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May 22, 1998

ABSTRACT

The Intermodal Surface Transportation Efficiency Act (ISTEA) has been law for six years and has undergone an initial phase of reauthorization review that will conclude in 1998. This landmark piece of legislation emphasizes transportation systems that promote mobility and accessibility and that in conjunction with the Clean Air Act Amendments will help to minimize transportation-related fuel usage and vehicle emissions. To achieve these objectives at the local and regional level, the States have entered into a relationship with Metropolitan Planning Organizations and other key transportation service providers to develop transportation plans and programs. The application of Intelligent Transportation Systems (ITS) toward fulfilling these objectives plays an important role in the overall implementation of this legislation.

The objective of this research is to (1) investigate the current state of California's implementation of ISTEA with respect to ITS, (2) assess the extent to which ITS has been integrated within the State's transportation planning process, and (3) recommend opportunities for linkages between ISTEA and ITS that have not yet been recognized.

Initially a literature search was conducted which studied ISTEA's key features, specific ITS-related issues, the institutional environment, and the specifics of ISTEA's implementation in California. This statewide implementation includes State and regional planning, the development of Early Deployment Plans, Field Operational Tests, the Southern California Priority Corridor, Automated Highway Systems, and the ITS architecture program.

To gain further insight into how ISTEA has been implemented within California in relation to ITS, a survey was developed and implemented through interviews of transportation professionals who have first hand knowledge and experience gained from performing actual "field" work implementing ISTEA. The interviewees represented members of both the public and private sectors, from both Northern and Southern California, representing both local and regional interests as well as Statewide interests, and from both the Operations and Planning side of the house.

The survey provided information in the areas of (1) practitioners' knowledge and experience with ISTEA, (2) practitioners' knowledge and familiarity with ITS, (3) ISTEA's support for ITS implementation, (4) achieving ISTEA objectives via ITS, (5) impacts of inter-jurisdictional relationships on ITS implementation, and (6) the reauthorization of ISTEA and associated opportunities for ITS implementation.

The survey analysis findings are presented in the form of overall results that are generally common across all the interviewees and in the form of comparative analyses between diverse groups of interviewees such as between the private and public sectors, respondents from Northern and Southern California, public sector respondents from the State or local jurisdictions, and public sector respondents with specialties in Operations and Planning.

Key Words: Intermodal Surface Transportation Efficiency Act, Intelligent Transportation Systems, implementation, benefits, linkages, research and development, California

EXECUTIVE SUMMARY

The Intermodal Surface Transportation Efficiency Act (ISTEA, or the Act) (1) has been law for six years and has undergone an initial phase of reauthorization review that will conclude in 1998. This landmark piece of legislation emphasizes transportation systems that promote mobility and accessibility and that in conjunction with the Clean Air Act Amendments (CAAA) are intended to help to minimize transportation-related fuel usage and vehicle emissions. To achieve these objectives at the local and regional level, the States have entered into a relationship with Metropolitan Planning Organizations (MPO) and other key transportation service providers to develop transportation plans and programs. The application of Intelligent Transportation Systems (ITS) toward fulfilling these objectives plays an important role in the overall implementation of this legislation.

The objective of this research is to (1) investigate the current state of California's implementation of ISTEA with respect to ITS, (2) assess the extent to which ITS has been integrated within the State's transportation planning process, and (3) recommend opportunities for linkages between ISTEA and its reauthorization and ITS that have not yet been recognized.

Initially a literature search was conducted which studied ISTEA's key features, specific ITS-related issues including the then newly established Intelligent Vehicle Highway Systems (IVHS) program -- subsequently renamed ITS, the institutional environment, and the specifics of ISTEA's implementation in California.

ISTEA is distinguished for its key features that are used to help develop efficient systems management and maintenance; intermodalism; state and metropolitan transportation planning; responsiveness to social, economic and environmental needs; flexible financing and fiscal realism; and advanced technology.

ISTEA establishes policies that recognize the shift in focus from the building of a surface transportation system to the management and maintenance of that surface transportation system. ISTEA authorizes six major programs to enhance system management and maintenance, including: pavement management system, bridge management system, public transit facilities and equipment management system, intermodal management system, traffic congestion management system, and highway safety management system. These systems are established for the purpose of improving the operation and maintenance of transportation facilities, and providing systematic analysis improving system performance and supporting transportation plans and projects.

System-wide performance measures and rigorous analysis for system management and maintenance are also emphasized in ISTEA. While national standards of minimum acceptable performance measures are not specified, ISTEA encourages urban areas to focus on performance. For example, congestion management systems promote a broader assessment of system performance that is geared more to objectives of mobility, accessibility, and the quality of the entire trip. With the focus on performance measures and effective analysis, the six management systems can be well integrated as substantial components of the overall planning process, and can be expected to be important sources of information and means of improving transportation investment effectiveness.

Intermodalism considers the whole trip with regard to the efficient movement of goods and people. Intermodalism also means the efficient use of all necessary and available modes throughout a trip's duration, including seamless connections or transfers among different modes. ISTEA's promotion of the development of a national intermodal transportation system provides a foundation to take advantage and make efficient use of transportation resources, and strengthens the nation's global economic competitiveness. The National Commission on Intermodal Transportation was established under ISTEA to study the status of intermodal standardization, impacts on public works infrastructure, legal impediments to efficient intermodal transportation, financial issues, new technology, problems in documenting intermodal transfer needs, and the relationship of Intermodal transportation to productivity.

ISTEA empowers state, regional, and local transportation planning and policy making in response to the transportation needs of communities. In particular, ISTEA creates significant new roles for the nation's MPOs by broadening the scope of transportation planning. The Act recognizes changes in development patterns, the economic and cultural diversity of metropolitan areas, and the need to provide these areas with more control over transportation policies and their implementation.

Planning process requirements are strengthened for state departments of transportation (DOTs) and MPOs with the decentralization of transportation planning. A list of key planning factors has been developed to effectively guide transportation planning at state and metropolitan levels. The metropolitan planning processes set forth in ISTEA emphasize the linkages between improved planning and better decision-making, and provide the tools for comprehensive planning. MPOs are required to consider six management systems at the metropolitan level to ensure a planning process which produces satisfactory investment decisions.

ISTEA encourages early and substantial public participation at all stages of the transportation planning process by including key stakeholders, such as the business community, neighborhood groups, and special interest groups who have not traditionally been involved in this process. Substantial public involvement could open the planning process to controversy, but could also be crucial in building consensus and achieving transportation decisions that will best serve the interests of the region.

ISTEA also recognizes the need to invest in transportation at the community level by integrating transportation with environmental, land use, and economic issues. ISTEA requires conformity with the CAAA of 1990 which has led to a large number of projects to reduce emissions of certain pollutants. In particular, congestion mitigation and air quality improvement programs have directed transportation projects' funds toward non-attainment areas under CAAA of 1990. This in turn contributes to meeting the attainment of national ambient area air quality standards.

ISTEA also promotes integration of transportation and land use with the attempt to lead to social-economic improvements. It allows local and regional agencies to choose between freeways and more local roads, between transit investments and freeways, and between projects for bicycle/pedestrian use and other types of projects.

The intention is that the inclusion of land use and economic considerations into transportation holds the key for transportation investments that revitalize communities.

ISTEA emphasizes flexibility in allocating funds to transportation projects. State and metropolitan areas can choose to use an unrestricted amount of funds for National Highway System and Surface Transportation Projects on transportation planning and development. Transit, bicycle, and pedestrian facilities are also eligible for Surface Transportation Projects funds through the Congestion Mitigation and Air Quality Improvement Program. Rather than having resources identified as for either highway or public transit, states and urban areas are able to allocate increasing amounts of funds based on the competitive ability of candidate projects to satisfy regional priorities.

Funding flexibility in ISTEA also comes with fiscal limitations as ISTEA requires transportation plans to be fiscally constrained, given the reality of limited financial resources. All plans must include a financial element which identifies resources that are reasonably available to implement the plan.

ISTEA also encourages the development and application of advanced technologies in the transportation system. The Act deems that continuing development and use of new technologies is vital for a cleaner, safer, and more efficient transportation system, and for the U.S.'s ability to compete in the global marketplace. Advanced technologies cover a variety of aspects of contemporary technology development, especially advanced communication and vehicle control. Under the initiation of the IVHS Act of 1991 within ISTEA, projects on new technologies' research and application are funded and new partnerships with the private sector are formed to encourage the nation to move forward to provide transportation innovations for the 21st Century. It is this component of ISTEA, that is, the IVHS Act, that subsequently lead to the creation of a national ITS Program.

The policies for planning and development of advanced technologies in transportation systems address different aspects of technology application, including institutional arrangements, program design, funding arrangements, and deployment agendas. In general, development of advanced technologies can be summarized into two elements: Institutional establishment and ITS programs. ISTEA provides substantial institutional support needed for enhanced research and development and effective application of innovative technology. An important principle is to encourage institutions that would establish partnerships and enhance collaboration with governmental agencies, university research institutions, and private sector organizations. ITS-related programs include specially designated ITS Priority Corridors, Field Operational Tests (FOTs), consortia of advanced transportation systems and electric vehicles, development of standards for ITS technologies, technology and operational testing evaluations, study of commercial vehicle safety technology.

California was already a leading state in the area of transportation planning before the enactment of ISTEA. The State had passed legislation addressing the changing context of transportation planning in California, including mandates for a State long-range transportation plan, mass transportation housing density programs, state and local transportation partnership programs, standard designs for bikeway planning, and initiation of state transportation

improvement programs. In response to ISTEA, the existing transportation planning statutes have been revised and new legislation addressing the implementation of ISTEA has been added. This statewide implementation includes State and regional planning, the development of Early Deployment Plans (EDPs), Field Operational Tests, the Southern California Priority Corridor, Automated Highway Systems, and the ITS architecture program.

To gain further insight into how ISTEA has been implemented within California in relation to ITS, a survey was developed and carried out through interviews of transportation professionals who have first-hand knowledge and experience gained from performing actual "field" work implementing ISTEA. The results of the survey represent the views and opinions of the survey respondents.

The survey provided information in the areas of (1) practitioners' knowledge and experience with ISTEA, (2) practitioners' knowledge and familiarity with ITS, (3) ISTEA's support for ITS implementation, (4) achieving ISTEA objectives via ITS, (5) impacts of inter-jurisdictional relationships on ITS implementation, and (6) the reauthorization of ISTEA and associated opportunities for ITS implementation.

An initial candidate list of potential people to survey was developed based on the experience of the research team in the area of ITS and ISTEA implementation. Breadth across rather than depth within individual organizations in the State was preferred. This initial list was reviewed and additional names supplied by the members of Caltrans' Office of New Technology & Research staff. Based on this input, the final list was developed. The survey's goal was to capture the views, insights, and general sense of ITS/ISTEA issues of a relatively small group of experts in the transportation field from as many "walks of transportation life" in California as possible. The study and its associated sample size were, a priori, not intended to be of the kind where standard statistical validity tests and associated techniques would be used. The survey results were nonetheless valuable as the opinions and expertise of transportation professionals in the State were obtained. They represented a broad cross-section of California's professional transportation community.

Twenty-four people participated in the survey resulting in twenty-one completed surveys. The interviewees represented members of both the public and private sectors, from both Northern and Southern California, representing both local and regional interests as well as Statewide interests, and from both transportation Operations and Planning. On a few occasions the survey was conducted in a group setting with multiple respondents. On two of these occasions, with two and three people respectively, in actuality the result was a completed survey representing each group's consensus views considered more as a unit rather than two or three individuals. This clustering resulted in twenty-one completed surveys on which the analysis was based. Moreover, minor changes were made to the survey to reflect whether the respondent was a member of the public or private sector. In general, this meant that the word "agency" was replaced with the word "company" and phrases such as "in your region" were either removed entirely or replaced with "in the regions of California you are familiar with", as appropriate. The interviews were conducted in person and/or via telephone from July through September 1997.

Public sector interviewees represented the following types of organizations: Metropolitan Planning Organizations including San Diego Association of Governments, Metropolitan Transportation Commission, Southern California Association of Governments,

Sacramento Area Council of Governments, and Kern County Council of Governments; Caltrans, including Headquarters-Office of New Technology and Research and District Offices throughout California; Transportation Authorities including the Los Angeles County Metropolitan Transportation Authority and the Orange County Transportation Authority; other organizations such as the California Alliance for Advanced Transportation Systems.

Private sector interviewees represented consulting firms who have been providers of support to the public sector in preparation of EDPs, Regional Transportation Plans (RTPs), and ITS project participation.

The survey analysis findings are presented in the form of overall results that generally reflect the summary of all the interviewees' answers and in the form of comparative analyses between diverse groups of interviewees, such as between the private and public sectors, respondents from Northern and Southern California, public sector respondents from the State or local jurisdictions, public sector respondents with specialties in operations or planning and respondents from both urban and rural parts of California.

Relative to overall findings, survey participants are both well aware of the overall implementation of ISTEA and directly involved in various aspects of ISTEA implementation in their respective areas and regions of California. They also have a good knowledge about the specific focus of implementation in their regions.

Among ISTEA's major elements, System Management and Maintenance and the Metropolitan Planning Process are the areas with which respondents are most extensively involved. Another element, Intermodalism, generated an almost unanimous expression of concern over the sense of vagueness and ambiguity in its definition and confusion associated with this aspect of ISTEA's implementation. The concern over definition generally focused on the relative newness of the concept of intermodalism especially as it is applied to passengers and a lack of any unified approach to understanding what it means and how to implement it across jurisdictions. Intermodalism

Integration of land use and economic factors was the weakest ISTEA element in terms of stated level of knowledge as well as implementation. Issues related to land use generally fall out of the knowledge and experience base of the respondents.

Knowledge and implementation of Major Investment Studies (MIS) and the Public Involvement elements of ISTEA are also considered to be very important. Public Involvement is perceived to be based on participation of elected representatives and officials and interest groups, rather than members of the general public. While MIS's vary considerably among public agencies, the MIS tool is perceived to be very important for analysis of transportation systems. There is also strong interest to incorporate ITS as another alternative in the MIS process, though ITS is not yet considered to be a traditional and customary practice among transportation alternatives. Strong interest as well as concern also exist in the area of transportation technology research and development.

Overall, there is considerable involvement in ITS-related activities, particularly in ITS strategic planning, EDPs, coordination with other agencies, and project management. A wide range of ITS-related projects has been undertaken by the various agencies interviewed. Of all potential project areas, traffic management and traveler information type projects comprise the bulk. Another question focused more on the Public Involvement element of ISTEA and examined

whether or not and to what extent public involvement in the regional planning process has been helpful for ITS-related projects. ITS and public involvement may be integrated by means of 1) clarifying objectives for ITS implementation, 2) assisting in the selection of projects that fit local/regional needs, 3) building consensus among public agencies, communities, and other interest groups and 4) educating the public on ITS-related issues. Overall, there has been a fairly moderate level of assistance with respect to public involvement in the regional planning process toward ITS-related projects with the exception of public education, which gathers somewhere between marginal and moderate levels of assistance.

The survey inquired as to the most important improvements needed to foster a connection between ISTEA (and its reauthorization) and ITS over the next five years. Of the following four specific choices listed 1) favorable policies at federal and state levels, 2) technical assistance from Caltrans, 3) funding predictability, and 4) inter-jurisdictional coordination, overall, the highest ranked category was funding predictability to help achieve a linkage between ISTEA and ITS.

Survey results indicated that the reauthorization of ISTEA should strive to mainstream ITS into the regional transportation planning process with a steady stream of funding that would help to produce a continuous multi-year funded program. This multi-year aspect to the funding would provide a better sense of consistency and continuity to the program as a whole and to individual projects. Funding flexibility is also important to allow local and regional transportation agencies to use funds on ITS based on their own priorities and requirements. Another recommendation is for more of a regional focus to projects rather than simply very locally applied investigations of ITS technologies. ITS project planning should cross jurisdictional boundaries and should be performed from a more systems perspective rather than be jurisdictionally-based, if possible. Moreover, funds could serve as an incentive for this more systems approach. There was also a call for a more clear vision of how to incorporate or to mainstream ITS with all other functions that are performed by Regional Transportation Planning Agencies (RTPAs). In particular, the implementation of ITS needs to be incorporated into the general transportation planning process in which ITS must compete for funds as a viable transportation alternative via the MIS process in the RTP. With the relatively minor extent to which ITS is thought of as a potential alternative, especially to air quality districts and transit properties, again in the view of the interviewees, more incentives are needed to increase the attractiveness of ITS for use by these organizations. The interviewees emphasized the following four points, or "needs": 1) systematic planning across jurisdictional boundaries, 2) additional outreach, 3) quantified costs and benefits to the maximum extent possible, and 4) improvements and expansion upon the private sector role in ITS implementation.

With respect to the private and public sectors, there were differences in the area of level of knowledge and implementation of ISTEA and ITS, with survey results indicating the private sector overall with a greater knowledge and implementation level for ISTEA and ITS than the public sector. When considering the reauthorization of ISTEA, the private sector focuses on three primary issues: 1) the need to mainstream ITS, 2) the critical nature of education and outreach, and 3) the MIS process should examine ITS as a viable alternative to solve transportation problems. The public sector places importance and emphasis on the need 1) to

develop deployment paths for ITS and 2) to incorporate EDPs into the RTP structure and process.

With respect to the State and Local jurisdictional levels, there were both similarities as well as some differences in the area of level of knowledge and implementation of ISTEA and ITS. Survey results indicate that local area interviewees are generally stronger than the State in the system management and maintenance, MIS, and air quality issues, whereas the State is particularly strong in intermodalism, public involvement, and the metropolitan planning process. The State is particularly strong in its ITS involvement in the areas of being a participating member of ITS America, and the area of education and training. The development of EDPs is an area where local area involvement is stronger than from the State.

Both the State and Local areas indicate that funding predictability is a very important improvement that is needed to foster stronger linkages between ISTEA and ITS. Neither the State nor Local areas place much importance on technical assistance from Caltrans as being needed to improve the relationship between ISTEA and ITS. With respect to the level of support - consensus building, financial, technical, and coordination assistance - received from other agencies, both State and Local areas indicate a generally equal amount of support received from other Local agencies, whereas, the State indicates a greater level of support than do Local areas coming from Caltrans Headquarters.

With respect to differences between responses from Northern and Southern California, the latter shows slightly greater strength in the areas of system management and maintenance, intermodalism, and transportation technology research and development. Over the course of ISTEA implementation, both the North and the South have been involved in various areas of ISTEA implementation. Implementation in air quality conformity and consideration of land use and economic factors play a minor role compared to other areas such as system management and maintenance, intermodalism, and the metropolitan planning process.

Since ISTEA was enacted, the South has gained experience with activities in different ITS technology areas, whereas there is somewhat less extensive involvement in ITS from the perspective of respondents in the North. Differences in regional transportation systems between the South and the North partially contribute to the variations of focuses and levels of ITS implementation.

North perceives a stronger linkage between ISTEA and ITS than does the South for certain of the major ISTEA elements, namely, system management and maintenance, major investment study, and air quality improvement. The only ISTEA elements where both North and South tend to agree on their perception of the linkages between ISTEA and ITS are the promotion of the metropolitan planning process, and transportation research and development from ISTEA. Moreover, both the South and North feel the connection between ITS and air quality improvement has not yet been fully established or realized.

Among all the issues involved in ITS implementation in Southern California, funding is the most important for the South and favorable policy the second most important. The funding issue is less critical for the North with coordination equally important as funding. Both the North and the South indicate a higher level of support from the local jurisdictions than from Caltrans Headquarters in both consensus building and coordination assistance.

Overall, differences between South and North reflect the frustration that the South faces as a result of its deeper involvement in ITS to date than the North and the "gear-up" mode the North experiences. The success experienced and lessons learned from the South will affect the North's participation of ITS.

Respondents from both Operations and Planning divisions have a good knowledge in their areas of specialization. Respondents from operations are distinctively strong in system management and maintenance while respondents from planning have a high level of knowledge in intermodalism, public involvement, the metropolitan planning process, major investment study, air quality conformity, and consideration of land use and economic factors. Corresponding to their knowledge of ISTEA elements, each party has done extensive implementation in the areas in which they are specialized. Operations and Planning respondents experience a disconnect with each other, in which each group knows little of the other with respect to ISTEA implementation.

Operations and Planning staff exhibit fairly equivalent levels of involvement in ITS-related matters. By far, Operation divisions' ITS deployment involve mostly highway operations such as through the Transportation Management Center and signal coordination. Planning divisions focus more on strategic planning and local/regional projects. Respondents from Operations felt that the State should take lead on operations of new technology and should be more proactive in statewide standards development. Planning respondents are concerned more with policy issues, such as partnerships between the State and local agencies, technical assistance and standards, and documentation of cost-benefit evaluation in particular.

With respect to improvements needed to foster a stronger linkage between ISTEA and ITS, Operations and Planning interviewees agree that funding predictability is the most important area upon which to focus. Favorable policies is second only to funding for the planning interviewees. The two groups generally view differently the types of support received from Caltrans Headquarters. Planning respondents indicate there is greater support from Headquarters on consensus building and coordination assistance and the Operations see greater level of technical assistance from Headquarters. In general, Planning is more concerned with the policy in ITS implementation and its linkage to other areas that ISTEA promotes. Better integration between these two divisions is needed so that each can use the other's specialized knowledge in ITS implementation. This will help to generate the ITS implementation that most fits local needs.

While the survey focuses on regions in urban areas that are active in ITS implementation, some input was also received from a rural area in Southern California. In rural areas, knowledge about ISTEA and ITS as well as the implementation of ISTEA is not as extensive as seen in urban areas. The linkage between ISTEA and ITS is felt to be rather weak where ISTEA is thought to be neither supportive nor obstructive toward ITS implementation. There is not much public interest and involvement in the regional planning process for ITS-related projects and the degree of integration of ITS in regional transportation planning is considered weak. Nevertheless, a stronger linkage between ISTEA and ITS is thought important for rural regions' transportation systems.

Due to small staff complements in rural regions, agencies view support from Caltrans Headquarters as critical in increasing their willingness for ITS involvement. Rural agencies experience much less support overall than felt in urban areas from other local agencies. Rural

agencies want and expect more attention from both Headquarters and other statewide agencies such as the California Alliance for Advanced Transportation Systems. Rural areas want and depend on examples of fully implemented projects from other areas to assist them in ITS project selection and design. Thus, the State should encourage rural regions in their pursuit of ITS by offering better education, technical and coordination assistance.

While the survey results are not based on a very broad-based sample of all transportation professionals in California familiar with both ISTEA and ITS, the results are valuable nonetheless. The results can and should be interpreted more descriptively than statistically significant - to give a sense of the issues and experience and recommendations for improvements. The multitude of disparate results give rise to a set of common themes that summarize more concisely the survey results, identify potential opportunities for future research, make recommendations for addressing identified problems.

The survey results indicate that MISs are supportive toward ITS implementation. Local agencies view the MIS as potentially a very useful tool for transportation planning alternatives assessment. Currently there are no Federal guidelines contained within ISTEA on how to implement an MIS. While a "one size fits all" approach is not what the various local and regional agencies want or strive for, some general high-level guidelines would be helpful for the local and regional transportation planners to use in their studies of transportation alternatives. Local needs are still paramount but such guidelines would nevertheless be beneficial. Because of the attractiveness of the MIS tool for local and regional planners in the transportation planning process, incorporating ITS into this process would likely attract additional local and regional attention in considering the comparative advantages of ITS relative to other transportation alternatives. Thus the further integration of ITS into the MIS process will assist in making the transportation planning process more complete while offering opportunities for the application of new technologies. Since Operations are generally less knowledgeable and less involved in the MIS process compared to their Planning staff counterparts, enhancement of the MIS tool in ITS implementation for operations should be beneficial in assisting them in project selection and design.

For people willing to participate in ITS-related work but not yet actively involved in its implementation, there is an eagerness to see documented benefits of it to assist in the decision-making process. They ask the question: Should we use ITS here in this instance or some other means to solve this problem? On the other hand, for people already familiar with ITS projects, especially in design, management, and implementation, they have observed some positive impacts from the ITS implementation to date. Such ITS implementations have taken the form of an FOT, a specific Priority Corridor project, or some other project that is initiated, sponsored, and implemented at the local level. How to quantify the benefits of such relatively short-lived ITS implementations and how to filter such information down especially to local planning agencies as well as to the public is the crucial task at hand. The State, i.e. Caltrans, is truly in a unique position by virtue of its Statewide authority, experience, and access to a multitude of resources (funding, technical expertise, information) to continue in its leadership role to satisfy the need voiced by the local and regional agencies.

Local and regional transportation officials are looking for continuous efforts at improving their knowledge of ITS. There are participants in ITS project implementation whose

educational background and professional experience is considerably different than other members of the professional staffs at transportation-related organizations. Their strengths and weaknesses are different. Such differences exist within the same organization, such as between planners and operations' staff. Differences also exist across organizations, where other factors play more than a minor role with respect to distinguishing characteristics, such as geography, i.e. urban vs. rural. The extent to which education should be used to help level the playing field for all people engaged in ITS-related work needs to be determined.

The survey findings have indicated that outreach efforts to the general public and to elected officials is still at a fairly rudimentary level. As a consequence, local jurisdictions are not inclined to become as actively involved as they could be in ITS planning. Outreach approaches that are specific to the transportation needs of local and regional communities would hopefully achieve better results than a more generic approach. The local and regional agencies tend to focus on issues affecting their own region more than on statewide issues. Continuing efforts at benefit documentation will assist to achieve the effectiveness of outreach.

While intermodalism is one of the major elements of ISTEA, it is, however, still fraught with some ambiguity in its definition, how it is interpreted, used, and applied in the context of ISTEA implementation, and its distinction from the related terms, multimodal transportation and multimodalism in the view of the survey respondents. Respondents' concern was repeatedly mentioned over the term, intermodalism, and in their words, its "vagueness and ambiguity". There seems to be a disconnect concerning intermodalism along State/Local jurisdictional lines as evidenced in the survey results. Bridging this gap will require a deliberate and concerted effort to move the word intermodalism beyond simply its status as the currently popular buzz word, to identity and to conduct any needed research in this area, to link it more effectively with the ITS arena, and to move more extensively into the implementation phase.

The survey results indicate that the weakest area in terms of knowledge and familiarity of individual ISTEA elements is land use and economic factors. This area generally falls out of the knowledge and experience base of the respondents, with the partial exception of the planning community among the survey's respondents. The subject area of linkages between land use and transportation, in particular, between urban land use and transportation, is sizable and at least somewhat controversial with at least two primary schools of thought on the subject. Even with an undisputed theoretical justification for a linkage between land use and transportation, translating theory into a comprehensive set of models that account for the interaction effects between land use and transportation is an area of research that has not yet been fully exploited or addressed. A consequence of this low level of knowledge about the subject area itself is that the whole area of ITS and land use/economic factors is a fairly untapped and potentially rich resource for research and application.

While it is perceived desirable to have a stronger linkage between ITS and ISTEA in general, the connection between ITS and air quality improvement has not yet been fully realized. In numerous cases, air quality improvement is viewed as an indirect benefit of ITS applications rather than a direct benefit. There is concern over linkage between ITS and air quality because most deployments of ITS are more locally oriented and air quality issues need more of a regional approach in the search for solutions, e.g. regional emissions reductions. When ITS is perceived

and implemented regionally and consistently across local jurisdictions, then air quality improvements may be more effectively evaluated and hopefully demonstrated.

While applications of advanced technologies in the public transportation arena generally play an active role in the field of intelligent transportation systems, they have not played such a fundamental role in California's implementation of ITS projects based on the survey results. An application of ITS to the transit field offers an opportunity to explore the potential for addressing congestion, safety, and air quality problems and documenting the benefits for transit attributable to ITS. Making transit smart, or at least smarter, should also include applying ITS in the context of Transit Management Centers.

Respondents have expressed a strong desire for consistency and continuity in federal ITS policies and programs. Local and regional agencies have been especially concerned with the issue of consistency in the focus and overall implementation of federal ITS policies and plans. ITS is a relatively new experience for local and regional agencies and it requires both time and commitment to become fully oriented. Thus, federal ITS policies and programs are crucial to the success of ITS implementation at the local and regional level. However, the observed changes in focus over time at the federal level has made local commitment to ITS implementation difficult, and challenging at best, as locals tend to follow federal intentions rather than their own desired implementation strategies.

There have been calls for additional and specific guidelines to assist incorporating ITS with other functions performed by regional transportation planning agencies. The incorporation between the general transportation plan and EDP thus becomes especially important for ITS implementation in the short term by addressing ITS in the context of regional transportation systems. This study reveals that there is only a moderate level of integration existing between the RTP and EDP coupled with variations among the RTPAs. Revising RTP guidelines by adding a specific ITS component should be feasible and likely beneficial in the current state of the ITS planning process. Guideline revisions should consider the general applicability of ITS programs across an entire region as well as identifying each region's particular transportation needs.

Local and regional transportation agencies see value in and a need to develop deployment strategies and plans for ITS. With a concerted effort at ITS deployment in the State, a lot may be learned from actual situations, such as operation and maintenance of ITS infrastructure and liability issues. Requests for ITS deployment may be met at the federal and State levels with assistance and guidance in carefully chosen deployable projects. Moreover, examples of ITS deployment will assist local agencies in understanding ITS, especially those agencies with resource limitations, such as lack of staff. In the rural area, due to its limited staff capacity, the transportation planning and operation agencies hope for and depend on examples of fully implemented projects from other areas to "prime the pump" for the rural regions to assist them develop their own ITS projects.

State leadership is to be encouraged, especially in standards development and in providing assistance to the local and regional areas. For example, the State's assistance to Northern California could address their concerns for coordination and technical support for ITS implementation. Meanwhile, with respect to Southern California, a commitment for funding support for the projects already being implemented is essential. Rural agencies felt much less

support overall from other local agencies than felt by their urban counterparts. Rural agencies want and expect more assistance from both Headquarters and other Statewide agencies such as the California Alliance for Advanced Transportation Systems (CAATS). The State should encourage rural regions in their pursuit of ITS by offering better education, technical and coordination assistance. CAATS could also play a role to assist rural regions interested in ITS. In fact, CAATS has played a significant role in the area of ITS deployment with its initiative to bring together transportation and ITS experts from throughout the State to set the stage for the development of a Statewide Deployment Plan for ITS. Continued State leadership as well as cooperation among state, regional, and local stakeholders, will contribute toward the realization of ITS benefits.

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ABBREVIATIONS AND ACRONYMS

AHS	**Automated Highway Systems**
AQC	**Air Quality Conformity**
ATIS	**Advanced Traveler Information Systems**
ATMS	**Advanced Traffic Management Systems**
ATS	**Advanced Transportation Systems**
ATSAC	**Automated Traffic Surveillance And Control**
Caltrans	**California State Department of Transportation**
CAAA	**Clean Air Act Amendments**
CAD	**Computer Aided Dispatch**
CAATS	**California Alliance for Advanced Transportation Systems**
CCTV	**Closed Circuit Television**
CTP	**California Transportation Plan**
DOT	**Department of Transportation**
EDP	**Early Deployment Plan**
EPA	**Environmental Protection Agency**
FHWA	**Federal Highway Administration**
FOT	**Field Operational Test**
HOV	**High Occupancy Vehicle**
IM	**Intermodalism**
IRTIS	**Inter-Regional Traveler Information System**
ISTEA or the Act	**Intermodal Surface Transportation Efficiency Act**
ITS	**Intelligent Transportation Systems**
IVHS	**Intelligent Vehicle Highway Systems**
LU/EF	**Integration of Land Use and Economic Factors**
MPO	**Metropolitan Planning Organization**
MIS	**Major Investment Study**

MPP	**Metropolitan Planning Process**
MTC	**Metropolitan Transportation Commission**
MTS	**Metropolitan Transportation System**
NAHSC	**National Automated Highway Systems Consortium**
NHS	**National Highway System**
NSA	**National Systems Architecture**
ONT&R	**Office of New Technology & Research**
PATH	**Partners for Advanced Transit and Highways**
PI	**Public Involvement**
PSA	**Precursor System Analyses**
RF	**Radio Frequency**
RTPA	**Regional Transportation Planning Agency**
RTIP	**Regional Transportation Improvement Program**
RTP	**Regional Transportation Plans**
SCAG	**Southern California Association of Governments**
SACOG	**Sacramento Area Council of Governments**
SANDAG	**San Diego Association of Governments**
SMM	**System Management and Maintenance**
STIP	**State Transportation Improvement Program**
TIC	**Traveler Information Center**
TMC	**Transportation Management Center**
TTRD	**Transportation Technologies Research & Development**
VTDS	**Video Traffic Detection System**
YATI	**Yosemite Area Traveler Information System**

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1.0 INTRODUCTION

The Intermodal Surface Transportation Efficiency Act (ISTEA, or the Act) (1) has been law for six years and has undergone an initial phase of reauthorization review that will conclude in 1998. This legislation emphasizes transportation systems that promote mobility and accessibility and that in conjunction with the Clean Air Act Amendments (CAAA) will help to minimize transportation-related fuel usage and vehicle emissions. To achieve these objectives at the metropolitan level, the States have entered into a relationship with Metropolitan Planning Organizations (MPOs) and other key transportation service providers to develop transportation plans and programs. While, MPOs have played a major role in urban transportation planning since the early 1960s, they have gained significant decisionmaking powers under ISTEA. The metropolitan planning process set forth in ISTEA focuses on the linkages between improved planning and improved decision-making and provides the methods for such planning. ISTEA includes the following six major components to achieve these objectives (2):

- a proactive and inclusive public involvement process;
- consideration of land-use planning, energy conservation, and environmental management;
- Major Investment Studies (MIS) conducted to address important transportation problems in a corridor or subarea that might involve field testing and implementation programs;
- development of financial plans for implementing transportation plans and transportation improvement programs;
- assurance that the transportation plans conform to State plans consistent with standards set forth in relevant air quality legislation; and
- development and implementation of management systems (intermodal, congestion, public transit, pavement, bridge, and safety).

1.1 Motivation and Objectives

The objective of this work is to answer the following core questions:

- What is the current state of California's implementation of ISTEA?

- To what extent have Intelligent Transportation Systems (ITS) been integrated within California's transportation planning process with respect to the development and implementation of these six systems?
- Are there opportunities for integration that have not been recognized and implemented?

Potential avenues in which ITS could be used relative to the implementation of ISTEA have been investigated and it has been determined what has worked, what has not, and what opportunities there are for improvement.

1.2 Contributions of the Research

This work has made a contribution by identifying and subsequently recommending potentially beneficial linkages between the development and implementation of the six management systems mandated by ISTEA and California's ongoing ITS work in the areas of research, development, field testing, evaluation, and operations. An important product of this research has been the identification of further research needs that have hitherto not been identified, i.e. gaps in the research program, and associated opportunities for satisfying such needs to provide benefits to California's ITS program.

1.3 Contents of the Report

This report covers the following areas of investigation: Section 2 contains results of a literature review of the ISTEA legislation in general and how ISTEA has been implemented in California. Section 3 describes a) the development and implementation of a survey instrument that was used to obtain further information about California's implementation of ISTEA and its linkages with ITS and b) results and analysis of the survey. Section 4 offers recommendations and conclusions.

2.0 DOCUMENTATION OF LITERATURE REVIEWS

2.1 Overview Of ISTEA Legislation

2.1.1 General

The Intermodal Surface Transportation Efficiency Act of 1991, signed into law in December 1991, sets a new agenda or direction for surface transportation planning and development in America. "As the latest stage of the historic evolution of efforts in transportation planning" (3), ISTEA significantly redirected federal transportation policies to address the changing context of American society and the changing needs for the transportation system. Setting a vision for an "economically efficient and environmentally sound transportation system to serve the nation's economic viability in global economic competition of the 21st century" (1), ISTEA has attempted to comprehensively integrate the objectives directly associated with the transportation system, addressing system efficiency, mobility, safety, accessibility, quality of life issues, community needs, and energy conservation.

2.1.2 Key Features

The shift in what transportation objectives are considered results in innovative policies that cover a wide range of aspects of the transportation system. In particular, ISTEA is distinguished for its features in helping to develop efficient systems management and maintenance; intermodalism; state and metropolitan transportation planning; responsiveness to social, economic and environmental needs; flexible financing and fiscal realism; and advanced technology. The above six key features are summarized in the literature review of the ISTEA legislation as well as in other documentation.

2.1.2.1 System Management And Maintenance With Emphasis On Performance Measures

Recognizing that the National Highway System (NHS) is near its completion, ISTEA establishes policies that are different from previous legislation. A prime example is the shift in focus from the building of a surface transportation system to the management and maintenance of that surface transportation system.

ISTEA authorizes six major programs or systems to enhance system management and maintenance. They are: pavement management system, bridge management system, public transit facilities and equipment management system, intermodal management system, traffic congestion management system, and highway safety management system. The objective of establishing these management systems is to improve the operation and maintenance of transportation facilities, as well as to provide systematic analysis for improving system performance and supporting transportation plans and projects (2). There are linkages among the management systems, and they will be accessible to a variety of users, including local agencies, MPOs, transit agencies, research organizations, and others.

System-wide performance measures and rigorous analysis for system management and maintenance are emphasized in ISTEA through the six management systems. While national standards of minimum acceptable performance measures are not specified, ISTEA encourages urban areas to focus on performance (3). Under ISTEA, performance measures for person/goods movement and user access are considered equally important. For example, congestion management systems promote a broader assessment of system performance that is geared more to objectives of mobility, accessibility, and trip quality (4). With the focus on performance measures and effective analysis, the six management systems can be well integrated as substantial components of the overall planning process, and can be expected to be important sources of information and means of improving transportation investment effectiveness.

2.1.2.2 Intermodalism

Intermodalism, one of the significant features of ISTEA, organizes the whole trip with regard to the efficient movement of goods and people. Intermodalism means the efficient use of all necessary and available modes throughout a trip's duration, including seamless connections or transfers among different modes (5).

ISTEA's promotion of development of a national intermodal transportation system provides a foundation to take advantage of and make efficient use of transportation resources, and strengthens the nation's global economic competitiveness. The Act requires participation of the following federal transportation agencies: Federal Highway Administration, Federal Aviation Administration, Maritime Administration, Federal Railroad Administration, and Federal Transit Administration (1). The National Commission on Intermodal Transportation was established under the Act to "study the status of intermodal standardization, intermodal impacts on public works infrastructure, legal impediments to efficient intermodal transportation, financial issues, new technology, problems in documenting intermodal transfer needs, and the relationship of intermodal transportation to productivity"(6).

It is becoming clear that future gains in economic performance of the transportation sector are going to come from enhanced system connectivity and improved reliability in congested metropolitan areas, rather than from major expansions or widenings of the existing highway system. In particular, "intermodal planning is a key part of economic revitalization in inner city and brownfield areas, as congestion and highway development in the suburbs have stripped these areas of the access advantages they once had." (5). A brownfield area is defined by the U.S. Environmental Protection Agency (EPA) as abandoned, idled, or under-used industrial and commercial areas where expansion or redevelopment is complicated by real or perceived environmental contamination. These areas are typically situated in urban areas near utilities, highways, railways and inexpensive labor pools.

2.1.2.3 Empowerment of State and Metropolitan Transportation Planning With Enhanced Public Involvement

ISTEA empowers state, regional, and local transportation planning and policy making in response to the transportation needs of communities. In particular, ISTEA creates significant new roles for the nation's MPOs by broadening the scope of transportation planning. The Act recognizes changes in development patterns, the economic and cultural diversity of metropolitan areas, and the need to provide these areas with more control over transportation policies and their implementation (2).
Planning process requirements are strengthened for State Departments of Transportation (DOTs) and MPOs with the decentralization of transportation planning. A list of key planning factors has been developed to effectively guide transportation planning at State and metropolitan levels. This is "particularly significant for DOTs, as they have never before been subject to a federal mandate for transportation planning" (4). The metropolitan planning processes set forth in ISTEA emphasize the linkages between improved planning and better decision-making, and provide the tools for comprehensive planning. MPOs are required to consider six management systems at the metropolitan level to ensure a planning process which produces satisfactory investment decisions.

ISTEA encourages early and substantial public participation at all stages of the transportation planning process by including key stakeholders, such as the business community, neighborhood groups, and special interest groups (particularly those with special transportation needs) who have not traditionally been involved.

Substantial public involvement could open the planning process to controversy, but could also be crucial in building consensus and achieving transportation decisions that will best serve the interests of the region.

2.1.2.4 Air Quality, Land Use, and the Economy

ISTEA also recognizes that it is time to consider transportation investments from the standpoint of communities by integrating transportation with environmental, land use, and economic issues.

The law requires conformity with the CAAA of 1990 (7). This legislation led to a large number of projects to reduce the emission of certain pollutants. In particular, congestion mitigation and air quality improvement programs have directed transportation projects' funds toward non-attainment areas under CAAA of 1990. This in turn contributes to meeting the attainment of national ambient area air quality standards.

ISTEA also promotes integration of transportation and land use designed to lead to socio-economic improvements. It allows local and regional agencies to choose between freeways and more local roads, between transit investments and freeways, and between projects for bicycle/pedestrian use and other types of projects. Numerous examples exist which demonstrate the emerging fusion of transit-oriented development and community development. The inclusion of land use and economic considerations into transportation are important for transportation investments that revitalize communities (5).

2.1.2.5 Funding Flexibility and Fiscal Realism

The Act emphasizes flexibility in allocating funds to transportation projects. State and metropolitan areas can choose to use funds from National Highway System and Surface Transportation Projects on transportation planning and development. Transit, bicycle, and pedestrian facilities are also eligible for Surface Transportation Projects funds through the Congestion Mitigation and Air Quality Improvement Program. Rather than having resources identified as for either highway or public transit, the State and urban areas are able to allocate funds based on the competitive ability of candidate projects to satisfy regional priorities.

Funding flexibility in ISTEA also comes with fiscal limitations. The Act requires transportation plans to be fiscally constrained, given the reality of limited financial resources. All plans must include a financial element which identifies resources that are reasonably available to implement the plan. This requirement of fiscal reality "encourages good financial planning and prevents transportation plans and transportation improvement projects from becoming a "wish-list" of projects with no realistic chance of implementation" (2). Fiscal constraints also require that maintenance and operation of the transportation system is funded.

2.1.2.6 Development of Advanced Technology

In addition to these breakthroughs, ISTEA encourages the development and application of advanced technologies in the transportation system. The Act deems that continuing development and use of new technologies is vital for a cleaner, safer, and more efficient transportation system, and for America's ability to compete in the global marketplace of the next century. Advanced technologies cover a variety of aspects of contemporary technology development, especially advanced communication and vehicle control. The Act also states that transportation systems must be operated and maintained with attention to technology innovation (1).

Under the initiation of the Intelligent Vehicle Highway Systems (IVHS) Act of 1991 within ISTEA, projects on new technologies' research and application have been funded and new partnerships with the private sector have formed to encourage the nation to move forward to provide transportation innovations for the 21st Century. It is this component of ISTEA, that is, the IVHS Act, that subsequently lead to the creation of a national ITS Program.

2.1.3 Specific ITS-Related Issues

The policies for planning and development of advanced technologies in transportation systems, under the chapter concerning research within the Act (6),

address different aspects of technology application, including institutional arrangements, program design, funding arrangements, and deployment agendas. In general, development of advanced technologies can be summarized into two elements: Institutional establishment and IVHS programs.

2.1.3.1 Establishment of Institutional Component

The Act provides substantial institutional support needed for enhanced research and development and effective application of innovative technology. An important principle is to establish institutions that would foster partnerships and enhance collaboration with governmental agencies, university research institutions, and private sector organizations. To achieve this principle, ISTEA proposes the following features:

- Enhance public-private partnerships and collaboration on technology research and development. The participants in the partnership include governmental agencies at all levels, university research institutes, and private-sector entities.
- Authorize national level authorities' participation in the development of advanced technologies. These authorities are responsible for the planning, guidance, and collaboration on research and development.
- Establish university transportation centers and research institutes in support of advanced transportation technology projects and related policy issues.
- Encourage transportation technology related industries.

2.1.3.2 IVHS Program

Under ISTEA, the Intelligent Vehicle-Highway Systems Act of 1991 establishes the IVHS Program, with approximately $660 million authorized for the 6-year authorization period (6). IVHS is defined as the development and/or application of electronics, communications, or information processing (including advanced traffic management systems, commercial vehicle operations, advanced traveler information systems, advanced vehicle control systems, advanced public transportation systems, satellite vehicle tracking systems, and advanced vehicle communications systems) used

individually or in combination to improve the efficiency and safety of surface transportation systems. The IVHS program was established to research, develop, and operationally test intelligent vehicle-highway systems and promote implementation of such systems as a component of the nation's surface transportation system (1). Under this guidance, the Act set up specific programs for the development of advanced technology.

2.1.3.2.1 IVHS Corridors

The IVHS Corridors program provides for technology deployment tests under "real-world" conditions. IVHS corridors selected must show particular benefits such as congestion reduction or air quality improvements, and assist in the development and implementation of IVHS through financial and technical assistance assigned in ISTEA (1).

Criteria are specified for the selection of IVHS corridors from existing highway corridors. The criteria consist of high traffic density, severe or extreme non-attainment of air quality standards, inability to expand facilities, a variety of facilities, and complex traffic patterns.

The IVHS corridors need to achieve five major measures of benefits: improved operational efficiency, reduced regulatory burden, improved commercial productivity, improved safety, and enhanced motorist and traveler performance.

2.1.3.2.2 Field Operational Tests

State and local governments, universities, and other non-federal entities can initiate projects for operational tests relating to intelligent vehicle highway systems. The projects that gain the highest priorities are those which have high potential benefits, advance the current state of knowledge, and build on successes achieved in previous work on IVHS.

2.1.3.2.3 Consortia Of Advanced Transportation Systems and Electric Vehicles

The Act initiates a consortia on advanced transportation systems and electric vehicle research and development. The consortia is organized with "extensive participation of university research organizations and private-sector industries for the collaborative design and development of intelligent transportation technologies" (6). The consortia's tasks include (1) design and development of electric vehicles and advanced transportation systems, or related systems or equipment, or other work for the purpose of enabling serial production processes; (2) encouragement of small and medium-sized private businesses in conjunction with large established manufacturers; (3) development of technical staff in electric vehicle and transit-related technical design, manufacture, conversion, and maintenance; and (4) creation of access to computer protocols that are compatible with large-scale manufacturing while encouraging smaller businesses to participate through outside contracts.

2.1.3.2.4 Other Projects

Other projects include: development of compatible standards of IVHS technologies; evaluation of technologies, including evaluation of operational testing projects; and study of commercial motor vehicle safety technology.

2.1.4 Relation of Technology Development to Other ISTEA Features

While strategic planning for research, development, and deployment of advanced transportation technologies is stressed under the Research Chapter of ISTEA, the Act makes it clear that the objective for development of intelligent transportation technologies is set in a broad context with the emphasis on its compatibility with other objectives that ISTEA promotes.

The Act stresses that the development of advanced transportation technology should emphasize competition, energy efficiency, productivity, economic growth and efficiency, and be environmentally sound, with consideration of safety and the

development of cost allocation techniques. The research and development of IVHS should focus not only on capacity, productivity, and safety, but also the reduction of social, economic, and environmental costs associated with transportation. Among the key criteria for the IVHS corridors' selections is "severe or extreme non-attainment for ozone under CAAA 1990, as determined by the Administrator of the Environmental Protection Agency" (1).

Intermodalism characteristics of the Act are addressed in various sections of the Act's technology development component. The research guidelines not only focus on technologies for the automobile and highway, but also for transit, with the establishment of the National Transit Institute as an authority in coordinating transit-related technology research. In the IVHS Act, the selected IVHS corridors should have a significant blend of automobile, transit, and commercial motor carrier traffic, with various transportation facilities such as tunnels, toll roads, and bridges (1).

The Act also focuses additional attention on the appropriate institutional arrangements for the research and development of advanced transportation technologies. Throughout the strategic planning of advanced transportation systems, institutional issues are emphasized in several respects. Examples of such issues include the initiation of new collaborative national authorities, strong promotion of public-private partnerships, and cooperation, and assistance among federal, state, and local governments. Especially for the FOT Projects, the Act offers not only technical, but also financial assistance by "grants to State and Local governments for feasibility and planning studies for development and implementation of IVHS."

2.2 Implementation of ISTEA in California[1]

2.2.1 Related California Legislation

California was already a leading state in the area of transportation planning before the enactment of ISTEA. The State had passed legislation addressing the changing context of transportation planning in California, including mandates for a State long-range transportation plan, mass transportation housing density programs, State and local transportation partnership programs, standard designs for bikeway planning, initiation of State Transportation Improvement Programs, and other elements (8).

In response to the comprehensive objectives promoted by ISTEA, existing transportation planning statutes have been revised and new legislation that addresses the implementation of ISTEA has been added. The major legislation since ISTEA is summarized as follows (9):

- California government code 65089 on performance measures, database, parking cashing-out, etc., amended by state in 1992,1994, and 1995.

  This is a recently authorized statute, reflecting the implementation of ISTEA strategies in California. The amended bill encourages the development of performance measures in the evaluation of multimodal system performance. It also addresses issues not emphasized before, including consistency between congestion management plans and regional transportation improvement plans, land use impacts by transportation decisions, database on traffic impacts, parking cashing-out programs in local development, mandates on businesses to facilitate employees ridesharing, use of public transit, and other means of travel rather than use of single occupancy vehicles.

- California government code 65070 on long range transportation planning, amended by state in 1992.

  This bill mandates new planning principles for long-range transportation plans. Emphasis is placed on the following: integrating state and regional transportation plans; specifying content of transportation plans; providing details on the planning process, in particular the submission and adoption of the plan; and achieving consistency between State and federal transportation improvement programs.

[1] Additional background material on the implementation of ISTEA in California may be found in the following: Lewis, Paul G. and Sprague, Mary, 1997, *Federal Transportation Policy and the Role of Metropolitan Planning Organizations in California*, Public Policy Institute of California, April 1997.

- California government code 65080 on regional transportation plan, amended by state in 1992.

  The amendment adds the requirement of considering planning codes specified in ISTEA into State, regional, and local transportation planning, and revises requirements on the content of regional transportation plans.

- California government code 65081.3 on corridors and right-of-way preservation, amended by state in 1992.

  This new requirement addresses corridor designation and preservation priorities. It reflects the objective of system management in ISTEA, and requires the involvement of regional transportation planning agencies (RTPAs) in corridor preservation.

- California government code 65082 on regional transportation improvement program, amended by state in 1992 and 1996.

  It mandates that the State congestion management program be incorporated into the Regional Transportation Improvement Program (RTIP). RTIP, as defined by the California Transportation Commission, is "a seven year list of proposed transportation projects submitted to the California Transportation Commission by the RTPAs as a request for state funding" (10).

2.2.2 State and Regional Planning

As previously summarized, ISTEA recognizes the differing transportation needs of regional entities, and enhances transportation planning processes at state and regional levels. Efforts have been made to improve the effectiveness of the local and regional planning process and the achievement of comprehensive ISTEA objectives at the state and regional level.

2.2.2.1 Regional Transportation Planning

Regional transportation planning is conducted by RTPAs in cooperation with the State Department of Transportation. The RTPA is an entity designated by the Director of Caltrans pursuant to California Government Code 29532. The RTPAs are either Councils of Government or Local Transportation Commissions. Transportation

planning at the regional level is strengthened by further responding to the objectives of ISTEA. Such objectives are (10):

- Revision of guidelines for Regional Transportation Plans (RTPs) in 1992 and 1994. The revised guidelines serve as a common framework for regional transportation plans with the intention to "promote an effective and integrated multimodal regional transportation planning process as an integrated part of comprehensive planning throughout California" (10), while still allowing flexibility.
- Enhanced public involvement in the regional transportation planning process as required by ISTEA and the State. State legislation mandates that regional transportation planning agencies must involve the general public as well as other local, state, and federal agencies during the development of transportation programs and plans.
- Extensive coordination and ongoing consultation in the statewide and regional transportation planning process, particularly, coordination between regional transportation planning agencies and others such as transportation providers, air quality districts, local planning agencies, and congestion management agencies.
- Comprehensive planning analysis. Planning analysis is mandated both by federal and State legislation. Consideration includes transportation--related factors such as land use, financial needs, air quality, and environmental considerations including wetlands, endangered species, and cultural resources.
- Regional Transportation Planning Agencies' participation in Major Investment Studies (2). Major Investment Studies are in-depth planning analyses conducted on a corridor or sub-regional area which integrate social, economic, and environmental considerations early in the process of transportation planning. The region is responsible for either coordinating, performing, or participating in MISs.
- Transportation and air quality conformity. Regional transportation planning agencies are responsible for making conformity determinations on the plans and transportation improvement programs to ensure the region's conformity to the State Transportation Improvement Program (STIP), especially for those in ozone and carbon monoxide non-attainment areas (2). STIP is defined as "a seven year list of transportation projects proposed in RTIPs which are approved by the California Transportation Commission"(10).

The most recent RTP for each of the four largest MPO's in California were obtained, reviewed, and summarized in the following sub-sections (Sections 2.2.2.1.1-2.2.2.1.4). The summaries include the primary goals and the key characteristics associated with each of the RTPs.

2.2.2.1.1 Metropolitan Transportation Commission (MTC) 1994 RTP

There are five primary goals that have been established for this RTP:

- *Improve mobility for persons and freight*.
  Focus on Metropolitan Transportation System (MTS) efficiency, safety, management, and maintenance, as well as partnership development among the organizational entities that operate the MTS.
- *Promote equity for system users*.
  Focus on the development of an equitable decision-making process, equitable distribution of costs and benefits, and mobility improvement for the transportation disadvantaged.
- *Enhance sensitivity to the environment.*
  Fully consider both short- and long-term environmental impacts and mitigation of adverse impacts.
- *Support economic vitality of the region*.
  Reinforcement of the relationship between the regional economy and the capability of the transportation system, in the following ways: multimodal MTS, transit investment, and port and related infrastructure.
- *Support community vitality in the region*.
  Transportation improvement should help communities and enhance quality of life.

The key characteristics of this RTP are as follows:

- Consideration of financial constraints and detailed analysis of project funding arrangements.
- Focus on MTS with respect to street maintenance, bridge seismic retrofit, transit improvement, corridor operational improvement, highway improvement (HOV lanes), and bicycle and pedestrian improvement.
- Consistency between regional transportation improvement and county transportation improvement, and funding allocation to the projects in the nine counties of the Bay Area.
- Detailed consideration of ISTEA planning factors in the RTP, and comparison of RTP implementation and the ISTEA planning factors.

Full details for the MTC RTP may be found in (11).

2.2.2.1.2 Sacramento Area Council Of Governments (SACOG) 1996 RTP

There are seven primary goals that have been established for this RTP:

- *System preservation*
  Preserve existing transportation facilities as a means of protecting transportation investments and maintaining an effective system.
- *Land use/mobility*

Meet the mobility needs of people; bring changes in existing urban form that will facilitate the development of the most efficient and effective transportation system; coordinate among local General Plans.

- *Air quality*
  Attain CAAA air quality standards, ensure consistency between RTP and the Regional Air Quality Plan for Sacramento air quality maintenance area.
- *Environment*
  Mitigate environmental impacts of the transportation system, and minimize energy consumption.
- *Safety*
  Safer transportation system and safer use of the transportation system.
- *Economy*
  Efficient use of funds, and contribution to the region's economic vitality.
- *Organization*
  Foster interagency coordination and cooperation, and serve as a forum for local agencies to work together to achieve common goals.

The key characteristics of this RTP are as follows:

- Strong focus on air quality improvement.
- Attention to ITS on system performance improvements, especially in the areas of highway improvement in metropolitan areas, and interstate corridor traffic improvements. The projects related to ITS implementation include master traffic controller systems for downtown traffic and assisting Caltrans Traffic Operating Systems.
- Evaluation of Regional Transportation Plan using performance measures
  - Roadway measures: trip length and level of roadway congestion
  - Mode choice measures: no significant change of mode choice will occur
  - Accessibility measures: the plan will bring substantial increase in the accessibility to jobs via public transit.
  - Emission measures: Plan implementation will assist in emissions decreases for all the studied pollutants, except for particulate matter, and it succeeds in keeping the growth in vehicle trips to a lower rate than the population growth.
- Consideration of financial constraints and funding allocation analysis.
- Comparison of RTP implementation and ISTEA planning factors.

Full details for the SACOG RTP may be found in (12).

2.2.2.1.3 San Diego Association of Governments (SANDAG) 1996 RTP

There are five principal goals that have been established for this RTP:

- A mix of modes capable of meeting the need for mobility and goods movement.
- Coordination with other jurisdictions.
- Encourage telecommunication advances to provide alternatives for personal travel, primarily provided by the private sector
- Develop a balance between land use and the transportation system.
- Mobility for all, including the transportation disadvantaged.

The key characteristics of this RTP are as follows:

- Design of policies and actions based on transportation modes, technologies, and air quality
- Incorporation of ITS development and deployment into 1996 RTP. While ITS projects are addressed throughout the major elements of the plan, these are emphasized in the advanced transportation technology element.
- Consideration of financial constraints and funding allocation analysis.

Full details for the SANDAG RTP may be found in (13).

2.2.2.1.4 Southern California Association of Governments (SCAG) 1996 RTP

There are five principal goals that have been established for this RTP:

- Meet the regional and subregional mobility and access needs.
- Ensure that transportation investments are cost effective, environmentally sound, energy efficient.
- Serve the transportation needs of the disadvantaged for safe, reliable, and economic service.
- Consistency between region, subregions, communities.
- Promote innovative transportation strategies and new technologies.

The key characteristics of this RTP are as follows:

- Incorporate ITS development and deployment into 1997 RTP. It promotes the application of intelligent transportation technologies to enhance the efficiency of existing systems. In particular, it develops or refines ITS projects for the region. Each ITS project has its own key implementation, involving local governments, SCAG, Caltrans, County Transportation Commissions, and the Southern California Economic Partnership.
- Evaluate Regional Transportation Plan using performance measures.
  Mobility measure - travel time, peak speed, freeway severe congestion miles, peak travel delay.
  Accessibility measure - work opportunities within 25/100 minutes, non-work opportunities.
  Environment measure - federal and state standards
  Reliability measure - level of service by transit and highway
  Safety measure(s) - injury-related accidents and fatality rates by passenger miles

Livable community measure - vehicle trip reduction, vehicle miles reduction
Equity measure - low/high income share of net benefits
Cost-effectiveness measure - life cycle capital and operations costs, life cycle benefits, net present value.
Customer satisfaction measure - user survey.

- Comparison of RTP implementation and ISTEA planning factors.
- Consideration of financial constraints and funding allocation analysis.
- 15 Major Investment Studies have been completed since ISTEA and 7 investments are being studied.

Full details for the SCAG RTP may be found in (14).

2.2.2.2 State Transportation Planning

The California Department of Transportation (Caltrans) has taken the lead in transportation planning to implement the features of ISTEA. While implementation of ISTEA's regional transportation planning elements is primarily local in nature, implementation of state transportation planning is distinguished by its development of state-wide strategies, in addition to other federal and state mandates on ISTEA implementations.

After the passage of ISTEA, the California State legislature mandated the preparation of a long-range strategic State Transportation Plan in 1992 (8). This California Transportation Plan (CTP) lays out directions for long-term planning, developing, operating, and maintaining California's transportation system. The objectives set forth by the California Transportation Plan comply with the comprehensive objectives in ISTEA. Planning a transportation system to fit California's needs, CTP focuses on "transportation and economic development, transportation system safety, maintenance and enhancement, and environmental/land use community considerations" (11), as addressed in ISTEA. Meanwhile, the plan outlines the future of transportation by refining the state's role in integrating all transportation modes and promoting the development of new transportation technologies.

Apart from this comprehensive long-range plan, the state has also developed strategic plans for specific transportation systems and modes, including the following (10):

- ISTEA Management Systems Work Plans The plans use data outputs from the following six management systems and integrate them into the regional planning process: pavement management, bridge management, public transportation facilities, intermodal transportation facilities, congestion management, and traffic safety management. Work Plans for implementing these systems were required to be in place by 1995. The Caltrans' Office of ISTEA Management Systems guides the development of the systems.
- California Aviation System Plan integrates the regional aviation system plans for capital improvements on a Statewide basis.
- California Rail Passenger Program outlines ten-year plans for capital improvements and service expansions for intercity rail and for local commuter and urban rail services.
- Inter-regional Roads System Plan identifies the rural state highway network as a system connecting the state's economic centers and proposes improvement projects for these facilities.
- State Pedestrian and Bikeway Plan guides the development of state, regional, and local pedestrian and bicycle networks required by ISTEA.
- Advanced Transportation Systems Program Plan advances the research, development, and deployment of new technologies in the design, construction, operation, and maintenance of the transportation system.

2.2.3 Advanced Transportation Systems

California is at the cutting edge of technology development. As a result of visions of the future of California's transportation system, the development and application of new technologies become important objectives for long-range strategic planning of the transportation system. As the strategic long-term planning vehicle for the State, the California Transportation Plan is distinguished for its strong advocacy of new technological approaches to transportation development.

Under the policy to promote economic viability for California by providing for flexibility in choice and mobility of people, goods, services, and information, the

strategies developed in the California Transportation Plan set a strong focus on the development and use of new technologies as approaches to achieve its objectives. Fostering technological and operational innovations and developing an advanced technology transportation industry are some of the approaches to encourage transportation investment. Based on the plan, new technologies serve to improve the management efficiency of transportation systems, specifically, the application of development and deployment of Advanced Traffic Management Systems (ATMS). Information technologies are used to fully and systematically coordinate all transportation modes. Apart from economic viability, providing Californians with a safe, convenient, and reliable transportation system is a critical goal. Under this plan, developing advanced vehicle control systems and traveler information systems are also regarded as critical to the success of the transportation system (15).

The promotion of transportation technology research and development by ISTEA, together with the reality of technological innovation and progress, further stresses the need for comprehensive strategies and planning for the development and deployment of advanced transportation technologies. It is under this context that an advanced transportation systems program was established in 1992 in California.

California's advanced transportation program planning is based on principles of user orientation, public-private partnership, cost efficiency, environmental compatibility, multimodality, and strategic planning (16).

Caltrans provides leadership in the program, with the participation of various stakeholders in advanced transportation systems, including government at all levels, the private sector, academia, national laboratories, and professional organizations. As indicated under ISTEA's technology research and development emphasis, the collaboration among the constituencies is critical to the success of the programs.

The advanced transportation systems program plan is the guideline for California's ITS activities. The plan's areas of focus include the development of traveler information systems involving tourism information, traveler (especially commuters)

information, and telecommunication systems. Through products of the communications/consumer electronics' industry, this information will serve the public by providing the latest traffic and travel information. Traffic management systems and emergency management services integrate freeway and surface arterial operations so that travel corridors and areas can be efficiently managed while retaining local community goals. Moreover, in the plan to improve safety, there is a program for the development of advanced vehicles which, in particular, responds to vehicle safety issues in ISTEA. Equally important, public transportation is another focus of technology development, which is expected to provide users with better transit options. The plan is also committed to system integration to develop and deploy Advanced Transportation Management Systems (ATMS) for maximizing use of surface transportation modes and facilities (16).

Among all these strategies, five major programs have been developed to conduct early stage research, development, testing, and evaluation. They are made up of Early Deployment Plans (EDPs), Field Operational Tests (FOTs), the Southern California ITS Priority Corridor, Automated Highway Systems, and participation in the development of a National ITS Architecture.

2.2.3.1 Early Deployment Plans

Caltrans works with several metropolitan areas to develop and implement strategic early deployment plans of ITS. These areas include the San Francisco Bay Area, Fresno County, Kern County, Sacramento County, and jurisdictions in the Southern California Priority Corridor. Targeting ITS technologies to solve problems at the local level, these plans assist local agencies with guidance for incorporating ITS into overall transportation plans and improvement programs, with deployment being the primary objective. The plans identify the ongoing projects involving application of ITS technologies, and evaluate whether these projects meet declared goals. The deployment planning process is a major outreach tool because it focuses on "getting stakeholders

involved with real problems and alternative ITS solutions in the mainstream decision making environment" (16). Regional transportation planning agencies and other regional agencies that deal with transportation and air quality are also actively involved. Moreover, private-public partnerships are emphasized in the plans.

The following three sub-sections provide a summary for each of the EDP for MTC, SACOG, and SANDAG including the EDP's primary goals, elements of the EDP planning process, and linkages between the EDP and the corresponding RTP. No EDP was available for review from SCAG.

2.2.3.1.1 MTC 1996 EDP

This EDP has defined priorities for use of ITS, particularly electronic and communications technologies, in the region over the next five to ten years. There are three principal goals established for this EDP:

- Provide information about ITS to, and solicit ideas/concepts from, a broad range of stakeholders, and enable participants to gain ownership to the EDP.
- Build a regional consensus on an Action Plan for early ITS deployment, and support MTS management strategy and RTP goals.
- Develop public/private partnership for ITS deployment. This partnership is to permit innovative joint arrangements for ITS deployment.

There are four major top-level elements of the EDP planning process:

- Identify transportation problems facing the Bay Area.

Such problems could be related to lack of facilities, travel delays, lack of information, safety and security, regulation and charges, comfort, convenience, ease of use, and environmental impacts.

- Identity ITS services that can address those problems.

ITS Services of High Priority:
Examples of ITS Services include traffic-responsive signal timing, traffic-responsive freeway ramp metering, real-time transit operations control, transit priority at traffic signals, incident

diagnosis and response, real-time transit information, real-time roadway information, electronic transit fare payment, electronic toll collection, and non-stop compliance checks for trucks.

- Identify and evaluate ITS projects that can provide needed services
- Develop an action plan for implementing the projects critical for the region

  - Action plan envisions a substantial expansion of ITS deployment
  - Action plan includes a rough estimate of deployment cost, not specific funding sources for implementation
  - Each project in the Action Plan requires a project sponsor from a local or regional agency, state agency, or partnership of local agencies
  - Projects considered in the Action Plan have highest priority and significance to the region

    - Deploy a probe vehicle system
    - Expand the freeway traffic operations systems
    - Deploy advanced transit signal systems
    - Deploy transit fleet management systems
    - Deploy corridor transportation management systems
    - Expand TravInfo
    - Deploy the TransLink Joint Electronic Transit Fare Card
    - Enhance rideshare matching services

Connection between RTP and EDP:

The 1994 RTP has paid little attention to ITS. The emphasis on MTS improvement in the RTP neither addresses the potential necessity of ITS nor considers ITS approaches among all the selected projects. The 1996 ITS Early Deployment Plan has a very strong connection to the comprehensive RTP goals. In particular, it focuses on Metropolitan Transportation Systems improvement.

Full details for the MTC EDP may be found in (17).

2.2.3.1.2 SACOG 1996 EDP

This EDP is to use innovative approaches to solve transportation problems occurring in the Sacramento region, and recommend a blueprint for implementing strategies.

There are six principal goals established for this EDP:

- Reduce congestion
- Reduce pollution
- Improve travel safety
- Improve transit service utilization
- Facilitate commercial vehicle movements in the region
- Minimize the impacts of through and inter-regional travel

There are five major top-level elements of the EDP planning process:

- Participants
  -ITS workshops and focus group meetings for local agencies; SACOG Advisory Committee, Freight Advisory Committee, Transit Coordinating and Productivity Committee, Bicycle and Pedestrian Task Force

- Identify problems of the region's transportation infrastructure
  -Problems related to: congestion, air pollution, safety, transit productivity, freight transportation, through and inter-regional travel

- Identity ITS services
  -*ITS Services of General Applicability in the Region:*
    - Traffic Control
    - Incident Management
    - En-route Driver Information
    - Emission Testing and Mitigation
    - Public Transportation Management

  -*ITS Services for Specific Traveler Groups and Areas*
    - Route Guidance
    - Pre-Trip Travel Information
    - Ride Matching and Reservation
    - Demand Management and Operations
    - Personalized Public Transit
    - Public Travel Security
    - Commercial Fleet Management
    - Hazardous Material Incident Response and Emergency Vehicle Management

- Develop ITS project concepts

  -*ITS projects developed under this EDP are structured to*
    - maintain the current autonomy of individual agencies for ITS development within their boundaries
    - identify program elements which benefit most from multi-agency coordination and regional perspective
    - identify projects which may "fall between the cracks"

  -*Types of projects*
    - Traveler Information Database (short-term)
    - Regional En-Route Traveler Information and Route Guidance Services
    - Regional Demand Management and Operations Services
    - Regional Incident Management/Hazardous Materials Incident Response Services
    - Regional Emission Testing and Mitigation Services
    - Sacramento Urban Area Traffic Control Network (short-term)
    - Placer County Traffic Control Network
    - Sierra Counties Traveler Information System
    - Transit Services Network (short-term)
    - Standardized Network Information Exchange Protocols
    - Regional Decision Support and Data Collection Systems

- Implement ITS projects

  - Emphasis on institutional issues in implementation process. EDP divides projects into two categories: single agency/organization projects, and multi-agency/operator collaborative projects.
  - Limited opportunities for innovative funding. ITS projects will have to compete with other transportation projects for the limited and diminishing pool of public funds

Connection between RTP and EDP:

The 1994 RTP refers to ITS in terms of system performance improvements, especially in the areas of highway improvements in metropolitan area, and interstate corridor traffic improvements. This EDP emphasizes institutional arrangements in the process of ITS project development and implementation, and provides knowledge on ITS issues for the local agencies. However, it seems somewhat independent of the RTP.

Full details for the SACOG EDP may be found in (18).

2.2.3.1.3 SANDAG 1997 ITS Strategic Plan

SANDAG's ITS strategic plan is a long-range planning document outlining the regional deployment of transportation technologies in terms of the role of technologies in resolving problems, range of ITS to be deployed and timeline for individual ITS deployment. The development and deployment of ITS projects provide an opportunity for improving existing and forecasting future transportation conditions through the enhancement and integration of transportation management and information systems.

There are six primary goals established for this EDP (ITS Strategic Plan):

- Increase efficiency
- Improve productivity
- Improve mobility and accessibility
- Reduce use of energy with negative environmental impacts
- Improve safety
- Develop a transportation system that supports effective deployment of appropriate technologies

There are seven major top-level elements of the EDP planning process:

- Participants
  - Executive ITS Committee - formed by SANDAG, Caltrans-District 11, and City of San Diego.
  - ITS Subcommittee - members of an executive ITS committee formed from transportation professionals, interested parties from the region's jurisdictions and agencies.
  - Consultant Team
  - Agency Coordination and Public Outreach.
- Identify problems of the region's transportation infrastructure
- ITS user services
  - Travel and Transportation Management
    - Traffic control
    - En-route driver information
    - Incident management
    - Traveler information services

- Public Transportation Management
    - Public transportation management
    - Public travel safety
    - En-route transit information
- Travel Demand Management
    - Pre-trip travel information
    - Demand management and operations
- Commercial Vehicle Operations
    - Commercial vehicle electronic clearance
    - Commercial vehicle administration process
- Electronic Payment
    - Electronic payment services
- Advanced Vehicle Control and Safety Systems
    - Vision enhancement for crash avoidance
- Emergency Management
    - Emergency notification and personal security

- Define functional requirements to support user services
    - Identification of user service functions provides a key linkage between user service plan and system architecture.
    - Functional areas consist of traffic surveillance, vehicle surveillance, inter-agency coordination, 1-way mobile communications, 2-way mobile communications, Stationary Communications, Individual Traveler Interface, Payment Systems, Variable Message Display, Signalized Traffic Control, Navigation, Database processing, Traffic Prediction Data Processing, Traffic Control Data Processing, Routing Data, In-Vehicle Sensors/Devices.

- Define System Architecture
    - Present the system architecture functional requirements for the ITS strategic plan.

- ITS program areas, project and strategic deployment plan

    -*The ITS Program Areas*
    - Traffic control/Management
    - Incident Management
    - Transit
    - Traveler Information System
    - Commercial Vehicle Operations

- Implementation

    - ITS Deployment Vision

- Near term: deployment should lean heavily towards the development of base infrastructure rather than application of advanced systems. For deployment of advanced systems, focus on prototype, studies, preliminary engineering, and funding identification.
- Critical mass of base infrastructure: focus more on further deployment and advanced systems.
- Ultimate vision: ITS deployment covers all desired functions.

- Institutional Structure for Deployment
  - SANDAG Board
  - San Diego Region ITS Strategic Planning Subcommittee
  - TMC Network Traffic System Subgroup
  - Transit System Subgroup
  - Commercial Vehicle Operations Subgroup
  - Incident Management Subgroup
  - Inter-CAD/Emergency Service Subgroup
  - Traveler Information Systems Subgroup
  - Communications Infrastructure Subgroup

Connection between RTP and EDP:

Strong consistency exists between the 1996 RTP and the 1996 EDP. ITS-related issues and projects addressed in RTP match the elements in the EDP. The EDP, however, focuses less on RTP's plans and strategies.

Full details for the SANDAG EDP may be found in (19).

2.2.3.2 Field Operational Tests

Field Operational Tests, as major elements of the IVHS program which later evolved into the ITS program, are mandated under the IVHS program of ISTEA. FOTs serve as the transition between research and development of technologies and their full-scale deployment. Field Operational Tests evaluate how well new technologies work in the real world, and assess benefits and costs associated with the application of particular technologies. In California, there are currently a total of nine federally or state funded FOTs, including San Diego SMART Call Box, Los Angeles Spread Spectrum Signal Control, Anaheim Advanced Traffic Control, Orange County Mobile Surveillance, Irvine

Integrated Ramp Control, TransCal serving the I-80 and U.S. 50 corridors between the San Francisco Bay Area and the Lake Tahoe area, TravInfo in the San Francisco Bay Area, Yosemite Area Traveler Information System (YATI), and Otay Mesa Electronic Clearance (20).

- **SAN DIEGO SMART CALL BOX**

This FOT was designed to thoroughly test and evaluate the alternative uses of call boxes for a selected group of traffic management and traveler information applications. This project envisioned expanding the scope of call box functionality beyond the traditional role of a physically accessed voice communication device to a multi-functional IVHS system component. It was hoped that call boxes could eventually provide a wide range of ITS functionality, including traffic census data collection, near real-time incident detection, hazardous weather condition detection and reporting, changeable message signs control, and closed-circuit television (CCTV) surveillance systems. There was a subtest for each application. While it was expected that call boxes would serve this multi-faceted functionality, the evaluation found that call boxes were not appropriate for all functions. There were system integration problems in the changeable message signs, closed-circuit television, and incident detection elements.

STATUS: Test is complete; evaluation is complete; final report has been published.

- **LOS ANGELES SPREAD SPECTRUM SIGNAL CONTROL**

The overall goal of this FOT is to test the feasibility of using an radio frequency (RF) network to interconnect and control arterial traffic signals, with the objectives of reducing installation and maintenance costs and improving performance and reliability. This would be an alternative to the hard-wired interconnect systems and could reduce construction costs, construction time, and cable plant maintenance costs. The test is being conducted by the City of Los Angeles' Department of Transportation in the Mar Vista district. The system would serve as an extension of the existing Automated Traffic Surveillance And Control (ATSAC) system. A new radio transmission technology, Spread Spectrum Radio, will be used for this test.

STATUS: The entire network (87 radios) has been deployed; evaluation is complete; draft evaluation report is currently under review.

- **ANAHEIM ADVANCED TRAFFIC CONTROL**

This project offers an environment necessary for a complete FOT of advanced traffic signal control strategies in a major event location, and compares them to the "traditional" methods of first-generation control used today. The network will consist of 25 traffic signals. The first element of this project is the implementation of a 1.5 Generation Control System that will automate the current process of collecting input data necessary to run signal timing optimization software. The second element is the feasibility study, design, and implementation of an adaptive second-generation control system, SCOOT. The third element is the integration of a Video Traffic Detection System (VTDS), to the Anaheim Traffic Management System.

STATUS: The SCOOT system has been deployed; draft evaluation report is currently being written; video system has been deployed; evaluation is complete; final report has been published.

- **ORANGE COUNTY MOBILE SURVEILLANCE**

This FOT will evaluate the benefits of a mobile, integrated video surveillance/wireless communications system which can, with maximum flexibility, support traffic management functions in construction, incident, and special event locations. There are three major components to the Mobile Surveillance System concept: (1) Video image traffic detection, (2) Ramp metering, and (3) Data and control transmission. Hughes Aircraft Company has developed an open architecture, wireless communication system using Spread Spectrum Radio communications.

STATUS: The Anaheim city street test is completed including the evaluation. The freeway application is on-going.

- **IRVINE INTEGRATED RAMP CONTROL**

The City of Irvine will integrate an existing centrally-controlled freeway ramp meter system with arterial signals consisting of existing signal controllers, a new prototype Advanced Traffic Controller (2070), and a candidate adaptive control measure. The MIST system will monitor and control arterial traffic through Variable Message Signs, ramp metering, and adaptive traffic signaling. This test will evaluate the benefits of ATMS/ATIS coordination as well as inter-agencies coordination between Caltrans and the City of Irvine.

STATUS: Both freeway and arterial street components have been deployed and are currently undergoing system acceptance by Caltrans District 12 and the City of Irvine, respectively. Evaluation is not expected to begin until summer of 1998.

- **TRANSCAL**

The project is composed of the following system: Inter-Regional Traveler Information System (IRTIS): data collected from different agencies and disseminated through commercial radio and TV, kiosks, public telephone, in-vehicle devices, and personal digital assistants.

STATUS: Test is complete; evaluation is on-going and expected to complete by summer 1998.

- **TRAVINFO**

This FOT's primary goal is to implement through a public/private partnership a centralized Traveler Information Center (TIC) to collect, integrate, and broadly disseminate timely and accurate traveler information throughout the San Francisco Bay Area. The evaluation of TravInfo consists of four elements: institutional, traveler response, network performance, and technology. One element of the technology component will consist of an evaluation of the effectiveness of the TIC, TravInfo's hub for data collection, processing, and dissemination.

STATUS: TravInfo went on-line in September 1996 and the test will continue through September 1998; evaluation is on-going.

- **YOSEMITE AREA TRAVELER INFORMATION SYSTEM (YATI)**

The objective of the YATI system is to provide real-time information to the Yosemite-area traveler. The FOT was conducted on the operational system to determine the future applicability of real-time traveler information systems in rural areas. A database and data distribution system architecture has been developed, and a real-time traveler information system in the Yosemite area has been designed. Field testing of the operational system was conducted to determine the system's effectiveness and applicability to other rural areas.

STATUS: First year of test and evaluation are complete; Second year of test is complete and evaluation is being written; A request for third year funding has been made.

- **OTAY MESA ELECTRONIC CLEARANCE**

This project, located near the Mexican border, will demonstrate the use of electronic recorders to automatically check safety and credential records and verify the identity of commercial vehicles, that is, the shipper and the nature of the cargo. This procedure will allow selected commercial vehicles to pass border check points with expedited inspections without stopping at all.

2.2.3.3 Southern California ITS Priority Corridor

The Southern California Priority Corridor is one of four ITS priority corridors in the nation. The Southern California Priority Corridor covers six counties in four regions: Los Angeles and Ventura, San Bernardino and Riverside, San Diego, and Orange. Caltrans, local agencies, and the private sector have formed coalitions to accelerate the deployment of various aspects of intelligent transportation systems. Major programs in the Southern California ITS Priority Corridor are listed as follows:

1. Strategic deployment plans developed by each of the four regions, as well as a corridor-wide plan that weaves the regional plans together.

   The plans are to identify near-term and long-term transportation technology needs, programs, projects, and funding. The planning process involves public participation and an adequate definition of the needs of all users of transportation systems and modes, including commercial freight operators, transit operators, and travelers.

2. An intermodal transportation management and information system near-term project (Showcase Project) (21).

   This near-term showcase implementation program is to optimize and coordinate freeway and street operations with public and private transportation and transit systems within the corridor. It aims to integrate all modes and roads into a coordinated transportation management and information system. In particular, it develops an information exchange network and eventual advanced traveler information system and advanced traffic management system for all six counties.

3. An advanced traffic management systems (ATMS) testbed.

   This real-world testbed is to evaluate new technologies and strategies in the management of advanced transportation systems. The ATMS testbed is expected to "provide an instrumental, multi-jurisdictional and multi-agency transportation operational environment linked to university laboratories for real-time technologies and applications", setting up "a meeting ground for practitioners and researchers to try new approaches to transportation systems management". It will enable "off-line testing of products and further development of research prototypes prior to installation in the field". Private industry is encouraged to demonstrate and evaluate their technologies under real-world traffic conditions (16).

4. Field Operational Tests.

   Six of the nine FOTs are conducted in the Southern California Priority Corridor, including the San Diego Smart Call Box, Los Angeles Spread Spectrum Signal Control,

Irvine Integrated Ramp Control, Anaheim Advanced Traffic Control, Orange County Mobile Surveillance, and the Otay Mesa Electronic Clearance. Brief descriptions of these FOTs are given in Section 3.3.2.

A critical principle of the Southern California Priority Corridor is the promotion of institutional cooperation to accomplish desired objectives. This cooperation would help to lay a solid foundation for public-private partnerships, and public-public cooperation.

2.2.3.4 Automated Highway Systems

Recognizing the potential of Automated Highway Systems (AHS), Congress included a provision on AHS in ISTEA. Part B, Section 6054 (b) of the Act directs that "The Secretary (of Transportation) shall develop an automated highway and vehicle prototype from which future fully automated intelligent vehicle-highway systems can be developed. Such development shall include research in human factors to ensure the success of the man-machine relationship. The goal of this program is to have the first fully automated roadway or an automated test track in operation by 1997. This system shall accommodate installation of equipment in new and existing motor vehicles" (22). Demonstration of the proof of technical feasibility successfully occurred in August 1997 on a portion of the High Occupancy Vehicle facility on I-15 in San Diego.

While research and development in the general area of vehicle automation has been ongoing for decades, the current program on vehicle and highway automation began with the one- year Precursor System Analyses (PSA) initiated by the Federal Highway Administration in 1993 and the commencement of work within the National Automated Highway Systems Consortium (NAHSC) in 1994. The PSA projects investigated the issues and risks associated with the deployment of automated highway systems, considering technical as well as institutional and societal issues.

California played a considerable role in the PSA projects and played a major role in work of the NAHSC. Caltrans and the California PATH (Partners for Advanced Transit and Highways) Program at the University of California at Berkeley were two of

the ten core members of the Consortium, along with other academic institutions, private-sector companies in the automobile manufacturing and highway infrastructure building industry, as well as the Federal government.

Caltrans has represented the state/regional/metropolitan transportation planning and operating agencies stakeholder group. With this perspective, it has provided the consortium with expertise in operating and maintaining highways, in addressing legal, societal, and institutional issues, in assessing environmental impacts, and in performing safety and hazard analysis. The PATH Program, as an academic research organization and partner with Caltrans for the last ten years, has been a pioneer in the field of advanced transportation systems, providing the historical background as well as ongoing research capabilities.

2.2.3.5 ITS Architecture: National and State

ISTEA established a program to encourage implementation of ITS. To ensure that ITS projects are deployed effectively and operate consistently across jurisdictional boundaries and different modes of transportation, a National Systems Architecture (NSA) was created.

The effort to develop a common national system architecture to guide the evolution of ITS in the U.S. over the next 20+ years was managed by the Federal Highway Administration (FHWA) from September 1993 until its conclusion in 1996. The Program's objectives were to develop a national ITS architecture. This national architecture describes in detail what types of interfaces should exist among ITS components, how they will exchange information and work together to deliver the given ITS User Services, and, ultimately, how they will guide multi-level government and private-sector business planners in developing and deploying nationally compatible systems. By ensuring system compatibility, the objective was to accelerate ITS introduction nationwide and develop a strong and diverse marketplace for related products and services.

The NSA offers both a conceptual framework and policy guidance for ITS implementors, while preserving local flexibility. A significant consequence of this flexibility, however, has been the requirement that local ITS implementors develop a regional architecture. In the pursuit of this endeavor in California, a study is underway whose primary purposes are to identify the implications of the NSA for ITS projects in California and to develop recommendations for planning cost-effective deployment of NSA-compatible ITS projects statewide (23).

2.3 Summary and Conclusions

This section documents the investigation of the literature to gain a preliminary understanding of the ISTEA legislation in general and its implementation in California in the context of the State's efforts in the area of ITS. This background material provided assistance in conducting the remainder of the project tasks, especially the development and implementation of the plan with which to assess more directly the State's implementation of ISTEA by means of its research, development, and deployment of Intelligent Transportation Systems. This plan consisted of the development and implementation of a survey instrument with which to solicit information from transportation professionals with expertise in the ITS and ISTEA arena.

The Intermodal Surface Transportation Efficiency Act of 1991, signed into law in December 1991, set a new era for surface transportation planning and development in America. As a breakthrough in the historic evolution of efforts in transportation planning, ISTEA significantly redirects federal transportation policies to address the changing transportation needs of American society and the changing needs of our transportation system. Setting a vision for an economically efficient and environmentally sound transportation system to enhance the nation's economic viability in the global marketplace of the 21st century, ISTEA comprehensively integrates the objectives of system efficiency, mobility, safety, accessibility, quality of life issues, community needs, air quality and energy conservation.

The shift in which transportation objectives are considered priorities has resulted in innovative policies that cover a wide range of aspects of transportation systems. In particular, ISTEA is distinguished for its features in helping to develop efficient systems management and maintenance, intermodalism, state and metropolitan transportation planning. These features are responsive to the integration of social, economic and environmental needs, flexible financing and fiscal realism, and development of advanced technology.

The State's implementation of ISTEA with respect to ITS consists of three primary elements: related state-wide legislation, the State and regional transportation planning processes, and the State's efforts in the area of Advanced Transportation Systems (ATS). California's work in ATS consists of five major programs to conduct research, development, testing, and evaluation. They are made up of Early Deployment Plans, Field Operational Tests, the Southern California ITS Priority Corridor, Automated Highway Systems, and participation in the development of national ITS Architecture.

3.0 SURVEY INSTRUMENT

To gain further insight into how ISTEA has been implemented within California in relation to ITS, a questionnaire was developed and carried out through interviews of numerous transportation professionals who have the first-hand knowledge and experience gained from doing the actual "field" work of ISTEA implementation. Depending solely on the published literature sources would have provided an incomplete picture of ISTEA's implementation in California and its connections with ITS.

This section describes the survey instrument used in the second phase of the project, including its design and the results and analysis of its implementation.

3.1 Survey Study Design

This section presents the survey instrument design and findings of its analysis. A copy of the survey instrument is provided in Appendix A. The objective of the survey was to gather data on the following subjects:

- How ISTEA has been implemented in California from actual practitioners in the transportation field
- Practitioners' knowledge and familiarity with ITS
- ISTEA opportunities for and barriers against ITS
- How ITS can help achieve ISTEA objectives
- Impacts of inter-jurisdictional relationships on ITS implementation
- What the legislative reauthorization of ISTEA should do to provide better opportunities for ITS implementation

The survey was sub-divided into sections corresponding to each of these objectives. The structure of the questionnaire consisted of a combination of structured questions in a multiple-choice format and open-ended questions to allow the interviewee the ability to more freely express him/herself about a particular issue (as well as allow the interviewer to probe further into certain questions to elicit additional detail).

An initial candidate list of potential people to survey was developed based on the experience of the research team in the area of ITS and ISTEA implementation. Breadth across rather than depth within individual organizations was preferred. This initial list was reviewed and additional names supplied by the researchers' Project Oversight Team in Caltrans' Office of New Technology and Research (ONT&R). Additional names were also suggested by other members of the ONT&R. Based on this input, the final list was developed. The survey's goal was to capture the views, insights, and general sense of the ITS/ISTEA issues of a relatively small group of experts in the transportation field from as many "walks of transportation life" in California as possible. The study and its associated sample size were, a priori, not intended to be of the sort or the magnitude where standard statistical validity concerns and associated techniques would come into play, such as the use of oversampling to obtain a pre-determined distribution of particular respondents by professional type. This strategy does not lessen the value of the results of the survey as opinions based on the experience and expertise of

transportation professionals in the State were obtained. The sample size was necessarily small due to resource constraints. For example, views representing more expertise on environmental issues in general and air quality in particular were not obtained, though such candidates were on the final list. Nevertheless, a sufficiently broad cross-section of California's professional transportation world was represented. The percentage breakdown with respect to individual categories such as local/state or public/private is shown in Section 3.2.2 where the comparative analyses are discussed.

Repeated attempts (at least three) to contact all people on the final list were made. However, both because of the shortage of time, and unreturned phone calls, final arrangements to survey approximately six people on the final list were, unfortunately, not made. Twenty-four people participated in the survey. There were a few occasions in which the survey was implemented in a group setting with multiple respondents. On two of these occasions, one with two people and the other with three people, the completed survey represented the group's consensus views considered more as a unit rather than two or three individuals. This clustering resulted in twenty-one completed surveys on which the analysis was based. Minor changes were made to the survey to reflect whether the respondent was a member of the public or private sector. In general, this meant that the word "agency" was replaced with the word "company" and phrases such as "in your region" were either removed entirely or replaced with "in the regions of California you are familiar with", as appropriate. Appendix A contains the survey used for public sector respondents. The interviews were conducted in person and/or via telephone from July through September 1997. Respondents represented the following organizations:

<u>Public Sector</u>:

Metropolitan Planning Organizations:

- San Diego Association of Governments
- Metropolitan Transportation Commission (San Francisco Bay Area)
- Southern California Association of Governments (Los Angeles, Orange, Ventura, San Bernardino, Riverside, and Imperial Counties)
- Sacramento Area Council of Governments
- Kern County Council of Governments

California State Department of Transportation:

- Headquarters-Office of New Technology & Research
- District Offices throughout California (Operations and Planning staff)

Transportation Authorities:

- Los Angeles County Metropolitan Transportation Authority
- Orange County Transportation Authority

Other Organizations:

- California Alliance for Advanced Transportation Systems (CAATS)

Private Sector:

Consulting firms:

- Providers of support to the public sector in preparation of Early Deployment Plans, Regional Transportation Plans, and participation in ITS projects.

3.2 Survey Results and Analysis

This section is divided into two parts covering survey results that were (1) generally representative of the respondents taken as a whole and (2) a more detailed comparative examination of the results between different groups of respondents. The results of the survey represent the views and opinions of the survey respondents.

3.2.1 Overall Common Views

This section discusses the overall survey results associated with each of the survey's six primary areas.

3.2.1.1 Knowledge and Implementation of ISTEA

Survey participants are both well aware of the overall implementation of ISTEA as well as directly involved in various aspects of ISTEA implementation in their respective areas and regions of the state. They also have a good knowledge about the specific focus of implementation in their regions. The following list, taken directly from the legislative language, comprises the major elements of ISTEA.

- System Management and Maintenance (SMM)
- Intermodalism (IM)
- Public Involvement (PI)
- Metropolitan Planning Process (MPP)
- Major Investment Study (MIS)
- Air Quality Conformity (AQC)
- Integration of Land Use and Economic Factors (LU/EF)
- Transportation Technologies R&D (TTR&D)

Results are given in Table 1 with the percentage of respondents indicating a particular level of knowledge.

Table 1: Level of Knowledge of ISTEA - General Results

	POOR	FAIR	GOOD	EXCELLENT	TOTAL[2]
SMM	4.8%	21.4%	40.5%	33.3%	100.0%
IM	4.8%	21.4%	59.5%	14.3%	100.0%
PI	2.4%	16.7%	38.1%	38.1%	95.2%
MPP	0.0%	4.8%	42.9%	52.4%	100.0%
MIS	16.7%	16.7%	31.0%	35.7%	100.0%
AQC	11.9%	11.9%	40.5%	31.0%	95.2%
LU/EF	26.2%	26.2%	33.3%	9.5%	95.2%
TTR&D	0.0%	31.0%	45.2%	23.8%	100.0%

Among these elements, SMM and MPP are those with which respondents are most extensively involved that encompass almost all the elements in transportation systems. There was an almost unanimous expression of concern over the vagueness and ambiguity in the definition of IM and confusion associated with this aspect of ISTEA's implementation. The concern over definition generally focused on the relative newness of all the attention being paid to IM and a lack of any unified approach to understanding what it means and how to implement it across jurisdictions. This concern over definition vagueness, however, did not preclude respondents from expressing the view that they thought their staff had at least a "good" knowledge of IM.

[2] Some totals do not equal 100% because not all 21 participants responded to this question.

Of all the elements, integration of land use and economic factors was the weakest ISTEA element in terms of stated level of knowledge as well as implementation. Issues related to land use generally fall out of the knowledge and experience base of the survey respondents.

Knowledge and implementation of Major Investment Studies and Public Involvement are also considered to be very important. Public Involvement is perceived to be based on participation of elected representatives and officials and interest groups, rather than members of the general public. While MIS's vary considerably among public agencies, the MIS tool is perceived to be very important for analysis of transportation systems. There is also strong interest in incorporating ITS as another alternative in the MIS process, even though ITS is not yet considered to be a traditional and customary choice among transportation alternatives. There is also strong interest in transportation technology research and development.

3.2.1.2 Knowledge and Familiarity with ITS

We found that among the major ITS-related activities (See Table 2), ITS strategic planning, Early Deployment Plan(s), coordination with other agencies, and project management were the ITS-related activities in which respondents were most involved. At least 90% of respondents participated in each of these. All other categories, except for ITS project evaluation(s), had approximately 75% of respondents involved. Only 50% of respondents participated in evaluation. Less attention is paid to evaluation since project evaluations are customarily performed by an outside and independent research organization, whereas respondents, especially those in public sector organizations, are involved with project design and management oversight.

Table 2: ITS-Related Activities - General Results

	INVOLVEMENT OF RESPONDENTS	
	Number	Percent
PARTICIPATING MEMBER OF ITS AMERICA	16	76.2%
ITS STRATEGIC PLANNING	20	95.2%
EDPs	19	90.5%
ITS PROJECT DESIGN	15	71.4%

ITS PROJECT MANAGEMENT	19	90.5%
ITS PROJECT EVALUATION	10	47.6%
EDUCATION AND TRAINING	15	71.4%
COORDINATION WITH OTHER AGENCIES	19	90.5%

A wide range of ITS-related projects has been undertaken by the various agencies interviewed. Of all potential project areas, traffic management and traveler information type projects comprise the bulk. ITS applications in the transit area are seen only in a few applications. No project mentioned is designed to address air quality issues directly. Interviewees generally felt that ITS does not yet directly and specifically affect air quality improvement.

Respondents were asked about the level of knowledge of ITS and the perception of its contribution to the region from both the perspective of the interviewee and his/her staff. Note, however, that the staff's views were represented by the interviewee. Table 3 gives the overall average ranking for those respondents who answered the question. The levels of knowledge of "poor", "fair", "good", and "excellent" were assigned numerical values of 1,2,3, and 4 respectively. Overall, the self evaluation results indicated a greater level of knowledge and perception of ITS's contribution then relative to the staff's evaluation. There was, in general, except for operations staff, a "good" to "excellent" self knowledge of ITS. Differences between Operations and Planning staff are discussed in more detail in Section 3.2.2.4.2. The general perception of the contribution of ITS is generally between "little" and "moderate", (Again, there are exceptions to this, e.g. with respect to interviewees representing the State and the private sector.) This view is held since to date there has not yet been a sufficient demonstration of quantifiable benefits that are needed to answer the all-too-often asked question: "What is in it for me or my agency? I need to see the benefits." While there is great potential in ITS, this potential needs to be transformed into realizable benefits, as yet not completely manifested.

Table 3: Evaluation of ITS - General Results

	Number	Average Score
LEVEL OF SELF KNOWLEDGE	21	3.3
PERCEPTION OF ITS CONTRIBUTION (SELF)	20	3.1
LEVEL OF STAFF KNOWLEDGE	19	2.7
PERCEPTION OF ITS CONTRIBUTION (STAFF)	17	2.8

In adding to our understanding of the level of knowledge of ITS, we inquired about the National Systems Architecture (NSA) Program and the use of the final deliverables produced by this program. Results are given in Table 4 and are the overall average ranking for the respondents. The three possible answers were "no, not at all", "yes, but only some of it", and "yes, all of it" with respect to whether the respondent and his/her staff had reviewed the NSA. These answers were assigned the numerical rankings of 1, 2, and 3, respectively. Overall, there were very few interviewees who have read the NSA deliverables in their entirety, though most have read at least some of it. With respect to the staff, again with some exceptions relative to members of the private sector and State respondents, no one has read all of the NSA deliverables and in fact, a majority of staff has not read the NSA deliverables at all. The issue is availability of time and resources needed to assimilate such a voluminous collection of material, even the executive summaries.

Table 4: Familiarity with National Systems Architecture - General Results

	PERCENTAGE
SELF	
NONE	24%
SOME	62%
ALL	14%
STAFF	
NONE	48%
SOME	38%
ALL	0%

With respect to an inquiry as to the level of agency/company expertise for the planning and deployment of ITS projects, there was, overall, at least some to quite strong expertise level. The three possible answers were "no expertise", "some expertise", and "quite strong expertise", and assigned the numerical rankings of 1, 2, and 3, respectively. The overall average score was 2.4.

3.2.1.3 ISTEA's Support for ITS Implementation

While it is perceived desirable to have a stronger linkage between ITS and ISTEA in general, the connection between ITS and air quality improvement has not yet been fully realized. In numerous cases, air quality improvement is viewed as an indirect benefit of ITS applications rather than a direct benefit. There is concern over linkage between ITS and air quality because most deployments of ITS are more locally oriented and air quality issues need more of a regional approach in the search for solutions, e.g. regional emissions reductions. Will air quality improvements be achieved when ITS is perceived and implemented regionally and consistently across local jurisdictions? Another frequently expressed concern, not limited to air quality, is the lack of sufficiently demonstrable and quantifiable benefits from ITS deployment.

Among all the difficulties regions faced over the course of ITS implementation, the following four categories arose:

- A consistent vision and focus of programs at the federal level, for both the short and long term, appears to be lacking. This lack is particularly crucial for and most strongly felt in regions that have been extensively involved in ITS. They have experienced changes in focus from year to year as a result of inconsistent policies and programs at the federal level.
- Distribution of ITS funds should not come in big single allotments (as is the case for EDP); rather, funds should be channeled more slowly and should continue over years. Also, identified multi-year ITS funding sources should be incorporated with capital improvement programs.
- Professional capacity building is needed for ITS implementation. Different types of skills are needed and it must be recognized that such resources would be different from traditional staff in planning and traffic engineering. While it is important to recruit more electrical engineering and computer science professionals, education efforts are also needed to improve the knowledge of ITS in the organizations.
- Other concerns expressed include:

1. Some local agencies have no interest in and hence show no willingness to cooperate in ITS implementation
2. Procedures related to development of successful public-private partnerships (contract process and intellectual property rights) are needed
3. Documentation on the costs and benefits of ITS are needed
4. Nature of ITS-related systems' operation and maintenance

Integration of regional transportation planning and ITS planning, however, is still inadequate. Even some people extensively involved in ISTEA/ITS implementation felt that the limited ongoing efforts affect their perception of the potential ITS contribution to their regions' transportation system. Moreover, only an integrated and systematic implementation will be able to demonstrate the full beneficial impacts of ITS.

Concerning the level of support each ISTEA element (See Section 3.2.1.1) provides to the implementation of ITS, results are given in Table 5 and indicate overall the average ranking for the respondents. The categories used are "obstructive", "neither obstructive nor supportive", "somewhat supportive", and "very supportive" with the numerical values assigned of 1 through 4, respectively. Overall there is some level of support indicated by the results with the highest and lowest levels of support arising from TTR&D and LU/EF. This is expected and not a surprise. ITS has been supported by ISTEA and hence the large score for TTR&D.

Table 5: ISTEA's Support of ITS - General Results

	Number	Average Score
System Management and Maintentance (SMM)	20	3.0
Intermodalism (IM)	20	2.8
Public Involvement (PI)	20	2.9
Metropolitan Planning Process (MPP)	20	3.2
Major Investment Study (MIS)	17	3.0
Air Quality Conformity (AQC)	18	2.9
Integration of Land Use and Economic Factors (LU/EF)	17	2.6
Transportation Technologies R&D (TTR&D)	19	3.6

Another question focused more on the Public Involvement element of ISTEA and examined whether or not and to what extent public involvement in the regional planning process has been helpful for ITS-related projects. Aspects of how ITS and public involvement could be integrated (and evaluated by the interviewee) are listed as follows:

- Clarify objectives for ITS implementation
- Assist in the selection of projects that fit local/regional needs
- Build consensus among public agencies, communities, and other interest groups
- Educate the public on ITS-related issues

Results are given in Table 6 with the overall average ranking. The categories used are "marginally", "moderately", "significantly" with assigned numerical values of 1, 2, and 3, respectively. Overall, public involvement in the regional planning process has been "moderately" helpful with the exception of education, which is viewed as between "marginally" and "moderately" helpful. These results are expected, especially the lowest average score for "educate the public on ITS-related issues", since what ITS is all about has not yet filtered down to the general public.

Table 6: Extent of Assistance of Public Involvement in Regional Planning Process for ITS Projects - General Results

	Number	Average Score
CLARIFY OBJECTIVES FOR ITS IMPLEMENTATION	19	2.2
ASSIST IN PROJECT SELECTION THAT FIT LOCAL NEEDS	19	2.2
BUILD CONSENSUS AMONG PUBLIC AGENCIES	19	2.1
EDUCATE THE PUBLIC ON ITS-RELATED ISSUES	19	1.7

Another question placed additional emphasis on the Metropolitan Planning Process element of ISTEA and examined whether or not and to what extent ITS implementation has been

integrated into the current planning process on a regional level. Aspects of how ITS and the MPP could be integrated (and evaluated by the interviewee) are listed as follows:

- ITS is updated into the RTP
- ITS projects are designed and implemented via the transportation planning process
- Strong interest exists for RTPA to pursue ITS
- Coordination is achieved between planning agencies and other organizations

Results are given in Table 7 with overall average rankings. The categories used are "poorly", "adequately", "well", and "superbly" with assigned numerical values of 1 through 4, respectively. Overall, the extent ITS implementation has been integrated into the current planning process has been judged as ranging from "adequately" to "well" done.

Table 7: Extent of ITS Implementation into Planning Process - General Results

	Number	Average Score
ITS UPDATED IN RTP	20	2.3
ITS PROJECTS DESIGNED AND IMPLEMENTED VIA TRANSPORTATION PLANNING PROCESS	20	2.2
INTEREST TO PURSUE ITS	19	2.4
COORDINATION ACHIEVED BETWEEN PLANNING AGENCY AND OTHER ORGANIZATIONS	20	2.4

A final question probed further into the Transportation Technology R&D element of ISTEA and examined how important advanced transportation technologies are for a region's transportation systems. The categories used are "not important at all", "somewhat important", "important", and "very important", with assigned numerical values of 1 through 4, respectively. Overall, implementation of advanced transportation technologies is considered very important, with an average score of 3.6.

3.2.1.4 Achieving ISTEA Objectives via ITS

The survey inquired as to the most important improvements needed to foster a connection between ISTEA (and its reauthorization) and ITS over the next five years. The

following four specific choices were listed with an option for others to be offered by the interviewees:

- Favorable policies at federal and state levels
- Technical assistance from Caltrans
- Funding predictability
- Inter-jurisdictional coordination

Results are given in Table 8 with the percentage of respondents' rankings of each category. Overall, the highest ranked category was funding predictability to help achieve a linkage between ISTEA and ITS. Approximately 61% of the interviewees ranked this category as number 1 and about 95% of the interviewees ranked this category as either number 1 or 2. For "Technical assistance from Caltrans", approximately 10% of the interviewees ranked this category either number 1 or 2, and in fact, over half the interviewees ranked this category number 4 or 5 out of five. This result could very well mean that there is overall satisfaction with the level of technical assistance obtained from Caltrans and it is not viewed as deficient in any way and thus requiring any improvement. The category receiving the second highest ranking was "favorable policies", with about 20% of the interviewees ranking this category as number 1 and about half the interviewees ranking this category as either number 1 or 2.

The interviewees felt that ITS is useful in fulfilling ISTEA objectives at the local, regional, and State levels. ITS can add value to existing transportation systems, serving as tools to fill gaps between infrastructure and system management, especially in the process of transitioning from highway building to system management and maintenance. To make local ITS projects and programs more useful, incorporating local programs with State programs will

Table 8: Improvements Needed to Foster ISTEA/ITS Linkages - General Results

	RANK 1	RANK 2	RANK 3	RANK 4	RANK 5
FAVORABLE POLICIES AT FEDERAL & STATE LEVELS	18.1%	31.7%	28.6%	13.6%	4.5%
TECHNICAL ASSISTANCE FROM CALTRANS	4.8%	4.8%	23.8%	52.4%	4.8%
FUNDING PREDICTABILITY	61.9%	33.3%	4.8%	0.0%	0.0%
INTER-JURISDICTIONAL COORDINATION	9.5%	25.1%	45.1%	15.0%	0.0%

assist local agencies to design more useful ITS projects. Evaluations for implemented systems would also help to document the benefits. However, some responses indicated that there is a disconnect between the limited extent of ITS implementation over the relatively short time period since ISTEA was enacted and people's perception of ITS' potential contribution.

Results also indicate that the local and regional agencies would like to have Caltrans as an equal partner in the planning and implementation of ITS. Leadership is especially desired in the area of standards development and ITS deployment planning and incorporating ITS into California transportation planning guidelines.

3.2.1.5 Impacts of Inter-Jurisdictional Relationships on ITS Implementation

This section of the survey inquired into the types of support the agency/company has received from other agencies, including local and regional agencies as well as Caltrans Headquarters. The types of support include

- Consensus building
- Financial support
- Technical assistance
- Coordination assistance

Results are given in Table 9 with the overall average ranking. The categories used are "no support", "some support", and "strong support" with assigned numerical values of 1 through 3, respectively. Overall, the results indicate fairly close views for each of the four categories, with some exceptions. Of particular interest are the differences in views relative to the extent of support per category from the local and regional level compared with from Caltrans Headquarters. The largest differences occurred for the consensus building and financial support categories. Generally, there is a higher level of consensus building support from other local and regional organizations, whereas there is a higher level of financial support from Caltrans Headquarters than at the local level which is to be expected.

Table 9: Level of Support Received - General Results

	Number	Average Score
CONSENSUS BUILDING SUPPORT		
LOCAL AGENCIES	21	2.6
CALTRANS HEADQUARTERS	19	2.3
FINANCIAL SUPPORT		
LOCAL AGENCIES	21	2.1
CALTRANS HEADQUARTERS	20	2.4
TECHNICAL ASSISTANCE		
LOCAL AGENCIES	21	2.0
CALTRANS HEADQUARTERS	20	2.0
COORDINATION ASSISTANCE		
LOCAL AGENCIES	21	2.3
CALTRANS HEADQUARTERS	20	2.1

Another question in this section inquired more deeply into the extent of coordination with other organizations, both public and private. Survey responses confirmed answers received in this section's other questions.

3.2.1.6 Reauthorization of ISTEA: Opportunities for ITS Implementation

The interviewees felt that the reauthorization of ISTEA in its final form should strive to mainstream ITS into the regional transportation planning process with a steady stream of funding that would help to produce continuous multi-year funding. This multi-year aspect to the funding would provide a better sense of consistency and continuity to the program as a whole and to individual projects. Funding flexibility is also important to allow local and regional transportation agencies to use funds on ITS based on their own priorities and requirements. Another recommendation is for more of a regional focus to projects rather than simply very locally applied investigations of ITS technologies. ITS project planning should cross jurisdictional boundaries and should be performed from a more systems perspective rather than be jurisdictionally-based, if possible. Moreover, funds could serve as an incentive for this more systems approach. There was also a call for a more clear vision of how to incorporate or to

mainstream ITS with all other functions that are performed by regional transportation planning agencies. In particular, the implementation of ITS needs to be incorporated into the general transportation planning process in which ITS must compete for funds as a viable transportation alternative via the MIS process in the RTP. With the relatively minor extent to which ITS is thought of as a potential alternative, especially for air quality districts and transit properties, interviewees thought that more incentives are needed to make ITS more attractive to these organizations.

The interviewees emphasized the following four points, or needs, that were expressed in previous sections of the survey:

- Systematic planning across jurisdictional boundaries
- Additional outreach
- Quantified costs and benefits to the maximum extent possible
- Improvement and expansion of the private sector role in ITS implementation

3.2.2 Comparative Analyses of Responses Between Distinct Groups

The twenty-one completed surveys represent responses from several diverse groups of California transportation professionals, including (1) sector: private or public, (2) jurisdiction: local/regional or State, (3) location: North or South, and (4) professional transportation specialty: Operations or Planning. In addition, to a limited extent, different geographical settings (urban or rural) were also examined.

The percentage breakdown relative to each of the groups is as follows:

Private Sector:	14.3%
Public Sector:	85.7%
State (public only):	19.0%
Local (public only):	66.7%
South (public and local):	38.1%
North (public and local):	28.6%
Operations (public only):	14.3%
Planning (public only):	71.4%

3.2.2.1 Sector: Public and Private

3.2.2.1.1 Knowledge and Implementation of ISTEA

With respect to the overall evaluation respondents gave to the question inquiring about their staff's knowledge level of each of ISTEA's primary elements, the following results predominated:

- With the exception of the land use and economic factors integration element, the private sector does not rate its knowledge level as "poor", whereas the public does rate its knowledge as "poor" for at least some of each of the other elements, except for public involvement.
- Approximately 65% of the private sector ranks as "excellent" its level of knowledge for the following ISTEA elements: SMM, IM, MPP, MIS, LU/EF, TTR&D
- Only PI, MPP, MIS, and AQC are given an "excellent" ranking above 30% from the public sector.
- Only for the PI element does the public sector rank higher than the private sector, i.e. approximately 39% and 33% of the public and private sector's knowledge levels respectively are ranked as "excellent" and approximately 83% and 33% of the public and private sector's knowledge levels respectively are ranked as either "good" or "excellent".

Detailed results are given in Figure 1[3].

[3] For Figure 1 (and Figures 2 through 4 as well) a lot of information is presented. The x-axis displays four levels of knowledge (poor = P, fair = F, good = G, and excellent = E) for each of the ISTEA elements (SMM, IM, PI, MPP, MIS, AQC, LU/EF, and TTRD, defined in Section 3.2.1.1). All combinations of ISTEA elements and levels of knowledge are shown for both the private and public sectors, however, due to space constraints, only the "poor" and "good" knowledge levels are actually labeled along the x-axis. For example, for the SMM (System Management & Maintenance) element of ISTEA, "SMM-P" and "SMM-G" are displayed for the poor and good level of knowledge for the SMM element, respectively. The private and public data for "SMM-F" and "SMM-E" are to the left and right of "SMM-G", respectively.

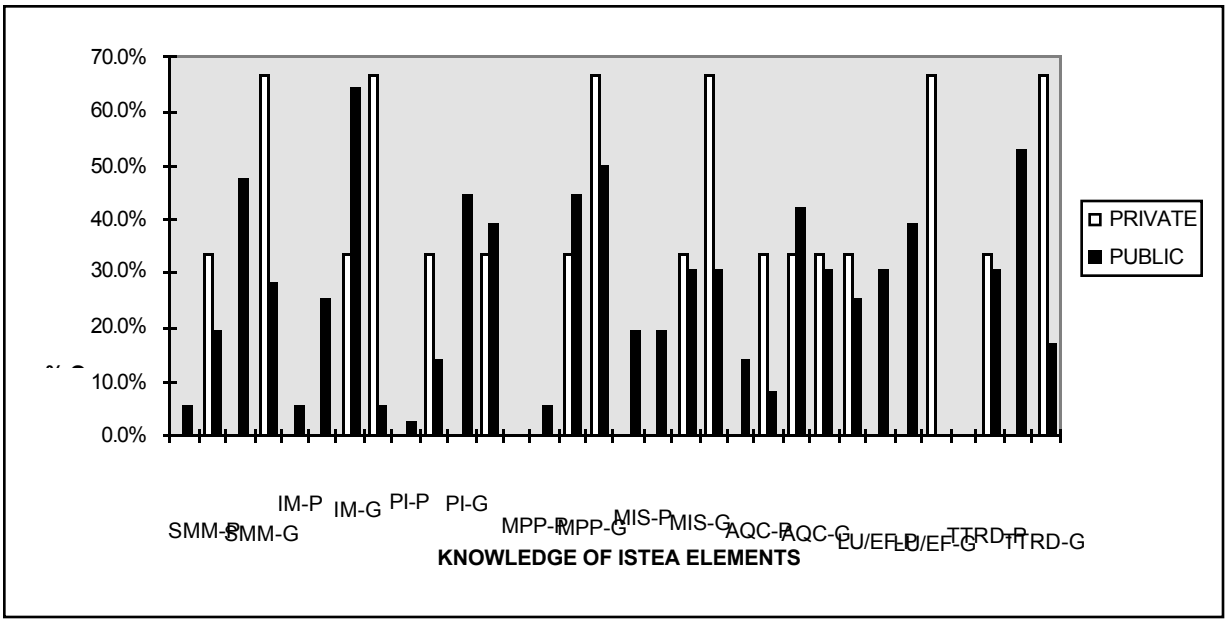

Figure 1: Level of Knowledge of ISTEA - Private and Public

With respect to project implementations, the public sector is deeply involved in metropolitan planning-related implementations as well as system management and maintenance activities. Relatively few activities occur in the areas of land use and economic factors integration and air quality conformity. With respect to ITS implementation, public sector interviewees generally feel that TTR&D is a relatively new area of focus for them, and they see themselves more as users of the technology rather than developers of it. The private sector assists the public sector on various technical aspects of ISTEA implementation, in particular, metropolitan planning, MIS, and TTR&D. Moreover, with respect to technology research and development, the private sector participates in diverse research and development projects around the State, including design, planning, testing , and implementation.

3.2.2.1.2 Knowledge and Familiarity with ITS

In the course of the interviews, we found that for major ITS-related activities (See Table 10), public and private sector responses are considerably different from each other. The

private sector indicated participation in all listed aspects of ITS, whereas public sector participation could more appropriately be labeled a mixed bag with a great amount of variability as indicated in Table 10. The highest level of participation for the public sector among the listed categories are for ITS strategic planning, EDP, ITS project management, and coordination with other agencies/firms with approximately 90% participation.

Table 10: ITS-Related Activities – Private and Public

	PRIVATE	PUBLIC
NUMBER	3	18
PARTICIPATING MEMBER OF ITS AMERICA	100%	72.2%
ITS STRATEGIC PLANNING	100%	94.4%
EDPs	100%	88.9%
ITS PROJECT DESIGN	100%	66.7%
ITS PROJECT MANAGEMENT	100%	88.9%
ITS PROJECT EVALUATION	100%	38.9%
EDUCATION AND TRAINING	100%	66.7%
COORDINATION WITH OTHER AGENCIES	100%	88.9%

Interview responses that pertain to the level of knowledge of ITS and its contribution to a region by both the respondent and his/her staff indicate that the private sector rated itself more knowledgeable than the public sector. An explanation for this, assuming the answers were honestly given and don't reflect any inflated self-evaluations, is that the private sector is motivated by the need to bring in business and to this end, becoming as smart as possible on the necessary topics of the day is crucial. Results are given in Table 11. The levels of knowledge of "poor", "fair", "good", and "excellent" were assigned numerical values of 1,2,3, and 4 respectively.

Table 11: Evaluation of ITS – Private and Public

	PRIVATE	PUBLIC
	Average Score	

LEVEL OF SELF KNOWLEDGE	3.3	3.3
PERCEPTION OF ITS CONTRIBUTION (SELF)	3.7	2.5
LEVEL OF STAFF KNOWLEDGE	3.7	3.0
PERCEPTION OF ITS CONTRIBUTION (STAFF)	3.7	2.6

Results indicate that with respect to familiarity with the NSA, the private sector have read or have more of a mastery than does the public sector (both for the individual respondent and his/her staff.) Results are given in Table 12.

Table 12: Familiarity with National Systems Architecture – Private and Public

	PRIVATE	PUBLIC
SELF		
NONE	0.0%	27.8%
SOME	33.0%	66.7%
ALL	67.0%	5.5%
STAFF		
NONE	0.0%	55.6%
SOME	100.0%	27.8%
ALL	0.0%	0.0%

The question pertaining to the level of expertise that the agency or firm has for the planning and deployment of ITS projects indicates again that the private sector has considerably greater expertise than members of the public sector. The average scores for the private and public sectors were 3.0 and 2.3, respectively. Once again, the private sector may be motivated by the desire to bring in business to the firm. The private sector representatives interviewed have expertise in the ITS field, but do not represent a random sample of the private sector. All survey respondents were chosen, a priori, as implementors of ISTEA and familiar with ITS. Moreover, the private sector participates in a full range of ITS implementation: assisting RTPAs, developing EDPs, Southern California Priority Corridor project work, and FOTs.

3.2.2.1.3 ISTEA's Support for ITS Implementation

One of the specific questions asked concerned the level of support each ISTEA element (See Section 3.2.1.1) provides to the implementation of ITS. Results are given in Table 13 as the overall average ranking for the respondents. The categories used are "obstructive", "neither obstructive nor supportive", "somewhat supportive", and "very supportive" with the numerical values assigned of 1 through 4, respectively. The private sector has indicated a lower level of support than the public sector with respect to the following ISTEA elements: PI, MPP, AQC, and LU/EF. The private sector has indicated a greater level of support than the public sector with respect to the following ISTEA elements: SMM, IM, and TTR&D. The largest differences between the private and public sectors occur for the PI and LU/EF ISTEA elements.

Table 13: ISTEA's Support of ITS – Private and Public

	PRIVATE	PUBLIC
	Average Score	
System Management and Maintenance (SMM)	3.5	2.9
Intermodalism (IM)	3.3	2.8
Public Involvement (PI)	2.0	3.0
Metropolitan Planning Process (MPP)	3.0	3.2
Major Investment Study (MIS)	3.0	3.0
Air Quality Conformity (AQC)	2.7	2.9
Integration of Land Use and Economic Factors (LU/EF)	2.0	2.7
Transportation Technologies R&D (TTR&D)	4.0	3.6

The question that focused on the Public Involvement element of ISTEA and examined whether or not and to what extent public involvement in the regional planning process has been helpful for ITS-related projects indicates the following results in Table 14. The categories used are "marginally", "moderately", "significantly" with assigned numerical values of 1, 2, and 3, respectively. The private sector, relative to the public sector, sees a greater degree of help from all categories.

Table 14: Extent of Assistance of Public Involvement in Regional Planning Process for ITS Projects – Private and Public

	PRIVATE	PUBLIC
	Average Score	
CLARIFY OBJECTIVES FOR ITS IMPLEMENTATION	2.5	2.2
ASSIST IN PROJECT SELECTION THAT FIT LOCAL NEEDS	2.5	2.2
BUILD CONSENSUS AMONG PUBLIC AGENCIES	2.5	2.1
EDUCATE THE PUBLIC ON ITS-RELATED ISSUES	2.5	1.6

Another question focused more on the Metropolitan Planning Process element of ISTEA and examined whether or not and to what extent ITS implementation has been integrated into the current planning process on a regional level. Results are given in Table 15, (the categories used are "poorly", "adequately", "well", and "superbly" with assigned numerical values of 1 through 4, respectively), and indicate that the private and public sectors are either very close to each other in results, or the private sector is considerably greater than the public sector relative to the extent of how ITS implementation has been integrated into the current planning process. All private sector interviewees possessed expertise in updating the RTP, whereas the public sector did not.

Table 15: Extent of ITS Implementation into Planning Process – Private and Public

	PRIVATE	PUBLIC
	Average Score	
ITS UPDATED IN RTP	3.0	2.1
ITS PROJECTS DESIGNED AND IMPLEMENTED VIA TRANSPORTATION PLANNING PROCESS	2.0	2.2
INTEREST TO PURSUE ITS	3.0	2.2
COORDINATION ACHIEVED BETWEEN PLANNING AGENCY AND OTHER ORGANIZATIONS	2.3	2.4

A final question probed further into the Transportation Technology R&D element of ISTEA and examined how important advanced transportation technologies are for a region's transportation systems. The categories used are "not important at all", "somewhat important", "important", and "very important", with assigned numerical values of 1 through 4, respectively.

The overall average scores for the private and public sectors are 3.5 and 3.6, respectively. There is general agreement for public and private sectors with respect to how important the implementation of advanced transportation technologies are.

Public sector respondents acknowledge that working with ITS is a relatively new experience for them and that it will require both time and more experience to become fully oriented and comfortable with ITS. Moreover, the public sector feels there needs to be more consistency in policies across jurisdictional boundaries, i.e. federal, state, and local. The public sector is cautious about ITS implementation due to, in their opinion, an insufficient level of consensus and local needs being addressed. Some public sector respondents expressed the view that certain aspects of federal policy have had negative impacts on ITS implementation, such as unique project selection criteria that tend to lead to projects and applications which differ significantly from region to region and/or over time, making comparisons across geographical boundaries difficult.

With respect to public-private partnerships, the public sector is concerned with policy issues associated with private-public cooperation, e.g. consultant hiring policies, the procurement process, and intellectual property rights. With respect to the linkage between air quality conformity and ITS, the generally held view is one of a disconnect between the two, though a stronger linkage is desirable. Private sector respondents added that air quality conformity and emission control efforts should more closely parallel ITS efforts and that there could be improved coordination between policy makers and air quality management districts.

3.2.2.1.4 Achieving ISTEA Objectives via ITS

Results are given in Table 16 for the percentage of respondents' rankings of the following four categories where improvements would be needed to foster a stronger linkage between ISTEA and ITS:

- Favorable policies at federal and state levels
- Technical assistance from Caltrans
- Funding predictability
- Inter-jurisdictional coordination

Both the private and public sectors indicate that funding predictability is the highest ranked of the four categories. All private sector respondents ranked "funding predictability" number one for needed improvements. Slightly greater than one-half of public sector respondents ranked "funding predictability" as the number-one improvement needed. Both private and public sectors do not place much weight on technical assistance from Caltrans or on inter-jurisdictional coordination. Note that the percentages for a particular rank for either private or public sector may not sum to one hundred percent, as ties were allowed in responses.

Table 16: Improvements Needed to Foster ISTEA/ITS Linkages – Private and Public

	RANK 1	RANK 2	RANK 3	RANK 4	RANK 5
FAVORABLE POLICIES AT FEDERAL & STATE LEVELS					
PRIVATE	33.3%	33.3%	33.3%	0.0%	0.0%
PUBLIC	15.7%	31.4%	27.8%	15.7%	5.2%
TECHNICAL ASSISTANCE FROM CALTRANS					
PRIVATE	0.0%	0.0%	33.3%	66.7%	0.0%
PUBLIC	5.6%	5.6%	22.2%	50.0%	5.6%
FUNDING PREDICTABILITY					
PRIVATE	100.0%	0.0%	0.0%	0.0%	0.0%
PUBLIC	55.6%	38.9%	0.0%	5.6%	0.0%
INTER-JURISDICTIONAL COORDINATION					
PRIVATE	0.0%	33.3%	33.3%	33.3%	0.0%
PUBLIC	11.6%	23.1%	43.5%	21.8%	0.0%

While the private sector focuses on funding issues, they do so in the context of a vision of ITS deployment. Meanwhile, the public sector is more involved with policy issues, especially the integration of state and local programs, state-local partnerships, operation of advanced technology systems, inter-jurisdictional cooperation, consistency of systems across jurisdictions, and developing incentives for private participation. The private sector's views are based more on their vision rather than on particular details of policy issues.

3.2.2.1.5 Impacts of Inter-Jurisdictional Relationships on ITS Implementation

Results of our inquiry into the types of support the respondent's agency or company have received from other agencies are given in Table 17. The categories used are "no support", "some support", and "strong support" with assigned numerical values of 1 through 3, respectively. The private and public sectors provide fairly close answers for consensus building and financial support categories. The results differ with respect to technical assistance and coordination assistance, with the private sector indicating that both local agencies and Caltrans Headquarters provide greater support than corresponding support levels the public sector says it receives. The private-public ITS relationship is that of contractor-client. In this situation, the private sector contractor especially assists in the technical work required and is usually at least somewhat removed from the day-to-day politically charged environment that the public sector has to deal with.

Table 17: Level of Support Received – Private and Public

	PRIVATE	PUBLIC
	Average Score	
CONSENSUS BUILDING SUPPORT		
LOCAL AGENCIES	2.7	2.6
CALTRANS HEADQUARTERS	2.3	2.3
FINANCIAL SUPPORT		
LOCAL AGENCIES	2.2	2.1
CALTRANS HEADQUARTERS	2.5	2.4
TECHNICAL ASSISTANCE		
LOCAL AGENCIES	2.7	1.9
CALTRANS HEADQUARTERS	2.7	1.9
COORDINATION ASSISTANCE		
LOCAL AGENCIES	2.7	2.2
CALTRANS HEADQUARTERS	3.0	1.9

3.2.2.1.6 Reauthorization of ISTEA: Opportunities for ITS Implementation

The private sector focuses on three primary issues: 1) reauthorization of ISTEA needs to mainstream ITS, 2) education and outreach are critical, and 3) the MIS process should look at ITS as a viable alternative to solving transportation problems. The public sector puts greater importance and emphasis on the need 1) to develop deployment paths for ITS, and 2) for EDPs to get incorporated into the RTP structure and process.

3.2.2.2 Jurisdiction: Local and State

3.2.2.2.1 Knowledge and Implementation of ISTEA

With respect to the overall evaluation respondents gave to the question inquiring about their staff's knowledge level of each of ISTEA's primary elements, the following results predominated:

- Locals do not rank their state of knowledge as "poor" for more than 10% of the respondents with the exception of LU/EF integration (17.9%). The State, however, ranks its level of knowledge as "poor" for SMM (25%), MIS (50%), AQC (30%), and LU/EF (50%).
- For PI, MPP, and TTR&D: neither State nor Local ranks their knowledge as "poor".
- Considering just the "excellent" category, Local and State declare approximately the same percentage of knowledge.
- Considering just the "excellent" and "good" ranking categories, Locals rank higher percentages for SMM, MIS, AQC and State ranks a higher percentage for PI. The remainder of the categories are ranked fairly evenly between State and Local.

Detailed results are given in Figure 2.

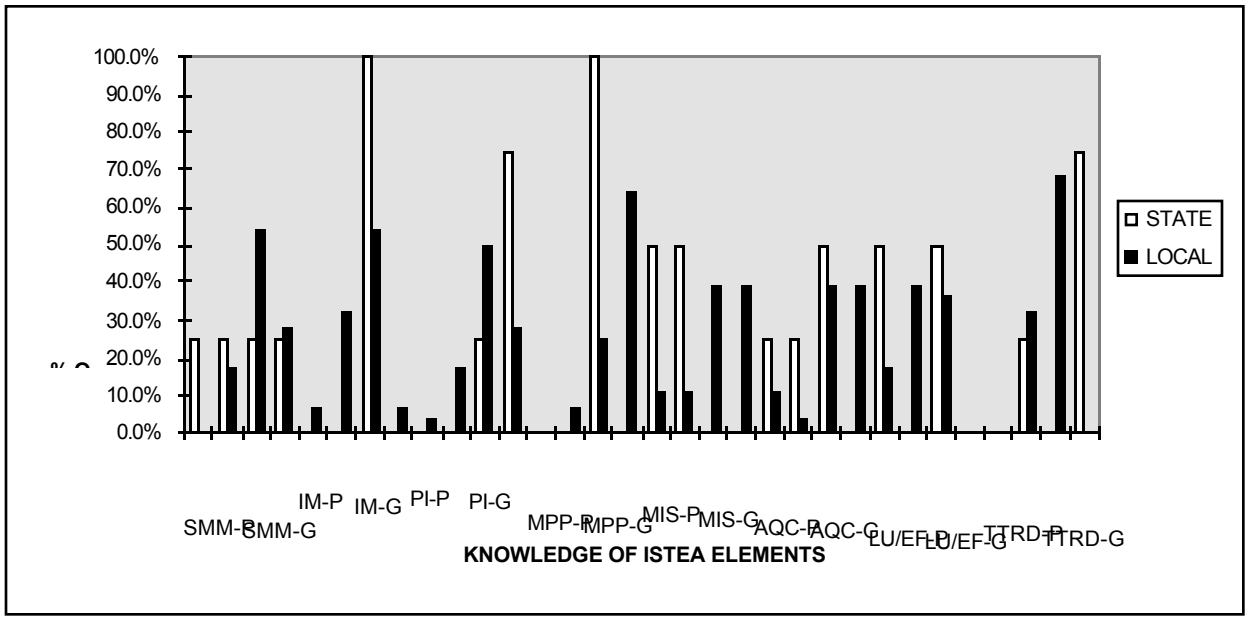

Figure 2: Level of Knowledge of ISTEA - State and Local

Since all Local and State respondents are from the public sector, it is expected and intuitive to see generally "good" to "excellent" levels of knowledge for both these groups with respect to PI and MPP. The greater knowledge of State than Local for PI may be explained by the observation that "public involvement" may not mean the same thing to representatives of these two groups. Locals do much better, i.e. a significantly greater percentage of respondents indicating "good" or "excellent" level of knowledge, than State with respect to MIS, which is expected. Similar results occur with respect to AQC. With respect to TTR&D, there is relative parity when considering the overall percentages spread over the "poor"-to-"excellent" continuum. With respect to LU/EF, neither the State nor Local is "excellent", again which is expected; the highest ranking is "good", with Local having a slightly greater knowledge than State. A generally greater knowledge for intermodalism is declared by State respondents compared with the answers Local respondents provided. Compared to the Locals involvement in different areas of ISTEA implementation, State respondents are mainly involved in the areas of SMM and TTR&D.

3.2.2.2.2 Knowledge and Familiarity with ITS

In the course of the interviews, we found the Local and State responses have definite differences for the major ITS-related activities (See Table 18). All of the State respondents are involved in several of the listed activities. In approximately one-half of the categories, State involvement is greater than Local involvement, and for the other half is less. Involvement in the EDP show a bottoms-up reaction rather than top-down. This means that involvement in the EDP stems more from local and regional agencies and moves upward to the State level, which is expected. The category of being a participating member of ITS America reflects more of a top-down approach, i.e. State is greater than Local – another expected result. Education and training also reflects a top-down reaction as expected. The category ranked lowest by both State and Local is ITS project evaluation, which is expected since usually an independent evaluator is commissioned to perform the evaluation and State and Local representatives do not have a central, but rather an ancillary role.

Table 18: ITS-Related Activities – State and Local

	STATE	LOCAL
NUMBER	4	14
PARTICIPATING MEMBER OF ITS AMERICA	100.0%	64.3%
ITS STRATEGIC PLANNING	100.0%	92.9%
EDPs	50.0%	100.0%
ITS PROJECT DESIGN	50.0%	71.4%
ITS PROJECT MANAGEMENT	100.0%	85.7%
ITS PROJECT EVALUATION	50.0%	35.7%
EDUCATION AND TRAINING	100.0%	57.1%
COORDINATION WITH OTHER AGENCIES	75.0%	92.9%

Survey results also indicate that the State ranks its level of knowledge of ITS and its contribution to a region by both the respondent and his/her staff as greater than the Locals. An

explanation for this is that ITS, and previous to it, IVHS, originated at the State level and filtered down to the local level. Results are given in Table 19. The levels of knowledge of "poor", "fair", "good", and "excellent" were assigned numerical values of 1,2,3, and 4 respectively.

Table 19: Evaluation of ITS – State and Local

	STATE	LOCAL
	Average Score	
LEVEL OF SELF KNOWLEDGE	3.8	3.2
PERCEPTION OF ITS CONTRIBUTION (SELF)	4.0	2.3
LEVEL OF STAFF KNOWLEDGE	3.3	2.9
PERCEPTION OF ITS CONTRIBUTION (STAFF)	3.5	2.4

For the question pertaining to the knowledge level of the NSA, the State has read or has more of a mastery of the NSA than Local, (both for the individual respondent and his/her staff.) The slightly higher knowledge level relative to the NSA for the State than for Local may be due to the architecture development effort being considered as another example of a top-down effort, originating at the national level and filtering down to the State then to the local level. Results are given in Table 20.

Table 20: Familiarity with National Systems Architecture – State and Local

	STATE	LOCAL
SELF		
NONE	25.0%	28.6%
SOME	50.0%	71.4%
ALL	25.0%	0.0%
STAFF		
NONE	0.0%	71.4%
SOME	50.0%	21.4%
ALL	0.0%	0.0%

State respondents have a greater level of expertise in the area of planning and deployment of ITS projects compared to Local respondents.

3.2.2.2.3 ISTEA's Support for ITS Implementation

One of the specific questions asked concerned the level of support each ISTEA element (See Section 3.2.1.1) provides to the implementation of ITS. Results are given in Table 21 and indicate overall average ranking for the respondents. The categories used are "obstructive", "neither obstructive nor supportive", "somewhat supportive", and "very supportive" with the numerical values assigned of 1 through 4, respectively. The Locals category has indicated a support level less than or equal to that given by the State category with respect to all ISTEA elements except MPP. The largest differences between Local and State categories occur for the IM and TTR&D elements. A contributing factor for such large differences in scores may be that advanced technology applications are more of a top-down effect, i.e. originating with the State. An interesting observation is that the State and Local average scores are the same for MIS. The State is very much involved in Major Investment Studies whenever State highways are part of the region under analysis.

Table 21: ISTEA's Support of ITS – State and Local

	STATE	LOCAL
	Average Score	
System Management and Maintenance (SMM)	3.0	2.9
Intermodalism (IM)	3.3	2.6
Public Involvement (PI)	3.3	2.9
Metropolitan Planning Process (MPP)	3.0	3.3
Major Investment Study (MIS)	3.0	3.0
Air Quality Conformity (AQC)	3.0	2.9
Integration of Land Use and Economic Factors (LU/EF)	2.7	2.7
Transportation Technologies R&D (TTR&D)	4.0	3.5

The question that focused on the Public Involvement element of ISTEA and examined whether or not and to what extent public involvement in the regional planning process has been helpful for ITS-related projects indicates the following results in Table 22. The categories used are "marginally", "moderately", "significantly" with assigned numerical values of 1, 2, and 3, respectively. Relative to the State category, the Local category sees a greater degree of help from all areas. This is expected, as the Locals are closer to the project than is the State. Since ITS implementation is structured through consensus building among different jurisdictions and interest groups, the transportation planning and operating agencies perceive Public Involvement as playing a significant role in clarifying and unifying local interests for ITS.

Table 22: Extent of Assistance of Public Involvement in Regional Planning Process for ITS Projects – State and Local

	STATE	LOCAL
	Average Score	
CLARIFY OBJECTIVES FOR ITS IMPLEMENTATION	1.5	2.4
ASSIST IN PROJECT SELECTION THAT FIT LOCAL NEEDS	1.8	2.3
BUILD CONSENSUS AMONG PUBLIC AGENCIES	1.8	2.2
EDUCATE THE PUBLIC ON ITS-RELATED ISSUES	1.5	1.7

Another question focused more on the Metropolitan Planning Process element of ISTEA and examined whether or not and to what extent ITS implementation has been integrated into the current planning process on a regional level. Results, which are given in Table 23 (the categories used are "poorly", "adequately", "well", and "superbly" with assigned numerical values of 1 through 4, respectively) indicate that Locals see a greater degree of ITS implementation into current planning processes than does the State. Locals view, on average, the extent ITS implementation has been integrated into the current planning process as ranging from "adequately" to "well" done, whereas, the State views range between "poorly" and "adequately". Again, Local respondents are just that, more local to the situation on the ground who observe the goings on in the planning process more on a daily basis.

Table 23: Extent of ITS Implementation into Metropolitan Planning Process – State and Local

	STATE	LOCAL
	Average Score	
ITS UPDATED IN RTP	1.4	2.4
ITS PROJECTS DESIGNED AND IMPLEMENTED VIA TRANSPORTATION PLANNING PROCESS	1.6	2.4
INTEREST TO PURSUE ITS	1.4	2.5
COORDINATION ACHIEVED BETWEEN PLANNING AGENCY AND OTHER ORGANIZATIONS	1.8	2.6

A final question probed further into the Transportation Technology R&D element of ISTEA and examined how important advanced transportation technologies are for a region's transportation systems. The categories used are “not important at all”, “somewhat important”, “important”, and “very important”, with assigned numerical values of 1 through 4, respectively. Average scores are 4.0 and 3.4 for the State and Local, respectively. This considerable difference in scores is again due to the generally top-down approach to advanced transportation technologies.

An additional concern from the State is that there is lack of sufficient interest from local agencies to pursue ITS. The differences associated with ITS relative to the non-ITS environment, such as jurisdictional relationships and level of knowledge in local agencies, makes it somewhat more difficult for the State to implement ITS.

3.2.2.2.4 Achieving ISTEA Objectives via ITS

With respect to the four areas where improvements would be needed to foster a stronger linkage between ISTEA and ITS, Table 24 shows the percentage of respondents' rankings of each category for needed improvements. Both the State and Locals indicate that funding predictability is the highest ranked of the four categories; 50% of the State respondents

and 57.1% of the Local respondents rank this category as number 1 in importance; 100% of State and 92.8% of Local consider the funding predictability category as ranked either 1 or 2. Neither the State nor Local place much weight on technical assistance from Caltrans being needed for improvement.

Table 24: Improvements Needed to Foster ISTEA/ITS Linkages – State and Local

	RANK 1	RANK 2	RANK 3	RANK 4	RANK 5
FAVORABLE POLICIES AT FEDERAL & STATE LEVELS					
STATE	25.0%	0.0%	50.0%	25.0%	0.0%
LOCAL	13.2%	39.6%	21.4%	13.2%	6.6%
TECHNICAL ASSISTANCE FROM CALTRANS					
STATE	0.0%	0.0%	0.0%	50.0%	25.0%
LOCAL	7.1%	7.1%	28.6%	50.0%	0.0%
FUNDING PREDICTABILITY					
STATE	50.0%	50.0%	0.0%	0.0%	0.0%
LOCAL	57.1%	35.7%	7.1%	0.0%	0.0%
INTER-JURISDICTIONAL COORDINATION					
STATE	0.0%	33.3%	66.7%	0.0%	0.0%
LOCAL	14.3%	21.4%	50.0%	14.3%	0.0%

State respondents also strongly felt that education and outreach are needed to foster regions' willingness for ITS participation. They suggest that the California Transportation Planning guidelines should incorporate ITS in the RTP, and use ITS as an alternative solution in MIS. Local area respondents are concerned with the consistency of federal and state programs in the focus and overall implementation plan. With respect to State leadership, local area representatives want the State to assist in the coordination of activities, in the integration of systems and plans, and in the documentation of benefits. Local respondents feel there is a need to learn from actual implementation, that is, it is time to move on from research and testing to real

situations. Finally, Local respondents wish that the mechanism for obtaining and sharing information be more open and flexible than currently exists.

3.2.2.2.5 Impacts of Inter-Jurisdictional Relationships on ITS Implementation

Results of our inquiry into the types of support the respondents' agency or company have received from other agencies are given in Table 25. The categories used are "no support", "some support", and "strong support" with assigned numerical values of 1 through 3, respectively. The State and Local levels provide fairly close answers across all categories relative to the amount of local agency support, whereas, for each category, the State indicates greater and sometimes considerably greater levels of support from Headquarters than does Local.

Table 25: Level of Support Received – State and Local

	STATE	LOCAL
	Average Score	
CONSENSUS BUILDING SUPPORT		
LOCAL AGENCIES	2.8	2.5
CALTRANS HEADQUARTERS	3.0	2.2
FINANCIAL SUPPORT		
LOCAL AGENCIES	2.0	2.2
CALTRANS HEADQUARTERS	3.0	2.2
TECHNICAL ASSISTANCE		
LOCAL AGENCIES	1.8	2.0
CALTRANS HEADQUARTERS	2.0	1.9
COORDINATION ASSISTANCE		
LOCAL AGENCIES	2.3	2.2
CALTRANS HEADQUARTERS	2.7	1.8

3.2.2.2.6 Reauthorization of ISTEA: Opportunities for ITS Implementation

The State hopes that the reauthorization of ISTEA could: 1) mandate MPOs to consider ITS as an alternative, and 2) specify MIS guidelines for the examination of ITS in the MIS process. At the local level, State leadership is needed, especially in consensus building.

3.2.2.3 Location: North and South

3.2.2.3.1 Knowledge and Implementation of ISTEA

From the survey, respondents from both the North and the South generally have a higher level of knowledge in areas of metropolitan planning processes, major investment studies, and air quality conformity than for the other ISTEA elements. For these three ISTEA elements, greater than a majority of the respondents self-rated their knowledge level at least "good". Comparatively, the South rates its own knowledge level greater than that of the North in the areas of system management and maintenance, intermodalism, and transportation technology R&D. In fact, the North rated their own knowledge level as "poor" for at least 40% of the respondents for intermodalism, land use and economic factors, and transportation technology R&D. The largest percentage of Southern respondents grading themselves as "poor" was approximately 20% for air quality conformity, major investment study, and land use and economic factors. Details are found in Figure 3.

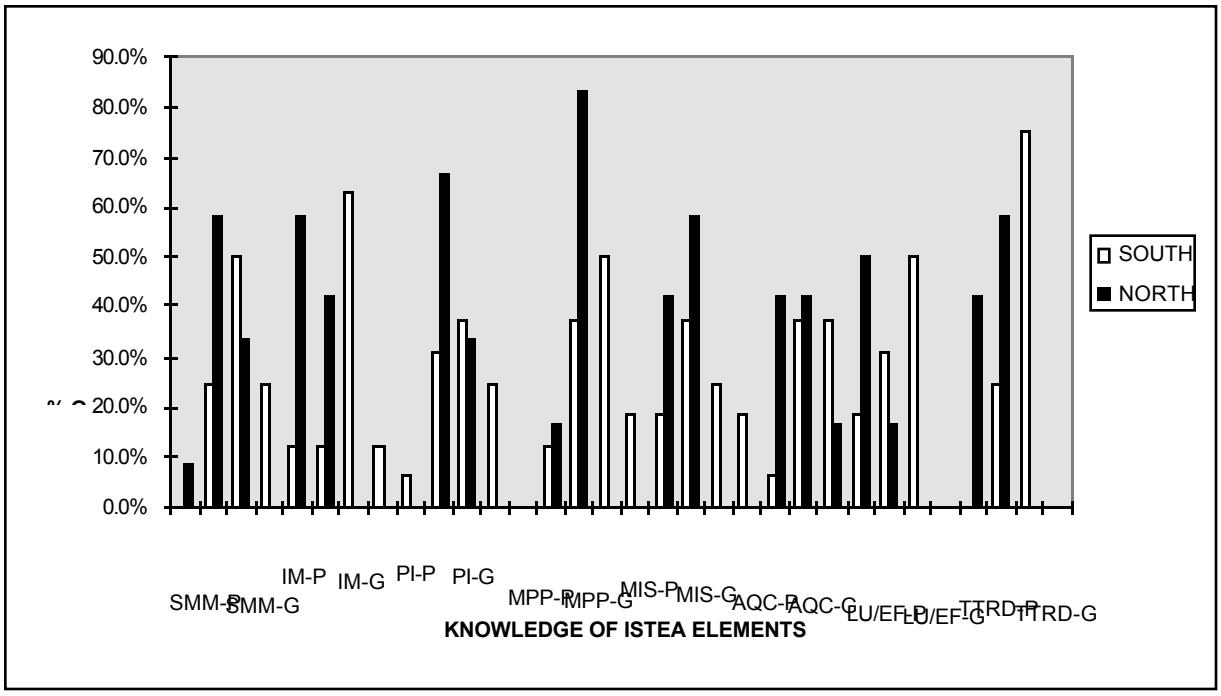

Figure 3: Level of Knowledge of ISTEA - North and South

In the past six years, both the North and the South have been involved in various fields of ISTEA implementation. In particular, they both have done extensive work in system management and maintenance and metropolitan planning. On the other hand, implementation in air quality conformity and consideration of land use and economic factors are relatively weak. Incentives are needed to foster ISTEA implementation in these areas.

The respondents in general understood and implemented intermodalism based on their regions' unique transportation needs. Respondents in the South revealed significantly higher knowledge in intermodalism, possibly due to the presence of an international border crossing coupled with extensive trucking traffic. However, both North and South felt that a clearer definition of intermodalism is needed. In areas of transportation technology research, development and planning, respondents in the South have gained experience with activities in different ITS technology areas, whereas there is less extensive involvement in both ITS and intermodalism from the perspective of respondents in the North. Differences in regional

transportation systems between the South and the North partially contribute to the different areas of focus and extent of ISTEA implementation.

3.2.2.3.2 Knowledge and Familiarity with ITS

While respondents from the South indicated strength in ITS implementation in their region, it is interesting to note respondents from the North also reveal extensive involvement in ITS-related activities (See Table 26). The North shows general interests in all the aspects, including participation in ITS America. Overall, both regions are relatively weak in ITS project evaluation as well as in education and training. The especially low level of involvement in project evaluation is not a surprise, as project evaluation is customarily performed by an independent evaluator, particularly for Field Operational Tests. Issues regarding education and training are also important, since ITS is not a traditional practice for most of the local and regional agencies.

Table 26: ITS-Related Activities – North and South

	SOUTH	NORTH
COUNT	8	6
PARTICIPATING MEMBER OF ITS AMERICA	50.0%	83.3%
ITS STRATEGIC PLANNING	100.0%	83.3%
EDPs	100.0%	100.0%
ITS PROJECT DESIGN	62.5%	83.3%
ITS PROJECT MANAGEMENT	87.5%	83.3%
ITS PROJECT EVALUATION	37.5%	33.3%
EDUCATION AND TRAINING	50.0%	66.7%
COORDINATION WITH OTHER AGENCIES	87.5%	100.0%

Respondents from the North were generally more conservative than their Southern counterparts in revealing their own and their staff's level of knowledge and perception of the contribution ITS makes to their region (See Table 27- the levels of knowledge of "poor", "fair", "good", and "excellent" were assigned numerical values of 1,2,3, and 4 respectively). An explanation for this may be the fact that Southern California has had more experience with ITS

than their Northern counterparts and so the responses from the North and the South are not based on the same level of experience. Knowledge of National System Architecture and its applications, however, are fairly close between South and North and are at a fairly low level (See Table 28). Moreover, both North and South indicated on average approximately the same expertise level – "some expertise" -- for the planning and deployment of ITS projects.

Table 27: Evaluation of ITS – North and South

	SOUTH	NORTH
LEVEL OF SELF KNOWLEDGE	3.4	3.0
PERCEPTION OF ITS CONTRIBUTION (SELF)	2.3	2.3
LEVEL OF STAFF KNOWLEDGE	3.3	2.5
PERCEPTION OF ITS CONTRIBUTION (STAFF)	2.8	2.0

Table 28: Familiarity with National Systems Architecture – North and South

	SOUTH	NORTH
	Average Score	
SELF		
NONE	25.0%	33.0%
SOME	75.0%	67.0%
ALL	0.0%	0.0%
STAFF		
NONE	75.0%	66.7%
SOME	12.5%	33.3%
ALL	0.0%	0.0%

Southern respondents indicated a greater level of ITS projects and programs undertaken relative to the North. Moreover, Southern respondents felt strongly that the time was appropriate to at least start moving beyond research and testing and into actual deployment in order to apply lessons learned from experience. Respondents from the North are generally, though not exclusively, at an earlier stage than the South in the research-testing-evaluation-

implementation process. The North is more at the stage of gearing up and waiting to see the results of ITS implementation in Southern California. The impacts and the lessons learned in Southern California will be helpful and beneficial for Northern California.

3.2.2.3.3 ISTEA's Support for ITS Implementation

Responses from the North indicate a greater level of support than from the South toward ITS implementation for all ISTEA elements except for intermodalism (See Table 29 - the categories used are "obstructive", "neither obstructive nor supportive", "somewhat supportive", and "very supportive" with the numerical values assigned of 1 through 4, respectively). The average support level score for several of the elements are even for South and North, e.g. PI, MPP, LU/EF, and I. For the North, there is an overall level higher than "somewhat supportive", especially in areas of system management and maintenance, major investment study, and air quality improvement. Responses from the South do not perceive much that ISTEA could do for ITS implementation and have rated this relationship generally between "somewhat supportive" and "neither supportive nor obstructive" except for MPP and TTR&D. The only elements thought by both North and South to be very supportive for ITS are the promotion of the metropolitan planning process, and transportation research and development from ISTEA. The largest difference in average scores occurs for the air quality conformity element. Northern California is "behind" the South, or rather more fortunate than the South in that the former has only recently started to experience the levels of traffic congestion and air quality problems that Southern California has had to endure and address for decades. Nevertheless, especially with respect to air quality, the magnitude of the problems is still significantly different between the North and the South. As the North is beginning to experience more congestion and air quality problems at generally the same time that ITS is moving toward more deployment to try to address these problems, ITS may be viewed as more of the appropriate answer to solve such problems than it is viewed in the South. Nevertheless, both the North and South feel the connection between ITS and air quality improvement has not yet been fully established or

realized. The connection understood at this stage is that air quality improvement could be an indirect benefit of ITS applications from reduced delay and smoother flow.

Table 29: ISTEA's Support for ITS – North and South

	SOUTH	NORTH
	Average Score	
System Management and Maintenance (SMM)	2.6	3.3
Intermodalism (IM)	2.8	2.5
Public Involvement (PI)	2.8	3.0
Metropolitan Planning Process (MPP)	3.2	3.3
Major Investment Study (MIS)	2.7	3.4
Air Quality Conformity (AQC)	2.6	3.5
Integration of Land Use and Economic Factors (LU/EF)	2.7	2.8
Transportation Technologies R&D (TTR&D)	3.3	3.8

In terms of the effect of public involvement on ITS, results in Table 30, (the categories used are "marginally", "moderately", "significantly" with assigned numerical values of 1, 2, and 3, respectively), reveal that public involvement in the planning process for ITS-related projects is only "moderately" helpful. The results are generally the same for the South and North with the exception of "build consensus among public agencies, communities, and other interest groups", with the South and North indicating less than a moderate level of assistance and between moderate and significant levels of assistance, respectively. This exception may be due to frustration in the South over the course of their experience in ITS-related activities coupled with regional differences in the internal structure of the transportation planning process.

Table 30: Extent of Assistance of Public Involvement in Regional Planning Process for ITS Projects – North and South

	SOUTH	NORTH
	Average Score	
CLARIFY OBJECTIVES FOR ITS IMPLEMENTATION	2.4	2.5
ASSIST IN PROJECT SELECTION THAT FIT LOCAL NEEDS	2.4	2.3

BUILD CONSENSUS AMONG PUBLIC AGENCIES	1.9	2.4
EDUCATE THE PUBLIC ON ITS-RELATED ISSUES	1.5	1.8

In terms of the extent to which ITS has been integrated into the current planning process, both the North and South generally felt the level of integration having been, at least, "adequately" done, as results show in Table 31. The categories used are "poorly", "adequately", "well", and "superbly" with assigned numerical values of 1 through 4, respectively. There are generally only small differences between the results of the North compared to the South, with the one exception being the extent to which ITS is updated in the RTP.

Table 31: Extent of ITS Implementation into Planning Process – North and South

	SOUTH	NORTH
	Average Score	
ITS UPDATED IN RTP	2.9	1.8
ITS PROJECTS DESIGNED AND IMPLEMENTED VIA TRANSPORTATION PLANNING PROCESS	2.4	2.3
INTEREST TO PURSUE ITS	2.4	2.6
COORDINATION ACHIEVED BETWEEN PLANNING AGENCY AND OTHER ORGANIZATIONS	2.7	2.5

The implementation of advanced transportation technologies is considered important by respondents from both the North and South at generally the same level.

3.2.2.3.4 Achieving ISTEA Objectives via ITS

Among all the issues involved in ITS implementation in Southern California, funding predictability is the most important issue for the South, with 75% of the respondents ranking it as number one. Favorable policies at federal and state levels are thought to be the second most important issue the South is facing. Inter-jurisdictional coordination is the third, while technical assistance is thought the least critical among the four. Results are described in Table 32.

The funding issue is less critical for the North than for the South, as only 33% of the Northern respondents ranked it the most important. Coordination is equally important as

funding. Technical assistance and favorable policies are ranked as third and fourth critical issues.

Differences between South and North on policy issues reflect the frustration that the South is facing as a result of its deeper involvement in ITS than the North and more of the "gear-up" mode the North experiences than the South. The South especially has been more impacted than the North by a somewhat inconsistent federal policy toward ITS. The South would also like to see revisions in the ITS project selection process so that the process is more open and clear with a greater degree of project applicability across diverse geographical areas. Southern respondents also thought that there is insufficient incentive and vision for ITS implementation at the federal level. At the state planning level, the South wants to have Caltrans more of an equal partner. Inconsistencies between federal policy and California policy have also been observed by the South in ITS implementation. The North, however, possibly due to its generally earlier stage and focus on ITS implementation than the South, is more concerned with institutional issues (multi-agency cooperation and public-private relationships) and professional capacity building.

Table 32: Improvements Needed to Foster ISTEA/ITS Linkages – North and South

	RANK 1	RANK 2	RANK 3	RANK 4	RANK 5
FAVORABLE POLICIES AT FEDERAL & STATE LEVELS					
SOUTH	10.7%	42.9%	25.0%	0.0%	10.7%
NORTH	16.7%	33.3%	16.7%	33.3%	0.0%
TECHNICAL ASSISTANCE FROM CALTRANS					
SOUTH	12.5%	0.0%	25.0%	62.5%	0.0%
NORTH	0.0%	16.7%	50.0%	33.3%	0.0%
FUNDING PREDICTABILITY					
SOUTH	75.0%	25.0%	0.0%	0.0%	0.0%
NORTH	33.3%	50.0%	16.7%	0.0%	0.0%
INTER-JURISDICTIONAL COORDINATION					
SOUTH	0.0%	12.5%	62.5%	25.0%	0.0%
NORTH	33.3%	33.3%	33.3%	0.0%	0.0%

3.2.2.3.5 Impacts of Inter-Jurisdictional Relationships on ITS Implementation

In the process of ITS implementation, both the North and the South indicate a higher level of support from the local jurisdictions than from Caltrans Headquarters in both consensus building and coordination assistance (See Table 33 - the categories used are "no support", "some support", and "strong support" with assigned numerical values of 1 through 3, respectively). For the area of technical support, the South indicates generally the same level of support from both local agencies and Caltrans Headquarters, whereas, the North indicates a greater degree of support from local agencies than from Caltrans Headquarters.

With specific regard to the support from Caltrans Headquarters, the South perceives a higher level of support than the North in all four categories. Northern survey responses indicate an overall lower level of support from the State than from local agencies; in particular, there is little support in technical and coordination assistance from Caltrans Headquarters.

The difference in these average scores between North and South evaluations of support from Headquarters is partially due to the extensive ITS-related activities for which the South is involved. As a result, the focus on the State from Southern California is stronger than from Northern California. The North is especially lacking in coordination and technical assistance from the State.

Table 33: Level of Support Received – North and South

	SOUTH	NORTH
	Average Score	
CONSENSUS BUILDING SUPPORT		
LOCAL AGENCIES	2.6	2.3
CALTRANS HEADQUARTERS	2.3	2.0
FINANCIAL SUPPORT		
LOCAL AGENCIES	2.0	2.4
CALTRANS HEADQUARTERS	2.4	2.1
TECHNICAL ASSISTANCE		
LOCAL AGENCIES	1.9	2.1
CALTRANS HEADQUARTERS	2.0	1.7

COORDINATION ASSISTANCE		
LOCAL AGENCIES	2.4	2.1
CALTRANS HEADQUARTERS	2.3	1.2

3.2.2.3.6 Reauthorization of ISTEA: Opportunities for ITS Implementation

Overall, the South indicates that the reauthorization of ISTEA needs to have consistency of focus and continuity of programs rather than changing them year by year, which leads to confusion among local agencies in the implementation process. Meanwhile, it would be desirable to channel a steady stream of funds into ITS programs instead of bigger but less frequent amounts. As more ITS projects and programs are nearing completion, especially in Southern California, it is the appropriate time to evaluate implemented programs and learn from such implementations. The North places more emphasis on having incentives for inter-jurisdictional coordination as well as incorporating ITS projects in regional transportation plans.

3.2.2.4 Professional Transportation Specialty: Operations and Planning

3.2.2.4.1 Knowledge and Implementation of ISTEA

Respondents from both Operations and Planning have a "good" level of knowledge in their areas of specialization. Respondents from operations are distinctively strong in system management and maintenance, with all the interviewees responding at levels of "good" or "excellent". Respondents from planning have a significantly high level of knowledge in intermodalism, public involvement, the metropolitan planning process, major investment study, air quality conformity, and consideration of land use and economic factors. Both Operations and Planning have approximately equivalent knowledge levels in the area of transportation technology R&D, with about 70% of the interviewees indicating at least a "good" level of knowledge. Details are found in Figure 4.

Corresponding to their knowledge of ISTEA elements, Planning respondents also have extensive experience in the areas of metropolitan planning process, public involvement, air

quality conformity, and consideration of land use and economic factors. Respondents from operations, based on their specialization, have extensive experience in system management and maintenance and active participation in ITS research and implementation. Operations respondents, however, felt a disconnect with the planning side of the agency, in which each group knows little of what the other group does in terms of ISTEA implementation. Both Planning and Operations are however aware of the MIS tool and its relationship to ITS. Both have suggested that ITS should be an alternative for Major Investment Study analysis.

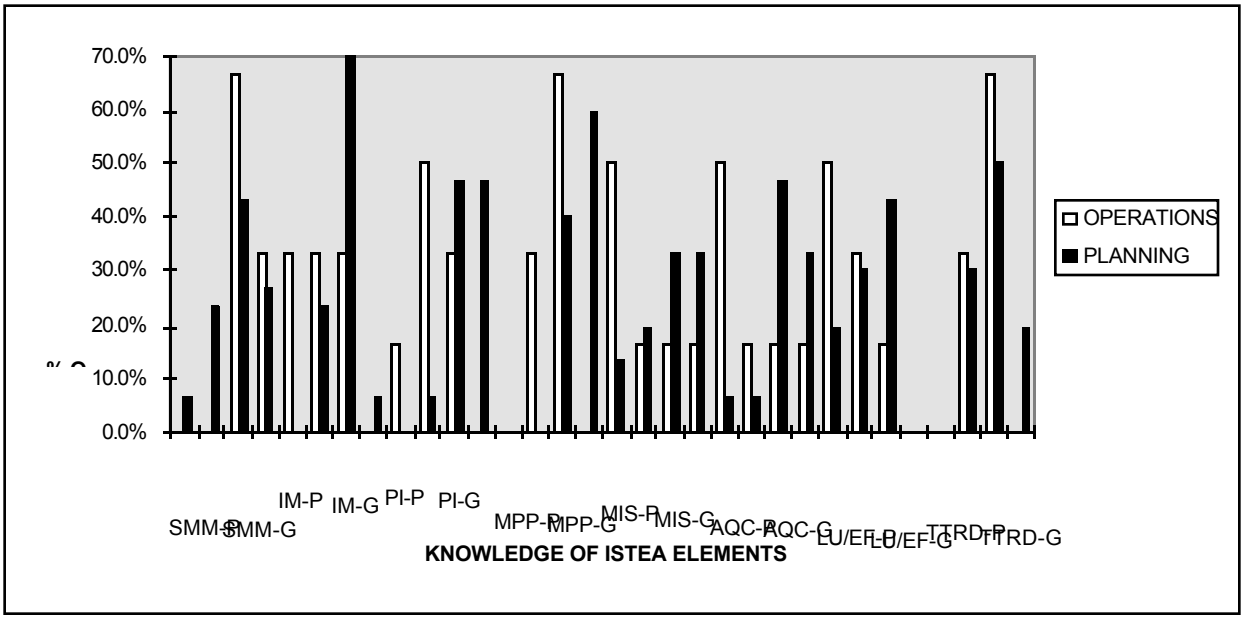

Figure 4: Level of Knowledge of ISTEA - Operations and Planning

3.2.2.4.2 Knowledge and Familiarity with ITS

Survey results from both Planning and Operations are similar with respect to the extent of involvement in ITS-related activities for strategic planning, EDP, project design, evaluation and coordination (See Table 34). Among them, only participation in ITS program evaluation is rated with a low level (less than 40%) of participation. The most significant

differences arise in the areas of ITS America membership, project management, and education and training. The operations' respondents were from Caltrans District offices and the planning respondents were from regional transportation planning agencies. Caltrans membership in ITS America is more a Headquarters activity rather than a district office level activity. This does not, however, preclude an individual Caltrans District from involvement in ITS America activities. Relative to overall project management, it is not unusual for management oversight to be the responsibility of the regional RTPA, e.g. MTC in the case of TravInfo and SANDAG and SCAG in the case of the Southern California Priority Corridor Showcase Project. By far, Operations divisions' ITS deployment mostly involve highway operations-related work such as at a Transportation Management Center (TMC) and signal coordination. Planning divisions focus more on strategic planning and local/regional projects.

Table 34: ITS-Related Activities – Operations and Planning

	OPERATIONS	PLANNING
NUMBER	3	15
PARTICIPATING MEMBER OF ITS AMERICA	0.0%	86.7%
ITS STRATEGIC PLANNING	100.0%	93.3%
EDPs	100.0%	86.7%
ITS PROJECT DESIGN	66.7%	66.7%
ITS PROJECT MANAGEMENT	66.7%	93.3%
ITS PROJECT EVALUATION	33.4%	40.0%
EDUCATION AND TRAINING	100.0%	66.7%
COORDINATION WITH OTHER AGENCIES	100.0%	86.7%

With respect to the level of knowledge and the perception of the contribution ITS has made, the planning interviewees indicate a greater level of knowledge than operations interviewees. All other categories are approximately equivalent in average score (See Table 35 - the levels of knowledge of "poor", "fair", "good", and "excellent" were assigned numerical values of 1,2,3, and 4 respectively). Although both Operations and Planning felt at least some expertise in ITS planning and deployment, planning interviewees indicated a greater level of interest in examining the NSA, with 80% having read at least some of the NSA. On the other hand, two-

thirds of respondents from Operations divisions have read none of NSA, and one-third have read only some (See Table 36).

Table 35: Evaluation of ITS – Operations and Planning

	OPERATIONS	PLANNING
	Average Score	
LEVEL OF SELF KNOWLEDGE	2.7	3.5
PERCEPTION OF ITS CONTRIBUTION (SELF)	2.3	2.5
LEVEL OF STAFF KNOWLEDGE	3.0	3.0
PERCEPTION OF ITS CONTRIBUTION (STAFF)	2.8	2.5

Table 36: Familiarity with National Systems Architecture – Operations and Planning

	OPERATIONS	PLANNING
	Average Score	
SELF		
NONE	66.7%	20.0%
SOME	33.3%	73.0%
ALL	0.0%	7.0%
STAFF		
NONE	66.7%	53.3%
SOME	0.0%	33.3%
ALL	0.0%	0.0%

3.2.2.4.3 ISTEA's Support for ITS Implementation

Except for SMM and MPP, Operations and Planning interviewees indicate general parity in the level of support from all other ISTEA elements toward ITS (See Table 37 - the categories used are "obstructive", "neither obstructive nor supportive", "somewhat supportive", and "very supportive" with the numerical values assigned of 1 through 4, respectively.). What is most interesting is that whereas Operations staff members have a good level of knowledge in

system management and maintenance and Planning is specialized in metropolitan planning, their responses are initially counter-intuitive. Why would each group indicate a lower average score in its area of focus compared to the other group? One answer may be that lower levels of experience are positively correlated with a more optimistic and hopeful view of the support ISTEA provides toward ITS, while experience offers a more sobering realistic view of the support.

Table 37: ISTEA's Support of ITS – Operations and Planning

	OPERATIONS	PLANNING
	Average Score	
System Management and Maintenance (SMM)	2.3	3.0
Intermodalism (IM)	3.0	2.7
Public Involvement (PI)	2.7	3.0
Metropolitan Planning Process (MPP)	4.0	3.1
Major Investment Study (MIS)	3.0	3.0
Air Quality Conformity (AQC)	3.0	2.9
Integration of Land Use and Economic Factors (LU/EF)	2.5	2.8
Transportation Technologies R&D (TTR&D)	3.7	3.5

With respect to the connection between public involvement in the regional planning process and ITS (See Tables 38 and 39), respondents from Operations and Planning are generally very close to each other in responses. In Table 38, the categories used are "marginally", "moderately", "significantly" with assigned numerical values of 1, 2, and 3, respectively. In Table 39, the categories used are "poorly", "adequately", "well", and "superbly" with assigned numerical values of 1 through 4, respectively. In some isolated categories such as "clarify objectives for ITS implementation" (Table 38) and "ITS is updated into Regional Transportation

Plan" (Table 39), however, operations see generally greater benefits for ITS implementation from public involvement as well as the extent to which ITS has been integrated into the current planning process. Once again, as in the case of the previous section, results here seem counter-intuitive and are based more on perception than experience.

Table 38: Extent of Assistance of Public Involvement in Regional Planning Process for ITS Projects – Operations and Planning

	OPERATIONS	PLANNING
	Average Score	
CLARIFY OBJECTIVES FOR ITS IMPLEMENTATION	2.7	2.1
ASSIST IN PROJECT SELECTION THAT FIT LOCAL NEEDS	2.5	2.1
BUILD CONSENSUS AMONG PUBLIC AGENCIES	2.0	2.1
EDUCATE THE PUBLIC ON ITS-RELATED ISSUES	1.7	1.6

Table 39: Extent of ITS Implementation into Planning Process – Operations and Planning

	OPERATIONS	PLANNING
	Average Score	
ITS UPDATED IN RTP	2.5	2.1
ITS PROJECTS DESIGNED AND IMPLEMENTED VIA TRANSPORTATION PLANNING PROCESS	2.0	2.2
INTEREST TO PURSUE ITS	2.0	2.3
COORDINATION ACHIEVED	2.5	2.4

3.2.2.4.4 Achieving ISTEA Objectives via ITS

For both Operations and Planning, funding predictability is the highest ranked of the four issues discussed (See Table 40). It is ranked the most important by ALL the Operations' respondents, whereas only 46.7% of Planning respondents ranked it the most important of the four categories. In implementing ITS, Operations' respondents felt there would be difficulty in funding ITS projects because the capital investment for ITS infrastructure could be expensive.

Due to worries over funds for transportation, Operations is concerned that ITS projects would place lower in priority in the competition over funds than other more traditional transportation projects and hence lose out to them. For the Planning respondents, while there are funding-related concerns, importance is also placed on policy issues such as cooperation, program focus, public-private sector relationships, and cost-benefit documentation. For Planning respondents, the importance of favorable policies is second only to funding predictability. Technical assistance is ranked overall the lowest by both Planning and Operations respondents when the full distribution of percentage rankings is examined.

Table 40: Improvements Needed to Foster ISTEA/ITS Linkages – Operations and Planning

	RANK 1	RANK 2	RANK 3	RANK 4	RANK 5
FAVORABLE POLICIES AT FEDERAL & STATE LEVELS					
OPERATIONS	0.0%	33.3%	66.7%	0.0%	0.0%
PLANNING	18.7%	31.1%	18.7%	18.7%	6.2%
TECHNICAL ASSISTANCE FROM CALTRANS					
OPERATIONS	0.0%	0.0%	33.3%	66.7%	0.0%
PLANNING	6.2%	6.2%	24.8%	43.3%	6.2%
FUNDING PREDICTABILITY					
OPERATIONS	100.0%	0.0%	0.0%	0.0%	0.0%
PLANNING	46.7%	46.7%	6.7%	0.0%	0.0%
INTERJURISDICTIONAL COORDINATION					
OPERATIONS	0.0%	33.3%	66.7%	0.0%	0.0%
PLANNING	14.3%	21.4%	50.0%	14.3%	0.0%

3.2.2.4.5 Impacts of Inter-Jurisdictional Relationships on ITS Implementation

With respect to the level of support from local jurisdictions, there is not much difference between Operations' and Planning responses, except in terms of financial support (see Table 41 - the categories used are "no support", "some support", and "strong support" with assigned numerical values of 1 through 3, respectively), in which Planning respondents indicate a much greater level of financial support from local agencies than do the Operations respondents. The Operations respondents were from Caltrans District offices and deal more with Caltrans Headquarters directly than with other local agencies. The Planning respondents, in contrast, deal with both local agencies as well as Headquarters.

The two groups, however, generally view differently the types of support received from Caltrans Headquarters. Planning respondents indicate there is greater support from Headquarters on consensus building and coordination assistance than do Operations respondents. Operations respondents indicate a greater level of technical assistance from Headquarters than do Planning respondents. Thus, Headquarters logically provides more support to Operations and Planning staff corresponding to their area of specialization.

Table 41: Level of Support Received – Operations and Planning

	OPERATIONS	PLANNING
	Average Score	
CONSENSUS BUILDING SUPPORT		
LOCAL AGENCIES	2.7	2.5
CALTRANS HEADQUARTERS	1.7	2.5
FINANCIAL SUPPORT		
LOCAL AGENCIES	1.5	2.3
CALTRANS HEADQUARTERS	2.5	2.4
TECHNICAL ASSISTANCE		
LOCAL AGENCIES	1.8	1.9
CALTRANS HEADQUARTERS	2.3	1.8
COORDINATION ASSISTANCE		
LOCAL AGENCIES	2.3	2.2
CALTRANS HEADQUARTERS	1.7	2.0

For ITS planning and implementation, respondents from Operations felt that the State should take the lead on applications of new technology and should be more proactive in statewide standards development. Planning respondents are concerned with constructive policy issues, in general, and partnership between the State and local agencies, technical assistance and standards, and documentation of cost-benefit evaluation in particular. Current State deployment has an insufficient amount of information on how to integrate State programs with local agencies.

3.2.2.4.6 Reauthorization of ISTEA: Opportunities for ITS Implementation

Respondents from Operations hope that the reauthorization of ISTEA will provide paths toward deployment to assist the local areas in ITS systems implementation. Participants from Operations express caution with the future of the Priority Corridor; good vision and consistent planning are seen as critical ingredients to its success.

3.2.2.5 Geographical Setting: Urban and Rural

While the survey focuses on the regions active in ITS implementation and overwhelmingly in urban areas, input was also received from a rural area in Southern California. There are differences between urban and rural implementation of ITS; an emphasis on rural issues is placed in this section.

From the perspective of both Planning and Operations in rural areas, there is generally less knowledge about ISTEA and ITS than in their urban counterparts. Implementation of ISTEA is also not as extensive as seen in urban areas. Moreover, the connection between ISTEA and ITS is generally felt to be rather weak, where ISTEA is thought to be "neither obstructive nor supportive" toward ITS implementation. Due to the geographical and transportation system differences between rural and urban areas, at this stage air quality is of less concern in rural areas and it is hard to link it to ITS. There is not much public involvement in the regional planning process for ITS-related projects, and the degree of integration of ITS in regional transportation planning is considered weak. Nevertheless, rural regions would like to see a stronger linkage

between ISTEA – or now its reauthorization – and ITS, and see ITS as important for their regions' transportation systems in the future.

Funding is also considered very important in rural areas, followed by needs for technical assistance and favorable federal policies. Due to small staff complements in rural regions, agencies view support from Caltrans Headquarters as critical in increasing their willingness to be involved in ITS. More outreach to rural regions and documented cost-benefit analyses would also be very helpful in assisting the development of relevant local projects in rural areas.

While there has been some support from local jurisdictions in ITS implementation, the rural agencies felt much less support overall than was felt in urban areas from other local agencies. Rural agencies want and expect more attention from both Headquarters and other statewide agencies such as the California Alliance for Advanced Transportation Systems. Due to their limited staff complements, rural areas need and depend on examples of fully implemented projects from other areas to assist them in ITS project selection and design.

4.0 RECOMMENDATIONS AND CONCLUSIONS

A great deal of material has been presented in Section 3.2. While the findings are not derived from a very broad-based sample of all transportation professionals in California familiar with both ISTEA and ITS, the results are valuable nonetheless. The results should be interpreted more descriptively than statistically - to give a sense of the issues, concerns, experience, and suggestions for improvements. The following question immediately comes to mind: How can these results be utilized effectively? In this section, the results have been further synthesized and organized into several topic areas which attempt to 1) concisely summarize the survey results, 2) identify opportunities for future research in this area, 3) make recommendations for addressing identified problems, and 4) offer conclusions for this study.

4.1 Major Investment Studies and ITS

The survey results indicate that MISs are supportive of ITS implementation. Local agencies view the MIS as potentially a very useful tool for transportation planning alternatives assessment. Currently there are no Federal guidelines contained within ISTEA on how to implement an MIS. While a "one size fits all" approach is not what the various local and regional agencies want or strive for, some general high-level guidelines would be helpful for them to use in their studies of transportation alternatives, even though local needs are still paramount. Incorporating ITS into the MIS process would likely attract additional local and regional attention in considering the comparative advantages of ITS relative to other transportation alternatives, thus making the transportation planning process more complete and offering opportunities for the application of new technologies. Since Operations staff are generally less knowledgeable and less involved in the MIS process compared to their Planning counterparts, enhancement of the MIS tool in ITS implementation for operations should be beneficial in assisting them in project selection and design.

4.2 Documenting ITS Benefits

For people willing to participate in ITS-related work but not yet actively involved in its implementation, there is an eagerness to see documented benefits to assist in the decision-making process. They ask the question: Should we use ITS here in this instance, or should we use some other means to solve this problem? On the other hand, people already familiar with ITS projects, especially in design, management, and implementation have observed some positive impacts from the ITS implementation to date. Such ITS implementations have taken the form of an FOT, a specific Priority Corridor project, or some other project that is initiated, sponsored, and implemented at the local level. How to quantify the benefits of such relatively short-lived ITS implementations and how to filter such information down, especially to local planning agencies as well as to the public, are crucial tasks at hand. The State, i.e. Caltrans, is in a unique position by virtue of its statewide authority, experience, and access to a multitude of resources (funding, technical expertise, information) to continue in its leadership role to satisfy the need voiced by the local and regional agencies.

4.3 Education and Outreach

Local and regional transportation officials are looking for ways to improve their knowledge of ITS. There are participants in ITS project implementation whose educational background and professional experience are considerably different than other members of the professional staffs at transportation-related organizations. Their strengths and weaknesses are different. Such differences exist within the same organization, such as between Planners' and Operations' staff. Differences also exist across organizations, where other factors play more than a minor role with respect to distinguishing characteristics, such as geography, i.e. urban vs. rural. A major question is: To what extent should education be used to help level the playing field for all people engaged in ITS-related work?

The survey findings have indicated that outreach efforts to the general public and to elected officials are still at a fairly rudimentary level. As a consequence, local jurisdictions are not inclined to become as actively involved as they could be in ITS planning. Outreach approaches that are specific to the transportation needs of local and regional communities would hopefully achieve better results than a more generic approach. The local and regional agencies tend to focus on issues affecting their own region more than on Statewide issues. Continuing efforts at benefit documentation will assist in achieving effective outreach.

4.4 Intermodalism: More Than Just a Popular Buzz Word

While intermodalism is one of the major elements of ISTEA, it is, in the views of survey respondents, still however, fraught with ambiguity in its definition, how it is interpreted, used, and applied in the context of ISTEA implementation; and its distinction from the related terms, multimodal transportation and multimodalism. Respondents' concern was repeatedly

mentioned over the term *intermodalism* and, in their words, its "vagueness and ambiguity". The United States Department of Transportation (24) has defined such related terms as follows:

Intermodal Transportation: Use of more than one type of transportation; e.g. transporting a commodity by barge to an intermediate point and by truck to destination.

Intermodalism: Typically used in three contexts: (1) Most narrowly, it refers to containerization, piggyback service, or other technologies that provide the seamless movement of goods and people by more than one mode of transport. (2) More broadly, intermodalism refers to the provision of connections between different modes, such as adequate highways to ports or bus feeder services to rail transit. (3) In its broadest interpretation, intermodalism refers to a holistic view of transportation in which individual modes work together or within their own niches to provide the user with the best choices of service, and in which the consequences on all modes of policies for a single mode are considered. This view has been called balanced, integrated, or comprehensive transportation in the past.

Multimodal Transportation: Often used as a synonym for intermodalism. Congress and others frequently use the term intermodalism in its broadest interpretation as a synonym for multimodal transportation. Most precisely, multimodal transportation covers all modes without necessarily including a holistic or integrated approach.

Yet there has been an extensive amount of discussion of intermodalism in the literature, including contributions by Caltrans (25). This reference discusses the following topics related to intermodalism:

- Objectives of intermodal transportation systems
- Intermodal services
- Intermodal vs. multimodal systems
- Intermodal performance criteria
- Benefits of intermodal systems
- Intermodal challenges
- Role of ITS in the evolution of intermodal systems including user services, system architecture, technologies, interoperability, TMCs, and marketing opportunities
- Implementation

There seems to be a disconnect concerning intermodalism along State/Local jurisdictional lines as evidenced in the survey results (See Figure 2 in Section 3.2.2.2.1). Bridging this gap will require a deliberate and concerted effort to move *intermodalism* beyond its status as a currently popular buzz word, to link it more effectively with the ITS arena, to identify and

conduct any needed research in this area, and to move more extensively into the implementation phase.

4.5 Linkages Between ITS and Land Use and Economic Factors

The survey results indicate that the weakest area in terms of knowledge and familiarity of individual ISTEA elements is land use and economic factors. This area generally falls outside the knowledge and experience base of the respondents, with the partial exception of planners among the survey's respondents. The subject of linkages between land use and transportation, in particular between urban land use and transportation, is sizable and at least somewhat controversial with at least two primary schools of thought on the subject having to do with the strength of the connection between land use and transportation and conclusions that can be drawn in the area of policymaking (26). Even with an undisputed theoretical justification for a linkage between land use and transportation, translating theory into a comprehensive set of models that account for the interaction effects between land use and transportation, i.e. travel demand, is an area of research that has not yet been fully addressed. A consequence of this low level of knowledge about the subject area is that the whole arena of ITS and land use/economic factors is a relatively untapped and potentially rich field for further research.

4.6 Air Quality and ITS

While it is perceived desirable to have a stronger linkage between ITS and ISTEA in general, the connection between ITS and air quality improvement has not yet been fully realized. In numerous cases, air quality improvement is viewed as an indirect benefit of ITS applications rather than a direct benefit. There is concern over linkage between ITS and air quality because most deployments of ITS are locally oriented and air quality issues need more of a regional approach in the search for solutions, e.g. regional emissions reductions. When ITS is implemented regionally and consistently across local jurisdictions, then air quality improvements may be more effectively evaluated and hopefully demonstrated. There are, however, examples where local area emission "hot spots" and ITS converge, and an assessment of the impacts on

emission levels for certain pollutants resulting from the implementation of ITS is both needed and desirable. A prime example is the use of electronic toll collection methodologies at bridge toll entrances. One of the toll lanes at the entrance to the Carquinez Bridge in the San Francisco Bay Area is available for use by vehicles with an electronic tag to "read" the vehicle and deduct the appropriate toll amount from it. With reductions in the level of stop-and-go driving, in particular fewer accelerations which significantly contribute to emissions, a benefit may be obtained at such local area emission generating locations. The implementation of electronic toll collection on more San Francisco Bay Area bridges in the near future will allow for further research and testing in this area to document local area emissions impacts and could definitely result in air quality benefits being proven.

4.7 Widening the Scope for ITS Implementation

While applications of advanced technologies in the public transportation arena generally play an active role in the field of intelligent transportation systems, based on survey results, they have not played such a fundamental role in California's implementation of ITS projects. An application of ITS to the transit field offers an opportunity to explore the potential for addressing congestion, safety, and air quality problems, as well as documenting the benefits for transit attributable to ITS. Making transit "smart", or at least smarter, should also include applying ITS in the context of Transit Management Centers.

4.8 Federal Policy: The Need for Consistency

Respondents, especially local and regional agencies, have expressed a strong desire for consistency and continuity in federal ITS policies and programs. ITS is a relatively new experience for local and regional agencies and requires both time and commitment to become fully oriented. Thus, continuity in federal ITS policies and programs are crucial to the success of ITS implementation at the local and regional level. However, the observed changes in focus over time at the federal level has made local commitment to ITS implementation difficult, and challenging at best, as locals tend to follow federal intentions rather than their own desired implementation

strategies. In the Southern California Priority Corridor, the Regional Transportation Planning Agencies involved have put a big portion of their staff and financial resources into the projects. Because of their deeper involvement and more extensive experience with ITS, they need consistency and continuity at the federal level so that they can allocate limited resources efficiently to the committed projects and programs designed earlier rather than continually making changes over time. Continuity of ITS programs and policies at the federal level will give regions confidence of a more successful participation in ITS.

4.9 Integration of ITS and Regional Transportation Planning

There have been calls for additional and specific guidelines to assist incorporating ITS with other functions performed by regional transportation planning agencies.

The incorporation between the general transportation plan and Early Deployment Plan thus becomes especially important for ITS implementation in the short term by addressing ITS in the context of regional transportation systems. This study reveals only a moderate level of integration existing between the RTP and EDP coupled with variations among the RTPAs. Revising Regional Transportation Plan guidelines by adding a specific ITS component should be feasible and likely beneficial in the current state of the ITS planning process. Guideline revisions should consider the general applicability of ITS programs across an entire region as well as identifying each region's particular transportation needs.

4.10 ITS Deployment: Plans, Projects, and Programs

Local and regional transportation agencies, especially those in Southern California, see value in and a need to develop deployment strategies and plans for ITS. With a concerted effort at ITS deployment in the State, a lot may be learned from actual situations, such as operation and maintenance of ITS infrastructure and liability issues. Requests for ITS deployment may be met at the federal and state levels with assistance and guidance in carefully chosen deployable projects. Moreover, examples of ITS deployment will assist local agencies in understanding ITS, especially those agencies with resource limitations such as lack of staff. In the rural area, due to

limited staff, the transportation planning and operation agencies hope for and depend on examples of fully implemented projects from other areas to "prime the pump" for the rural regions to assist them to develop their own ITS projects.

4.11 State Leadership

State leadership is to be encouraged, especially in standards development and in providing assistance to the local and regional areas. For example, the State's assistance to Northern California could address their concerns for coordination and technical support for ITS implementation. In Southern California, a commitment for funding support for the projects already being implemented is essential. Rural agencies felt much less support overall from other local agencies than felt by their urban counterparts. Rural agencies want and expect more assistance from both Headquarters and other Statewide agencies such as the California Alliance for Advanced Transportation Systems (CAATS). The State should encourage rural regions in their pursuit of ITS by offering better education as well as technical and coordination assistance. CAATS could also play a role to assist rural regions interested in ITS. In fact, CAATS has played a significant role in the area of ITS deployment with its initiative to bring together transportation and ITS experts from throughout California to set the stage for the development of a Statewide Deployment Plan for ITS (27). Continued State leadership as well as cooperation among state, regional, and local stakeholders, will contribute toward the realization of ITS benefits.

5.0 APPENDIX A: SURVEY INSTRUMENT

THE CALIFORNIA ISTEA/ITS CONNECTION

LINKAGES BETWEEN ITS AND THE IMPLEMENTATION OF ISTEA

Date of interview: _____

Name of interviewee: _____

Position and title of interviewee: _____

Organization: _____

SCRIPTED INTRODUCTION

The PATH Program at the University of California at Berkeley is investigating the linkages between the implementation of ISTEA in California and Intelligent Transportation Systems (ITS) by means of interviews with project managers and members of the transportation planning staff who have familiarity with planning and/or implementation of ITS in their jurisdiction. In general, ITS refers to a broad range of diverse technologies, comprised of information processing, communications, control, and electronics with the objective of addressing today's and tomorrow's transportation-related issues such as safety, congestion, and air pollution. The objective of this survey is to gather data on how ISTEA has been implemented in California, your knowledge and familiarity with ITS, ISTEA opportunities for or barriers against ITS, how ITS can help achieve ISTEA objectives, impacts of inter-jurisdictional relationships on ITS implementation, and what NEXTEA should do to provide better opportunities for ITS implementation. Before beginning the survey, we would like to thank you very much for assisting us in this study.

I. IMPLEMENTATION OF ISTEA

1. ISTEA is composed of many elements, such as system management and maintenance, development of intermodalism, and major investment studies. Please give an overall evaluation of your staff's knowledge of each of the elements following.

	STAFF KNOWLEDGE			
ISTEA ELEMENTS	Poor	Fair	Good	Excellent
System Management and Maintenance				
Intermodalism				
Public Involvement				
Metropolitan Planning Process				
Major Investment Study				
Air Quality Conformity				
Integration of Land Use and Economic Factors				
Transportation Technologies R&D				
Others (please specify)				

2. For the ISTEA elements just discussed, please describe the stage at which each of them has been implemented by your organization. For example, briefly describe how far along your organization has been in the process of implementing air quality conformity.

   System management and maintenance _____

   Intermodalism _____

   Public involvement _____

   Metropolitan planning process _____

   Major investment study _____

   Air quality conformity _____

   Integration of land use and economic factors _____

   Transportation technology research and development _____

Others (please specify): _____

II. KNOWLEDGE AND FAMILIARITY WITH ITS

1. In which of the following areas of ITS-related activities is your agency involved? Please check all applicable areas.

   __ Participating member of ITS America and associated committees
   __ ITS strategic planning
   __ Early deployment plan(s)
   __ ITS project design(s)
   __ ITS project management
   __ ITS project evaluation(s), e.g. evaluation of a Field Operational Test
   __ Education and training
   __ Coordination with other agencies
   __ Others (please specify):

   _____

   _____

2. Please list the major ITS-related projects in your region in which your organization has participated since the enactment of ISTEA, that is, since 1991. For each project, is/was it a Field Operational Test, a demonstration project, R&D, anything else?

3. Please give an overall evaluation of ITS with respect to you and your staff.

a). Your level of knowledge: Your perception of its contribution to your region:

__ Poor
__ Fair
__ Good
__ Excellent

__ None
__ Little
__ Moderate
__ Significant

b). Staff's level of knowledge:

__ Poor
__ Fair
__ Good
__ Excellent

Staff's perception of its contribution to your region:

__ None
__ Little
__ Moderate
__ Significant

4a).Have you reviewed the National Systems Architecture?

__ No, not at all
__ Yes, but only some of it
__ Yes, all of it

4b).Have the majority of your staff reviewed the National Systems Architecture?

__ No, not at all
__ Yes, but only some of it
__ Yes, all of it

If Yes, how has the NSA been incorporated into your ITS planning work?

_____

_____

5. What level of expertise does your agency have for the planning and deployment of ITS projects?

__ No expertise
__ Some expertise
__ Quite strong expertise

What plans, if any, are there to improve the level of expertise?

_____

_____

III. ISTEA Opportunities For or Barriers Against ITS

1. Based on your experience since the enactment of ISTEA, how supportive of the implementation of ITS in your region has this legislation been with respect to each of the following areas? For example, how supportive has the requirement for system management and maintenance been for the implementation of ITS? Please give each a rating according to the scale below.

   1: obstructive; 2: neither obstructive nor supportive; 3: somewhat supportive; 4: very supportive; NA: not applicable; DK: don't know

   __ System management and maintenance
   __ Intermodalism
   __ Public involvement
   __ Metropolitan planning process
   __ Major investment study
   __ Air quality conformity
   __ Integration of land use and economic factors
   __ Transportation technology research and development
   __ Others (please specify)

   _____

   _____

   For those areas you checked with a "1", please briefly explain why.

   _____

   _____

2. Has public involvement in the regional planning process been helpful for ITS-related projects?

   __ Yes __ No

   If Yes, how helpful has it been with respect to each of the following areas?

   1: marginally; 2: moderately; 3: significantly

__ Clarify objectives for ITS implementation
__ Assist in the selection of projects that fit local/regional needs
__ Build consensus among public agencies, communities, and other interest groups
__ Educate the public on ITS-related issues
__ Others (please specify):

_____

_____

If No, why not?

_____

_____

3. Have there been ITS projects implemented in the area of system management and maintenance since the enactment of ISTEA in your region?

__ Yes __ No

If Yes, list those ITS projects and check all the system management elements applicable.

	SYSTEM MANAGEMENT ELEMENTS				
ITS PROJECTS (PLEASE LIST)	Traffic Mgmt./Ops.	Incident Mgmt.	Transit Mgmt.	Safety (hwy. & vehicle)	Others (please specify)

4. Has ISTEA facilitated the application of intelligent transportation technologies to improve air quality in your region? If so, please briefly describe how.

5. Has your agency faced difficulties in the process of ITS implementation in your region? If so, please list up to five of the most critical.

6. Has ITS implementation been integrated into the current planning process in your region?

__ Yes __ No

If Yes, please evaluate how well this integration has succeeded in terms of the following aspects: 1: poorly; 2: adequately; 3: well; 4: superbly

__ ITS is updated into Regional Transportation Plan
__ ITS projects are designed and implemented via transportation planning process
__ Strong interest exists for the regional transportation planning agencies to pursue ITS
__ Coordination is achieved between the planning agency and other organizations (transportation, air quality, planning)
__ Others (please specify)

_____

_____

If No, why not?

_____

_____

7. Based on your experience, how important is the implementation of advanced transportation technologies for your region's transportation systems?

   __ Not important at all
   __ Somewhat important
   __ Important
   __ Very important

8. In your region, has ISTEA in any way encouraged or led to the funding or execution of undesirable ITS projects? That is, has the expenditure of ISTEA funds on ITS projects had any negative impacts? If yes, please describe.

IV. How ITS Can Help Achieve ISTEA Objectives

1. In the near term (up to five years from now), what are the most important improvements needed to foster a connection between ISTEA and ITS? Please rank such improvements in order of importance.

   __ Favorable policies at federal and state levels
   __ Technical assistance from Caltrans
   __ Funding predictability
   __ Inter-jurisdictional coordination
   __ Others (please specify)

   _____

   _____

2. What improvement, if any, should be accomplished at the State ITS planning level to foster regional willingness for participation in ITS?

3. How useful are ITS projects toward fulfilling ISTEA objectives, such congestion and incident management, at the local and regional levels? What can be done to make ITS projects more useful for local and regional agencies?

V. Impacts of Inter-Jurisdictional Relationships on ITS Implementation

1. To what extent has your agency received support from other local and/or regional agencies, including Caltrans Districts, in the process of ITS implementation? Please check off only those areas where support was either needed or desired and use the following scale to indicate the level of support for each such area:

   1: no support; 2: some support; 3: strong support

   __ Consensus building
   __ Financial support
   __ Technical assistance
   __ Coordination assistance
   __ Other areas (please specify).

   _____

   _____

2. To what extent has your agency received support from Caltrans Headquarters in the process of ITS implementation? Please check off only those areas where support was either needed or desired and use the following scale to indicate the level of support for each such area:

   1: no support; 2: some support; 3: strong support

   __ Consensus building
   __ Financial support
   __ Technical assistance
   __ Coordination assistance
   __ Others (please specify).

3. How well does your agency coordinate with other public-sector organizations (for example, MPOs, local/regional DOTs, regional CHP offices, regional air quality districts) and the private sector in implementing ITS?

	COORDINATION				
ORGANIZATION	Poorly	OK	Well	Superbly	Other *
Public Sector:					
Private Sector					

* = Please specify whether, for example, no coordination exists but would be desirable, or no coordination necessary, etc.

VI. WHAT SHOULD NEXTEA DO TO PROVIDE BETTER OPPORTUNITIES FOR ITS IMPLEMENTATION?

1. Would it be desirable for your organization to foster stronger linkages between ITS, NEXTEA and its implementation? If so, please give brief details.

2. What issues should be addressed in NEXTEA to encourage the integration of ITS into the regional planning process?

Are there any other comments you would like to make or anything you would like to add?

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