Commission Briefing Paper 4L-01

Evaluation of Core Capacity Deficiencies' Impact on Crowding Out Economic Growth and on Shifting Economic Growth into Outlying Areas

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the linkages between core capacity deficiencies and reduced economic growth due to the loss or "crowding out"[i] of economic activity and the geographical shifting of economic activity to outlying areas. The paper presents linkages between a strong efficient transportation system and economic growth by examining the Transportation Satellite Accounts maintained by the Bureau of Transportation. Next, the paper examines the economic factors impacting the core capacity of the highway system and the cost of congestion resulting from highway capacity deficiencies. Finally, the paper discusses firms' location decisions; businesses may decide to shift their economic activity away from congestion and into outlying areas. The location decisions made at the firm level and the capacity of the transportation system have broad impacts on the productivity and economic efficiency of the United States economy.

Background and Key Findings

- A large, integrated and flowing transportation system is essential to economic growth. Transportation services contributed approximately $600 billion or 5.5 percent of the $11 trillion 2005 Annual Gross Domestic Product (GDP).
- Urban highway traffic congestion imposes economic costs on people and businesses, impacting the environment, quality of life and business activity. Congestion reduces service areas for workforce, supplier and consumer markets. This paper focuses on how roadway traffic congestion affects the economy in the areas of business costs, productivity, and output.
- The business costs of congestion include increased costs of obtaining inputs, delivering output, higher costs to obtain workers, and reduced market penetration. Winston and Langer estimate that the cost of congestion to the highway freight sector in 1997 was about $10 billion (in 2000 dollars), with a cost to motor carriers of about $2.5 billion and to shippers of about $7.6 billion. [ii] In comparison, the Freight Bottleneck Report by FHWA estimated the cost of recurring delay to the freight industry to be $7.8 billion (in 2004 dollars). In some sense these estimates serve as a lower bound to the "full"

economic costs because they monetize only some (the easiest to estimate) of the cost components.

- The full impact of traffic congestion is difficult to calculate. Businesses may be "crowded out" from making their most efficient economic choice since traffic congestion imposes costs to businesses beyond the mere vehicle and driver costs of delay. These costs include potential effects on inventory costs, logistics costs, reliability costs, just-in-time processing costs, and reductions in market areas for workers, customers, and incoming/outgoing deliveries.[iii]
- Businesses may respond to worsening traffic congestion by shifting to outlying areas, adjusting to smaller market areas for workers, suppliers, and customers. Some of these changes result in losses of economic productivity that are difficult to measure.

Role of Transportation in the Economy

The relationship between transportation infrastructure and economic development has been the focus of increasing analysis, discussion and interest during the past decade. Historically such investments have been valued based on efficiency gains such as travel cost and time savings. However, it is now recognized that transportation infrastructure impacts include logistics, inventory and distribution cost, reliability, and supply chain efficiency.

Stakeholder groups comprised of elected officials, transportation and economic development specialists, government agencies and business leaders, have specified numerous transportation impacts:[iv]

- linking key economic centers in a region to national markets;
- providing more efficient flows of commerce through the region;
- facilitating the movement of people to jobs and public services;
- opening new sites for commercial and industrial development;
- providing local access roads to stimulate retail development;
- diversifying the local economy; and
- lowering the cost of doing business through lower transportation costs.

One of the most recognizable ways in which transportation supports the economy is by increasing economic competitiveness. By increasing mobility and decreasing travel inefficiencies, such as travel time delays, an efficient transportation network reduces costs of production and distribution. This reduction in costs enables US businesses to produce more efficiently; thus, maintain a competitive edge in global markets. Currently there is no agreed upon measure for the contribution of the U.S. transportation network to global competitiveness.

Fortunately, there are methods to measure the contribution of transportation services to the U.S. economy. The Transportation Satellite Accounts (TSA), developed jointly by the Bureau of Transportation Statistics and the Bureau of Economic Analysis, provide a way to measure the contribution of transportation to the nation's economy. The following bullets provide several important features regarding the relationship between transportation and the economy.[v]

- Transportation services contributed an estimated $600 billion, or 5.5 percent of the $11 trillion 2005 annual Gross Domestic Product (GDP). Transportation services measures services that move people and goods on the transportation system.
- Fifty percent of that GDP (about $300 billion) arises from in-house transportation service. Approximately 70 percent of that is from in-house trucking. Of the remaining 30 percent, waterborne transportation contributes a little more than 15 percent, followed by air at 10 percent and rail at five percent. The other $300 billion in GDP is attributable to for-hire transportation services.
- The benefits to GDP may be larger when one includes transportation's role in moving people to work or school, in bringing goods home from retail outlets and boosting the international competitiveness of the United States.
- Transportation's role remains important as the economy shifts from a manufacturing focus to a services focus. The services sector,[vi] as defined in the national accounts, is the fastest growing sector in the U.S. economy. According to the national accounts, demand for for-hire transportation generated from the service sector grew about $6 billion between 1992 and 1996. Analysis of TSA data shows that the services sector used an additional $12 billion of in-house transportation to support this growth.
- These estimates include only the impact of transportation services moving people and products. The estimates do not include the impact of government transportation infrastructure investment on the economy.

The extent to which the transportation system fails to provide sufficient capacity can lead to a reduction in the direct, indirect and induced benefits of transportation and a corresponding decrease and/or redistribution of economic activity. **"Crowding out,"** for the purposes of this paper, refers to the net decrease or loss in economic activity due to insufficient transportation capacity and the resulting inefficiencies as a result of congestion. This represents a net loss to the national economy. **"Shifting" of economic activity** occurs when capacity deficiencies lead to a redistribution of economic activity from urban centers to outlying areas. Shifting can have positive gains, for example shifting of economic activity to economically deprived areas may result in overall efficiency gains. Shifting can also have negative impacts where low-density development concentrates commercial and employment centers near freeways that further congregates traffic into congested corridors.

Core Capacity Deficiency

Core capacity deficiency is defined as a condition of traffic delay on a major transportation link, where the flow of traffic is slowed below reasonable speeds, because the number of vehicles trying to use the road exceeds the traffic network capacity to handle them. A core deficiency impacts the *national* movement of goods and services. Figures 1 and 2 from the FHWA Freight Analytical Framework depict the magnitude of core capacity deficiencies on the National Highway System for 1998 and 2020, respectively. The yellow and red segments denote core capacity deficiencies.[vii]

Figure 1

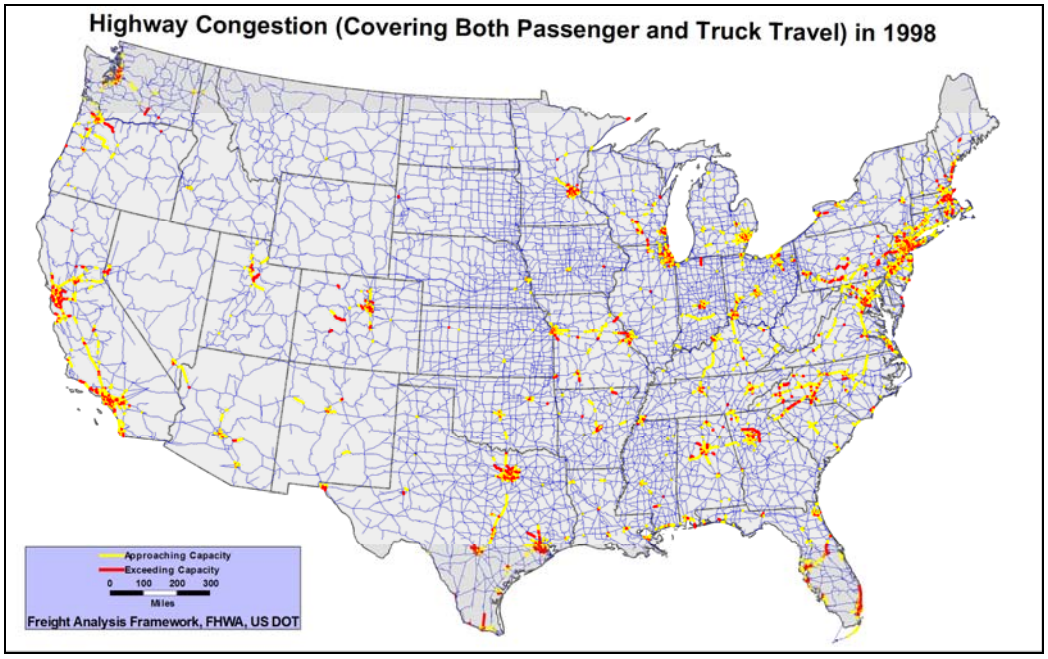
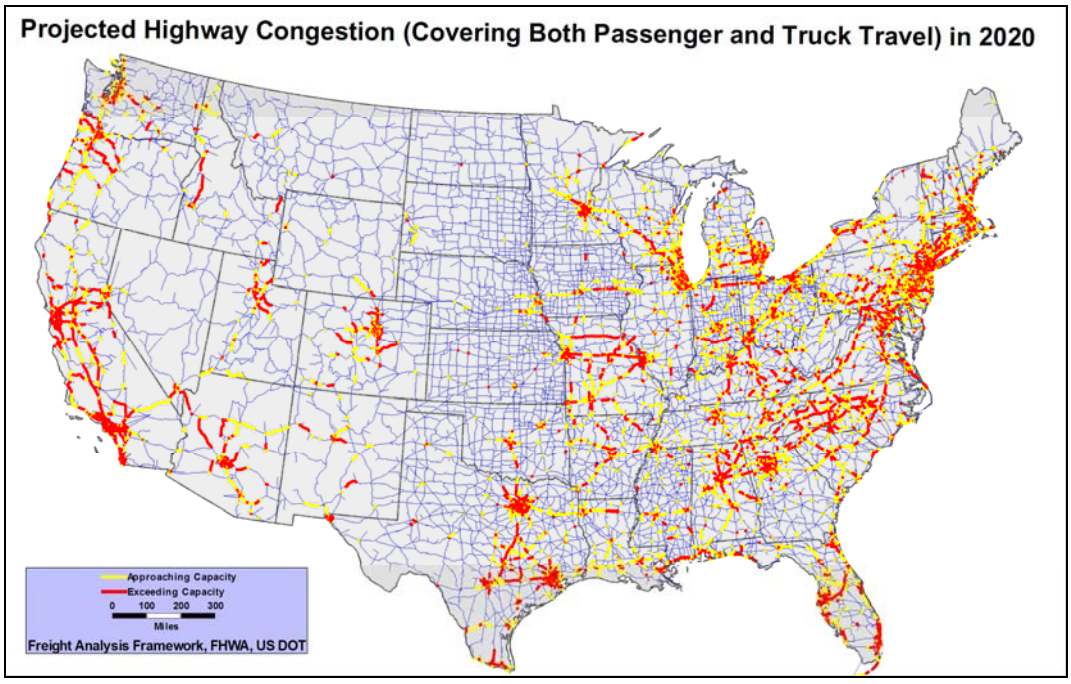


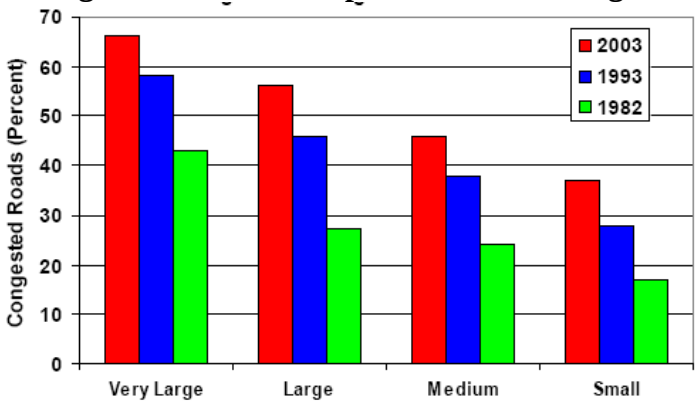
Figure 2



Comparisons of Figures 1 and 2 demonstrate the spreading of congestion as economic activity and growth expands from the urban core into outlying areas. Particularly notable is the impact on capacity in the heartland region, extending from Michigan and Illinois down to Louisiana, Texas and Mississippi, indicating an increase in rural capacity deficiency in coming years. According to the 2005 TTI's Urban Mobility Report, the amount of traffic experiencing congested conditions in the peak travel periods (three hours in the morning and three hours in the

afternoon) has doubled in the 20 years of the study from 32 percent in 1982 to 67 percent in 2003. Figure 3 below demonstrates the trend of growing capacity constraints and congestion, even in smaller cities.[viii]

Figure 3: Percentage of Roads that Experience Some Congestion in Peak Hours



Source: Texas Transportation Institute's Urban Mobility, 2005.

Economic Implications of Core Capacity Deficiencies

There have been many attempts to quantify the some of the economic costs of capacity deficiencies. As yet there is no comprehensive measure but many researchers agree upon several key components. One of the most commonly quoted sources, The Urban Mobility Report produced by David Schrank and Tim Lomax at the Texas Transportation Institute, focuses on the cost of congestion in the largest urban areas. The 2005 report estimated that congestion cost travelers $63.1 billion in 2003[ix]. This figure only accounts for travel time and vehicle operating costs in a limited number of cities.

It should be noted that the TTI report's "costs of congestion" represents only direct user costs. There will be additional economic impacts of lost GDP, personal income and employment to the extent that the user costs translate into out-of-pocket costs for the driver or business. For example, the time that hourly-paid delivery drivers spend idle in traffic represents costs to the business owner that could have been more productively utilized. These additional costs translate into lower profits for the firm, lower wages for the workers and higher prices for the consumers. The loss of the productive capacity of these resources results in real economic losses, ultimately reducing GDP.

Although national estimates are not available, local and regional analysis provides some indications of the impacts. An excellent report in this arena is NCHRP Report 463 which analyzed congestion in the Chicago and Philadelphia metropolitan areas and found:

- Industries with broader worker requirements and higher levels of truck shipping have higher costs associated with congestion;
- The models confirmed that congestion does reduce the agglomeration benefits of urban areas by reducing access to specialized labor and delivery markets;
- When congestion impacts the central business district (CBD) the economic costs were largest on those businesses located in the CBD. This is because many of the CBD

businesses are service oriented, relying on incoming supply deliveries but modest outgoing truck deliveries;

- When congestion impacts the older industrial areas the economic costs are more widely distributed among industries and business locations throughout the metropolitan area. That is because the industrial businesses have a high level of both incoming and outgoing truck shipments, to the CBD and other areas;
- When congestion was evenly distributed region wide, the economic costs were largest for businesses located on the periphery;
- When congestion is centered around an area with many skilled and educated workers, the economic cost was broadly distributed among locations, especially those employing executives and precision-skilled workers.

Two recent studies provide some quantification of the business impacts of congestion. Winston and Langer estimate that the cost of congestion (both recurring and incident related) to the highway freight sector in 1997 was about $10 billion (in 2000 dollars), with a cost to motor carriers of about $2.5 billion and to shippers of about $7.6 billion.[x] In comparison, the Freight Bottleneck Report by FHWA estimated the cost of recurring delay to the freight industry at $7.8 billion (in 2004 dollars). Additional research conducted by Winston and Shirley extends the freight transport costs to include inventory and distribution costs incurred by shippers as a result of congestion and unreliability. This adds an additional $7 billion in inventory and distribution annually for U.S. based firms. These costs represent a lower bound of the "full" economic costs because they monetize only the easiest to estimate cost components.

In addition to the national quantification and description of the economic impact of core transportation deficiencies, States and regions also provide estimates of these costs. Regional economic impact analysis (EIA) measures changes in jobs, business growth, sales revenues, land values, and other effects of surface transportation projects on the regional economy. This analysis is discussed in Commission report 4K-06.

While there is no consensus measure on the economic costs of crowding out due to core capacity deficiency, the research finds that these costs are both real and significant. Congestion effectively contracts the market area for inputs and sales, increases transportation costs and requires larger inventories, thus increasing production costs. Industries can compensate for congestion and reduce costs by changing the firm's location.

Spill Over

A full measure of the economic impacts of core capacity deficiencies would not be complete without examining the firms that choose to move away from the congested location. This is difficult since only the "survivors" remain in the congested area; any business that could not survive in a congested area has already closed up or moved out. Inland ports represent a unique opportunity to examine a business sector that found it more profitable to move away from the congested ports and shift to outlying areas.

The development of inland ports is aimed at redistributing much of the cargo handling activity from the overly congested ports to points inland where land is cheaper and the transportation network is less constrained. Efficiency gains arise for both the inland port community which

benefits from the infusion of capital and jobs, and the capacity constrained port facility which benefits from the reduced congestion, increasing operational throughput. Specific examples include Virginia Inland Port at Front Royal, Virginia and Alliance Inland Port in Texas.

The same sort of efficiency gains and economic development can arise from the shifting of manufacturing jobs. For example, both GM and Ford recently closed or announced the planned closing of automotive assembly plants in the Atlanta metro region, citing congestion as one factor in their complex firm location decision. Other automotive manufacturers have also opted not to operate in highly congested urban areas by locating new plants in more rural locations with good highway and rail access. Nissan, for example has located facilities in rural Tennessee and Mississippi. Both locations have access to east-west and north-south interstates as well as proximity to Class 1 rail service. However, both are well outside the congested metro areas and in communities that had historically higher unemployment rates.[xi]

The shifting of economic growth is not always away from developed areas. For example, Philips Electronics is re-evaluating its distribution network and is considering re-locating its full service warehousing and distribution centers closer to the ports of entry where capacity is constrained but the shorter transit times increase reliability..[xii] Service based businesses represent another example of businesses that thrive in congested areas. These businesses include restaurants, clothing retailers, and branch banking. Therefore the shifting of economic activity arising for capacity deficiencies can occur in both directions – from urban core to outer lying areas and from outer lying areas to urban cores- depending upon the private sector needs.

The economic impacts associated with the shifting of economic activity can be both positive and negative (often there will be net winners and losers if the shifting is occurring across jurisdictional boundaries). They depend upon the relative sizes of the economic gains from less congested travel, and potentially lower land prices versus the economic costs from longer travel distances and loss of agglomeration effects. In addition one can argue that a benefit of a developed transportation system is to "spread" the economic development so that areas with underutilized labor can attract capital and therefore participate in national economic growth.

Case Studies

This section summarizes a sample of regional analysis measuring how capacity deficiencies impact economic growth and competitiveness. The section also addresses the potential benefits to the recipient communities arising from the shifting of economic activity from capacity constrained regions to less congested communities. It should be noted that varying methods and data sources were used across the studies and therefore the studies are not directly comparable. Also impacts to the Gross *Regional* Product (GRP) will not equal the impact to Gross *National* Product (GNP) since firms will alter their economic behavior in response to the congestion. For example, firms may change their location and/or intensity of transportation use.

Urban gateway and distribution regions – examples of crowding out

- New York City recently examined the crowding out of economic activity as a result of capacity constraints. The report, completed November 2006, estimated that the economic impacts associated with excess congestion and capacity deficiency in 2005 totaled over

$4.0 billion in Gross Regional Product and cost the regional economy more than 51,500 jobs.[xiii]

- The greater Cincinnati metro region serves as a convergence point for key interstate trade routes and as a bi-state employment center. A study conducted in 2005 estimated that capacity constraints in the eastern portion of the region, if left unaddressed, would give rise to a $2.8 billion loss to GRP in year 2030.[xiv]

Multi-state corridors – examples of crowding out

Many states have found that planning core capacity investments in isolation of neighboring states is inadequate for efficient freight transportation planning. Unlike passenger travel, freight travel tends to be more multi-jurisdictional and multi-state. Two leaders in this area are the I-95 Corridor Coalition and the National I-10 Freight Corridor Coalition.

- The I-95 Corridor Coalition determined that their capacity constraints and congestion caused a loss of more than $23 billion dollars in lost time and fuel in the corridors 29 major urban areas in 2003.[xv] Again, to the extent that these direct user costs give rise to out-pocket-costs, there will be indirect and induced multiplier impacts on GRP and personal income above and beyond the direct costs.
- Another major corridor that undertook an analysis of the economic impacts associated with capacity constraints was the National I-10 Freight Corridor which runs east-west from Florida to California. A 2003 study indicated that capacity constraints, if left unaddressed, could lead to an economic loss of over $34 billion in Gross Regional Product (GRP), $26 billion in personal income and nearly 1.0 million jobs by 2030.[xvi]

Inland Port Distribution Networks – Spillover

As the international seaports continue to struggle with expanding on-site capacity; the transshipment, warehousing and distribution activities are increasingly shifting inland. Two examples are the Virginia Inland Port in Front Royal, Virginia and the Alliance Inland Port in Alliance, Texas.

- The Virginia Inland Port has stimulated the attraction of over 24 warehousing and distribution centers providing a total income of $599 million and over 7,000 direct jobs.[xvii] These direct benefits lead to additional economic benefits as the income earned by local workers is spent and re-spent in the economy. The inland port development has also increased the operational throughput, providing efficiency gains at the port of Norfolk.
- The Alliance Airport Center and Alliance Commerce Center encompass 2,900 acres located near the Dallas – Ft. Worth metroplex. In 2002 the Alliance project developer examined historical and projected development of the complex and estimated that from 1990 to 2009 the Alliance Inland Port would give rise to $37.5 billion in GDP benefits, over 30,000 full-time jobs annually and more than $616 million in local tax revenue. [xviii]

Conclusion

In some sense the United States is a victim of its own success, after all traffic congestion is evidence of social and economic vitality; empty streets and roads are a signs of failure. As noted by Brian Taylor "culturally and economically vibrant cities have the worst congestion problems, while declining and depressed cities don't have much traffic."[xix] The solutions must

accommodate and manage traffic while not allowing congestion to reach levels that negatively impact economic growth. The effective capacity of a congested zone can be expanded by strategically: expanding infrastructure; deploying operational strategies (for example, ramp metering and traffic signal timing); implementing market pricing on the roadway or zone; and improving land use plans. While these methods may not eliminate congestion it may still bring significant social and economic benefits by accommodating more activity.

CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF TRANSPORTATION EXPERTS - PAPER 4L-01

One reviewer commented as follows:

- The paper addresses the complex issues involving the relationship of transportation systems capacity and availability and regional economic growth. It notes that congestion constraints can crowd out economic activity in dense urban areas and cause activity to "spill over" into areas that are less crowded and expensive. This observation can help local and regional planners become aware of impacts of congestion related threats and opportunities on economic growth.

- *However, these factors pose problems for those seeking national transportation response.* Which strategy is better for fighting congestion – is it to attempt expensive improvements near the urban core that, if successful, will help keep distribution and consumption and jobs generated in close proximity -- or to allow the function to spread out to less crowed areas more amenable, (at least over the short term) to minimal transportation improvements and absorption of growth?

- Nevertheless it is useful to consider whether fixed, urban located gateway facilities like seaport and airports, can best distribute passenger and cargo by a "spill out" of their distributive functions to points more amenable for transfer that at their current front doors. For example, the port cargo gate distribution (via truck) may be more efficient and environmentally sustainable if transferred by railroad line haul from crowed urban areas to locations strategic inland locations (Alameda Corridor, Alameda Corridor East). On the other hand, bringing the domestic warehouse function close to seaports can eliminate costly congestion-inducing drayage to inland points and provide a set up for further inland movement by rail (e.g., the Savannah port –warehousing complex).

- The crowding out and spillover arguments can be used by regions and localities to beggar business from each other – and if federal funds are regularly applied (e.g., via earmarks) to advance one scheme over among without out a thorough venting of the costs and benefits the results could be harmful or at least unfair.

- Finally, the example of Virginia Inland Port as spillover is not quite accurate. The project was initially designed to draw cargo away from the Port of Baltimore. By creating an

inland port at Front Royal the Virginia Port hoped to increase market share by using efficient rail connections to access distribution centers (DCs) that then were mostly served by the Maryland Port. For several reasons, it was not successful at first. However a booming Northern Virginia & Metropolitan Washington economy created the demand for domestic DC's in the Front Royal Area and the availability of the port connection to Norfolk enhanced – if not fully stimulated – the creation of the now major distribution center that mixes both international and domestic freight.

Another reviewer commented as follows:

Papers 4L-01, 4L-02, and 4L-03 provide the Commission with a broad understanding of the issues and implications of future federal investment in national corridors and bottlenecks, and the impact of these investments on the nation's economy. This reviewer will not comment on the many good parts of these papers, but rather describe issues that may be missing or not sufficiently highlighted in order to allow the Commission to thoroughly review this subject area. Paper 4L-01 covered the topic well. The paper, however, would benefit from a discussion of the impact on land use and sprawl in discussion of economic impact of crowding out growth in urban area. In addition, one area that could be added to the case studies is a discussion of the capacity and economic impact at international border crossings, particularly given the level of international trade that occurs between the U.S. and both Canada and Mexico. This should include a discussion of the economic impact of delay at the borders due to both capacity issues as well as security/customs/immigration issues.

Another reviewer commented as follows:

I would echo the comments to paper 4M-01, particularly with example A. Also, it is critical to have regional and national corridor policies and visions in place to assist local and state decision-making.

Another reviewer commented as follows:

The paper's conclusion that suggests policy responses to problems of core capacity raise other issues. In particular, "Strategic" needs to be defined as it applies to facility expansion to address core capacity deficiencies. In addition, a statement on how to identify potential strategic projects and how to select strategic projects for construction would benefit readers

[i] Traditionally, crowding out refers to the concept that public sector spending and taxation reduces the resources available for private sector use and leads to a reduction (crowding out) of private economic activity. For the purpose of this paper, crowding out refers to the general loss of economic activity as a result of reduced transportation efficiency.

[ii] Federal Highway Administration (2005), *2004 Conditions and Performance Report*, available at http://www.fhwa.dot.gov/policy/2004cpr

[iii] NCHRP 463 (2001), "Economic Implications of Congestion," Transportation Research Board: Washington, D.C.

[iv] Weiss, Martin H. and Roger Figura (2003). "A Provisional Typology of Highway Economic Development Projects." US DOT, Federal Highway Administration: Washington DC.
[v] Preliminary results from on-going research on TSA to expand upon work published in 1999. U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Satellite Accounts: A new Way of Measuring Transportation Services in America*, BTS99-R-01, Washington, DC: 1999.
[vi] Service producing industries include: Wholesale trade, retail trade, transportation and warehousing, and utilities; and other services-producing industries (information; finance and insurance; real estate and rental and leasing; professional, scientific, and technical services; management of companies and enterprises; administrative and waste management services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services, except government).
[vii] For a more detailed discussion of capacity deficiencies and bottlenecks, please refer to Commission Paper XXX
[viii] Schrank, David and Tim Lomax (2005), "The 2005 Urban Mobility Report," Texas Transportation Institute, Texas A &M University: College Park, Texas.
[ix] This estimate is conservative since it does not include: additional costs to smaller cities outside the 85-city TTI sample; loss of productivity; environmental costs; safety costs; vehicle wear and tear on passenger cars; costs of cargo delays; inventory buffer stocks and unreliability costs.
[x] Federal Highway Administration (2005), *2004 Conditions and Performance Report* , available at http://www.fhwa.dot.gov/policy/2004cpr
[xi] More information on the role of transportation in the automotive industry location decision can be found at Center for Automotive Research, University of Michigan.
[xii] WSA staff interview with Jennifer Lytle of Philips Electronics in conjunction with the El Paso Border Improvement Study, El Paso MPO.
[xiii] HDR Engineering (2006), "The Economic Costs of Congestion in the New York City Region," Partnership for New York: New York, NY.
[xiv] Reyner, Anne and Paula Dowell (2005), "User Benefits and Economic Impact of the Eastern Corridor Multi-modal Investment on the Cincinnati Region," American Public Transportation Association Annual Meeting: Philadelphia, PA.
[xv] http://www.i95coalition.org/PDF/One%20pagers/One%20Pager_Economy_2_.pdf
[xvi] Wilbur Smith Associates (2003), "The National I-10 Freight Corridor Study: Economic Analysis Technical Memo," Texas Department of Transportation: Austin, TX.
[xvii] http://www.vaports.com/PDF/VPA%202006%20Strategic%20Plan.pdf
[xviii] Insight Research Corporation (2002), "Economic, Employment and Tax Revenue Impact Analysis – Alliance, Texas 1990-2009" Alliance Inland Port: Alliance, TX.
[xix] Taylor, Brian (2003) Conference Proceedings form "Traffic Congestion: Issues and Options", Gallaudet University Conference Center, Washington, D.C.