
I-5: Los Angeles	Urban	47.13	52.33	5.2	4	Non-Median	1,278,900	6,650,280	420,424
I-5: Los Angeles	Urban	46.9	47.13	0.23	4	Non-Median	1,278,900	294,147	18,596
I-5: Los Angeles	Urban	43.9	44.01	0.11	4	Non-Median	1,278,900	140,679	8,894
I-5: Los Angeles	Urban	13.78	14.16	0.38	4	Median	181,178	68,847	4,352
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	4	Non-Median	1,475,654	15,213,991	961,814
CA 710: LA	Suburban	4.96	10.18	5.22	3	Non-Median	1,475,654	7,702,913	486,971
I-5: Los Angeles	Urban	28.25	29.16	0.91	4	Non-Median	1,278,900	1,163,799	73,574
I-5: Los Angeles	Urban	36.65	39.36	2.71	5	Non-Median	1,278,900	3,465,819	219,106
I-5: Los Angeles	Urban	17.21	20.58	3.37	4	Non-Median	1,278,900	4,309,893	272,467
I-5: Los Angeles	Urban	14.16	16.9	2.74	4	Non-Median	1,278,900	3,504,186	221,531
I-5: Los Angeles	Urban	21.41	22.28	0.87	5	Non-Median	1,278,900	1,112,643	70,340
I-5: Los Angeles	Urban	16.9	17.21	0.31	4	Median	399,656	123,893	7,832
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	4	Non-Median	1,475,654	4,117,074	260,278
TOTAL				**39.25**				**52,927,014**	**3,345,995**
I-5: Los Angeles	Urban	41.6	43.9	2.3	5	Non-Median	1,278,900	2,941,470	185,957
I-5: Los Angeles	Urban	22.78	28.25	5.47	5	Non-Median	1,278,900	6,995,583	442,254
I-5: Los Angeles	Urban	44.01	45.1	1.09	5	Non-Median	1,278,900	1,394,001	88,127
I-5: Sacramento	Urban	24.51	25.53	1.02	4	Non-Median	1,278,900	1,304,478	82,468
I-5: Sacramento	Rural	29.87	34.65	4.78	2	Median	181,178	866,028	54,749
I-5: Los Angeles	Urban	29.16	35.94	6.78	4	Non-Median	1,278,900	8,670,942	548,169
I-5: Los Angeles	Urban	45.93	46.6	0.67	5	Non-Median	1,278,900	856,863	54,170
I-5: Los Angeles	Urban	45.1	45.93	0.83	5	Non-Median	1,278,900	1,061,487	67,106
I-5: Los Angeles	Urban	35.94	36.22	0.28	4	Non-Median	1,278,900	358,092	22,638
I-5: Los Angeles	Urban	36.43	36.65	0.22	6	Median	399,656	87,924	5,558
I-5: Sacramento	Urban	26.94	29.87	2.93	3	Median	399,656	1,170,993	74,029
I-5: Sacramento	Urban	26.69	26.94	0.25	3	Non-Median	1,278,900	319,725	20,213
I-5: Los Angeles	Rural	52.33	54.16	1.83	4	Non-Median	1,672,408	3,060,506	193,482
I-5: Sacramento	Rural	0	14.46	14.46	2	Median	181,178	2,619,827	165,623
I-5: San Joaquin	Urban	28.34	28.56	0.22	3	Non-Median	1,278,900	281,358	17,787
I-5: Sacramento	Urban	19.16	22	2.84	4	Non-Median	1,278,900	3,632,076	229,616
I-5: Los Angeles	Urban	40	42	1	3	Non-Median	1,278,900	1,700,937	107,532
I-5: San Joaquin	Rural	11.8	12.69	0.89	3	Median	181,178	161,248	10,194
I-5: San Joaquin	Rural	14.34	24.8	10.46	3	Median	181,178	1,895,117	119,807
I-5: Sacramento	Urban	23.1	24.51	1.41	5	Non-Median	1,278,900	1,803,249	114,000
I-5: San Joaquin	Rural	28.56	40.45	11.89	3	Median	181,178	2,154,200	136,187
I-5: Sacramento	Urban	14.46	16.7	2.24	3	Median	399,656	895,230	56,596
I-5: San Joaquin	Urban	24.8	28.34	3.54	4	Non-Median	1,278,900	4,527,306	286,212
I-5: Sacramento	Urban	16.7	18.82	2.12	4	Non-Median	1,278,900	2,711,268	171,404
I-5: San Joaquin	Rural	40.45	49.79	9.34	2	Median	181,178	1,692,198	106,979
I-5: Los Angeles	Urban	39.81	40.27	0.46	4	Non-Median	1,278,900	588,294	37,191
I-5: Sacramento	Urban	18.82	19.16	0.34	5	Non-Median	1,278,900	434,826	27,489
I-5: San Joaquin	Rural	12.69	14.34	1.65	5	Median	181,178	298,943	18,899
I-5: Los Angeles	Rural	54.16	59.95	5.79	4	Non-Median	1,672,408	9,683,241	612,165
I-5: Los Angeles	Urban	39.36	39.81	0.45	5	Non-Median	1,278,900	575,505	36,383
TOTAL				**97.88**				**64,742,915**	**4,092,985**
I-5: Los Angeles	Rural	86.67	88.61	1.94	4	Non-Median	1,672,408	3,244,471	205,112
I-5: Los Angeles	Rural	86.13	86.67	0.54	4	Non-Median	1,672,408	903,100	57,093
I-5: Los Angeles	Rural	84.76	86.13	1.37	4	Non-Median	1,672,408	2,291,199	144,847
I-5: Los Angeles	Rural	78.43	84.76	6.33	4	Median	181,178	1,146,854	72,503
I-5: Kern	Rural	15.86	87.03	71.17	2	Median	181,178	12,894,403	815,172
I-5: Los Angeles	Rural	68.1	69.65	1.55	4	Median	181,178	280,825	17,753
I-5: Los Angeles	Rural	69.65	78.43	8.78	4	Non-Median	1,672,408	14,683,740	928,292
I-5: Los Angeles	Rural	65.43	68.1	2.67	4	Non-Median	1,672,408	4,465,329	282,294
I-5: Los Angeles	Rural	59.95	65.43	5.48	4	Median	181,178	992,853	62,767
I-5: Fresno	Rural	0	66.16	66.16	2	Median	181,178	11,986,703	757,788
I-5: Kings	Rural	0	26.72	26.72	2	Median	181,178	4,841,063	306,047
I-5: Kern	Rural	7.04	9.28	2.24	4	Non-Median	1,672,408	3,746,193	236,831
I-5: Merced	Rural	0	32.45	32.45	2	Median	181,178	5,879,210	371,678
I-5: Kern	Rural	15.08	15.86	0.78	4	Median	181,178	141,318	8,934
I-5: Kern	Rural	10.35	15.08	4.73	4	Non-Median	1,672,408	7,910,488	500,094
I-5: Kern	Rural	9.28	10.35	1.07	4	Median	181,178	193,860	12,256
I-5: Kern	Rural	6.41	7.04	0.63	4	Median	181,178	114,142	7,216
I-5: Kern	Rural	5.36	6.41	1.05	4	Non-Median	1,672,408	1,756,028	111,014
I-5: Kern	Rural	0.58	5.36	4.78	4	Non-Median	1,672,408	7,994,109	505,380
I-5: Kern	Rural	0	0.58	0.58	4	Non-Median	1,672,408	969,996	61,322
I-5: Stanislaus	Rural	0	28.06	28.06	2	Median	181,178	5,083,841	321,396
I-5: San Joaquin	Rural	0.0	11.8	11.8	2	Median	181,178	2,137,895	135,156
TOTAL				**280.88**				**93,657,618**	**5,920,945**

APPENDIX X

DEDICATED TRUCK LANE VEHICLE-HOURS AND VEHICLE-MILES, VEHICLE OPERATING COSTS, AND USER COSTS AT VARIOUS VOLUMES

Introduction

This appendix shows supporting tables for the calculation of vehicle-miles, vehicle-hours, vehicle operating costs, and user travel time costs for low-, medium-, and high-volume traffic conditions for the added-dedicated-truck-lane configuration (these traffic conditions are described in Appendix S).

Methodologies

Sorting methodologies for the tables in this appendix are identical to those presented in Appendix S. Calculation methodologies for the tables shown here are identical to those for calculation of the corresponding values for the added-dedicated-truck-lane scenario at base volumes, which is presented in Appendix M. Values were summed for the low-, medium-, and high-volume conditions to determine a total cost for each type of segment.

Results

The vehicle-miles of travel and vehicle operating costs are shown in Table X1a for the existing freeway conditions (sorted by volume), in Table X2a for the dedicated truck lane lane added to the existing configuration, and Table X3a for the traffic remaining in the conventional lanes. Tables X1b, X2b, and X3b show vehicle-hours of travel and user travel-time costs for the existing configuration (sorted by volume), for the dedicated truck lane, and for the traffic remaining on the conventional lanes, respectively.

TABLE X1a. VEHICLE OPERATING COSTS - BASE CONDITION - SEGMENTATION 48 FT. BASIS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	806	9,274	99	1,137	1,447	16,637	1,424	3,014	175	370	2,555	5,407
I-5: Los Angeles	Urban	20.58	21.41	0.83	5,312	61,088	417	4,790	3,567	41,026	9,381	19,854	736	1,557	6,300	13,333
I-5: Sacramento	Urban	22	23.1	1.1	2,541	20,559	432	3,495	6,102	49,371	4,487	6,682	763	1,136	10,776	16,046
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,663	22,088	191	2,541	2,696	35,821	2,936	7,178	338	826	4,762	11,642
I-5: Los Angeles	Urban	46.6	46.9	0.3	1,442	14,578	146	1,481	896	9,057	2,546	4,738	259	481	1,582	2,944
I-5: Sacramento	Urban	25.53	26.69	1.16	2,941	19,679	481	3,219	6,682	44,718	5,193	6,396	849	1,046	11,801	14,533
I-5: Los Angeles	Urban	47.13	52.33	5.2	26,832	241,488	2,846	25,618	17,122	154,094	47,386	78,484	5,027	8,326	30,237	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	1,187	10,681	122	1,098	761	6,851	2,096	3,471	215	357	1,344	2,226
I-5: Los Angeles	Urban	43.9	44.01	0.11	449	5,161	67	771	496	5,706	793	1,677	118	251	876	1,854
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,532	17,620	109	1,249	2,250	25,880	2,706	5,726	192	406	3,974	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	98,976	560,864	7,623	43,196	63,516	359,925	174,793	182,281	13,462	14,039	112,170	116,976
CA 710: LA	Suburban	4.96	10.18	5.22	37,584	212,976	2,456	13,917	14,770	83,697	66,374	69,217	4,337	4,523	26,084	27,201
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,985	34,325	312	3,590	4,129	47,479	5,271	11,156	551	1,167	7,291	15,431
I-5: Los Angeles	Urban	36.65	39.36	2.71	11,057	127,153	1,230	14,149	16,981	195,280	19,526	41,325	2,173	4,598	29,988	63,466
I-5: Los Angeles	Urban	17.21	20.58	3.37	17,254	198,426	1,450	16,671	13,648	156,951	30,471	64,488	2,560	5,418	24,102	51,009
I-5: Los Angeles	Urban	14.16	16.9	2.74	10,522	120,998	796	9,149	17,179	197,556	18,581	39,324	1,405	2,973	30,338	64,206
I-5: Los Angeles	Urban	21.41	22.28	0.87	5,512	63,392	430	4,949	3,662	42,114	9,735	20,602	760	1,609	6,467	13,687
I-5: Los Angeles	Urban	16.9	17.21	0.31	1,176	13,518	83	956	1,717	19,750	2,076	4,394	147	311	3,033	6,419
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	23,436	143,964	1,540	9,461	9,397	57,722	41,388	46,788	2,720	3,075	16,594	18,760
TOTAL					**253,206**	**1,897,833**	**20,830**	**161,438**	**187,018**	**1,549,636**	**447,164**	**616,796**	**36,787**	**52,467**	**330,276**	**503,632**
I-5: Los Angeles	Urban	41.6	43.9	2.3	10,488	120,612	1,463	16,821	10,129	116,487	18,522	39,199	2,583	5,467	17,889	37,858
I-5: Los Angeles	Urban	22.78	28.25	5.47	18,188	241,637	2,092	27,800	29,497	391,886	32,120	78,532	3,695	9,035	52,092	127,363
I-5: Los Angeles	Urban	44.01	45.1	1.09	5,951	53,563	739	6,650	5,845	52,602	10,510	17,408	1,305	2,161	10,322	17,096
I-5: Sacramento	Urban	24.51	25.53	1.02	2,010	20,328	319	3,225	4,372	44,206	3,550	6,606	563	1,048	7,721	14,367
I-5: Sacramento	Rural	29.87	34.65	4.78	16,061	84,319	1,471	7,722	13,060	68,567	28,364	27,404	2,597	2,510	23,065	22,284
I-5: Los Angeles	Urban	29.16	35.94	6.78	19,526	224,554	2,052	23,599	27,238	313,231	34,484	72,980	3,624	7,670	48,102	101,800
I-5: Los Angeles	Urban	45.93	46.6	0.67	3,578	32,200	363	3,270	2,223	20,006	6,318	10,465	642	1,063	3,926	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	3,989	40,333	440	4,452	3,041	30,745	7,045	13,108	778	1,447	5,370	9,992
I-5: Los Angeles	Urban	35.94	36.22	0.28	762	8,758	85	975	1,170	13,451	1,345	2,846	150	317	2,066	4,372
I-5: Los Angeles	Urban	36.43	36.65	0.22	880	10,120	104	1,191	1,480	17,025	1,554	3,289	183	387	2,614	5,533
I-5: Sacramento	Urban	26.94	29.87	2.93	9,476	76,666	759	6,143	5,558	44,968	16,734	24,917	1,341	1,997	9,815	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	662	6,689	53	536	388	3,923	1,168	2,174	94	174	685	1,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	5,947	53,528	723	6,511	5,224	47,016	10,503	17,396	1,278	2,116	9,226	15,280
I-5: Sacramento	Rural	0	14.46	14.46	32,535	97,605	20,742	62,226	55,173	165,519	57,457	31,722	36,630	20,223	97,436	53,794
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,188	3,762	96	303	1,092	3,459	2,098	1,223	169	99	1,929	1,124
I-5: Sacramento	Urban	19.16	22	2.84	7,157	43,963	1,230	7,557	17,457	107,236	12,639	14,288	2,173	2,456	30,829	34,852
I-5: Los Angeles	Urban	40.27	41.6	1.33	2,202	22,270	683	6,910	11,119	112,425	3,890	7,238	1,207	2,246	19,636	36,538
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,859	13,831	794	2,259	4,066	11,572	8,582	4,495	1,402	734	7,180	3,761
I-5: San Joaquin	Rural	14.34	24.8	10.46	54,392	154,808	6,073	17,284	48,319	137,524	96,057	50,313	10,725	5,617	85,332	44,695
I-5: Sacramento	Urban	23.1	24.51	1.41	3,003	27,030	537	4,833	7,740	69,658	5,304	8,785	948	1,571	13,668	22,639
I-5: San Joaquin	Rural	28.56	40.45	11.89	54,694	183,106	4,410	14,763	50,284	168,343	96,590	59,509	7,788	4,798	88,802	54,711
I-5: Sacramento	Urban	14.46	16.7	2.24	3,763	23,117	597	3,668	8,184	50,271	6,646	7,513	1,055	1,192	14,452	16,338
I-5: San Joaquin	Urban	24.8	28.34	3.54	21,240	67,260	2,371	7,510	18,869	59,750	37,510	21,860	4,188	2,441	33,322	19,419
I-5: Sacramento	Urban	16.7	18.82	2.12	4,452	27,348	706	4,339	9,682	59,473	7,862	8,888	1,248	1,410	17,098	19,329
I-5: San Joaquin	Rural	40.45	49.79	9.34	20,623	65,305	6,489	20,547	28,929	91,607	36,420	21,224	11,459	6,678	51,088	29,772
I-5: Los Angeles	Urban	39.81	40.27	0.46	795	8,037	131	1,328	1,765	17,844	1,404	2,612	232	432	3,117	5,799
I-5: Sacramento	Urban	18.82	19.16	0.34	771	4,737	143	877	2,085	12,807	1,362	1,539	252	285	3,682	4,162
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,725	30,525	1,509	4,294	14,793	42,104	18,940	9,921	2,665	1,396	26,125	13,684
I-5: Los Angeles	Rural	54.16	59.95	5.79	18,528	97,272	2,254	11,832	16,274	85,440	32,721	31,613	3,980	3,846	28,740	27,768
I-5: Los Angeles	Urban	39.36	39.81	0.45	720	8,280	123	1,414	1,677	19,286	1,272	2,691	217	460	2,962	6,268
TOTAL					**339,166**	**1,851,561**	**59,552**	**280,841**	**406,731**	**2,378,430**	**598,970**	**601,757**	**105,169**	**91,273**	**718,291**	**772,990**
I-5: Los Angeles	Rural	86.67	88.61	1.94	11,000	29,740	1,860	5,028	5,474	14,799	19,426	9,666	3,284	1,634	9,666	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	3,062	8,278	518	1,400	1,524	4,119	5,407	2,690	914	455	2,691	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	7,768	21,002	1,313	3,551	3,865	10,451	13,718	6,826	2,319	1,154	6,826	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	35,891	97,039	6,068	16,405	17,860	48,287	63,384	31,538	10,716	5,332	31,540	15,693
I-5: Kern	Rural	15.86	87.03	71.17	175,434	429,511	35,667	87,323	139,767	342,188	309,818	139,591	62,989	28,380	246,830	111,211
I-5: Los Angeles	Rural	68.1	69.65	1.55	6,185	26,366	1,046	4,457	3,077	13,120	10,922	8,569	1,846	1,449	5,435	4,264
I-5: Los Angeles	Rural	69.65	78.43	8.78	33,188	151,192	5,611	25,560	16,515	75,234	58,611	49,137	9,909	8,307	29,165	24,451
I-5: Los Angeles	Rural	65.43	68.1	2.67	10,093	45,977	1,706	7,773	5,022	22,879	17,824	14,943	3,013	2,526	8,869	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	20,714	94,366	3,502	15,953	10,308	46,957	36,582	30,669	6,185	5,185	18,203	15,261
I-5: Fresno	Rural	0	66.16	66.16	148,860	347,340	53,743	125,401	95,117	221,939	262,888	112,886	94,911	40,755	167,977	72,130
I-5: Kings	Rural	0	26.72	26.72	60,120	140,280	20,821	48,583	39,299	91,697	106,173	45,591	36,770	15,789	69,402	29,802
I-5: Kern	Rural	7.04	9.28	2.24	12,096	28,224	2,207	5,150	5,857	13,666	21,362	9,173	3,898	1,674	10,343	4,441
I-5: Merced	Rural	0	32.45	32.45	56,463	138,237	21,974	53,798	62,721	153,558	99,714	44,927	38,806	17,484	110,765	49,906
I-5: Kern	Rural	15.08	15.86	0.78	3,276	8,424	717	1,845	2,559	6,579	5,785	2,738	1,267	599	4,519	2,138
I-5: Kern	Rural	10.35	15.08	4.73	23,839	61,301	4,350	11,185	11,543	29,682	42,100	19,923	7,682	3,635	20,385	9,647
I-5: Kern	Rural	9.28	10.35	1.07	5,393	13,867	984	2,530	2,611	6,714	9,524	4,507	1,738	822	4,611	2,182
I-5: Kern	Rural	6.41	7.04	0.63	3,175	8,165	579	1,490	1,537	3,953	5,607	2,654	1,023	484	2,715	1,285
I-5: Kern	Rural	5.36	6.41	1.05	5,292	13,608	966	2,483	2,562	6,589	9,346	4,423	1,705	807	4,525	2,141
I-5: Kern	Rural	0.58	5.36	4.78	24,091	61,949	4,396	11,304	11,665	29,996	42,545	20,133	7,763	3,674	20,600	9,749
I-5: Kern	Rural	0	0.58	0.58	2,923	7,517	533	1,372	1,415	3,640	5,162	2,443	942	446	2,500	1,183
I-5: Stanislaus	Rural	0	28.06	28.06	31,427	80,813	12,231	31,450	34,910	89,769	55,501	26,264	21,599	10,221	61,652	29,175
I-5: San Joaquin	Rural	0	11.8	11.8	9,204	26,196	2,464	7,013	19,012	54,111	16,254	8,514	4,351	2,279	33,575	17,586
TOTAL					**689,494**	**1,839,391**	**183,255**	**471,053**	**494,219**	**1,289,927**	**1,217,654**	**597,802**	**323,631**	**153,092**	**872,797**	**419,226**

TABLE X1b. TRAVEL TIME COST - BASE CONDITION - SEGMENTATION 48 FT. BASIS - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Cost ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	16.1	289.8	2.0	20.7	28.9	302.5	456	2,653	56	189	818	2,770
I-5: Los Angeles	Urban	20.58	21.41	0.83	106.2	1,527.2	8.3	87.1	71.3	745.9	3,004	13,982	236	797	2,017	6,829
I-5: Sacramento	Urban	22	23.1	1.1	50.8	541.0	8.6	63.5	122.0	897.7	1,437	4,953	244	582	3,451	8,218
I-5: Los Angeles	Urban	22.28	22.78	0.5	33.3	552.2	3.8	46.2	53.9	651.3	940	5,056	108	423	1,525	5,963
I-5: Los Angeles	Urban	46.6	46.9	0.3	28.8	316.9	2.9	26.9	17.9	164.7	815	2,902	83	246	507	1,508
I-5: Sacramento	Urban	25.53	26.69	1.16	58.8	410.0	9.6	58.5	133.6	813.1	1,663	3,754	272	536	3,779	7,444
I-5: Los Angeles	Urban	47.13	52.33	5.2	536.6	4,829.8	56.9	465.8	342.4	2,801.7	15,173	44,219	1,610	4,264	9,682	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	23.7	213.6	2.4	20.0	15.2	124.6	671	1,956	69	183	430	1,140
I-5: Los Angeles	Urban	43.9	44.01	0.11	9.0	101.2	1.3	14.0	9.9	103.7	254	927	38	128	281	950
I-5: Los Angeles	Urban	13.78	14.16	0.38	30.6	338.8	2.2	22.7	45.0	470.5	866	3,102	61	208	1,273	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,979.5	9,506.2	152.5	664.6	1,270.3	5,537.3	55,970	87,034	4,311	6,084	35,918	50,697
CA 710: LA	Suburban	4.96	10.18	5.22	751.7	3,736.4	49.1	214.1	295.4	1,287.6	21,253	34,209	1,389	1,960	8,352	11,789
I-5: Los Angeles	Urban	28.25	29.16	0.91	59.7	647.6	6.2	65.3	82.6	863.3	1,688	5,930	177	598	2,335	7,904
I-5: Los Angeles	Urban	36.65	39.36	2.71	221.1	2,399.1	24.6	257.3	339.6	3,550.5	6,252	21,965	696	2,355	9,602	32,507
I-5: Los Angeles	Urban	17.21	20.58	3.37	345.1	3,674.5	29.0	303.1	273.0	2,853.7	9,757	33,642	820	2,775	7,718	26,127
I-5: Los Angeles	Urban	14.16	16.9	2.74	210.4	2,240.7	15.9	166.3	343.6	3,591.9	5,950	20,515	450	1,523	9,714	32,886
I-5: Los Angeles	Urban	21.41	22.28	0.87	110.2	1,173.9	8.6	90.0	73.2	765.7	3,117	10,748	243	824	2,071	7,010
I-5: Los Angeles	Urban	16.9	17.21	0.31	23.5	250.3	1.7	17.4	34.3	359.1	665	2,292	47	159	971	3,288
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	468.7	2,360.1	30.8	145.6	187.9	888.0	13,253	21,608	871	1,333	5,314	8,130
TOTAL					**5,064.1**	**35,109.5**	**416.6**	**2,749.0**	**3,740.4**	**26,772.8**	**143,185**	**321,446**	**11,779**	**25,169**	**105,756**	**245,119**
I-5: Los Angeles	Urban	41.6	43.9	2.3	209.8	2,192.9	29.3	305.8	202.6	2,118.0	5,931	20,078	827	2,800	5,728	19,391
I-5: Los Angeles	Urban	22.78	28.25	5.47	363.8	4,393.4	41.8	505.5	589.9	7,125.2	10,285	40,224	1,183	4,628	16,680	65,235
I-5: Los Angeles	Urban	44.01	45.1	1.09	119.0	973.9	14.8	120.9	116.9	956.4	3,365	8,916	418	1,107	3,305	8,756
I-5: Sacramento	Urban	24.51	25.53	1.02	40.2	369.6	6.4	58.6	87.4	803.7	1,137	3,384	180	537	2,472	7,359
I-5: Sacramento	Rural	29.87	34.65	4.78	321.2	1,338.4	29.4	118.8	261.2	1,054.9	9,082	12,254	832	1,088	7,386	9,658
I-5: Los Angeles	Urban	29.16	35.94	6.78	390.5	4,082.8	41.0	429.1	544.8	5,695.1	11,042	37,380	1,160	3,928	15,402	52,142
I-5: Los Angeles	Urban	45.93	46.6	0.67	71.6	585.5	7.3	59.5	44.5	363.7	2,023	5,360	205	544	1,257	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	79.8	733.3	8.8	81.0	60.8	559.0	2,256	6,714	249	741	1,719	5,118
I-5: Los Angeles	Urban	35.94	36.22	0.28	15.2	159.2	1.7	17.7	23.4	244.6	431	1,458	48	162	661	2,239
I-5: Los Angeles	Urban	36.43	36.65	0.22	17.6	184.0	2.1	21.7	29.6	309.5	498	1,685	59	198	837	2,834
I-5: Sacramento	Urban	26.94	29.87	2.93	189.5	1,393.9	15.2	111.7	111.2	817.6	5,358	12,762	429	1,023	3,143	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	13.2	121.6	1.1	9.7	7.8	71.3	374	1,113	30	89	219	653
I-5: Los Angeles	Rural	52.33	54.16	1.83	119.0	823.5	14.5	100.2	104.5	723.3	3,363	7,540	409	917	2,954	6,622
I-5: Sacramento	Rural	0	14.46	14.46	650.7	1,525.1	414.8	957.3	1,103.5	2,546.5	18,398	13,963	11,729	8,765	31,200	23,314
I-5: San Joaquin	Urban	28.34	28.56	0.22	23.8	57.9	1.9	5.5	21.8	62.9	672	530	54	50	618	576
I-5: Sacramento	Urban	19.16	22	2.84	143.1	799.3	24.6	137.4	349.1	1,949.7	4,047	7,318	696	1,258	9,872	17,851
I-5: Los Angeles	Urban	40.27	41.6	1.33	44.0	404.9	13.7	125.6	222.4	2,121.2	1,245	3,707	386	1,150	6,288	19,421
I-5: San Joaquin	Rural	11.8	12.69	0.89	97.2	212.8	15.9	34.7	81.3	178.0	2,748	1,948	449	318	2,299	1,630
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,087.8	2,381.7	121.5	265.9	966.4	2,115.7	30,758	21,805	3,434	2,435	27,324	19,371
I-5: Sacramento	Urban	23.1	24.51	1.41	60.1	491.4	10.7	87.9	154.8	1,266.5	1,698	4,499	304	804	4,377	11,596
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,093.9	2,817.0	88.2	227.1	1,005.7	2,589.9	30,929	25,791	2,494	2,079	28,435	23,712
I-5: Sacramento	Urban	14.46	16.7	2.24	75.3	420.3	11.9	66.7	163.7	914.0	2,128	3,848	338	611	4,628	8,368
I-5: San Joaquin	Urban	24.8	28.34	3.54	424.8	1,222.9	47.4	136.5	377.4	1,086.4	12,011	11,196	1,341	1,250	10,670	9,946
I-5: Sacramento	Urban	16.7	18.82	2.12	89.0	497.2	14.1	78.9	193.6	1,081.3	2,518	4,552	399	722	5,475	9,900
I-5: San Joaquin	Rural	40.45	49.79	9.34	412.5	1,004.7	129.8	316.1	578.6	1,409.3	11,662	9,199	3,669	2,894	16,359	12,903
I-5: Los Angeles	Urban	39.81	40.27	0.46	15.9	146.1	2.6	24.1	35.3	324.4	449	1,338	74	221	998	2,970
I-5: Sacramento	Urban	18.82	19.16	0.34	15.4	86.1	2.9	15.9	41.7	232.9	436	789	81	146	1,179	2,132
I-5: San Joaquin	Rural	12.69	14.34	1.65	214.5	469.6	30.2	66.1	295.9	647.7	6,065	4,300	853	605	8,365	5,930
I-5: Los Angeles	Rural	54.16	59.95	5.79	370.6	1,496.5	45.1	182.0	325.5	1,314.5	10,477	13,701	1,274	1,667	9,203	12,035
I-5: Los Angeles	Urban	39.36	39.81	0.45	14.4	150.5	2.5	25.7	33.5	350.7	407	1,378	70	235	948	3,210
TOTAL					**6,783.3**	**31,536.2**	**1,191.0**	**4,693.8**	**8,134.6**	**41,034.1**	**191,794**	**288,730**	**33,676**	**42,974**	**230,001**	**375,688**
I-5: Los Angeles	Rural	86.67	88.61	1.94	220.0	457.5	37.2	77.4	109.5	227.7	6,220	4,189	1,052	708	3,095	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	61.2	127.4	10.4	21.5	30.5	63.4	1,731	1,166	293	197	862	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	155.4	323.1	26.3	54.6	77.3	160.8	4,393	2,958	743	500	2,186	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	717.8	1,492.9	121.4	252.4	357.2	742.9	20,296	13,668	3,431	2,311	10,099	6,801
I-5: Kern	Rural	15.86	87.03	71.17	3,508.7	6,607.9	713.3	1,343.4	2,795.3	5,264.4	99,206	60,498	20,169	12,300	79,036	48,199
I-5: Los Angeles	Rural	68.1	69.65	1.55	123.7	405.6	20.9	68.6	61.5	201.8	3,497	3,714	591	628	1,740	1,848
I-5: Los Angeles	Rural	69.65	78.43	8.78	663.8	2,326.0	112.2	393.2	330.3	1,157.4	18,768	21,296	3,173	3,600	9,339	10,597
I-5: Los Angeles	Rural	65.43	68.1	2.67	201.9	707.3	34.1	119.6	100.4	352.0	5,707	6,476	965	1,095	2,840	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	414.3	1,451.8	70.0	245.4	206.2	722.4	11,714	13,292	1,980	2,247	5,829	6,614
I-5: Fresno	Rural	0	66.16	66.16	2,977.2	5,343.7	1,074.9	1,929.2	1,902.3	3,414.4	84,179	48,924	30,391	17,663	53,787	31,261
I-5: Kings	Rural	0	26.72	26.72	1,202.4	2,158.2	416.4	747.4	786.0	1,410.7	33,997	19,759	11,774	6,843	22,223	12,916
I-5: Kern	Rural	7.04	9.28	2.24	241.9	434.2	44.1	79.2	117.1	210.2	6,840	3,975	1,248	725	3,312	1,925
I-5: Merced	Rural	0	32.45	32.45	1,129.3	2,126.7	439.5	827.7	1,254.4	2,362.4	31,929	19,471	12,426	7,578	35,468	21,629
I-5: Kern	Rural	15.08	15.86	0.78	65.5	129.6	14.3	28.4	51.2	101.2	1,853	1,187	406	260	1,447	927
I-5: Kern	Rural	10.35	15.08	4.73	476.8	943.1	87.0	172.1	230.9	456.6	13,481	8,634	2,460	1,576	6,527	4,181
I-5: Kern	Rural	9.28	10.35	1.07	107.9	213.3	19.7	38.9	52.2	103.3	3,050	1,953	556	356	1,477	946
I-5: Kern	Rural	6.41	7.04	0.63	63.5	125.6	11.6	22.9	30.7	60.8	1,796	1,150	328	210	869	557
I-5: Kern	Rural	5.36	6.41	1.05	105.8	209.4	19.3	38.2	51.2	101.4	2,993	1,917	546	350	1,449	928
I-5: Kern	Rural	0.58	5.36	4.78	481.8	953.1	87.9	173.9	233.3	461.5	13,623	8,726	2,486	1,592	6,596	4,225
I-5: Kern	Rural	0	0.58	0.58	58.5	115.6	10.7	21.1	28.3	56.0	1,653	1,059	302	193	800	513
I-5: Stanislaus	Rural	0	28.06	28.06	628.5	1,243.3	244.6	483.8	698.2	1,381.1	17,772	11,383	6,916	4,430	19,741	12,644
I-5: San Joaquin	Rural	0	11.8	11.8	184.1	403.0	49.3	107.9	380.2	832.5	5,205	3,690	1,393	988	10,751	7,622
TOTAL					**13,789.9**	**28,298.3**	**3,665.1**	**7,247.0**	**9,884.4**	**19,845.0**	**389,901**	**259,086**	**103,629**	**66,350**	**279,475**	**181,692**

TABLE X2a. VEHICLE OPERATING COSTS - DEDICATED LANE - BASED ON VOLUME

County	City/Suburban/Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction	Nighttime Off-Peak Other Vehicle-Miles of Travel, One Direction	Daytime Off-Peak Other Vehicle-Miles of Travel, One Direction	Vehicle Operating Cost ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Los Angeles	Urban	36.22	36.43	0.21	144	18	258	254	31	456
I-5: Los Angeles	Urban	20.58	21.41	0.83	911	74	675	1,608	131	1,192
I-5: Sacramento	Urban	22	23.1	1.1	154	26	370	272	46	653
I-5: Los Angeles	Urban	22.28	22.78	0.5	365	42	593	645	74	1,046
I-5: Los Angeles	Urban	46.6	46.9	0.3	522	53	325	923	94	573
I-5: Sacramento	Urban	25.53	26.69	1.16	169	28	384	298	49	677
I-5: Los Angeles	Urban	47.13	52.33	5.2	8,944	949	5,707	15,795	1,676	10,079
I-5: Los Angeles	Urban	46.9	47.13	0.23	396	41	254	699	72	448
I-5: Los Angeles	Urban	43.9	44.01	0.11	146	22	162	258	39	286
I-5: Los Angeles	Urban	13.78	14.16	0.38	299	21	440	528	37	776
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	11,997	924	7,699	21,187	1,632	13,596
CA 710: LA	Suburban	4.96	10.18	5.22	3,579	234	1,407	6,321	413	2,484
I-5: Los Angeles	Urban	28.25	29.16	0.91	732	77	1,012	1,292	135	1,787
I-5: Los Angeles	Urban	36.65	39.36	2.71	2,048	228	3,145	3,616	402	5,553
I-5: Los Angeles	Urban	17.21	20.58	3.37	3,595	302	2,843	6,348	533	5,021
I-5: Los Angeles	Urban	14.16	16.9	2.74	2,023	153	3,304	3,573	270	5,834
I-5: Los Angeles	Urban	21.41	22.28	0.87	999	78	663	1,764	138	1,172
I-5: Los Angeles	Urban	16.9	17.21	0.31	245	17	358	432	31	632
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	3,805	250	1,525	6,719	442	2,694
TOTAL					**41,072**	**3,536**	**31,122**	**72,534**	**6,245**	**54,961**
I-5: Los Angeles	Urban	41.6	43.9	2.3	2,185	305	2,110	3,859	538	3,727
I-5: Los Angeles	Urban	22.78	28.25	5.47	3,997	460	6,483	7,059	812	11,449
I-5: Los Angeles	Urban	44.01	45.1	1.09	1,553	193	1,525	2,742	340	2,693
I-5: Sacramento	Urban	24.51	25.53	1.02	153	24	333	270	43	588
I-5: Sacramento	Rural	29.87	34.65	4.78	1,255	115	1,020	2,216	203	1,802
I-5: Los Angeles	Urban	29.16	35.94	6.78	5,424	570	7,566	9,579	1,007	13,362
I-5: Los Angeles	Urban	45.93	46.6	0.67	1,167	118	725	2,060	209	1,280
I-5: Los Angeles	Urban	45.1	45.93	0.83	1,330	147	1,014	2,348	259	1,790
I-5: Los Angeles	Urban	35.94	36.22	0.28	212	24	325	374	42	574
I-5: Los Angeles	Urban	36.43	36.65	0.22	157	18	264	278	33	467
I-5: Sacramento	Urban	26.94	29.87	2.93	879	70	516	1,552	124	910
I-5: Sacramento	Urban	26.69	26.94	0.25	75	6	44	132	11	78
I-5: Los Angeles	Rural	52.33	54.16	1.83	2,745	334	2,411	4,848	590	4,258
I-5: Sacramento	Rural	0	14.46	14.46	2,169	1,383	3,678	3,830	2,442	6,496
I-5: San Joaquin	Urban	28.34	28.56	0.22	55	4	51	97	8	89
I-5: Sacramento	Urban	19.16	22	2.84	393	68	959	694	119	1,694
I-5: Los Angeles	Urban	40.27	41.6	1.33	418	130	2,112	739	229	3,730
I-5: San Joaquin	Rural	11.8	12.69	0.89	334	55	279	589	96	493
I-5: San Joaquin	Rural	14.34	24.8	10.46	2,615	292	2,323	4,618	516	4,102
I-5: Sacramento	Urban	23.1	24.51	1.41	188	34	484	331	59	854
I-5: San Joaquin	Rural	28.56	40.45	11.89	2,973	240	2,733	5,249	423	4,826
I-5: Sacramento	Urban	14.46	16.7	2.24	336	53	731	593	94	1,290
I-5: San Joaquin	Urban	24.8	28.34	3.54	885	99	786	1,563	175	1,388
I-5: Sacramento	Urban	16.7	18.82	2.12	318	50	692	562	89	1,221
I-5: San Joaquin	Rural	40.45	49.79	9.34	1,719	541	2,411	3,035	955	4,257
I-5: Los Angeles	Urban	39.81	40.27	0.46	272	45	603	480	79	1,066
I-5: Sacramento	Urban	18.82	19.16	0.34	44	8	118	77	14	209
I-5: San Joaquin	Rural	12.69	14.34	1.65	491	69	677	867	122	1,196
I-5: Los Angeles	Rural	54.16	59.95	5.79	8,685	1,056	7,629	15,338	1,866	13,472
I-5: Los Angeles	Urban	39.36	39.81	0.45	257	44	599	454	78	1,058
TOTAL					**43,281**	**6,554**	**51,199**	**76,435**	**11,575**	**90,419**
I-5: Los Angeles	Rural	86.67	88.61	1.94	3,492	590	1,738	6,167	1,043	3,069
I-5: Los Angeles	Rural	86.13	86.67	0.54	972	164	484	1,717	290	854
I-5: Los Angeles	Rural	84.76	86.13	1.37	2,466	417	1,227	4,355	736	2,167
I-5: Los Angeles	Rural	78.43	84.76	6.33	11,394	1,926	5,670	20,122	3,402	10,013
I-5: Kern	Rural	15.86	87.03	71.17	71,170	14,469	56,701	125,687	25,553	100,134
I-5: Los Angeles	Rural	68.1	69.65	1.55	2,790	472	1,388	4,927	833	2,452
I-5: Los Angeles	Rural	69.65	78.43	8.78	15,804	2,672	7,864	27,910	4,718	13,888
I-5: Los Angeles	Rural	65.43	68.1	2.67	4,806	813	2,391	8,487	1,435	4,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	9,864	1,668	4,908	17,420	2,945	8,668
I-5: Fresno	Rural	0	66.16	66.16	66,160	23,886	42,274	116,839	42,183	74,657
I-5: Kings	Rural	0	26.72	26.72	26,720	9,254	17,466	47,188	16,342	30,845
I-5: Kern	Rural	7.04	9.28	2.24	4,032	736	1,952	7,121	1,299	3,448
I-5: Merced	Rural	0	32.45	32.45	22,715	8,840	25,232	40,115	15,612	44,561
I-5: Kern	Rural	15.08	15.86	0.78	780	171	609	1,377	302	1,076
I-5: Kern	Rural	10.35	15.08	4.73	8,514	1,554	4,122	15,036	2,744	7,280
I-5: Kern	Rural	9.28	10.35	1.07	1,926	351	933	3,401	621	1,647
I-5: Kern	Rural	6.41	7.04	0.63	1,134	207	549	2,003	365	970
I-5: Kern	Rural	5.36	6.41	1.05	1,890	345	915	3,338	609	1,616
I-5: Kern	Rural	0.58	5.36	4.78	8,604	1,570	4,166	15,195	2,773	7,357
I-5: Kern	Rural	0	0.58	0.58	1,044	190	506	1,844	336	893
I-5: Stanislaus	Rural	0	28.06	28.06	19,642	7,644	21,819	34,688	13,500	38,532
I-5: San Joaquin	Rural	0	11.8	11.8	2,655	711	5,484	4,689	1,255	9,685
TOTAL					**288,574**	**78,649**	**208,399**	**509,625**	**138,895**	**368,035**

TABLE X2b. TRAVEL TIME COST - DEDICATED LANE - BASE VOLUME - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction	Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction	Daytime Off-Peak Other Vehicle-Hours of Travel, One Direction	Travel Time Cost ($)		
		Begin	End	Length (mi)				Peak Truck	Nighttime Off-Peak Truck	Daytime Off-Peak Truck
I-5: Los Angeles	Urban	36.22	36.43	0.21	2.9	0.4	5.2	81	10	146
I-5: Los Angeles	Urban	20.58	21.41	0.83	18.2	1.5	13.5	515	42	382
I-5: Sacramento	Urban	22	23.1	1.1	3.1	0.5	7.4	87	15	209
I-5: Los Angeles	Urban	22.28	22.78	0.5	7.3	0.8	11.9	207	24	335
I-5: Los Angeles	Urban	46.6	46.9	0.3	10.4	1.1	6.5	295	30	184
I-5: Sacramento	Urban	25.53	26.69	1.16	3.4	0.6	7.7	95	16	217
I-5: Los Angeles	Urban	47.13	52.33	5.2	178.9	19.0	114.1	5,058	537	3,227
I-5: Los Angeles	Urban	46.9	47.13	0.23	7.9	0.8	5.1	224	23	143
I-5: Los Angeles	Urban	43.9	44.01	0.11	2.9	0.4	3.2	83	12	91
I-5: Los Angeles	Urban	13.78	14.16	0.38	6.0	0.4	8.8	169	12	249
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	239.9	18.5	154.0	6,784	522	4,354
CA 710: LA	Suburban	4.96	10.18	5.22	71.6	4.7	28.1	2,024	132	795
I-5: Los Angeles	Urban	28.25	29.16	0.91	14.6	1.5	20.2	414	43	572
I-5: Los Angeles	Urban	36.65	39.36	2.71	41.0	4.6	62.9	1,158	129	1,778
I-5: Los Angeles	Urban	17.21	20.58	3.37	71.9	6.0	56.9	2,033	171	1,608
I-5: Los Angeles	Urban	14.16	16.9	2.74	40.5	3.1	66.1	1,144	87	1,868
I-5: Los Angeles	Urban	21.41	22.28	0.87	20.0	1.6	13.3	565	44	375
I-5: Los Angeles	Urban	16.9	17.21	0.31	4.9	0.3	7.2	138	10	202
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	76.1	5.0	30.5	2,151	141	863
TOTAL					**821.4**	**70.7**	**622.4**	**23,226**	**2,000**	**17,599**
I-5: Los Angeles	Urban	41.6	43.9	2.3	43.7	6.1	42.2	1,236	172	1,193
I-5: Los Angeles	Urban	22.78	28.25	5.47	79.9	9.2	129.7	2,260	260	3,666
I-5: Los Angeles	Urban	44.01	45.1	1.09	31.1	3.9	30.5	878	109	862
I-5: Sacramento	Urban	24.51	25.53	1.02	3.1	0.5	6.7	87	14	188
I-5: Sacramento	Rural	29.87	34.65	4.78	25.1	2.3	20.4	710	65	577
I-5: Los Angeles	Urban	29.16	35.94	6.78	108.5	11.4	151.3	3,067	322	4,278
I-5: Los Angeles	Urban	45.93	46.6	0.67	23.3	2.4	14.5	660	67	410
I-5: Los Angeles	Urban	45.1	45.93	0.83	26.6	2.9	20.3	752	83	573
I-5: Los Angeles	Urban	35.94	36.22	0.28	4.2	0.5	6.5	120	13	184
I-5: Los Angeles	Urban	36.43	36.65	0.22	3.1	0.4	5.3	89	10	149
I-5: Sacramento	Urban	26.94	29.87	2.93	17.6	1.4	10.3	497	40	292
I-5: Sacramento	Urban	26.69	26.94	0.25	1.5	0.1	0.9	42	3	25
I-5: Los Angeles	Rural	52.33	54.16	1.83	54.9	6.7	48.2	1,552	189	1,363
I-5: Sacramento	Rural	0	14.46	14.46	43.4	27.7	73.6	1,227	782	2,080
I-5: San Joaquin	Urban	28.34	28.56	0.22	1.1	0.1	1.0	31	3	29
I-5: Sacramento	Urban	19.16	22	2.84	7.9	1.4	19.2	222	38	542
I-5: Los Angeles	Urban	40.27	41.6	1.33	8.4	2.6	42.2	237	73	1,194
I-5: San Joaquin	Rural	11.8	12.69	0.89	6.7	1.1	5.6	189	31	158
I-5: San Joaquin	Rural	14.34	24.8	10.46	52.3	5.8	46.5	1,479	165	1,314
I-5: Sacramento	Urban	23.1	24.51	1.41	3.8	0.7	9.7	106	19	274
I-5: San Joaquin	Rural	28.56	40.45	11.89	59.5	4.8	54.7	1,681	136	1,545
I-5: Sacramento	Urban	14.46	16.7	2.24	6.7	1.1	14.6	190	30	413
I-5: San Joaquin	Urban	24.8	28.34	3.54	17.7	2.0	15.7	500	56	445
I-5: Sacramento	Urban	16.7	18.82	2.12	6.4	1.0	13.8	180	29	391
I-5: San Joaquin	Rural	40.45	49.79	9.34	34.4	10.8	48.2	972	306	1,363
I-5: Los Angeles	Urban	39.81	40.27	0.46	5.4	0.9	12.1	154	25	341
I-5: Sacramento	Urban	18.82	19.16	0.34	0.9	0.2	2.4	25	5	67
I-5: San Joaquin	Rural	12.69	14.34	1.65	9.8	1.4	13.5	278	39	383
I-5: Los Angeles	Rural	54.16	59.95	5.79	173.7	21.1	152.6	4,911	597	4,314
I-5: Los Angeles	Urban	39.36	39.81	0.45	5.1	0.9	12.0	145	25	339
TOTAL					**865.6**	**131.1**	**1,024.0**	**24,475**	**3,706**	**28,953**
I-5: Los Angeles	Rural	86.67	88.61	1.94	69.8	11.8	34.8	1,975	334	983
I-5: Los Angeles	Rural	86.13	86.67	0.54	19.4	3.3	9.7	550	93	274
I-5: Los Angeles	Rural	84.76	86.13	1.37	49.3	8.3	24.5	1,394	236	694
I-5: Los Angeles	Rural	78.43	84.76	6.33	227.9	38.5	113.4	6,443	1,089	3,206
I-5: Kern	Rural	15.86	87.03	71.17	1,423.4	289.4	1,134.0	40,246	8,182	32,063
I-5: Los Angeles	Rural	68.1	69.65	1.55	55.8	9.4	27.8	1,578	267	785
I-5: Los Angeles	Rural	69.65	78.43	8.78	316.1	53.4	157.3	8,937	1,511	4,447
I-5: Los Angeles	Rural	65.43	68.1	2.67	96.1	16.3	47.8	2,718	459	1,352
I-5: Los Angeles	Rural	59.95	65.43	5.48	197.3	33.4	98.2	5,578	943	2,776
I-5: Fresno	Rural	0	66.16	66.16	1,323.2	477.7	845.5	37,413	13,507	23,906
I-5: Kings	Rural	0	26.72	26.72	534.4	185.1	349.3	15,110	5,233	9,877
I-5: Kern	Rural	7.04	9.28	2.24	80.6	14.7	39.0	2,280	416	1,104
I-5: Merced	Rural	0	32.45	32.45	454.3	176.8	504.6	12,845	4,999	14,269
I-5: Kern	Rural	15.08	15.86	0.78	15.6	3.4	12.2	441	97	345
I-5: Kern	Rural	10.35	15.08	4.73	170.3	31.1	82.4	4,815	878	2,331
I-5: Kern	Rural	9.28	10.35	1.07	38.5	7.0	18.7	1,089	199	527
I-5: Kern	Rural	6.41	7.04	0.63	22.7	4.1	11.0	641	117	310
I-5: Kern	Rural	5.36	6.41	1.05	37.8	6.9	18.3	1,069	195	517
I-5: Kern	Rural	0.58	5.36	4.78	172.1	31.4	83.3	4,865	888	2,356
I-5: Kern	Rural	0	0.58	0.58	20.9	3.8	10.1	590	108	286
I-5: Stanislaus	Rural	0	28.06	28.06	392.8	152.9	436.4	11,107	4,323	12,338
I-5: San Joaquin	Rural	0	11.8	11.8	53.1	14.2	109.7	1,501	402	3,101
TOTAL					**5,771.5**	**1,573.0**	**4,168.0**	**163,185**	**44,475**	**117,847**

TABLE X3a. VEHICLE OPERATING COSTS - REMAINING CONVENTIONAL LANES - DEDICATED LANE CASE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Miles of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Miles of Travel, One Direction		Daytime Off-Peak Period Vehicle-Miles of Travel, One Direction		Vehicle Operating Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	662	9,274	81	1,137	1,188	16,637	1,170	3,014	143	370	2,099	5,407
I-5: Los Angeles	Urban	20.58	21.41	0.83	4,189	58,644	342	4,790	3,105	43,469	7,398	19,059	604	1,557	5,483	14,127
I-5: Sacramento	Urban	22	23.1	1.1	2,387	20,559	406	3,495	5,732	49,371	4,215	6,682	717	1,136	10,123	16,046
I-5: Los Angeles	Urban	22.28	22.78	0.5	1,297	22,088	149	2,541	2,104	35,821	2,291	7,178	264	826	3,715	11,642
I-5: Los Angeles	Urban	46.6	46.9	0.3	919	14,578	93	1,481	571	9,057	1,624	4,738	165	481	1,009	2,944
I-5: Sacramento	Urban	25.53	26.69	1.16	2,772	19,679	453	3,219	6,298	44,718	4,895	6,396	801	1,046	11,123	14,533
I-5: Los Angeles	Urban	47.13	52.33	5.2	17,888	241,488	1,898	25,618	11,414	154,094	31,590	78,484	3,351	8,326	20,158	50,081
I-5: Los Angeles	Urban	46.9	47.13	0.23	791	10,681	81	1,098	507	6,851	1,397	3,471	144	357	896	2,226
I-5: Los Angeles	Urban	43.9	44.01	0.11	302	5,161	45	771	334	5,706	534	1,677	80	251	590	1,854
I-5: Los Angeles	Urban	13.78	14.16	0.38	1,233	17,620	87	1,249	1,811	25,880	2,177	5,726	154	406	3,198	8,411
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	86,979	560,864	6,699	43,196	55,817	359,925	153,606	182,281	11,830	14,039	98,574	116,976
CA 710: LA	Suburban	4.96	10.18	5.22	34,005	212,976	2,222	13,917	13,363	83,697	60,052	69,217	3,924	4,523	23,600	27,201
I-5: Los Angeles	Urban	28.25	29.16	0.91	2,253	34,325	236	3,590	3,117	47,479	3,979	11,156	416	1,167	5,504	15,431
I-5: Los Angeles	Urban	36.65	39.36	2.71	9,009	127,153	1,002	14,149	13,836	195,280	15,910	41,325	1,770	4,598	24,435	63,466
I-5: Los Angeles	Urban	17.21	20.58	3.37	13,660	198,426	1,148	16,671	10,805	156,951	24,123	64,488	2,027	5,418	19,081	51,009
I-5: Los Angeles	Urban	14.16	16.9	2.74	8,498	120,998	643	9,149	13,875	197,556	15,008	39,324	1,135	2,973	24,504	64,206
I-5: Los Angeles	Urban	21.41	22.28	0.87	4,514	63,392	352	4,949	2,999	42,114	7,971	20,602	622	1,609	5,296	13,687
I-5: Los Angeles	Urban	16.9	17.21	0.31	931	13,518	66	956	1,360	19,750	1,643	4,394	116	311	2,401	6,419
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	19,631	143,964	1,290	9,461	7,871	57,722	34,669	46,788	2,278	3,075	13,901	18,760
TOTAL					**211,921**	**1,895,389**	**17,294**	**161,438**	**156,109**	**1,552,079**	**374,255**	**616,001**	**30,542**	**52,467**	**275,690**	**504,426**
I-5: Los Angeles	Urban	41.6	43.9	2.3	8,303	120,612	1,158	16,821	8,019	116,487	14,663	39,199	2,045	5,467	14,162	37,858
I-5: Los Angeles	Urban	22.78	28.25	5.47	14,190	241,637	1,633	27,800	23,014	391,886	25,060	78,532	2,883	9,035	40,643	127,363
I-5: Los Angeles	Urban	44.01	45.1	1.09	4,399	53,563	546	6,650	4,320	52,602	7,768	17,408	965	2,161	7,629	17,096
I-5: Sacramento	Urban	24.51	25.53	1.02	1,857	20,328	295	3,225	4,039	44,206	3,280	6,606	520	1,048	7,133	14,367
I-5: Sacramento	Rural	29.87	34.65	4.78	14,806	84,319	1,356	7,722	12,040	68,567	26,148	27,404	2,395	2,510	21,263	22,284
I-5: Los Angeles	Urban	29.16	35.94	6.78	14,102	224,554	1,482	23,599	19,672	313,231	24,905	72,980	2,617	7,670	34,740	101,800
I-5: Los Angeles	Urban	45.93	46.6	0.67	2,411	32,200	245	3,270	1,498	20,006	4,258	10,465	432	1,063	2,645	6,502
I-5: Los Angeles	Urban	45.1	45.93	0.83	2,659	40,333	294	4,452	2,027	30,745	4,696	13,108	518	1,447	3,580	9,992
I-5: Los Angeles	Urban	35.94	36.22	0.28	550	8,758	61	975	845	13,451	971	2,846	108	317	1,492	4,372
I-5: Los Angeles	Urban	36.43	36.65	0.22	723	10,120	85	1,191	1,216	17,025	1,277	3,289	150	387	2,148	5,533
I-5: Sacramento	Urban	26.94	29.87	2.93	8,597	76,666	689	6,143	5,042	44,968	15,182	24,917	1,217	1,997	8,905	14,614
I-5: Sacramento	Urban	26.69	26.94	0.25	587	6,689	47	536	344	3,923	1,036	2,174	83	174	608	1,275
I-5: Los Angeles	Rural	52.33	54.16	1.83	3,203	53,528	390	6,511	2,813	47,016	5,656	17,396	688	2,116	4,968	15,280
I-5: Sacramento	Rural	0	14.46	14.46	30,366	97,605	19,359	62,226	51,495	165,519	53,627	31,722	34,188	20,223	90,941	53,794
I-5: San Joaquin	Urban	28.34	28.56	0.22	1,133	3,762	91	303	1,042	3,459	2,001	1,223	161	99	1,840	1,124
I-5: Sacramento	Urban	19.16	22	2.84	6,764	43,963	1,163	7,557	16,498	107,236	11,945	14,288	2,053	2,456	29,135	34,852
I-5: Los Angeles	Urban	40.27	41.6	1.33	1,784	22,270	554	6,910	9,007	112,425	3,151	7,238	978	2,246	15,907	36,538
I-5: San Joaquin	Rural	11.8	12.69	0.89	4,526	13,831	739	2,259	3,787	11,572	7,992	4,495	1,305	734	6,687	3,761
I-5: San Joaquin	Rural	14.34	24.8	10.46	51,777	154,808	5,781	17,284	45,996	137,524	91,439	50,313	10,209	5,617	81,229	44,695
I-5: Sacramento	Urban	23.1	24.51	1.41	2,816	27,030	503	4,833	7,256	69,658	4,972	8,785	889	1,571	12,814	22,639
I-5: San Joaquin	Rural	28.56	40.45	11.89	51,722	183,106	4,170	14,763	47,551	168,343	91,341	59,509	7,364	4,798	83,976	54,711
I-5: Sacramento	Urban	14.46	16.7	2.24	3,427	23,117	544	3,668	7,453	50,271	6,052	7,513	960	1,192	13,162	16,338
I-5: San Joaquin	Urban	24.8	28.34	3.54	20,355	67,260	2,273	7,510	18,082	59,750	35,947	21,860	4,014	2,441	31,934	19,419
I-5: Sacramento	Urban	16.7	18.82	2.12	4,134	27,348	656	4,339	8,990	59,473	7,301	8,888	1,158	1,410	15,877	19,329
I-5: San Joaquin	Rural	40.45	49.79	9.34	18,904	65,305	5,948	20,547	26,518	91,607	33,385	21,224	10,504	6,678	46,831	29,772
I-5: Los Angeles	Urban	39.81	40.27	0.46	523	8,037	86	1,328	1,161	17,844	924	2,612	153	432	2,051	5,799
I-5: Sacramento	Urban	18.82	19.16	0.34	727	4,737	135	877	1,967	12,807	1,285	1,539	238	285	3,473	4,162
I-5: San Joaquin	Rural	12.69	14.34	1.65	10,234	30,525	1,440	4,294	14,116	42,104	18,073	9,921	2,543	1,396	24,929	13,684
I-5: Los Angeles	Rural	54.16	59.95	5.79	9,843	97,272	1,197	11,832	8,646	85,440	17,383	31,613	2,114	3,846	15,268	27,768
I-5: Los Angeles	Urban	39.36	39.81	0.45	463	8,280	79	1,414	1,078	19,286	817	2,691	140	460	1,904	6,268
TOTAL					**295,884**	**1,851,561**	**52,997**	**280,841**	**355,532**	**2,378,430**	**522,535**	**601,757**	**93,594**	**91,273**	**627,873**	**772,990**
I-5: Los Angeles	Rural	86.67	88.61	1.94	7,508	29,740	1,269	5,028	3,736	14,799	13,259	9,666	2,242	1,634	6,598	4,810
I-5: Los Angeles	Rural	86.13	86.67	0.54	2,090	8,278	353	1,400	1,040	4,119	3,691	2,690	624	455	1,836	1,339
I-5: Los Angeles	Rural	84.76	86.13	1.37	5,302	21,002	896	3,551	2,638	10,451	9,363	6,826	1,583	1,154	4,659	3,397
I-5: Los Angeles	Rural	78.43	84.76	6.33	24,497	97,039	4,141	16,405	12,190	48,287	43,262	31,538	7,314	5,332	21,528	15,693
I-5: Kern	Rural	15.86	87.03	71.17	104,264	429,511	21,198	87,323	83,066	342,188	184,131	139,591	37,435	28,380	146,696	111,211
I-5: Los Angeles	Rural	68.1	69.65	1.55	3,395	26,366	574	4,457	1,689	13,120	5,995	8,569	1,013	1,449	2,983	4,264
I-5: Los Angeles	Rural	69.65	78.43	8.78	17,384	151,192	2,939	25,560	8,651	75,234	30,701	49,137	5,190	8,307	15,277	24,451
I-5: Los Angeles	Rural	65.43	68.1	2.67	5,287	45,977	894	7,773	2,631	22,879	9,336	14,943	1,578	2,526	4,646	7,436
I-5: Los Angeles	Rural	59.95	65.43	5.48	10,850	94,366	1,834	15,953	5,399	46,957	19,162	30,669	3,240	5,185	9,535	15,261
I-5: Fresno	Rural	0	66.16	66.16	82,700	347,340	29,857	125,401	52,843	221,939	146,049	112,886	52,728	40,755	93,321	72,130
I-5: Kings	Rural	0	26.72	26.72	33,400	140,280	11,567	48,583	21,833	91,697	58,985	45,591	20,428	15,789	38,557	29,802
I-5: Kern	Rural	7.04	9.28	2.24	8,064	28,224	1,471	5,150	3,905	13,666	14,241	9,173	2,599	1,674	6,896	4,441
I-5: Merced	Rural	0	32.45	32.45	33,748	138,237	13,134	53,798	37,488	153,558	59,599	44,927	23,194	17,484	66,205	49,906
I-5: Kern	Rural	15.08	15.86	0.78	2,496	8,424	547	1,845	1,949	6,579	4,408	2,738	965	599	3,443	2,138
I-5: Kern	Rural	10.35	15.08	4.73	15,325	61,301	2,796	11,185	7,420	29,682	27,064	19,923	4,938	3,635	13,105	9,647
I-5: Kern	Rural	9.28	10.35	1.07	3,467	13,867	633	2,530	1,679	6,714	6,122	4,507	1,117	822	2,964	2,182
I-5: Kern	Rural	6.41	7.04	0.63	2,041	8,165	372	1,490	988	3,953	3,605	2,654	658	484	1,745	1,285
I-5: Kern	Rural	5.36	6.41	1.05	3,402	13,608	621	2,483	1,647	6,589	6,008	4,423	1,096	807	2,909	2,141
I-5: Kern	Rural	0.58	5.36	4.78	15,487	61,949	2,826	11,304	7,499	29,996	27,351	20,133	4,991	3,674	13,243	9,749
I-5: Kern	Rural	0	0.58	0.58	1,879	7,517	343	1,372	910	3,640	3,319	2,443	606	446	1,607	1,183
I-5: Stanislaus	Rural	0	28.06	28.06	11,785	80,813	4,586	31,450	13,091	89,769	20,813	26,264	8,100	10,221	23,119	29,175
I-5: San Joaquin	Rural	0	11.8	11.8	6,549	26,196	1,753	7,013	13,528	54,111	11,566	8,514	3,096	2,279	23,890	17,586
TOTAL					**400,920**	**1,839,391**	**104,606**	**471,053**	**285,820**	**1,289,927**	**708,030**	**597,802**	**184,735**	**153,092**	**504,762**	**419,226**

TABLE X3b. TRAVEL TIME COST - REMAINING CONVENTIONAL LANES - DEDICATED LANE CASE - BASED ON VOLUME

County	City/Suburban/ Rural	Post Mile of Segment			Peak Period Vehicle-Hours of Travel, One Direction		Nighttime Off-Peak Period Vehicle-Hours of Travel, One Direction		Daytime Off-Peak Period Vehicle-Hours of Travel, One Direction		Travel Time Costs ($)					
											Peak		Nighttime Off-Peak		Daytime Off-Peak	
		Begin	End	Length (mi)	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.	Truck	Other Veh.
I-5: Los Angeles	Urban	36.22	36.43	0.21	13.2	231.8	1.6	20.7	23.8	302.5	375	2,123	46	189	672	2,770
I-5: Los Angeles	Urban	20.58	21.41	0.83	83.8	1,303.2	6.8	87.1	62.1	790.3	2,369	11,932	193	797	1,756	7,236
I-5: Sacramento	Urban	22	23.1	1.1	47.7	467.3	8.1	63.5	114.6	897.7	1,350	4,278	229	582	3,241	8,218
I-5: Los Angeles	Urban	22.28	22.78	0.5	25.9	490.8	3.0	46.2	42.1	651.3	734	4,494	84	423	1,190	5,963
I-5: Los Angeles	Urban	46.6	46.9	0.3	18.4	280.3	1.9	26.9	11.4	164.7	520	2,567	53	246	323	1,508
I-5: Sacramento	Urban	25.53	26.69	1.16	55.4	410.0	9.1	58.5	126.0	813.1	1,567	3,754	256	536	3,562	7,444
I-5: Los Angeles	Urban	47.13	52.33	5.2	357.8	4,556.4	38.0	465.8	228.3	2,801.7	10,115	41,716	1,073	4,264	6,455	25,651
I-5: Los Angeles	Urban	46.9	47.13	0.23	15.8	201.5	1.6	20.0	10.1	124.6	447	1,845	46	183	287	1,140
I-5: Los Angeles	Urban	43.9	44.01	0.11	6.0	95.6	0.9	14.0	6.7	103.7	171	875	26	128	189	950
I-5: Los Angeles	Urban	13.78	14.16	0.38	24.7	332.4	1.7	22.7	36.2	470.5	697	3,044	49	208	1,024	4,308
CA 710: Los Angeles	Suburban	12.97	23.28	10.31	1,739.6	9,347.7	134.0	664.6	1,116.3	5,537.3	49,186	85,583	3,788	6,084	31,564	50,697
CA 710: LA	Suburban	4.96	10.18	5.22	680.1	3,736.4	44.4	214.1	267.3	1,287.6	19,229	34,209	1,257	1,960	7,557	11,789
I-5: Los Angeles	Urban	28.25	29.16	0.91	45.1	647.6	4.7	65.3	62.3	863.3	1,274	5,930	133	598	1,762	7,904
I-5: Los Angeles	Urban	36.65	39.36	2.71	180.2	2,399.1	20.0	257.3	276.7	3,550.5	5,095	21,965	567	2,355	7,824	32,507
I-5: Los Angeles	Urban	17.21	20.58	3.37	273.2	3,674.5	23.0	303.1	216.1	2,853.7	7,724	33,642	649	2,775	6,110	26,127
I-5: Los Angeles	Urban	14.16	16.9	2.74	170.0	2,240.7	12.9	166.3	277.5	3,591.9	4,806	20,515	363	1,523	7,846	32,886
I-5: Los Angeles	Urban	21.41	22.28	0.87	90.3	1,173.9	7.0	90.0	60.0	765.7	2,552	10,748	199	824	1,696	7,010
I-5: Los Angeles	Urban	16.9	17.21	0.31	18.6	250.3	1.3	17.4	27.2	359.1	526	2,292	37	159	769	3,288
CA 710: Los Angeles	Suburban	10.18	12.97	2.79	392.6	2,285.1	25.8	145.6	157.4	888.0	11,101	20,922	730	1,333	4,451	8,130
TOTAL					**4,238.4**	**34,125.0**	**345.9**	**2,749.0**	**3,122.2**	**26,817.3**	**119,839**	**312,432**	**9,780**	**25,169**	**88,278**	**245,526**
I-5: Los Angeles	Urban	41.6	43.9	2.3	166.1	2,192.9	23.2	305.8	160.4	2,118.0	4,695	20,078	655	2,800	4,535	19,391
I-5: Los Angeles	Urban	22.78	28.25	5.47	283.8	4,393.4	32.7	505.5	460.3	7,125.2	8,025	40,224	923	4,628	13,014	65,235
I-5: Los Angeles	Urban	44.01	45.1	1.09	88.0	973.9	10.9	120.9	86.4	956.4	2,488	8,916	309	1,107	2,443	8,756
I-5: Sacramento	Urban	24.51	25.53	1.02	37.1	369.6	5.9	58.6	80.8	803.7	1,050	3,384	167	537	2,284	7,359
I-5: Sacramento	Rural	29.87	34.65	4.78	296.1	1,317.5	27.1	118.8	240.8	1,054.9	8,373	12,062	767	1,088	6,809	9,658
I-5: Los Angeles	Urban	29.16	35.94	6.78	282.0	4,082.8	29.6	429.1	393.4	5,695.1	7,975	37,380	838	3,928	11,124	52,142
I-5: Los Angeles	Urban	45.93	46.6	0.67	48.2	585.5	4.9	59.5	30.0	363.7	1,363	5,360	138	544	847	3,330
I-5: Los Angeles	Urban	45.1	45.93	0.83	53.2	733.3	5.9	81.0	40.5	559.0	1,504	6,714	166	741	1,146	5,118
I-5: Los Angeles	Urban	35.94	36.22	0.28	11.0	159.2	1.2	17.7	16.9	244.6	311	1,458	35	162	478	2,239
I-5: Los Angeles	Urban	36.43	36.65	0.22	14.5	184.0	1.7	21.7	24.3	309.5	409	1,685	48	198	688	2,834
I-5: Sacramento	Urban	26.94	29.87	2.93	171.9	1,393.9	13.8	111.7	100.8	817.6	4,861	12,762	390	1,023	2,851	7,485
I-5: Sacramento	Urban	26.69	26.94	0.25	11.7	121.6	0.9	9.7	6.9	71.3	332	1,113	27	89	195	653
I-5: Los Angeles	Rural	52.33	54.16	1.83	64.0	823.5	7.8	100.2	56.3	723.3	1,811	7,540	220	917	1,591	6,622
I-5: Sacramento	Rural	0	14.46	14.46	607.3	1,501.6	387.2	957.3	1,029.9	2,546.5	17,172	13,748	10,947	8,765	29,120	23,314
I-5: San Joaquin	Urban	28.34	28.56	0.22	22.7	68.4	1.8	5.5	20.8	62.9	641	626	52	50	589	576
I-5: Sacramento	Urban	19.16	22	2.84	135.3	799.3	23.3	137.4	330.0	1,949.7	3,825	7,318	657	1,258	9,329	17,851
I-5: Los Angeles	Urban	40.27	41.6	1.33	35.7	404.9	11.1	125.6	180.1	2,121.2	1,009	3,707	313	1,150	5,093	19,421
I-5: San Joaquin	Rural	11.8	12.69	0.89	90.5	212.8	14.8	34.7	75.7	178.0	2,559	1,948	418	318	2,141	1,630
I-5: San Joaquin	Rural	14.34	24.8	10.46	1,035.5	2,381.7	115.6	265.9	919.9	2,115.7	29,279	21,805	3,269	2,435	26,010	19,371
I-5: Sacramento	Urban	23.1	24.51	1.41	56.3	491.4	10.1	87.9	145.1	1,266.5	1,592	4,499	285	804	4,103	11,596
I-5: San Joaquin	Rural	28.56	40.45	11.89	1,034.4	2,817.0	83.4	227.1	951.0	2,589.9	29,248	25,791	2,358	2,079	26,890	23,712
I-5: Sacramento	Urban	14.46	16.7	2.24	68.5	420.3	10.9	66.7	149.1	914.0	1,938	3,848	308	611	4,215	8,368
I-5: San Joaquin	Urban	24.8	28.34	3.54	407.1	1,222.9	45.5	136.5	361.6	1,086.4	11,511	11,196	1,285	1,250	10,225	9,946
I-5: Sacramento	Urban	16.7	18.82	2.12	82.7	497.2	13.1	78.9	179.8	1,081.3	2,338	4,552	371	722	5,084	9,900
I-5: San Joaquin	Rural	40.45	49.79	9.34	378.1	1,004.7	119.0	316.1	530.4	1,409.3	10,690	9,199	3,363	2,894	14,996	12,903
I-5: Los Angeles	Urban	39.81	40.27	0.46	10.5	146.1	1.7	24.1	23.2	324.4	296	1,338	49	221	657	2,970
I-5: Sacramento	Urban	18.82	19.16	0.34	14.5	86.1	2.7	15.9	39.3	232.9	411	789	76	146	1,112	2,132
I-5: San Joaquin	Rural	12.69	14.34	1.65	204.7	469.6	28.8	66.1	282.3	647.7	5,787	4,300	814	605	7,982	5,930
I-5: Los Angeles	Rural	54.16	59.95	5.79	196.9	1,496.5	23.9	182.0	172.9	1,314.5	5,566	13,701	677	1,667	4,889	12,035
I-5: Los Angeles	Urban	39.36	39.81	0.45	9.3	150.5	1.6	25.7	21.6	350.7	262	1,378	45	235	610	3,210
TOTAL					**5,917.7**	**31,502.4**	**1,059.9**	**4,693.8**	**7,110.6**	**41,034.1**	**167,319**	**288,421**	**29,969**	**42,974**	**201,049**	**375,688**
I-5: Los Angeles	Rural	86.67	88.61	1.94	150.2	457.5	25.4	77.4	74.7	227.7	4,246	4,189	718	708	2,113	2,084
I-5: Los Angeles	Rural	86.13	86.67	0.54	41.8	127.4	7.1	21.5	20.8	63.4	1,182	1,166	200	197	588	580
I-5: Los Angeles	Rural	84.76	86.13	1.37	106.0	323.1	17.9	54.6	52.8	160.8	2,998	2,958	507	500	1,492	1,472
I-5: Los Angeles	Rural	78.43	84.76	6.33	489.9	1,492.9	82.8	252.4	243.8	742.9	13,853	13,668	2,342	2,311	6,893	6,801
I-5: Kern	Rural	15.86	87.03	71.17	2,085.3	6,607.9	424.0	1,343.4	1,661.3	5,264.4	58,960	60,498	11,987	12,300	46,973	48,199
I-5: Los Angeles	Rural	68.1	69.65	1.55	67.9	405.6	11.5	68.6	33.8	201.8	1,920	3,714	325	628	955	1,848
I-5: Los Angeles	Rural	69.65	78.43	8.78	347.7	2,326.0	58.8	393.2	173.0	1,157.4	9,831	21,296	1,662	3,600	4,892	10,597
I-5: Los Angeles	Rural	65.43	68.1	2.67	105.7	707.3	17.9	119.6	52.6	352.0	2,990	6,476	505	1,095	1,488	3,223
I-5: Los Angeles	Rural	59.95	65.43	5.48	217.0	1,451.8	36.7	245.4	108.0	722.4	6,136	13,292	1,037	2,247	3,053	6,614
I-5: Fresno	Rural	0	66.16	66.16	1,654.0	5,343.7	597.1	1,929.2	1,056.9	3,414.4	46,766	48,924	16,884	17,663	29,882	31,261
I-5: Kings	Rural	0	26.72	26.72	668.0	2,158.2	231.3	747.4	436.7	1,410.7	18,887	19,759	6,541	6,843	12,346	12,916
I-5: Kern	Rural	7.04	9.28	2.24	161.3	434.2	29.4	79.2	78.1	210.2	4,560	3,975	832	725	2,208	1,925
I-5: Merced	Rural	0	32.45	32.45	675.0	2,126.7	262.7	827.7	749.8	2,362.4	19,084	19,471	7,427	7,578	21,199	21,629
I-5: Kern	Rural	15.08	15.86	0.78	49.9	129.6	10.9	28.4	39.0	101.2	1,411	1,187	309	260	1,102	927
I-5: Kern	Rural	10.35	15.08	4.73	306.5	943.1	55.9	172.1	148.4	456.6	8,666	8,634	1,581	1,576	4,196	4,181
I-5: Kern	Rural	9.28	10.35	1.07	69.3	213.3	12.7	38.9	33.6	103.3	1,960	1,953	358	356	949	946
I-5: Kern	Rural	6.41	7.04	0.63	40.8	125.6	7.4	22.9	19.8	60.8	1,154	1,150	211	210	559	557
I-5: Kern	Rural	5.36	6.41	1.05	68.0	209.4	12.4	38.2	32.9	101.4	1,924	1,917	351	350	931	928
I-5: Kern	Rural	0.58	5.36	4.78	309.7	953.1	56.5	173.9	150.0	461.5	8,758	8,726	1,598	1,592	4,241	4,225
I-5: Kern	Rural	0	0.58	0.58	37.6	115.6	6.9	21.1	18.2	56.0	1,063	1,059	194	193	515	513
I-5: Stanislaus	Rural	0	28.06	28.06	235.7	1,243.3	91.7	483.8	261.8	1,381.1	6,664	11,383	2,594	4,430	7,403	12,644
I-5: San Joaquin	Rural	0	11.8	11.8	131.0	403.0	35.1	107.9	270.6	832.5	3,703	3,690	991	988	7,650	7,622
TOTAL					**8,018.4**	**28,298.3**	**2,092.1**	**7,247.0**	**5,716.4**	**19,845.0**	**226,716**	**259,086**	**59,153**	**66,350**	**161,628**	**181,692**

APPENDIX Y

INTERMEDIATE CALCULATION SUMMARY TABLES FOR VEHICLE-MILES AND VEHICLE-HOURS OF TRAVEL, AND USER COSTS

The following summary tables are contained in this appendix:

TABLE Y1a. SUMMARY OF DAILY VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - HIGH VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	252,993	1,895,389
	Nighttime Off-Peak	20,743	160,649
	Daytime Off-Peak	187,318	1,552,868
TOTAL		**461,054**	**3,608,906**
Conventional Lanes including added lane	Peak Period	252,993	1,895,389
	Nighttime Off-Peak	20,743	160,649
	Daytime Off-Peak	187,318	1,552,868
TOTAL		**461,054**	**3,608,906**

TABLE Y1b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - HIGH VOLUME

Condition	Daily Vehicle-Miles		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	461,054	3,608,906	1.77	0.325	814,226	1,172,894	297,192,615	428,106,474	725,299,090
Conventional Lanes including added lane	461,054	3,608,906	1.77	0.325	814,226	1,172,894	297,192,615	428,106,474	725,299,090
Cost Difference					0	0	0	0	0

TABLE Y1c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - HIGH VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	5,060	35,368
	Nighttime Off-Peak	415	2,735
	Daytime Off-Peak	3,746	26,832
TOTAL		**9,221**	**64,935**
Conventional Lanes including added lane	Peak Period	5,060	31,941
	Nighttime Off-Peak	415	2,921
	Daytime Off-Peak	3,746	26,832
TOTAL		**9,221**	**61,693**

TABLE Y1d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - HIGH VOLUME

Condition	Daily Vehicle-Hours		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	9,221	64,935	28.27	9.16	260,721	594,509	95,162,984	216,995,967	312,158,951
Conventional Lanes including added lane	9,221	61,693	28.27	9.16	260,721	564,835	95,162,984	206,164,926	301,327,911
Cost Difference					0	-29,674	0	-10,831,041	-10,831,041

TABLE Y1e. INCREMENTAL COST SUMMARY FOR CONVENTIONAL ADDED FREEWAY LANE ($) - HIGH VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration,Planning, Design and Construction	26,863,668
Rehabilitation	1,692,657
System Maintenance	8,120
Vehicle Operating	0
Travel Time	-10,831,041
Total Incremental Cost	17,733,404

TABLE Y2a. SUMMARY OF DAILY VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - MEDIUM VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	339,166	1,851,561
	Nighttime Off-Peak	59,552	280,841
	Daytime Off-Peak	406,731	2,378,430
TOTAL		**805,448**	**4,510,832**
Conventional Lanes including added lane	Peak Period	339,166	1,851,561
	Nighttime Off-Peak	59,552	280,841
	Daytime Off-Peak	406,731	2,378,430
TOTAL		**805,448**	**4,510,832**

TABLE Y2b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - MEDIUM VOLUME

Condition	Daily Vehicle-Miles		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	805,448	4,510,832	1.77	0.325	1,422,430	1,466,020	519,186,966	535,097,434	1,054,284,400
Other Conventional Lanes - Base Volume	805,448	4,510,832	1.77	0.325	1,422,430	1,466,020	519,186,966	535,097,434	1,054,284,400
Cost Difference					0	0	0	0	0

TABLE Y2c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - MEDIUM VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	6,783	31,577
	Nighttime Off-Peak	1,191	4,694
	Daytime Off-Peak	8,135	41,034
TOTAL		**16,109**	**77,305**
Conventional Lanes including added lane	Peak Period	6,783	31,482
	Nighttime Off-Peak	1,191	4,694
	Daytime Off-Peak	8,135	40,957
TOTAL		**16,109**	**77,133**

TABLE Y2d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - MEDIUM VOLUME

Condition	Daily Vehicle-Hours		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	16,109	77,305	28.27	9.16	455,471	707,764	166,247,001	258,334,035	424,581,036
Conventional Lanes including added lane	16,109	77,133	28.27	9.16	455,471	706,191	166,247,001	257,759,696	424,006,697
Cost Difference					0	-1,574	0	-574,339	-574,339

TABLE Y2e. INCREMENTAL COST SUMMARY FOR CONVENTIONAL ADDED FREEWAY LANE ($) - MEDIUM VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration,Planning, Design and Construction	36,444,072
Rehabilitation	1,618,982
System Maintenance	20,250
Vehicle Operating	0
Travel Time	-574,339
Total Incremental Cost	37,508,965

TABLE Y3a. SUMMARY OF DAILY VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - LOW VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	689,494	1,839,391
	Nighttime Off-Peak	183,255	471,053
	Daytime Off-Peak	494,219	1,289,927
TOTAL		**1,366,969**	**3,600,371**
Conventional Lanes including added lane	Peak Period	689,494	1,839,391
	Nighttime Off-Peak	183,255	471,053
	Daytime Off-Peak	494,219	1,289,927
TOTAL		**1,366,969**	**3,600,371**

TABLE Y3b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - LOW VOLUME

Condition	Daily Vehicle-Miles		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	1,366,969	3,600,371	1.77	0.325	2,414,082	1,170,121	881,140,001	427,093,998	1,308,233,999
Conventional Lanes including added lane	1,366,969	3,600,371	1.77	0.325	2,414,082	1,170,121	881,140,001	427,093,998	1,308,233,999
Cost Difference					0	0	0	0	0

TABLE Y3c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - LOW VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	13,790	28,298
	Nighttime Off-Peak	3,665	7,247
	Daytime Off-Peak	9,884	19,845
TOTAL		**27,339**	**55,390**
Conventional Lanes including added lane	Peak Period	13,790	28,298
	Nighttime Off-Peak	3,665	7,247
	Daytime Off-Peak	9,884	19,845
TOTAL		**27,339**	**55,390**

TABLE Y3d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED CONVENTIONAL LANE - LOW VOLUME

Condition	Daily Vehicle-Hours		Unit Cost - 2001($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	27,339	55,390	28.27	9.16	773,005	507,127	282,146,687	185,101,427	467,248,114
Conventional Lanes including added lane	27,339	55,390	28.27	9.16	773,005	507,127	282,146,687	185,101,427	467,248,114
Cost Difference					0	0	0	0	0

TABLE Y3e. INCREMENTAL COST SUMMARY FOR CONVENTIONAL ADDED FREEWAY LANE ($) - LOW VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration,Planning, Design and Construction	50,151,403
Rehabilitation	2,045,782
System Maintenance	58,109
Vehicle Operating	0
Travel Time	0
Total Incremental Cost	52,255,294

TABLE Y4a. SUMMARY OF DAILY VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - HIGH VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	253,206	1,897,833
	Nighttime Off-Peak	20,830	161,438
	Daytime Off-Peak	187,018	1,549,636
TOTAL		**461,054**	**3,608,906**
AHS Lane - Base Volume	Peak Period	41,072	3,536
	Nighttime Off-Peak	3,536	31,122
	Daytime Off-Peak	31,122	60,705
TOTAL		**75,730**	**95,363**
Remaining Conventional Lanes	Peak Period	211,921	1,895,389
	Nighttime Off-Peak	17,294	161,438
	Daytime Off-Peak	156,109	1,552,079
TOTAL		**385,324**	**3,608,906**

TABLE Y4b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - HIGH VOLUME

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	461054	3608906	1.77	0.325	814,226	1,172,894	297,192,615	428,106,474	725,299,090
AHS Lane - Base Volume	75730	95363	1.48	0	111,929	0	40,854,141	0	40,854,141
Other Conventional Lanes - Base Volume	385324	3608906	1.77	0.325	680,486	1,172,894	248,377,516	428,106,474	676,483,990
Total - AHS Lane & Other Conventional	461054	3704269			792415	1172894	289231657	428106474	717,338,131
Cost Difference					-21,811	0	-7,960,958	0	-7,960,958

TABLE Y4c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED AHS LANE - HIGH VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	5,064	35,109
	Nighttime Off-Peak	417	2,749
	Daytime Off-Peak	3,740	26,773
TOTAL		**9,221**	**64,631**
AHS Lane - Base Volume	Peak Period	587	0
	Nighttime Off-Peak	51	0
	Daytime Off-Peak	445	0
TOTAL		**1,082**	**0**
Remaining Conventional Lanes	Peak Period	4,238	34,125
	Nighttime Off-Peak	346	2,749
	Daytime Off-Peak	3,122	26,817
TOTAL		**7,706**	**63,691**

Table Y4d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - HIGH VOLUME

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	9,221	64,631	28.27	9.16	260,721	591,733	95,162,984	215,982,705	311,145,689
AHS Lane - Base Volume	1,082	0	28.27	0	10,196	0	3,721,645	0	3,721,645
Remaining Conventional Lanes	7,706	63,691	28.27	9.16	217,896	583,127	79,532,076	212,841,218	292,373,293
Total - AHS and Conventional Lanes	8,788	63,691			228,092	583,127	83,253,721	212,841,218	296,094,938
Cost Difference					-32,628	-8,607	-11,909,263	-3,141,488	-15,050,751

TABLE Y4e. INCREMENTAL COST SUMMARY FOR ADDED AHS LANE ($) - HIGH VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and	67,072,902
Rehabilitation	4,753,134
System Maintenance	12,213
System Operating	1,453
Vehicle Operating	-7,960,958
Travel Time	-15,050,751
Total Incremental Cost	48,827,992

TABLE Y5a. SUMMARY OF DAILY VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - MEDIUM VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	339,166	1,851,561
	Nighttime Off-Peak	59,552	280,841
	Daytime Off-Peak	406,731	2,378,430
TOTAL		**805,448**	**4,510,832**
AHS Lane - Base Volume	Peak Period	43,281	6,554
	Nighttime Off-Peak	6,554	51,199
	Daytime Off-Peak	51,199	63,970
TOTAL		**101,035**	**121,724**
Remaining Conventional Lanes	Peak Period	295,884	1,851,561
	Nighttime Off-Peak	52,997	280,841
	Daytime Off-Peak	355,532	2,378,430
TOTAL		**704,413**	**4,510,832**

TABLE Y5b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - MEDIUM VOLUME

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	805448	4510832	1.77	0.325	1,422,430	1,466,020	519,186,966	535,097,434	1,054,284,400
AHS Lane - Base Volume	101035	121724	1.48	0	149,330	0	54,505,456	0	54,505,456
Remaining Conventional Lanes	704413	4510832	1.77	0.325	1,244,001	1,466,020	454,060,417	535,097,434	989,157,851
Total - AHS Lane & Other Conventional	805448	4632556			1393331	1466020	508565872	535097434	1,043,663,307
Cost Difference					-29,099	0	-10,621,093	0	-10,621,093

TABLE Y5c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED AHS LANE - MEDIUM VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	6,783	31,536
	Nighttime Off-Peak	1,191	4,694
	Daytime Off-Peak	8,135	41,034
TOTAL		**16,109**	**77,264**
AHS Lane - Base Volume	Peak Period	618	0
	Nighttime Off-Peak	94	0
	Daytime Off-Peak	731	0
TOTAL		**1,443**	**0**
Remaining Conventional Lanes	Peak Period	5,918	31,502
	Nighttime Off-Peak	1,060	4,694
	Daytime Off-Peak	7,111	41,034
TOTAL		**14,088**	**77,230**

Table Y5d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - MEDIUM VOLUME

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	16,109	77,264	28.27	9.16	455,471	707,393	166,247,001	258,198,326	424,445,327
AHS Lane - Base Volume	1,443	0	28.27	0	13,603	0	4,965,224	0	4,965,224
Remaining Conventional Lanes	14,088	77,230	28.27	9.16	398,337	707,083	145,393,062	258,085,200	403,478,261
Total - AHS and Conventional Lanes	15,532	77,230			411,941	707,083	150,358,285	258,085,200	408,443,485
Cost Difference					-43,531	-310	-15,888,716	-113,126	-16,001,842

TABLE Y5e. INCREMENTAL COST SUMMARY FOR ADDED AHS LANE ($) - MEDIUM VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	89,355,273
Rehabilitation	5,679,363
System Maintenance	24,511
System Operating	1,308
Vehicle Operating	-10,621,093
Travel Time	-16,001,842
Total Incremental Cost	68,437,520

TABLE Y6a. SUMMARY OF DAILY VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - LOW VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	689,494	1,839,391
	Nighttime Off-Peak	183,255	471,053
	Daytime Off-Peak	494,219	1,289,927
TOTAL		**1,366,969**	**3,600,371**
AHS Lane - Base Volume	Peak Period	288,574	78,649
	Nighttime Off-Peak	78,649	208,399
	Daytime Off-Peak	208,399	426,513
TOTAL		**575,623**	**713,562**
Remaining Conventional Lanes	Peak Period	400,920	1,839,391
	Nighttime Off-Peak	104,606	471,053
	Daytime Off-Peak	285,820	1,289,927
TOTAL		**791,347**	**3,600,371**

TABLE Y6b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - LOW VOLUME

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	1,366,969	3,600,371	1.77	0.325	2,414,082	1,170,121	881,140,001	427,093,998	1,308,233,999
AHS Lane - Base Volume	575,623	713,562	1.48	0	850,772	0	310,531,663	0	310,531,663
Remaining Conventional Lanes	791,347	3,600,371	1.77	0.325	1,397,527	1,170,121	510,097,224	427,093,998	937,191,222
Total - AHS and Conventional Lanes	1,366,969	4,313,933			2,248,298	1,170,121	820,628,888	427,093,998	1,247,722,886
Cost Difference					-165,784	0	-60,511,113	0	-60,511,113

TABLE Y6c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED AHS LANE - LOW VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	13,790	28,298
	Nighttime Off-Peak	3,665	7,247
	Daytime Off-Peak	9,884	19,845
TOTAL		**27,339**	**55,390**
AHS Lane - Base Volume	Peak Period	4,122	0
	Nighttime Off-Peak	1,124	0
	Daytime Off-Peak	2,977	0
TOTAL		**8,223**	**0**
Remaining Conventional Lanes	Peak Period	8,018	28,298
	Nighttime Off-Peak	2,092	7,247
	Daytime Off-Peak	5,716	19,845
TOTAL		**15,827**	**55,390**

Table Y6d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED AHS LANE - LOW VOLUME

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day ($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	27,339	55,390	28.27	9.16	773,005	507,127	282,146,687	185,101,427	467,248,114
AHS Lane - Base Volume	8,223	0	28.27	0	77,502	0	28,288,162	0	28,288,162
Remaining Conventional Lanes	15,827	55,390	28.27	9.16	447,497	507,127	163,336,407	185,101,427	348,437,834
Total - AHS and Conventional Lanes	24,050	55,390			524,999	507,127	191,624,569	185,101,427	376,725,996
Cost Difference					-248,006	0	-90,522,118	0	-90,522,118

TABLE Y6e. INCREMENTAL COST SUMMARY FOR ADDED AHS LANE ($) - LOW VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	106,993,402
Rehabilitation	8,948,569
System Maintenance	65,321
System Operating	2,252
Vehicle Operating	-60,511,113
Travel Time	-90,522,118
Total Incremental Cost	-35,023,688

TABLE Y7a. SUMMARY OF VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - HIGH VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other
Base Condition - Base Volume	Peak Period	253,206	1,897,833
	Nighttime Off-Peak	20,830	161,438
	Daytime Off-Peak	187,018	1,549,636
TOTAL		**461,054**	**3,608,906**
Dedicated Truck Lane - Base Volume	Peak Period	41,072	0
	Nighttime Off-Peak	3,536	0
	Daytime Off-Peak	31,122	0
TOTAL		**75,730**	**0**
Remaining Conventional Lanes	Peak Period	211,921	1,895,389
	Nighttime Off-Peak	17,294	161,438
	Daytime Off-Peak	156,109	1,552,079
TOTAL		**385,324**	**3,608,906**

TABLE Y7b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - HIGH VOLUME

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	461,054	3,608,906	1.77	0.325	814,226	1,172,894	297,192,615	428,106,474	725,299,090
Dedicated Lane - Base Volume	75,730	0	1.77	0	133,740	0	48,815,099	0	48,815,099
Remaining Conventional Lanes	385,324	3,608,906	1.77	0.325	680,486	1,172,894	248,377,516	428,106,474	676,483,990
Total - Dedicated Lane and Conventional Lanes	461,054	3,608,906			814,226	1,172,894	297,192,615	428,106,474	725,299,090
Cost Difference					0	0	0	0	0

TABLE Y7c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - HIGH VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	5,064	35,109
	Nighttime Off-Peak	417	2,749
	Daytime Off-Peak	3,740	26,773
TOTAL		**9,221**	**64,631**
Dedicated Truck Lane - Base Volume	Peak Period	821	0
	Nighttime Off-Peak	71	0
	Daytime Off-Peak	622	0
TOTAL		**1,515**	**0**
Remaining Conventional Lanes	Peak Period	4,238	34,125
	Nighttime Off-Peak	346	2,749
	Daytime Off-Peak	3,122	26,817
TOTAL		**7,706**	**63,691**

TABLE Y7d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - HIGH VOLUME

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	9,221	64,631	28.27	9.16	260,721	591,733	95,162,984	215,982,705	311,145,689
Dedicated Lane - Base Volume	1,515	0	28.27	0	42,824	0	15,630,908	0	15,630,908
Remaining Conventional Lanes	7,706	63,691	28.27	9.16	217,896	583,127	79,532,076	212,841,218	292,373,293
Total - Dedicated Lane and Conventional Lanes	9,221	63,691			260,721	583,127	95,162,984	212,841,218	308,004,202
Cost Difference					0	-8,607	0	-3,141,488	-3,141,488

TABLE Y7e. INCREMENTAL COST SUMMARY FOR ADDED DEDICATED TRUCK LANE ($) - HIGH VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	61,708,821
Rehabilitation	3,774,525
System Maintenance	8,948
Vehicle Operating	0
Travel Time	-3,141,488
Total Incremental Cost	62,350,806

TABLE Y8a. SUMMARY OF VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - MEDIUM VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other
Base Condition - Base Volume	Peak Period	339,166	1,851,561
	Nighttime Off-Peak	59,552	280,841
	Daytime Off-Peak	406,731	2,378,430
TOTAL		**805,448**	**4,510,832**
Dedicated Truck Lane - Base Volume	Peak Period	43,281	0
	Nighttime Off-Peak	6,554	0
	Daytime Off-Peak	51,199	0
TOTAL		**101,035**	**0**
Remaining Conventional Lanes	Peak Period	295,884	1,851,561
	Nighttime Off-Peak	52,997	280,841
	Daytime Off-Peak	355,532	2,378,430
TOTAL		**704,413**	**4,510,832**

TABLE Y8b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - MEDIUM VOLUME

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	805,448	4,510,832	1.77	0.325	1,422,430	1,466,020	519,186,966	535,097,434	1,054,284,400
Dedicated Lane - Base Volume	101,035	0	1.77	0	178,429	0	65,126,549	0	65,126,549
Remaining Conventional Lanes	704,413	4,510,832	1.77	0.325	1,244,001	1,466,020	454,060,417	535,097,434	989,157,851
Total - Dedicated Lane & Other Conventional Lanes	805,448	4,510,832			1,422,430	1,466,020	519,186,966	535,097,434	1,054,284,400
Cost Difference					0	0	0	0	0

TABLE Y8c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - MEDIUM VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	6,783	31,536
	Nighttime Off-Peak	1,191	4,694
	Daytime Off-Peak	8,135	41,034
TOTAL		**16,109**	**77,264**
Dedicated Truck Lane - Base Volume	Peak Period	866	0
	Nighttime Off-Peak	131	0
	Daytime Off-Peak	1,024	0
TOTAL		**2,021**	**0**
Remaining Conventional Lanes	Peak Period	5,918	31,502
	Nighttime Off-Peak	1,060	4,694
	Daytime Off-Peak	7,111	41,034
TOTAL		**14,088**	**77,230**

TABLE Y8d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - MEDIUM VOLUME

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	16,109	77,264	28.27	9.16	455,471	707,393	166,247,001	258,198,326	424,445,327
Dedicated Lane - Base Volume	2,021	0	28.27	0	57,134	0	20,853,939	0	20,853,939
Remaining Conventional Lanes	14,088	77,230	28.27	9.16	398,337	707,083	145,393,062	258,085,200	403,478,261
Total - Dedicated Lane and Conventional Lanes	16,109	77,230			455,471	707,083	166,247,001	258,085,200	424,332,201
Cost Difference					0	-310	0	-113,126	-113,126

TABLE Y8e. INCREMENTAL COST SUMMARY FOR ADDED DEDICATED TRUCK LANE ($) - MEDIUM VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	84,946,588
Rehabilitation	4,764,349
System Maintenance	21,491
Vehicle Operating	0
Travel Time	-113,126
Total Incremental Cost	89,619,302

TABLE Y9a. SUMMARY OF VEHICLE-MILES - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - LOW VOLUME

Condition	Period of the Day	Daily Vehicle-Miles	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	689,494	1,839,391
	Nighttime Off-Peak	183,255	471,053
	Daytime Off-Peak	494,219	1,289,927
TOTAL		**1,366,969**	**3,600,371**
Dedicated Truck Lane - Base Volume	Peak Period	288,574	78,649
	Nighttime Off-Peak	78,649	208,399
	Daytime Off-Peak	208,399	509,625
TOTAL		**575,623**	**796,673**
Remaining Conventional Lanes	Peak Period	400,920	1,839,391
	Nighttime Off-Peak	104,606	471,053
	Daytime Off-Peak	285,820	1,289,927
TOTAL		**791,347**	**3,600,371**

TABLE Y9b. VEHICLE OPERATING COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - LOW VOLUME

Condition	Daily Vehicle-Miles		2001-Unit Cost ($)		Total Cost per Day($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	1,366,969	3,600,371	1.77	0.325	2,414,082	1,170,121	881,140,001	427,093,998	1,308,233,999
Dedicated Lane - Base Volume	575,623	0	1.77	0	1,016,556	0	371,042,776	0	371,042,776
Remaining Conventional Lanes	791,347	3,600,371	1.77	0.325	1,397,527	1,170,121	510,097,224	427,093,998	937,191,222
Total - Dedicated Lane and Conventional Lanes	1,366,969	3,600,371			2,414,082	1,170,121	881,140,001	427,093,998	1,308,233,999
Cost Difference					0	0	0	0	0

TABLE Y9c. SUMMARY OF DAILY VEHICLE-HOURS - BASE CONDITION - BASE VOLUME VS.CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - LOW VOLUME

Condition	Period of the Day	Daily Vehicle-Hours	
		Trucks	Other Vehicles
Base Condition - Base Volume	Peak Period	13,790	28,298
	Nighttime Off-Peak	3,665	7,247
	Daytime Off-Peak	9,884	19,845
TOTAL		**27,339**	**55,390**
Dedicated Truck Lane - Base Volume	Peak Period	5,771	0
	Nighttime Off-Peak	1,573	0
	Daytime Off-Peak	4,168	0
TOTAL		**11,512**	**0**
Remaining Conventional Lanes	Peak Period	8,018	28,298
	Nighttime Off-Peak	2,092	7,247
	Daytime Off-Peak	5,716	19,845
TOTAL		**15,827**	**55,390**

TABLE Y9d. TRAVEL TIME COSTS - BASE CONDITION - BASE VOLUME VS. CONVENTIONAL LANES WITH ADDED DEDICATED TRUCK LANE - LOW VOLUME

Condition	Daily Vehicle-Hours		2001-Unit Cost ($)		Total Cost per Day($)		EUAC ($)		EUATC ($)
	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	Trucks	Other Vehicles	All Vehicles
Base Condition - Base Volume	27,339	55,390	28.27	9.16	773,005	507,127	282,146,687	185,101,427	467,248,114
Dedicated Lane - Base Volume	11,512	0	28.27	0	325,508	0	118,810,280	0	118,810,280
Remaining Conventional Lanes	15,827	55,390	28.27	9.16	447,497	507,127	163,336,407	185,101,427	348,437,834
Total - Dedicated Lane and Conventional Lanes	27,339	55,390			773,005	507,127	282,146,687	185,101,427	467,248,114
Cost Difference					0	0	0	0	0

TABLE Y9e. INCREMENTAL COST SUMMARY FOR ADDED DEDICATED TRUCK LANE ($) - LOW VOLUME

Cost Category	Incremental Cost (EUAC)
System Administration, Planning, Design and Construction	101,644,972
Rehabilitation	7,135,113
System Maintenance	60,178
Vehicle Operating	0
Travel Time	0
Total Incremental Cost	108,840,264