HIGHWAY CAPACITY AND INDUCED TRAVEL: ISSUES, EVIDENCE AND IMPLICATIONS

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INTRODUCTION

Purpose

The popular (and frequently even the academic) press often alludes to the traffic-inducing qualities of new highway construction. A columnist writing in the Washington *Post* once remarked that "Building highways to reduce congestion is equivalent to buying a larger belt to cure obesity." A 12/21/96 letter to the editor of the same paper said ". . . anecdotal evidence suggests a strong correlation between amount of pavement and intensity of gridlock: i.e., more pavement equals more gridlock." An example of this view in the academic press is a recent paper by Professor Mark Hansen which appeared in the Fall issue of the University of California's journal Access (1). In the article, *Do New Highways Generate Traffic*?, Professor Hansen stated: "New roads generate substantial new traffic in metropolitan regions. A 1.0 percent increase in lane miles generates a 0.9 percent increase in VMT within five years. With so much induced traffic, adding road capacity does little to reduce congestion."

There are a number of related implications of the frequently heard assertion about the traffic inducing properties of highways. The first is that by itself, new highway capacity "induces" an amount of new travel sufficient to fill the new capacity and therefore, highway construction cannot effect congestion relief. And second, since new highways cannot "cure" congestion, they are not useful.

This paper is an attempt to objectively address the induced travel issue, by answering the following questions: First, if new highway capacity does indeed "induce" new travel, to what extent compared to other factors? Second, if new highway capacity (as one of many factors) induces new travel, how should induced traffic be accounted for in the objective evaluation of highway investments?

Definition of "Induced" Travel

In order to understand the relationship between "induced travel" and new highway capacity, one must first define the term "induced travel". At one time, highway planners defined induced travel as the increase in highway trip making resulting from a highway improvement. All other changes such as shifts in destination, mode, and route were accounted for separately. The popular press and academicians now define induced travel as encompassing any combination of increases in trips and trip lengths resulting from a system change. Therefore, for the purposes of this paper, *induced travel is any increase in daily travel (measured as passenger or vehicle miles of travel) resulting from a change in the transportation system.*

Accounting for Induced Travel: Network, Geographic and Temporal Context/Scope

The network and geographic context/scope accounting for urban travel changes is an issue that must be considered with respect to the travel inducing effect of highways. As an example of the importance of measurement scale, assume a simple "slip" ramp was added between the collector/distributor lanes and the main lanes of a major freeway to minimize merging safety problems at a close-by location.

In most cases such a modest system change would have little or no effect on the absolute number of highway trips made and/or the length of existing trips. However, if the travel measurement or counts were limited to the main lanes of the freeway, this modest change might be seen to generate significant "induced" travel. In reality, little or no *net* additional travel actually would have occurred, just a "route" shift from the outer to inner lanes. This same type of accounting error can occur when the scope of travel measurement is by functional class of facility (e.g. tracking freeway volumes but not travel on surface arterials), by jurisdictional class (e.g. counting travel on state, but not locally, maintained streets) or by sub-area (e.g., measuring travel in one corridor but not in a parallel corridor).

In general, the narrower the geographic or network scope of the measurement, the larger the apparent amount of "induced" vehicular travel one might find as the result of a capacity increase or other system supply change.

Redistribution of traffic in time is another major effect of expansion of highway capacity. Travel previously undertaken in the off-peak periods may shift to peak periods because of the added peak period capacity now available, without an increase in total daily traffic. A recent study of the Zeeburger Tunnel in the Netherlands estimated the short-term effects of removing a bottleneck (2) and illustrated temporal distribution as well as route shifts. The study was based on panel surveys in the affected area and traffic counts 6 months apart, the first 4 months before the opening of the new roadway, and the second 2 months after. Considerable changes occurred in departure times and route choice. Twenty-nine per cent of commuters and 15% of non-commuters in the corridor changed their route to take advantage of the new tunnel. At the same time, a 19% increase occurred in morning peak (7-9am) commuter trips, with 6% and 11% reductions in the off-peak shoulders (i.e. 0-7 am and 9 am-noon).

For all purposes, peak trips increased 16%, while there were 8% and 11% reductions in the off-peak shoulders. There also was a 4% reduction in transit use and an 11% reduction in auto passenger journeys. Despite these changes, there was only a 5% increase in auto driver trips and virtually the same number of total person trips.

Observations limited to post-construction *peak* vehicle trip traffic flows in this case might lead to the false conclusion that 16% of the traffic on the facility had been induced, even though total *daily auto driver* trips increased only 5%. Since the primary effects of the new Dutch tunnel were route and departure time changes, only a small amount of new daily traffic was actually *induced* by the tunnel.

TRAVEL BEHAVIOR AND HIGHWAY CAPACITY EXPANSION

Decisions Affecting Urban Travel

All travel is a derivative of an individual's need or desire to pursue an activity at a location other than the given trip origin, at the given time. Over fifty years of research suggests that there are a number of highly inter-related decisions which impact travel defined in this way. The individual traveler must decide:

- Whether to travel to satisfy the activity need (or desire) such as to work, shop, visit relatives, attend school, etc.; in travel model terms, this decision is referred to as a trip frequency choice or trip generation.
- When to travel, i.e., what time of day and/or day of the week.
- Where to go to satisfy the activity need/desire; in travel model terms, this is referred to as destination choice or trip distribution.
- How to travel, i.e., by what mode and path; in travel model terms, this is referred to as mode and path choice, or mode split and trip assignment.

We know that the above travel decisions are influenced by three sets of attributes:

- Characteristics of the trip maker (e.g., income, age, employment status, family status/stage of life, household size, auto-ownership, housing type and location, etc.)
- Nature of the activity in question (e.g., work, school, shopping, etc.). Will it be undertaken by an individual, or a group such as a couple or family? When will it be undertaken (e.g., during the day, at night, on the weekend)?
- The characteristics of the transportation system. What are the costs, total travel times and other attributes such as the reliability and walking/waiting/transferring time of the available travel options?

The Role of Urban Highway Capacity

Transportation system capacity itself, a priori, does not influence travel behavior. Travel times, costs and other measures of perceived travel difficulty do influence travel decisions. Rapid expansion of capacity in highly congested conditions will result in reductions in travel times and costs, and like any change in the difficulty or ease of travel (e.g., reduced tolls, reduced price of gasoline or transit fares, reduced transit waiting times), will result in immediate changes in one or more of the travel decisions noted above. Modest capacity additions in marginally congested situations will result in smaller changes in perceived travel times and cost and therefore less dramatic travel changes.

To the extent that travel changes are induced by time and/or cost changes, their character and magnitude will differ in the short term vs. the long term. For example, in the short term, people are more likely to change their time of departure and/or their travel route because of the availability of a new, faster and/or cheaper transportation facility than they are to change their trip origin (e.g., residence) or destination, (e.g., job).

Land use changes induced by a new transportation facility obviously take the most time to occur.

Travel decisions are made by the universe of travelers in response to the need/desire to perform activities in locations. Transportation system connectivity, usage, and performance can influence the location, nature and timing of activity growth, i.e., where and how people choose to live and where and how developers decide to build new residential communities, factories, offices, stores, recreational facilities, hospitals, schools, etc. In some cases, e.g., regions with tremendous system-wide congestion, where mobility and access are extremely low, the character and extent of the transportation system can also effect the total amount of activity rather than simply its distribution within the given region.

Interestingly enough, there is evidence that transportation is not currently playing as important a role in land use decisions as in prior years. For example, *Money* magazine recently polled its subscribers (admittedly of higher than average income, education, etc.) about their decision criteria for choosing the ideal place to live (3). "Short commutes," the highest ranked direct transportation criterion, ranked 22nd out of 41 community factors. The availability of good public transportation was ranked 34th. Crime, the environment and health services, in that order, were the highest ranked factors. This is consistent with other surveys of citizens and developers and may reflect the fact that the high level of access and mobility generally available in the U.S. lessens its impact on specific location decisions.

Problems with Performing Analyses of the Relationship of Highway Capacity to Travel Demand

Establishing the precise causal relationship between urban travel and highway capacity is a difficult task. The key to success in these studies is to avoid attributing travel growth "induced" by changes in other causal factors such as changes in the total number of trip makers and their characteristics (e.g., incomes, employment status) and other exogenous factors such as real gasoline price reductions to highway capacity expansion . Analyses of the effect of highway capacity changes on travel over time, as a minimum, require traveler, system and travel data collected continuously over a relatively long period for comparable populations split into two groups - those benefitting from highway supply additions, and a control group for which highway supply did not change.

In North America, finding a reasonable control group for which highway capacity did not change over a significant period is practically impossible (4). Some empirical studies relating to induced travel have been done using aggregate data, which is more easily obtained. However, disaggregate data on individuals and their travel decision history is necessary to do a truly behavior- based analysis.

CHANGES IN FACTORS CAUSING TRAVEL GROWTH

Major Causal Factors Driving VMT Growth

Three types of factors have driven the increase in total person travel and VMT in the U.S. and elsewhere over the post-war period:

- Socio-economic/demographic factors, such as growth in population and households, labor force participation and employment, income, auto-ownership, vehicles owned and licenced drivers.
- Land use factors, such as: increasing single family home ownership and declining development densities, separation of different types of land uses, and auto-oriented site planning and urban design.
- Stable or declining transportation costs, reflecting real declines in gasoline prices and increased fuel efficiency, shifts to higher speed modes and disproportional growth in less congested regions (e.g., in the South and West) and less-congested parts of regions (e.g, suburbs at the urban fringe).

What has been the relative contribution of the various factors to travel growth? Consideration of historical changes in these factors, and their impacts on travel behavior, helps place the highway-induced travel issue in perspective.

Changes in Socio-economic/Demographic Factors

Obviously, all things being equal, the more people, households, employees, jobs, autos and economic activity there is, the more travel there will be.

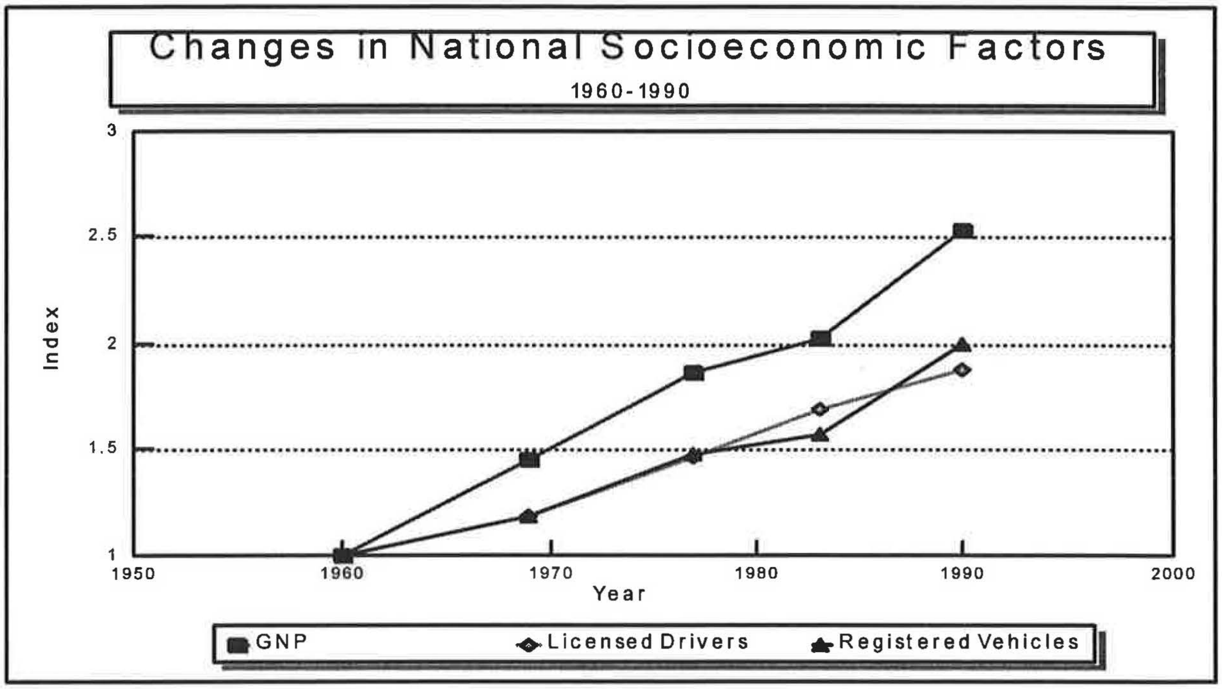


FIGURE 1

Population in major metro areas grew rapidly over the last 35 years. Aggregate growth amounted to about 15% in the Northeast, 20% in the Midwest, and 100% and 90% in the South and the West respectively (5). Nationally, suburban population grew from 35.2 million in 1950, to 117 million in 1990 (6). As the data show, one would expect travel to have more than doubled in major southern and western metro areas since trip-making is a near linear function of population, all else being equal.

Households are an even stronger determinant of travel than population because most travel (e.g., social-recreation travel, shopping) occurs as a collective activity by and for household members as a group. The 1969 NPTS showed that the average household contained 3.16 people (7). In 1990, the average was 2.56 people. This means that the same number of people constituted 23% more households in 1990 than in 1969. Therefore, all things being equal, there were up to 23% more trips for household serving purposes such as food shopping, laundry/dry cleaning pick-up, banking, etc. in 1990 than in 1969.

Employment grew at an even faster rate than population in largest metro areas. In part, this reflected the dramatic increase in the labor force participation of women, many of whom retain primary family care responsibilities. This combination of work and family-related activity generates unique travel needs that are difficult to serve.

Not only has the total growth in jobs been profound, but there has been a shift in jobs from central cities to the suburbs. *Commuting in America II*, (6) shows that in 1980, 38% of the total national employment, or 36.2 million jobs, were in central cities, 33% or 32.6 million jobs were in the suburbs and 29% were in non-metropolitan areas. In 1990, only ten years later, the number of jobs in the suburbs had risen to 48 million, or 37% of the total, while the number in central cities had risen to only 44 million, or 34% of the total. New jobs, irrespective of where they are, require additional commute travel, most of which takes place in the peak periods. In the suburbs, new commuters also usually mean additional auto trips. In 1990, 77.5% of all commuters destined to suburban jobs drove alone, compared to 68% for commuters going to jobs in central cities. New jobs also mean an increase in commercial travel related to new economic activity, and that travel can be expected to be highway oriented as well.

Other socio-economic factors with direct effects on travel also changed at rapid rates. As shown in Figure 1, over the period from 1960 to 1990, Gross National Product (GNP) grew nationally by 150%, the number of licensed drivers grew nationally by 87% (reflecting, in part, increasing driving parity between men and women) and registered vehicles grew by 100% (8). Each of these factors results in increases in highway travel.

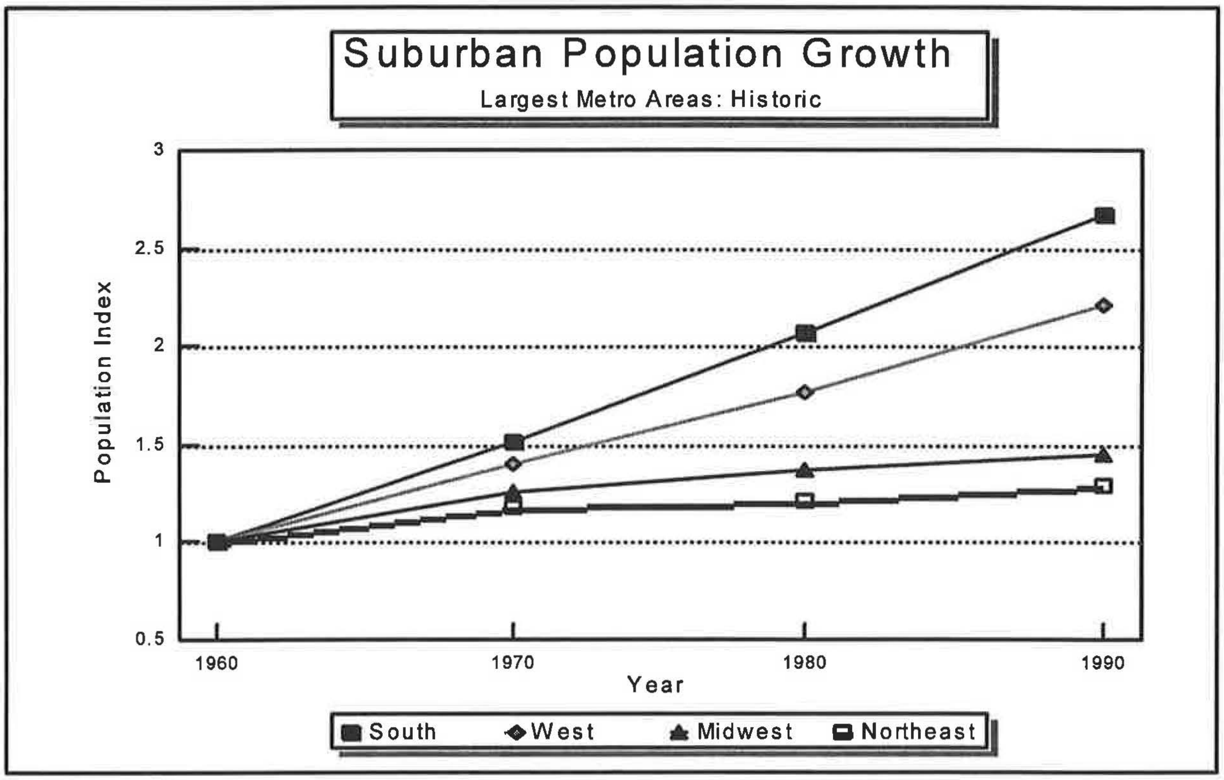


FIGURE 2

Figure 2 shows the growth in suburban populations in major metropolitan areas in each region of the country (5). In 1950, suburban population comprised 23% of the national population, while central cities had 33% and non-metropolitan areas had 44%. By 1990, suburban population grew to 47% of the total, while central cities declined to 29% and non-metropolitan areas to 24% (6). While much of the suburban growth was the result of absolute population shifts from central city and non-metropolitan areas, the disproportional growth in suburban population was also a direct result of new generations of natives and new immigrants choosing to live (and work) in the suburbs. For a variety of reasons, suburban dwellers tend to be auto-dependent. For example, in Montgomery County, Maryland, suburban residents generate on average twice as much VMT per person as residents of Washington D.C. (9).

At the same time as suburbs were disproportionally growing, residential densities continued to decrease, in central cities as well as the suburbs. Over a ten year period alone, from 1970 to 1980, residential densities in the 25 largest metro areas dropped by 17% in central cities and 13% in the urban fringe. The drop in central city densities was the result of declining population and household size, while the drop in suburban densities was the simple result of smaller households living on larger lots. Over-all urban residential densities dropped by 17.4% (10) The implications for travel are that as densities decline, so do the opportunities for making non-motorized trips. All things being equal, as densities decline, the number of motorized trips and probably trip lengths increase.

Other land use attributes in addition to density are important determinants of total travel. Data from the "LUTRAQ" (Land Use, Transportation and Air Quality) study (11) in Portland, Oregon suggest that a household in a low density, auto-oriented suburb will make, on average, 7.7 vehicle trips per day, while the same household in a higher density, transit-oriented suburb will make 6.05 vehicle trips per day. This study focused on how land-use and other policies could be used to forestall the need for additional highway capacity. LUTRAQ probably

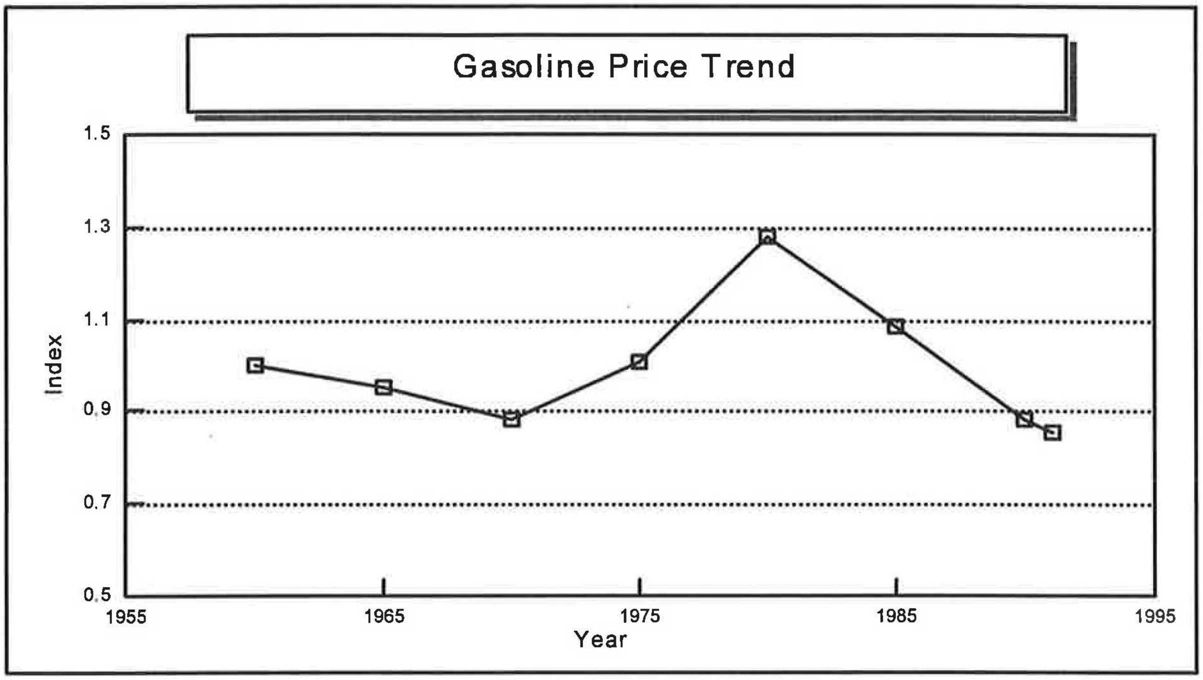
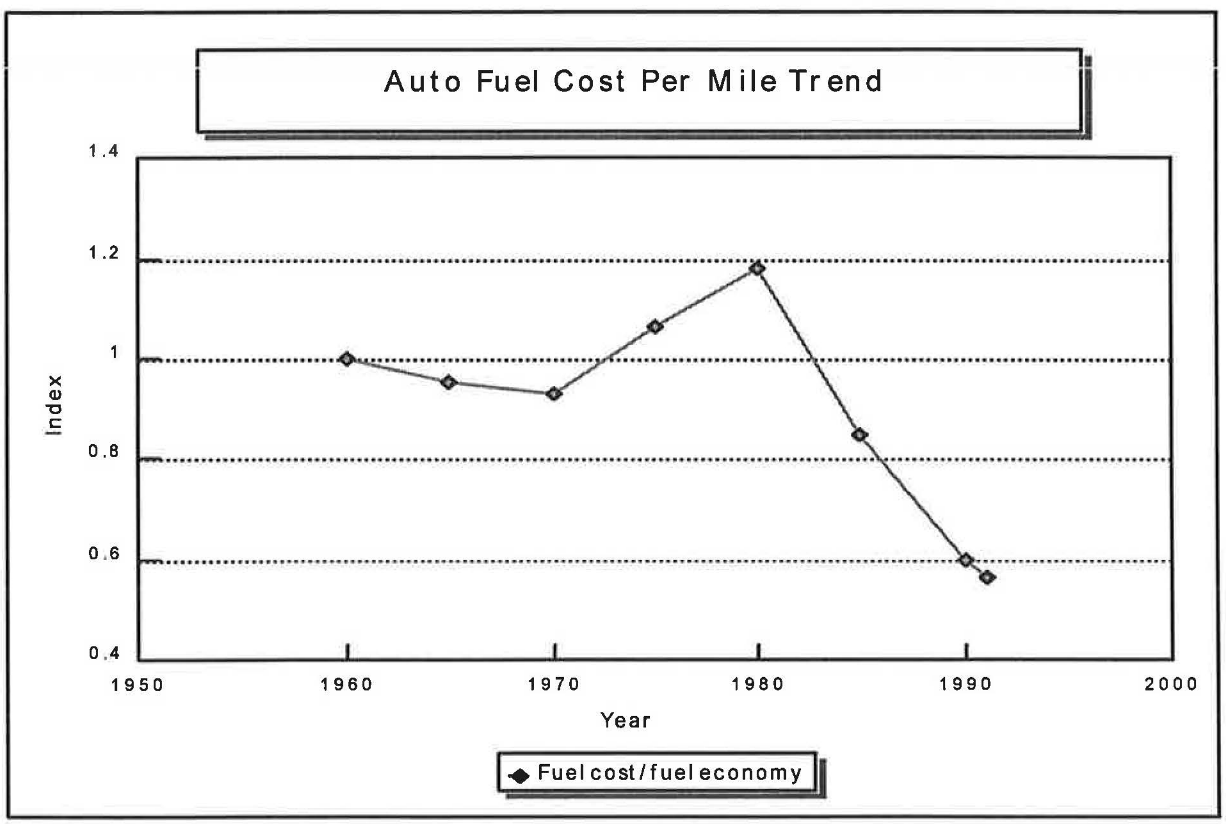


FIGURE 3



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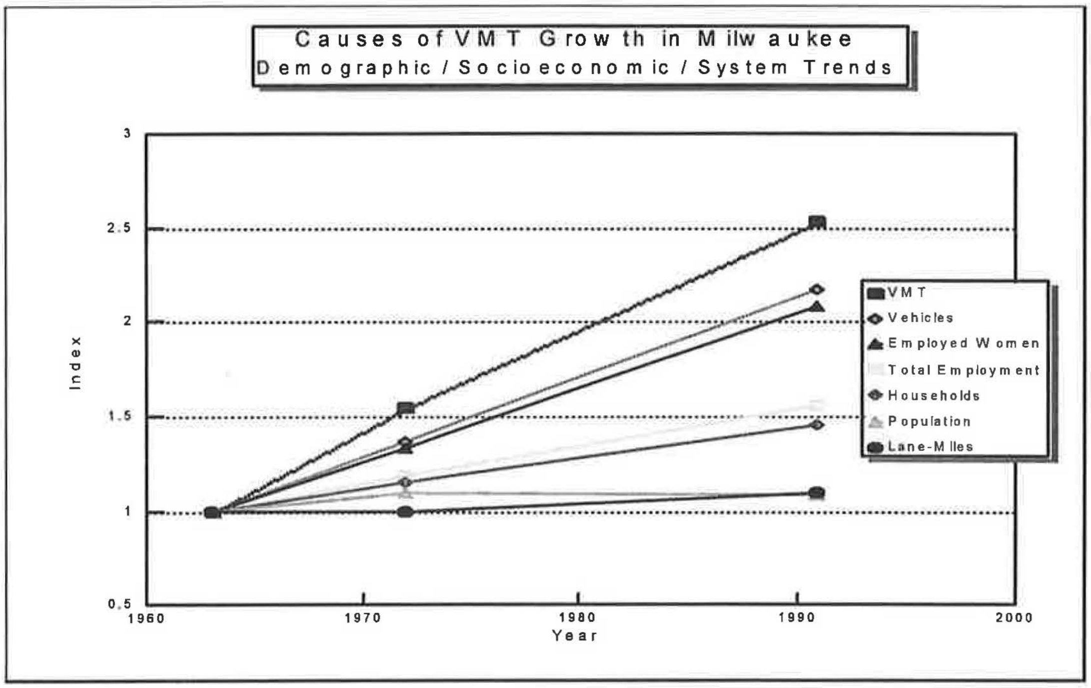


FIGURE 5

represents the best that can be done in rapidly growing U.S. suburbs to reduce vehicular travel demand through macro and micro-scale land-use policies such as an emphasis on mixed-use development, higher densities and transit-oriented site planning.

As Figure 3 shows, gasoline price, the monetary cost component of travel most evident to drivers, has actually dropped (in real terms) from the levels experienced during the oil shocks of the seventies (12). Compounding the drop in real gasoline prices has been the dramatic increases in auto fuel economy (13). Shown in Figure 4 is the combined effect of lower real gasoline prices and increasing fuel economy on the real cost of fuel per mile of vehicular travel.

Estimates of speed (travel time per mile of travel), based on National Personal Transportation Study (NPTS) data, suggest that, *weighted average* travel speeds actually increased by about 20% between 1969 and 1990 for commuters by all modes (7). This is due to a number of coinciding phenomena. First, the proportion of workers using faster modes (e.g., driving and commuter rail) has been increasing, while the proportion using slower modes, (e.g., buses and car pools) was declining. Second, though highway speeds everywhere have been declining for some time, an increasing proportion of highway travel is taking place in the suburbs, where trip densities are lower and relative speeds tend to be higher than in densely developed central cities. Current suburban speeds, though lower than previous suburban speeds, are still faster than previous speeds in central cities, so that speeds weighted by amount of travel have been either increasing or stable.

How Does Highway Capacity Stack Up Against the Other Causal Factors?

The previous discussion of the various factors influencing travel behavior has demonstrated how they affect travel and how they are changing. To answer the question of how relatively important they are compared to highway capacity, travel growth over time due to these primarily socio-economic factors was compared by FHWA staff to "induced" travel generated by new highway capacity. This was done for a "typical" U.S. city.

Data for the "typical" city actually comes from Milwaukee, Wisconsin (14). Milwaukee was selected by FHWA staff both because consistent data over time were available for it, and because it is relatively slow growing. If the effect of system supply and performance on highway travel is shown to be relatively small in Milwaukee compared to travel changes resulting from its relatively modest changes in important demographic factors, then they are likely to be even less significant as travel determinants in other, more rapidly growing regions. Figure 5 shows that from the period 1963 to 1991, Milwaukee has experienced relatively slow population growth compared to other U.S. metropolitan areas. While the total U.S. metropolitan population grew by 67% from 1960 to 1990, Milwaukee metropolitan area grew by only 9% during essentially the same period. Note in Figure 5, however, that in spite of the relatively small population growth, other socio-economic factors grew rapidly. Households and employment increased by about 50%, and registered vehicles and employed women more than doubled.

As Figure 5 shows, total VMT growth exceeded 150%. Total VMT changes are due to *all* causal factors, i.e., socio-economic, land use and transportation system, as discussed above.

In order to understand the relative importance of system supply/performance changes, total travel changes need to be partitioned into two parts, those "induced" by system supply/performance changes and those resulting from changes in other factors. We attempted to do this analytically, as described in the following paragraphs.

In order to do the partitioning analysis, it was necessary to use a travel elasticity (i.e., percentage change in travel demand proportional to a percent change in a system supply characteristic.) The literature was examined to investigate what the travel response to changes in highway capacity have actually been. Three sources of elasticities were utilized.

The first source was Hansen (1). He found that the *change in California State highway VMT per unit change in State highway lane miles was 0.9*, based on an evaluation of California county data over time. Although much of the change in State highway VMT in response to additional capacity may have come from diversions from non State highways and may not be truly "induced" per the definition given above, this elasticity was used in the analysis below to provide an upper bound estimate of induced travel based on Hansen's results.

The second source was the 1995 TRB publication "Expanding Metropolitan Highways; Implications for Air Quality and Energy Use," (15). In Appendix B, Cohen cites elasticities of highway percentage VMT change per unit percent travel time change, from a variety of sources ranging from a low of 0 to a high of -1.0. In particular, he notes the British "SACTRA" study finding of highway *VMT/travel time* (not capacity) elasticities ranging from -.5 in the short run, to -.1.0 in the long run.

Finally, a recent European study examined empirical evidence with regard to magnitude of induced traffic (16). The study was based on a comparison of forecast and observed traffic growth for a large number of road improvement projects. The study found that when traffic growth due to other factors is forecasted correctly for an average road improvement, the road will see 10% higher traffic than that which was forecasted in the short term, and 20% higher traffic in the long term. Goodwin suggested that these findings are consistent with VMT elasticities with respect to *travel time* of -0.5 in the short term and -1.0 in the long term.

In the analysis shown below, highway travel/travel time elasticities of both -.5 and -1.0 are used, along with Hansen's State highway lane mile elasticity of 0.9. In Figures 6-8, actual total VMT growth in the typical city is plotted over the period 1963 through 1991 (14). This total travel is partitioned into the VMT growth that could have been attributed to system supply/ performance changes, given the elasticities noted above, and that resulting from changes in the other factors.

What is clear from the figures is that regardless of the highway travel vs. highway supply / performance elasticity chosen (Cohen, Goodwin or Hansen), the vast majority of the VMT growth shown is directly related to factors other than changes in the highway system. Figure 9 shows that depending on the elasticity assumed, the percentage of the 1963 to 1991 VMT growth in Milwaukee that could be directly attributed to growth in the capacity of the highway system ranges from 6 to 22%. In other words, a conservative estimate is that over 78% of the VMT change in this slowly growing U.S. city was due to the non-system supply factors noted above.

Though the higher VMT/travel time elasticity used in Figure 8 (-1.0) undoubtedly reflects changes in land-use induced by additional highway capacity as well as travel behavior changes, there may be additional, even longer-term relationships between highway supply and land-use they do not reflect.

In the very long-term, highway capacity additions may lead to lower densities, more auto-oriented urban design and higher auto ownership and hence more total travel than would have been the case without the capacity. However, it can be shown that even with land-use policies in place which strongly discourage sprawl/ low densities/ high auto ownership and encourage transit use, auto travel growth will still remain heavily dependent on socio-economic and demographic change. Even in regions with these policies in place, if there is significant population growth, there will be significant new highway travel!

The LUTRAQ study mentioned above showed that the vehicle trips associated with each new household in a region could be reduced from 7.7 per day to 6.05 with pro-transit / pedestrian and auto-discouraging transportation and land use policies in place. This is a 22% drop, but the 78% remainder or 6.05 new vehicle trips per new

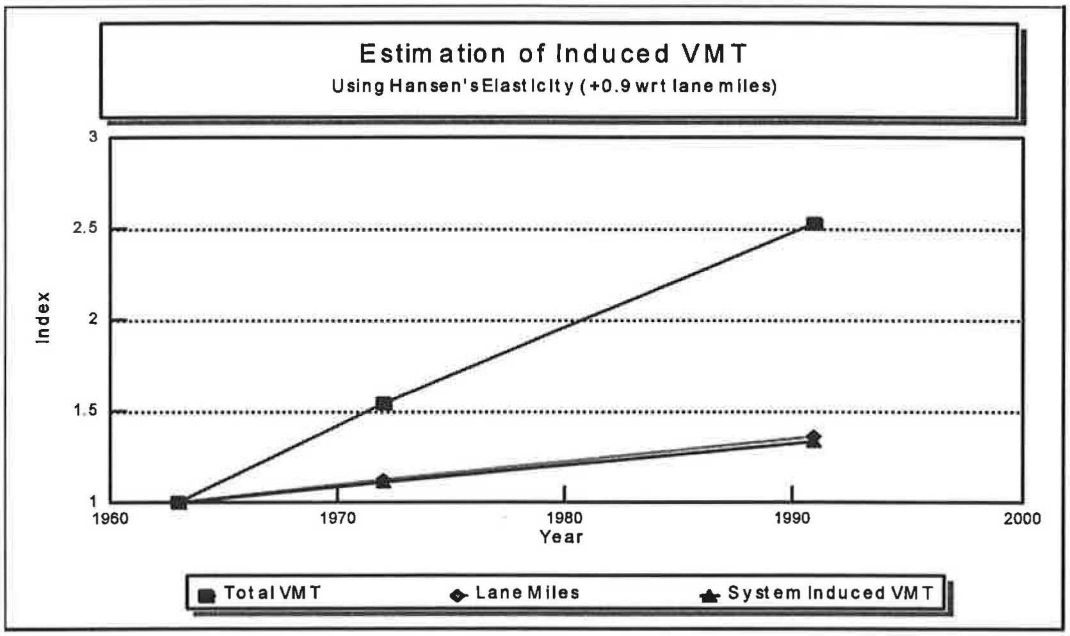
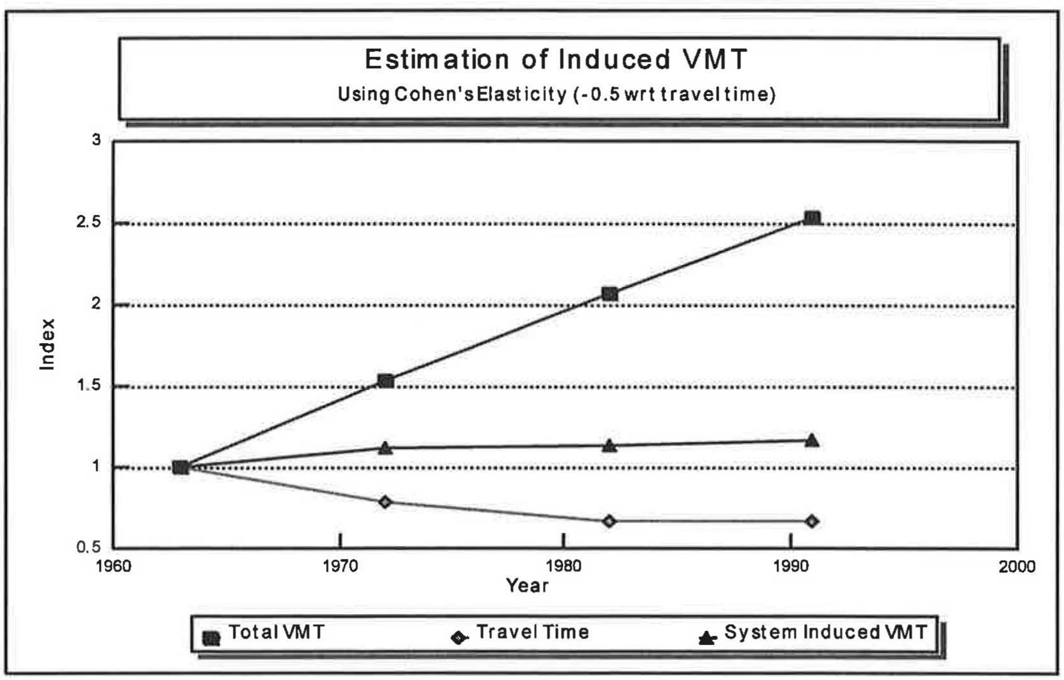


FIGURE 6



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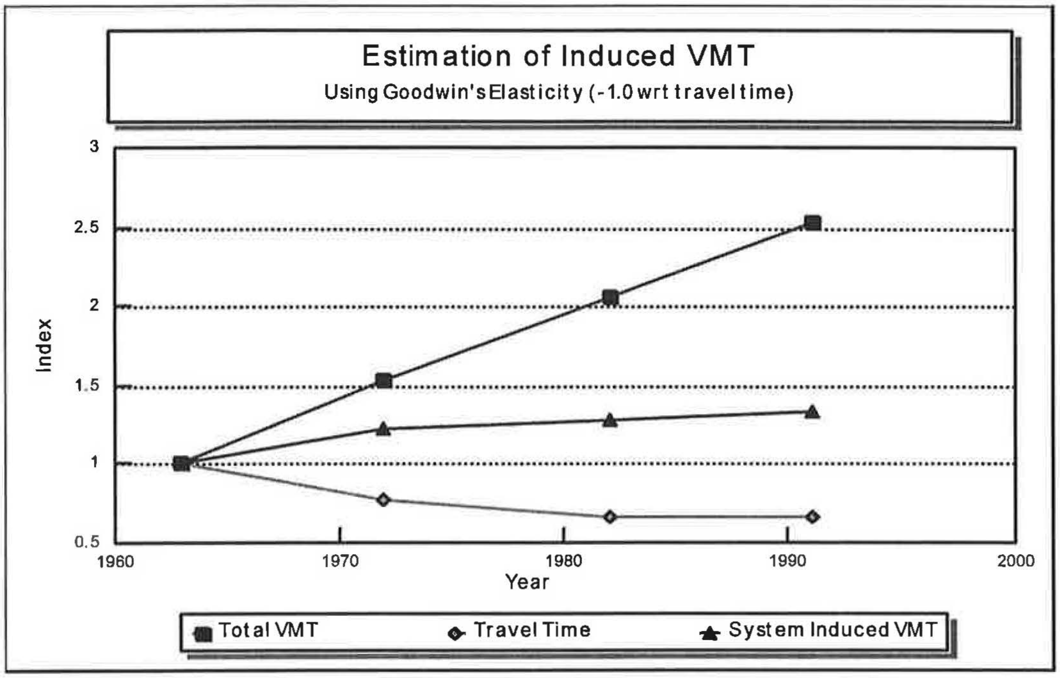

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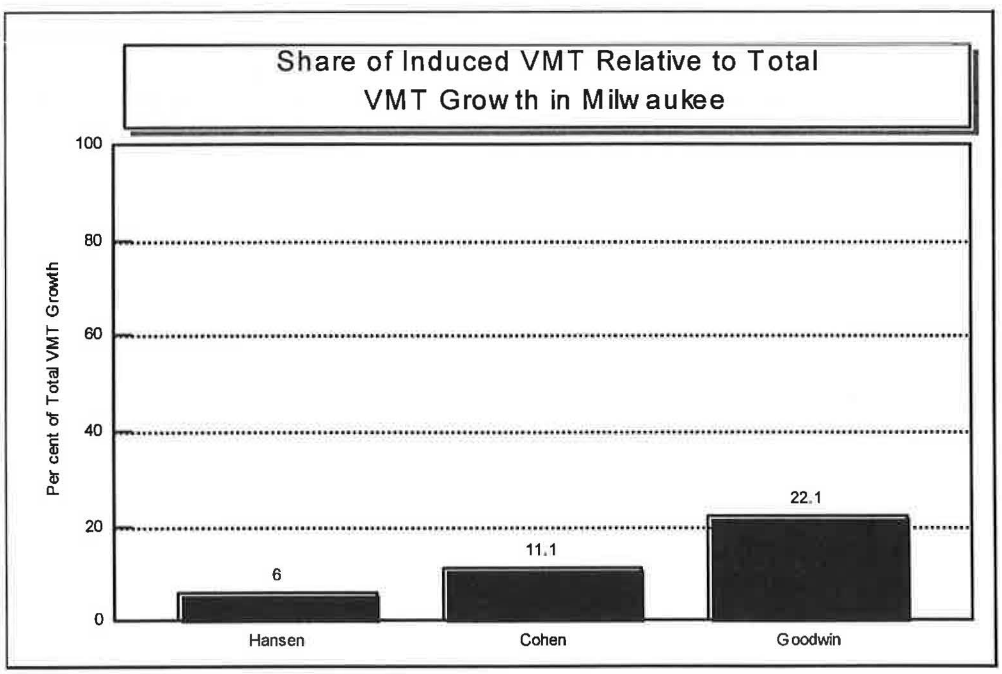

FIGURE 9

household will still need to be provided for. LUTRAQ land-use policies, with their strong emphasis on mixed use development and transit-oriented site design, would lessen suburban highway travel demand to the lowest level likely in the U.S. context short of constraints on lifestyles which are currently politically unacceptable.

The type of policy agenda LUTRAQ formulated and evaluated appears to have very positive transportation and other benefits. However, even with such strong efforts to reduce auto reliance and with extensive, costly complementary transit facilities and services, highway travel would still grow significantly due to population, household and employment growth and changes in the other socio-economic and demographic factors noted previously.

IMPLICATIONS FOR PLANNING AND EVALUATION

Implications for Evaluation of Highway Capacity Expansion Projects

Savings in the travel time component of total trip generalized cost is the primary, direct highway supply related cause of "induced" travel. In the long term, this direct effect can lead to changes in land-use and related auto ownership which also foster additional highway travel. However, there is strong empirical evidence which suggests that the magnitude of the travel changes resulting from changes in other, primarily socio-economic and demographic factors overwhelms those directly and indirectly driven by the expansion of highway capacity.

Given the complexity of highway supply/demand/socio-economic factor interactions, there are three issues of concern in evaluation of highway capacity projects:

- How might we evaluate the trade-offs between mobility benefits to highway users (both current and induced travelers) from highway expansion and costs to society in terms of public infrastructure and other environmental and social costs?
- Are the demand forecasting tools used by metropolitan planners adequate to the task of forecasting "induced" demand?
- How can we address induced travel concerns in the planning process?

These issues are addressed in the following sub-sections.

Evaluation

The discussion in Section 3 was an attempt to show how there are many factors which influence the growth of travel in general and highway travel in particular. Whether a particular highway investment is capable of reducing congestion over the short and long term, and whether the total benefits of the investment, congestion reduction and otherwise, exceed its total economic, environmental and social costs must be appraised on a case-by-case basis. This appraisal should not be limited to highway investments.

Clearly transit and any other type of investment which "removes" vehicle trips from the traffic stream and/or which may provide increased access to the urban fringe has travel inducing potential which must be considered in an evaluation framework for the particular facility. MPO's, state DOT's and transit operators will need to evaluate the trade-offs between the economic, social, and environmental benefits and costs of new transportation capacity, and this accounting should reflect induced travel.

MPOs will need good estimates of travel demand, travel time and travel cost effects, as well as positive and negative economic, environmental and social impacts so that a comprehensive, multi-modal evaluation can be accomplished.

Travel Demand Forecasting Tools

Travel demand forecasting models used by MPOs are already capable of estimating most of the demand impacts of highway capacity expansion:

- Changes in macro-scale land-use (and related trip making) can be estimated with a Lowry type land-use model or through Delphi techniques which reflect a consensus of best professional judgements.
- The propensity to shift destinations in response to travel time savings is addressed by trip distribution models.
- Mode and occupancy shifts, due to lower generalized costs for auto travel, are appropriately forecasted by mode choice models.
- Route diversions are forecasted with traffic assignment models.

The trip generation models used by most MPOs are not directly sensitive to capacity expansion. However, this does not necessarily pose a major problem. Recent research (17) has demonstrated that total person trip making is generally unaffected by the small savings in travel time typically achieved for most existing trips as a result of highway capacity expansion. Also, use of a trip generation model sensitive to land-use character and auto ownership, with a system-sensitive land-use forecasting approach and auto-ownership model can provide an indirect linkage between system supply and trip generation.

Unfortunately, a deficiency in most travel models is their inability to address shifts in travel by time of day as a result of peak period travel time changes. Only a few MPOs forecast travel by time period, and most models that forecast travel by time period use fixed peaking factors to obtain peak trips from daily trips. This is an important issue for estimation of travel speeds and evaluation of user travel time savings, because fixed peaking factors tend to overestimate peak travel (and therefore underestimate speeds) in the "no build" case, and underestimate peak travel (and therefore overestimate speeds) in the "build" case. This can lead to overestimation of travel time savings to both existing and induced travelers in the "build" case. This is an important issue in the evaluation of highway user benefits. However, estimates of total daily travel are generally not affected if the four-step models have been calibrated with appropriate peak and off-peak travel speeds by trip purpose.

Forecasting Land Use Impacts

Since transportation systems in major metropolitan areas in the U.S. are already highly developed, capacity expansion by itself is not likely to create net new economic growth and development (18). However, capacity expansion *can* cause shifts in patterns of development in ways that may ultimately change total travel. Recognizing this issue, some MPOs have developed integrated land use/transportation models. Others use Delphi techniques, ad-hoc processes or reasonableness checks of their land use inputs, and still others use sketch planning procedures to ensure a dynamic balance between forecasted land-use and proposed transportation supply changes.

CONCLUSIONS

The discussion of the various factors influencing travel growth historically suggests that the role of highway capacity expansion in increasing highway travel has been small relative to other factors. Highway capacity expansion interacts with far more important variables such as population, household and employment growth, personal income and auto ownership increases, regional economic growth and fuel price changes as determinants of total travel demand.

Adding highway capacity as a city grows (to cite Robert Dunphy of the Urban Land Institute) may thus be thought of as akin to buying new, larger shoes for a rapidly growing child. The child's feet may well grow faster without the constraining effects of undersized shoes, but its feet will grow regardless of whether new, larger shoes are purchased. Just as it would be irresponsible not to buy new, larger clothes for a growing child, it is irresponsible not to consider additional highway and other transportation capacity for a growing population, despite the fact that there is a relationship between new capacity and travel.

Planning processes must have the capability to objectively examine a thoughtful combination of strategies to assure that, while the population of a region grows, its access and mobility needs are sustained and its environmental quality is enhanced. It would be best to do this as part of comprehensive planning that includes coordinated land use and transportation planning, but no formal coordinated land-use planning mechanism exists at the regional level in the vast majority of U.S. cities. Most local jurisdictions jealously guard their land use planning and control prerogatives.

Regardless, metropolitan areas are encouraged to consider combinations of synergistic strategies, including:

- Balanced investment, covering both capacity expansion and better system operation and management (e.g., through Intelligent Transportation System (ITS) applications) for all modes.
- Alternative urban forms (at the macro level) and urban design (at the micro level)
- Appropriate pricing to maximize transportation system efficiency

The major determinants of travel demand are clearly socio-economic in nature. However, the inducement of travel due to any transportation system change, is an issue that needs to be and can be addressed by considering behavioral and land use change mechanisms.

Travel and land-use modeling techniques should be used in ways which account for the direct and indirect relationships between travel and system supply/performance. A need also exists for the development and application of improved modeling techniques which are sensitive to time-of-day, macro and micro land-use and other critical supply/demand interactions. This is the major thrust of the FHWA/FTA/OST/EPA Travel Model Improvement Program.

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