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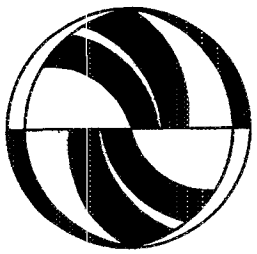

Regional Impacts of Neotraditional Neighborhood Development

Michael G McNally

Working Paper
UCTC No 172

The University of California
Transportation Center

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Regional Impacts of Neotraditional Neighborhood Development

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1. INTRODUCTION

In recent years, the Neotraditional Neighborhood Development (NTND) land use planning movement, which is also known as "Traditional Neighborhood Development", has gained increasing attention from planning, engineering, and development professionals. This increased popularity stems from the recognition that the concepts embodied in NTND address many of the most pressing social and economic problems in urban areas, including growth management, traffic congestion, open space preservation, and housing shortages. Through basic changes in land use patterns, street geometries, and network design, NTND attempts to improve accessibility via increased efficiency in travel/activity patterns. Improvements in network connectivity are coupled with lower speeds resulting in comparable travel times but reduced vehicle miles traveled, less congestion, and improved air quality.

Preliminary research has evaluated the potential performance of NTND designs for isolated developments. Further work, particularly with regard to trip generation rates and non-motorized travel, needs to be conducted. However, to realize potential benefits at the regional level, the very network continuity which produces the travel benefits of NTND at the development level must exist to some extent at the regional level. This paper presents some results and an approach to evaluate the potential of the NTND design concept to ameliorate the impacts of excessive growth on transportation infrastructure measured at the regional scale.

For land use patterns defined by density, mix, and location of alternative urban designs, the relative merits of NTND designs at the regional level may be assessed in terms of accessibility, operational requirements, and system performance, via simulation modeling. An assessment of the relative advantages and disadvantages of NTND design in the planning and

operation of public transportation systems is of particular importance given the intent of NTND design to achieve greater use of non-automotive modes. Isolated developments, while potentially sensitive to transit operational needs, are quite limited in supporting regional transit service if the surrounding development negates the advantages introduced by NTND design. The regional distribution of activities which define residential travel patterns will largely determine the level of transit usage for the area in question.

2. THE NTND CONCEPT

Neotraditional Neighborhood Development, as the name implies, proposes that new development break away from the existing Planned Unit Development (PUD) goals of insular residential communities described by cul de sacs and curvilinear street patterns, and return to the type of integrated communities of the Pre-WWII town and city which largely approximated gridiron street patterns (see Reference *1* for an overview of NTND concepts).

One of the primary goals of NTND is to address the issue of suburban congestion. This problem is dealt with through mixed land use development and through the designing of street and public spaces that equitably serve the pedestrian and the automobile. The combination of these two concepts provides for communities where not only is housing closer to job sites and shopping, but the street network used for these trips invites pedestrian activity. The intended outcome of such development is a reduction in the number of generated auto trips, an increase in pedestrian trips, and an increased accessibility to transit service.

Neotraditional planners generally claim that their design practices will result in reduced transportation impacts. The basic arguments made are that neotraditional neighborhood design

will reduce automobile dependence, increase public transit accessibility, and reduce travel distances and times (*2,3,4*). Kulash (*5*) claims that neotraditional street networks function more efficiently than conventional networks because: a) the large streets of a typically sparse conventional network operate under deficiency of scale, b) turning movements are more efficient on the smaller streets associated with neotraditional networks, c) the increased route choices offered by the typically dense neotraditional network make real-time route choice possible (drivers are not always forced onto a few large arterials), and d) uninterrupted flow is more likely to occur in a dense network of smaller streets because there are fewer signalized intersections.

Although these design concepts seek to mitigate traffic problems (among other development problems), proponents of NTND ironically have faced their strongest opposition from traffic engineers. Conflicts have been identified between current traffic engineering standards and the implementation of NTND goals. Major conflicts (*2,6*) include design aspects such as a) basic street layout, b) design speeds and curb radii, c) intersection geometry and spacing, d) sidewalk design, e) on-street parking, and f) traffic control. In older neighborhoods, these characteristics were selected to stimulate pedestrian activity while accommodating the local traffic. In contemporary communities, however, streets were designed with the prime emphasis on enhancing traffic flow NTND proponents claim that the traffic engineer's emphasis on designing for enhanced flow is stimulating auto dependency which in turn creates suburban congestion. Spielberg (*6*) underscores the need for traffic engineers to consider the importance of their role in shaping both existing and developing communities by questioning whether "...standards for traffic flow [will] determine the shape of future communities" and should engineers "reconsider standards..., or are they so well founded that change is unwise?".

In many regions, the term "growth" has begun to carry negative connotations. This is an indication that current development practices are not successful and that alternatives must be sought. The potential importance and utility of neotraditional design is far reaching in that it will facilitate the implementation of land use patterns that have the potential to ease many of the problems now associated with urban and suburban growth.

3. REVIEW OF THE LITERATURE

The transportation profession has perhaps had the most vocal response to Neotraditional Neighborhood Design. Ryan and McNally (*7*) provide a comprehensive review of design concepts, policies, and relevant research. The application areas which have been addressed include (a) traffic engineering, (b) transportation planning, and (c) public transit.

3.1 Traffic Engineering

Spielberg (*6*) defines the major conflicts existing between current traffic engineering practice and the demands being made by neotraditional subdivision design. Lerner-Lam et al. (*1*) identified a comprehensive list of potential traffic engineering problems and attempt to alert the traffic engineering profession that neotraditional neighborhood design is inevitable due to its popularity among planning boards and other policy makers. They suggest that the profession's concern should not be whether this concept is implemented but how it will be implemented safely and responsibly.

Perhaps the most comprehensive discussion of NTND design and its implications for the traffic engineer is the Synthesis Report prepared by the Institute of Transportation Engineers (*2*).

This report acts as a precursor to the preparation of new guidelines for recommended engineering practice in neotraditional neighborhoods. The report's intent is to educate the traffic engineering profession on the elements of neotraditional design, and to enhance their preparedness for dealing with new land use designs.

3.2 Transportation Planning

The literature covering transportation planning is devoted to discussion about the effects of this design on the transportation system. Virtually all studies dealing with the transportation planning aspects of NTND design argue that positive transportation impacts will result in the form of reduced automobile dependence, increased public transit accessibility, and reduced travel distances and travel times.

Kulash (*5*) offers an extensive discussion of the possible transportation impacts of neotraditional design, focusing on network capacity, travel distances, and travel speeds. In terms of capacity, he maintains that neotraditional neighborhoods can handle higher volumes of traffic; in terms of performance, he claims that the lower speeds over shorter distances in the NTND network produce similar travel times. Gordon and Peers (*4*) draw similar conclusions, and attribute the improved performance to: (a) trips being internalized within the community, (b) a reduction in the percent of trips made by car, and (c) to residents working closer to home.

Stone and Johnson (*3*) offer further evidence that many of NTND benefits may in fact be plausible. Using site impact assessment techniques, they compare hypothetical subdivisions and find that the neotraditional design has 25 percent less vehicle delay, 20 percent fewer trips generated, and 30 percent more entry points (used to define accessibility). McNally and Ryan

(*8*) present similar results using standard demand forecasting techniques to model comparable, hypothetical networks. Results indicated 10 percent fewer vehicle-kilometers-traveled in the neotraditional network for the same level of trip generation. Total vehicle-hours-traveled in the neotraditional network were reduced by 27 percent and average trip lengths were about 15 percent shorter than in the conventional network (see Table 1).

Friedman et al. (*9*) investigated potential changes in trip generation and mode choice for both "Traditional" and "Standard Suburban" neighborhoods. Their results, which provide a basis for measurement of the potential impacts of different land use patterns, indicate 18 percent fewer total daily trips and 38 percent fewer auto trips in the "Traditional" communities, and an auto mode share of 54 percent versus 68 percent in the "Standard Suburban" community.

3.3 Public Transit

Neotraditional neighborhood design has attracted the attention of transit professionals because it offers a significantly higher transit-oriented land use pattern than the typical suburban developments of recent decades. The key components to this increased transit accessibility are more concentrated activity centers, interconnected street systems that avoid circuitous paths and cul-de-sacs, and increased pedestrian accessibility.

Rabinowitz et al. (*10*) offer an objective review of the planning principles involved in neotraditional neighborhood design. The main focus of this report is to determine how seriously transit issues are currently being addressed by land developers. The evaluation focused on how transit was accommodated in alternate designs defined by: a) land use, b) accessibility to transit, and c) compatibility with transit operations. In the evaluation of NTND-related designs, all

ranked highly in their potential ability to accommodate public transit; only 12 percent of non-NTND designs included mass transit or provided a land use patterns suitable to effective transit service. The authors also address the need to reflect land use patterns in transit design. They attribute suburban land use patterns such as present in NTND designs as being highly beneficial to the success of transit systems.

4. PRELIMINARY INVESTIGATIONS

Several initial assessments have been made of the potential of the NTND design concept to ameliorate the impacts of growth on current transportation infrastructure and accessibility; typically, these evaluations utilize techniques of site impact analysis (*3,4*).

Simulations by McNally and Ryan (*8*) indicate that equivalent levels of activity can produce greater congestion and longer average trip lengths in conventional network structures; neotraditional designs, in general, can improve transportation system performance. Subsequent research by McNally and Ryan has advanced a comprehensive analysis of regional NTND impacts. An exploration of the impact of the regional density and mix of NTND developments on travel patterns has begun, with a focus on serving those patterns via public transportation and non-automotive modes. Two case studies networks have been extracted from the large sub-area from the Orange County Transportation Analysis Model, including origin-destination tables and both highway and transit networks. For land use patterns defined by density, mix, and location, the merits of NTND designs will be assessed relative to conventional designs in terms of accessibility, operational requirements, and system performance.

The expansion of scope to the regional scale addresses two major questions: 1) what are the relative advantages and disadvantages of NTND design in the planning and operation of public transportation systems? and 2) what are the regional impacts of NTND design on travel/activity patterns? The first question is of particular importance given the intent of NTND design to achieve greater use of non-automotive modes. Land use planning which is supportive of public transportation is, of course, required, but a more significant issue appears at the regional level. Isolated developments, while potentially sensitive to transit operational needs, are quite limited in supporting regional transit service if the surrounding development negates the advantages introduced by NTND design. Although transit access time is a key determinant, the location and mix of activity locations which define the travel-activity patterns of residents will largely determine the level of transit usage for the area in question. The second question is thus introduced, and suggest that a regional- rather than development-based approach is in order.

Preliminary analyses of hypothetical networks have utilized both site impact and conventional transportation planning models to simulate the relative advantages and disadvantages of NTND designs. Whereas local area or site impact models appear well suited for the analysis of isolated developments, the introduction of regional scale networks and of public transportation modes requires the application of conventional planning models such as TRANPLAN; this corresponds to a translation from site impact assessment to sub-area or regional modeling.

This effort deals explicitly with accessibility, and proposes fundamental analyses of the relative merits of alternative urban development structures. Accessibility is simultaneously defined by the transportation and the activity systems; the proposed approach is designed to investigate this basic relationship. The first phase of research assessed the traffic engineering

impacts of NTND concepts and provided estimates of their potential effectiveness to mitigate traffic congestion and other problems associated with existing development standards. The second phase is focused on an assessment of regional impacts of NTND concepts. These research phases were directed toward the development of basic hypotheses and comprehensive analyses via standard simulation modeling. Current effort is directed toward the empirical verification of generated hypotheses.

5. RESEARCH QUESTIONS

Questions related to how land use decision-making and design effect the transportation system are resurfacing, including questions relating to (a) trip generation rates, (b) the impact of network design on travel behavior?, and (c) the potential for integrating transit into land development practices?

5.1 Trip Generation

To what degree does land use affect trip generation on the micro-scale? Does the proximity of desired activities increase overall trip levels, or does is encourage trip chaining and a resultant decrease in overall trip rates. What level of automobile usage would be associated with these trip rates?

5.2 Network Design

What regional scale of NTND designed networks represents a threshold which must exist before behavioral changes begin to accrue? What are the impacts of alternate designs at both the network and the street level in terms of traffic operations?

5.3 Transit and Land Development

What is the potential for transit to serve the demands which arise from conventional or neotraditional suburban developments? To what degree does improved accessibility to transit affect overall transit usage relative to what activities are accessible via transit? To what degree can walking and other non-motorized modes effectively replace the automobile, and to what degree do these trips limit growth in transit usage?

6. RESEARCH APPROACH

After establishing a base impact assessment for isolated developments and then extending these results to regional impacts, a variety of research questions remain. The two key questions at hand are 1) to what degree are the results of these simulations valid in real suburban areas and 2) what impacts can NTND have on suburban accessibility and form?

It is hypothesized that a critical level of regional density and mix of NTND developments is required for a significant impact on regional travel patterns. The 1991 Southern California origin-destination travel survey (*11*) is being utilized with a sample of regional sub-areas to compare revealed travel patterns and traffic characteristics across alternative network structures, while controlling for land use and demographics.

There are few new NTND locations in southern California, and no cases which can be categorized as regional in extent. There are, however, extensive 'old suburbs' in southern California which are characterized by NTND design concepts. There are also, of course, numerous examples, with varying regional densities, of Planned Unit Developments (and areas with varying mixes of alternate designs). A sample of alternate designs is being selected using GIS files of local transportation networks plus land use databases. Also, the density of respondents to the 1991 SCAG O-D Survey is being mapped to insure suitable response from the selected sub-areas. Finally, demographics are being assembled from 1990 US Census data for the selected sub-areas.

The analysis will proceed in three stages. Using the O-D Survey results, Stage 1 will summarize and contrast basic travel characteristics for the selected sub-areas (controlling for non-local trips within each sub-area). This stage will focus on variance in trip generation rates, by purpose, mode, and time-of-day, and also on relative mode shares. These results will be used to construct sub-area trip tables which will be assigned to the extracted networks.

The second stage involves the classification of sub-area activity patterns. In prior research (*12,13*), the travel-activity patterns of residents of the region were successfully classified using O-D survey data; these patterns were then related to demographic and urban form measures (the results were used to assess impacts of energy constraints on travel). That methodology is being applied to generate representative activity patterns as a function of not only demographics and urban form, but of alternate network designs and the associated level of accessibility. This analysis complements earlier results by identifying the potential behavioral responses of reduced trip rates and the use of alternate modes.

In stage three, a variety of performance measures will be developed and compared. Basic measures of effectiveness will be supplemented with a preliminary assessment of air quality impacts. The project will continue with the use of TRANPLAN for network modeling and will use an air quality model in conjunction with TRANPLAN to estimate vehicle emissions. Evaluations of travel patterns will focus on the estimation of the degree of impact of network design versus other determinants of travel.

For development patterns defined by network configuration and land use density, mix, and location, the merits of NTND designs will be assessed relative to conventional designs in terms of accessibility, operational requirements, and system performance. The results of these analyses will allow for the assessment of the overall effectiveness of NTND designs in reducing vehicular travel, congestion, and air quality impacts. Finally, a preliminary assessment of the relative benefits and costs of NTND designs versus conventional congestion management strategies, relative to motorized trip reduction and air quality improvements, will be conducted. The potential importance and utility of this research is far reaching in that it will facilitate the implementation of land use patterns that have the potential to ease many of the problems now associated with urban and suburban growth.

7. SUMMARY

Because the neotraditional neighborhood design concept is relatively new and has not been sufficiently tested in the real world, questions remain as to the viability of this trend. Significant evaluation remains to be completed as to whether this design concept makes economic sense. For example, will developers be discouraged from planning denser street networks called for in

a neotraditional neighborhood due to high infrastructure costs? Another aspect of the viability of neotraditional design is simply whether the American public truly wants to live in the type of neighborhoods being proposed. Are mixed land uses, integrated housing types, and increased street life characteristics that the American public values and will seek out in a competitive real estate market?

In transportation planning, comprehensive analyses and evaluations are needed to assess the impacts of NTND design relative to other design approaches. Studies of isolated developments have been conducted. Since the transportation impacts of NTND design will probably accrue on a regional basis, a comparative assessment of design benefits which reflects a regional mix of NTND and conventional designs is necessary. Such an assessment will allow for the integration of regional transit systems and a more accurate depiction of regional travel patterns.

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Table 1. Summary of Measures of Effectiveness

Measure-of-Effectiveness	PUD	TND	Diff (%)[1]
1. Total Trips	14,019	14,733	+4.8
2. Vehicle-kilometers[2] (1000s)	290.13	259.36	-10.6
3. Total Vehicle-hours (1000s)	5.39	3.94	-26.8
4. Mean Speed (kph)[2]	53.85	65.75	+18.1
5. Mean Trip Length (km^2)	20.69	17.60	-15.5
6. Mean Trip Time (minutes)			
(a) Internal	1.74	1.50	-13.8
(b) Internal-External	14.79	9.87	-33.3
(c) External (thru)	14.64	10.76	-26.5
7. Intersection LOS			
(a) Arterial/Collector	0.78	0.79	1.9
(b) Collector/Collector	0.77	0.78	1.3
(c) Local/Collector	0.44	0.43	-2.7

1) Percent difference relative to PUD

2) 1 mile = 1.61 kilometers