WIDENING THE ROADS: DATA GAPS AND PHILOSOPHICAL PROBLEMS

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One of the most fundamental tools for dealing with growing transportation demands is expanding the capacity of the transportation system, preferably by a little more than current needs, to allow for some future growth. New homes, new offices, and new stores require expanded transportation capacity. This can be accomplished by adding new routes, additional capacity to existing routes, or better operations to squeeze more output from the same facilities. The same principle applies to highways and transit, although in most cases the growth is in demand for highways. That is why criticism of highway expansion as facilitating sprawl and generating more demand is so troubling. If one cannot expand the supply, what other choices are there? Virtually none that are palatable in a democracy.

This disagreement moved from an academic argument to the court room, in San Francisco, when the Sierra Club and Citizens for a Better Environment sued the Metropolitan Transportation Commission (MTC), the regional transportation planning agency, for noncompliance with federal air quality standards. A major issue concerned whether large highway capacity additions would adversely affect air quality, as well as MTC's ability to model these impacts. Environmental groups argued that adding highway capacity in a congested system would increase vehicle use by making automobile travel easier and more convenient, thereby offsetting at least some of the initial reductions in emissions from smoothing traffic flows (i.e., travelers would cease to avoid the peak periods; would shift from transit or car pools to driving; would be less concerned about chaining trip destinations and limiting distances; and would reconsider making trips foregone because congestion is so onerous). Longer run implications claimed by opponents are that the improvements would lead to further development of auto oriented exurban suburbs rather than urban infill, and further encourage regional economic growth. Supporters of the MTC position argued that increased capacity would speed traffic flow, thereby promoting greater fuel efficiency and reduced emissions. While conceding the potential for longer run increases in trip making and distances, they maintained that the added capacity was a small addition compared to the scale of the current highway network, and that there was no empirical evidence that highway improvements were growth inducing at the regional level. [The court ruled in MTC's favor, allowing modifications in the computer models used for conformity and lifting a highway ban which also prevented reopening some roads damaged in the 1989 Loma Prieta earthquake].

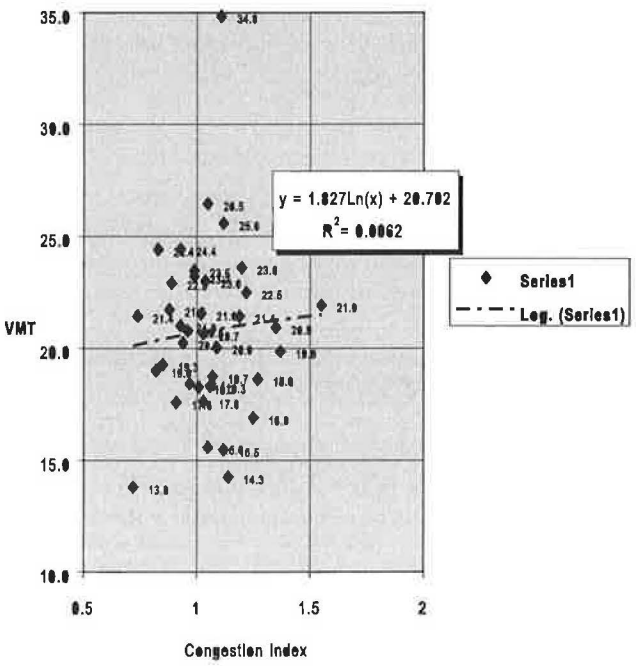
This paper offers some ideas on the topic based on the National Research Council report *Expanding Metropolitan Highways: Implications for Air Quality and Energy Use*, analysis of 1990 regional data, and thoughts about pacing improvements in the highway system to underlying growth in population, the economy, and travel.

TRB SPECIAL REPORT 245 - EXPANDING METROPOLITAN HIGHWAYS

The report of this study committee of the National Research Council does a credible job of narrowing the focus from broad philosophical (and basically unanswerable) questions. The results, as often happens with scientific studies, are not as conclusive as many wish, with many criticisms of current data and models. The committee acknowledged that the effects depend greatly on the specifics of the situation, and reported that "*On the basis of current knowledge, it cannot be said that highway projects are always effective for reducing emissions and energy use. Neither can it be said that they necessarily increase emissions and energy use in all cases*" (Transportation Research Board, Committee for a Study of the Impacts of Highway Capacity Expansion on Air Quality and Energy Consumption, Expanding Metropolitan Highways: Implications for Air Quality and Energy Use, TRB Special Report 245, National Research Council, 1995). The point is also made that limiting highway capacity is at best an indirect approach for achieving emissions reductions, and is likely to have small effects. (See Figure 1 which shows the relationship between regional VMT/capita and regional highway congestion.)

The land use and urban form chapter offers some interesting perspectives on the strong forces leading to metropolitan decentralization, even before the automobile. Several references are made to the difference between growth which is redistributed by highway improvements (from an inner suburb to a more distant location next to

Figure 1Congestion Index vs VMT



a freeway, for example) vs. stimulative growth. Several researchers have argued that public infrastructure investments, including highways, can stimulate private productivity and output. There is still disagreement among some of the experts, however. The committee decided that the highway impacts of interest for this report cannot be assumed to stimulate growth, although they do when other conditions, such as the presence of agglomeration economies or improved access to labor or materials, hold. A key point seems to be that since most areas already have pretty good highway access, relative impacts of improvements show diminishing importance. An interesting conflict between researchers and practitioners was pointed out in a study which showed that residential development was accelerated in corridors with capacity additions in California . The consensus of planners and developers was that residential development was unrelated to capacity expansions. One view is that developers' plans were influenced by the plans for capacity additions. An alternative opinion was that road plans may have been influenced by public sector expectations concerning anticipated growth in the corridor. The difficulty of establishing cause and effect creates a serious methodological problem.

The availability of analytical methods to address these issues was a central concern, and the committee concluded that current methods do not give policy makers important information they need to reliably predict the effects of expanding highways. Beyond the difficulties of understanding the influences of improved travel on demand is the critical link to emissions, and thence to air quality. Not only is it necessary to understand the number of drivers on the road, for emissions impacts it is necessary to know what kinds of vehicles are on the road, and whether they are being driven by mutant teenagers or Sunday drivers.

The committee addressed the current regulatory focus on limiting highway construction projects, claiming relatively small effects on air quality by the year 2010, currently the deadline for EPA regulations. The committee reported that historically, measures to control travel demand have had limited effect. Moreover, going beyond the scientific aspects, the committee showed surprising political insights into some of the conflicts raised by air quality policies. Pointing out that the issue of limiting highways has the potential to pit economic concerns against environmental ones, and that the usual result of such conflicts has been that the environmental goals lose. Anticipating this problem, the committee looked for a more constructive approach, technological improvements or market mechanisms.

REGIONAL COMPARISONS

Without good information on the effects of a highway improvement on travel - a major flaw addressed below - one of the few avenues for analysis of the longer term impacts of congestion on driving is to analyze current conditions across regions with different degrees of mobility from free flowing conditions (if there are such a thing), through the spectrum to teeth grinding congestion. This is particularly useful to gain insights to longer term equilibrium issues. In addition, a regional rather than a corridor analysis recognizes that many travelers actually use portions of the highway network far away from their usual commute and shopping trips , at least occasionally. For purposes of this analysis, the Texas Transportation Institute Roadway Congestion index was used as a consistent measure of regional congestion for 1990 (Tim Lomax and David Schrank, Trends in Urban Congestion: 1982-1993, Texas Transportation Institute, College Station Texas, 1996). The relationship between this measure of congestion and Vehicle Miles Traveled (VMT) on an average day is shown in Figure 1, for urbanized areas over one million population. A simple linear regression shows no significant statistical relationship. Moreover, the slope is actually positive, indicating that areas with more congestion also have more driving. Obviously, more factors need to be taken into account - a good start for further research.

A review of the extremes, however, offers some interesting insights. Residents of the New York urbanized area, which experiences some of the highest congestion in the U.S., have the lowest levels of driving, about 14 miles daily. They also have the most extensive transit system, some of the highest densities, and the largest levels of households without cars. New York has both high congestion and high levels of transit . The TTI index, however, suggests that New York does not have the highest levels of congestion. That would be Los Angeles, which has been the congestion leader since this index was first calculated in 1991. While first in congestion, LA residents ranked only ninth in daily driving, an average of 22 miles daily- fifty percent higher than New York, but well behind the driving leaders. The other leaders in regional congestion were Washington, D.C., San Francisco, Chicago, and Miami. Among these, the lowest levels of VMT per capita were in Chicago, another high density urban area with an extensive transit system. Also below average in driving were Washington, D.C. and Miami. However, in San Francisco, where traffic congestion is so pervasive that it was the biggest concern of residents for years, VMT per capita ranked 15th out of the largest metropolitan areas - slightly above average. Despite San Francisco's reputation as one of the most livable, lovable , and transit oriented communities, and Los Angeles' renown as the center of the car culture, per capita driving levels are quite close- 21 vs. 22, respectively. Perhaps in this case, the high levels of congestion in both regions tend to reduce driving differences.

Shifting to high VMT regions, the clear leader was Atlanta, where residents drove an average of 35 miles daily. This is certainly not because the highways are free flowing. Atlanta ranked ninth in the regional congestion index. The second and third ranked regions for driving were Dallas and Houston, where congestion was above average - Houston ranked 13th and Dallas tied for 17th highest among 50 urbanized areas. Among the next five areas with the highest levels of driving- Seattle, Milwaukee, St. Louis, San Jose, and San Diego- the relationship with congestion levels is somewhat mixed. San Diego and Seattle ranked sixth and seventh in congestion levels in 1990, San Jose was 16th, and the others were somewhat lower, with an average of about 1.00 - considered by TTI to be the beginning level of undesirable congestion.

This unscientific review of regional data shows that regional congestion is not well linked with levels of driving, at least during the 1990 study period. New Yorkers drive less than residents of other large urban areas, although the New York region is not on the A list of most congested areas. High levels of driving do not necessarily correspond with low congestion. Of the top eight urbanized areas for driving , six had above average to high levels of congestion, and two - Atlanta and Seattle - were among the top ranks for per capita transit ridership. Even among the nine urbanized areas with the largest freeway capacity per capita, only four ranked in the top nine for VMT. Even when these areas are classified by congestion levels, there are still a range of experiences. Kansas City had the highest level of freeway lane miles per capita , combined with the lowest congestion levels, yet the VMT per capita ranked twelfth. Atlanta ranked second to Kansas City in freeway supply, and ninth in congestion, with the highest levels of VMT - fully one third higher than the runner-ups, Dallas and Houston. Other cases of regions with high levels of freeway systems and low congestion were Minneapolis and Cincinnati, which ranked fourth and seventh in congestion levels. Their driving levels were substantially reduced, however, at 14th and 16th - typical for large urbanized areas. Three regions with high levels of freeway and high levels of driving were Houston, Dallas/Fort Worth, St. Louis and San Diego. Their congestion levels cover a wide range, from San Diego which is high, to Houston and Dallas, about average, and St. Louis, which had fairly low congestion levels.

IMPACTS OF HIGHWAY CAPACITY EXPANSION IN HOUSTON

The comparison of different regions offers some interesting insights into some of the potential long range equilibrium effects of highway supply, congestion, and levels of driving. Much of the differences are likely to be caused by demographics, local patterns of land use and interaction, and interconnection, speed and congestion on the transportation system. A more pressing issue for individual regions is the extent to which transportation improvements increase travel - or perhaps whether failing to make improvements will actually cause people to reduce their travel. The most aggressive program of transportation improvements over the last decade probably took place in Houston, so an examination of travel impacts offers some insights into how much of these capacity improvements were "lost" through increased driving.

A review of the transportation improvements resulting from the 1982 Houston Regional Mobility Plan illustrates the massive scale of such improvements. New toll roads, arterial and intersection improvements, a completion of gaps . . . at a spending level of $1 billion annually. These improvements were not limited to serving solo drivers. A significant part of the program was for improving the regional bus system, and developing a unique system of transitways. This transitway system

offered an exclusive lane for buses, vans and car pools. The total package represents one of the most significant investment packages in U.S. urban areas.

A major focus of the RMP was reducing congestion, and the results were positive. Freeway speeds during the evening peak period increased from 38 to 49 mph - a 28% increase. The number of miles of severely congested arterial streets was reduced from 74% in 1985 to 29 % in 1992. Especially important for downtown businesses was that the travel shed within 30 minutes of downtown - as measured in land area- tripled. Between 1979 and 1992, congestion, as measured by the TTI index, improved by more than 10%. Similarly, transit improvements were clearly evident, ranging from better on time performance to improved speeds in the HOV lanes. The results showed in bus ridership, which doubled over the decade. The number of transit commuters increased by 69%, quadruple the growth in overall commuting. The share of commuters driving to work alone actually declined, one of few urban areas to reduce the driving share.

Clearly, the vast improvements in mobility in Houston have had wide ranging impacts throughout the region. What impacts did this have on travel? That aspect of the question has not yet been studied in depth, to the authors' knowledge, and would certainly be an excellent research study. Over the decade between 1980 and 1990, regional VMT grew by 38%, about double the growth in regional population. This 2:1 ratio between travel and population growth is vastly smaller than the national averages - between 1983 and 1990, household VMT grew by 40% compared to a mere 4% gain in U.S. population (U.S. Department of Transportation, Federal Highway Administration, 1990 National Personal Transportation Survey: Summary of Travel Trends, page 6, Table 1). Regional comparisons offer some contrarian experiences as well. Between 1990 and 1994, federal data showed only a modest 1% growth in per capita VMT for the Houston urbanized area, where congestion has been declining, compared to a 14% increase in Dallas, where congestion was increasing. Portland, Oregon, where congestion has also been increasing as a result of public policies to reduce driving and increase alternate modes, also registered an 8% gain in VMT per capita (U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, 1990 and 1994). While there may of course be data differences involved, the findings are certainly stimulating.

WHOSE VMT? A CONTEXT FOR CAPACITY EXPANSIONS

An important distinction needs to be made between the travel markets served by capacity additions. The three D's which accounted for roughly equal shares in the growth in driving at the national lever were demographics, dependence on the auto, and distances. Demographics includes not only overall population growth, but also the disproportionate increases in the prime driving cohorts , and increases in per capita trip making even after controlling for age and gender. Simplistically, this is the result of more people going more places. The second D, increased dependency on the private auto was due (nationally) about equally to declining use of transit and declining auto occupancy. The last D is the growth in trip distances, presumably as a result of the continuing spread of urban areas (Based on 1990 NPTS data and reported in: Robert T. Dunphy, *Transportation and Growth: Myth and Fact*, Urban Land Institute, 1996). Of these three factors, increased speeds which result from highway capacity additions could be presumed to affect both the dependency and distance factors. Higher highway speeds could make transit less attractive — presuming there were a transit alternative, and might encourage longer distance trips for commuting purposes. The impact on the demographic factor, especially the population growth through new development becomes highly theoretical, especially those living at the urbanizing fringe, where most new development takes place in metropolitan areas.

One of the problems with the question about the impact of highway expansion on increased driving is that it takes a simplistic view of the future, where a single facility is being considered and a fixed time horizon, without consideration of regional growth. Such single facility focus is anathema to comprehensive planning, where an entire system of facilities is usually considered to serve a pattern of future growth. If the plans were adhered to and publicized, future citizens could expect facilities to be approved during a certain time period. This would be followed by further development tied in to the new facilities, which would generate additional traffic, resulting in slower speeds, and eliminating the travel gains which might (or might not) cause additional driving. Depending on how closely the capacity additions match the trends in traffic growth, it is possible that residents may actually endure substantial periods of slower speeds and increased congestion.

Missing in the debate about capacity expansions and travel is consideration of the needs of new development. Most new development is located at the periphery of metropolitan areas, and good planning needs to carefully evaluate the areas suitable for new development, and prepare transportation plans in advance to serve those growth areas. Each new roof top requires a range of new public and private services, water, sewer, schools, shops and churches - as well as new roads. The proper issue is not whether to improve highways in such areas, but how much. A clearly enunciated policy on levels of service, or better yet transit and highway accessibility, allows for a

rational approach to developing an adequate transportation network. It is in these newly developing areas where localities have the best opportunities to "fix" the transportation up front, before it is a problem. Regrettably, such areas are often allowed to undergo substantial growth before transportation needs are addressed, and some of the logical options are already precluded. Given the extraordinary difficulty of making highway improvements—or any infrastructure improvements—in established areas, we should certainly avoid repeating those mistakes in the newly urbanizing areas, where solving the problem should be much easier. Questioning the addition of new capacity seems like denial of the basics of growth. It would be inconceivable to plan for a growing population with no new schools, or no new water supplies. No one seriously questions the need for expanding landfills, sewers, or water supplies on the grounds that they will lead to more pollution. To limit highway additions is to anticipate that there is already excess capacity. Critics point out that solving the transportation problem by adding new highways is like letting one's belt out to accommodate a larger girth. On the other hand, limiting highways in a growing area may be like refusing to buy new shoes for the kids, because it will only allow their feet to grow.

A CRITICAL NEED FOR CURRENT INFORMATION

The oblique slant taken in much of this analysis points out the critical need for adequate information and studies to clarify some of these issues. Does improving the roads really make people drive enough more to wipe out all of the anticipated gains in congestion? Would a transit improvement have a similar impact, especially if it encouraged the opening up of a distant community where excessive driving were required, even beyond the amount of transit use. It is amazing that the transportation profession does not know the answer to these critical questions. Moreover, there seems to be no major initiative to redress this shameful gap. Perhaps when no one was building highways, this was an understandable transgression. However, there are now many cases of substantial highway improvements - in fact, creation of whole systems. As indicated above, Houston offers an example of improvements so substantial that congestion actually went down. The new freeway system in Phoenix offers another, as do the toll road systems being built in Orlando and Southern California. Research opportunities such as these are extremely rare, and may be a once in a lifetime chance for many in the profession. This session would have served well if we stop talking and start surveying.