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# *MEMORANDUM*

**TO:** Commission Members

**FROM:** Emmisse Roehrich-Patrick
Executive Director

**DATE:** 5 February 2013

**SUBJECT:** Rural Interstate Highway Congestion—Upcoming Staff Report

Attached for your information is an overview of an upcoming staff report on rural interstate congestion. The Tennessee Department of Transportation (TDOT) has been anticipating for many years an eventual capacity crunch on our rural interstate highways. The objectives of this study are to examine existing corridor studies and related information, evolving predictions of the timing of the problem, more detailed data about interstate traffic, and alternatives to address the problem.

Key to the staff's analysis was breaking the state's traffic flows into three components and two types of vehicles. This work was done by a contractor that had produced the aggregated data used by TDOT in its corridor studies. For our more detailed look at "traffic markets", the contractor disaggregated the data for points all along the state's major highways into (1) through traffic with neither origin nor destination in Tennessee, (2) traffic with only one end point, either origin or destination, in the state, and (3) internal point-to-point traffic. Each of these three components were further disaggregated into either car and light truck or heavy truck. Evaluating traffic data at this finer level produced more useful information for managing travel demand, conserving remaining interstate capacity, and prioritizing corridor transportation improvements. TDOT leadership and staff have been supportive of this project, providing essential information and valuable feedback on draft reports.

# Time for Renewal of Tennessee's Intercity, Interstate Transportation Corridors

Traffic congestion on Tennessee's 687 miles of 4-lane rural and small urban interstate highways is forecast to greatly increase intercity travel times. Every study of the problem reaches this same conclusion with only minor differences in the timing. Outside the larger cities, these corridors are the most intensively used and the most important to the state's economy.

Transportation makes a significant contribution to the state's economy. In 2010, Tennessee ranked eighth among the states for the number of paid employees and payroll at truck transportation establishments, with close to 45,000 employees and $1.9 billion in total payroll.[1] But the potential harm to Tennessee's economy from this looming rural interstate problem extends well beyond the transportation sector. In 2009, Tennessee's trade, construction, leisure and hospitality, and government sectors accounted for 38% of the state's total gross domestic product (GDP).[2] These sectors of the economy are heavily dependent on transportation.

Preventing congestion on our rural, intercity interstate highways from jeopardizing these critical sectors of the Tennessee economy will involve

- increasing the levels of service reliability within existing interstate capacity,
- adding new interstate capacity, and
- diverting transport demands to different transportation modes in interstate corridors.

These steps will require a re-ordering of the state's transportation investment priorities—focusing more on this aging but critically strategic rural and small urban part of the transportation system.

## *Strategic Focus on Rural Interstates*

Tennessee might do well to follow Georgia's approach, the *Interstate System Plan for Georgia*, which excludes the Atlanta metropolitan counties.[3] Like Georgia, Tennessee needs to focus on the interstate highway miles outside its Metropolitan Planning Organization (MPO) areas where the Tennessee Department of Transportation (TDOT), not MPO governing boards, is primarily responsible for the functioning of the Interstate Highway System. Such a focus would add value to the investments TDOT is already making in individual interstate corridor

[1] *US Census Bureau County Business Patterns (NAICS)*, accessed from http://www.census.gov/econ/cbp/index.html
[2] *TACIR analysis using 2009 Tennessee GDP data from the Bureau of Economic Analysis, U.S. Department of Commerce*
[3] *Georgia Department of Transportation Fact Sheet—Interstate System Plan for Georgia,* accessed from http://www.dot.state.ga.us/informationcenter/programs/studies/InterstateSystem/Documents/fact_sheet.pdf.

studies. A focus on these corridors would include not only highway improvements but would also take advantage of the best available options for diverting some auto and truck trips to the railroad system. This new focus should be developed systematically over the next two to three years in concert with coming changes in system-performance goal setting and asset-management planning for the National Highway System (NHS) mandated by the recent re-authorization of federal surface-transportation programs, Moving Ahead for Progress in the 21st Century Act (MAP-21).[4]

The anticipated decline in traffic service along rural stretches of our interstates was highlighted in TDOT's 2005 Long Range Transportation Plan, in which it was identified as the most serious future threat to the operation to the state's highway system, outside of large urban areas. Subsequent cross-state interstate corridor studies of I-40/I-81 and I-75 have revealed the staggering costs of avoiding future traffic congestion in those interstate corridors. These two corridor studies developed two prioritized lists of projects totaling $6.3 billion. Of concern, is the fact that these first two prioritized lists of projects leave substantial rural portions of these corridors, projected to experience traffic congestion by 2030, without any proposed improvements. Overall, more solutions were proposed for the larger urban areas. TDOT is now beginning a third cross-state corridor study for I-24. An I-65 corridor study would be done later.

A new I-24 corridor study is already underway at TDOT. TDOT will need to finish a corridor study for I-65 in order to complete the set of major intercity interstate corridor studies. Consideration should be given to updating the I-40/81 corridor study to provide a corridor plan that provides more solutions for expected 2030 traffic congestion in that corridor. The listings of projects recommended in the previous corridor studies are based on what is needed, without regard for available funding to build them. All corridor recommendations must be brought together into a cash-flow analysis that reflects fiscal constraints as a part of the strategic planning focus.

## *How We Got to Where We Are*

In 2010, four-lane rural, intercity and small city interstate highways outside of the major urbanized areas comprised 1.4% of the total lane miles of Tennessee roads but carried 12.3% of the statewide (combined urban and rural) vehicle-miles of travel (VMT). Trip density on rural interstates in 2010 was 3.1 million VMT per lane mile annually. By comparison, all of the multi-lane, urbanized-area, interstate routes have 1.2% of statewide lane miles and carried 16.5% of statewide VMT in 2010. Trip density on Tennessee's urban interstates was 5.0 million VMT per lane mile annually.

The state's other urban and rural major roadways—freeways, expressways, principal arterials, and minor arterials—not on the Interstate System, totaled 25,946 lane-miles. These roadways are not used as intensively as either rural or urban interstates. In 2010, non-interstate major

[4] *Moving Ahead for Progress in the 21st Century Act of 2012,* accessed from http://www.gpo.gov/fdsys/pkg/BILLS-112hr4348enr/pdf/BILLS-112hr4348enr.pdf

roads carried 45 % of statewide VMT at an annual trip density of 1.2 million VMT per lane mile, which is less than half of the intensity of traffic service of the rural interstates.

From 1990 to 2010, the Tennessee road program put a much greater emphasis on adding lane-miles for major non-interstate roads. New capacity in these groups increased by 7,047 lane miles, up 37% from 18,899 lane miles in 1990[5] to 25,946 lane miles in 2010.[6] While lane miles of these important, non-interstate routes were being added at a prolific rate, the percentage of the state's annual VMT using these routes actually dropped. In 1990, these combined functional classes of urban and rural roads carried 46%[7] of the state's annual VMT. By 2010, that portion of the state's VMT had dropped to 45%[8] despite adding 7,047 lane-miles. The massive investments to expand the relatively high-capacity, non-interstate roads failed to increase the market share of travel demand accommodated by these roadways. The traffic growth pressures on the interstates continued to build in spite of the large capacity expansion of an alternative network of relatively high-capacity roads.

From 1990 to 2010, 570 lane-miles were added to the interstate highway system. Almost all of that increase took place in major urbanized areas. This was a 12.5% increase in lane miles from 4,558 lane miles in 1990 to 5,128 lane miles in 2010. Interstate highway market share of statewide VMT rose from 26.6% in 1990 to 29.1 % in 2010, despite a much smaller increase in urban and rural interstate lane-miles over the 20-year period, compared to non-interstate major highways.

## *Population Is Concentrated Near Interstates*

Significant increases in population density in close proximity to the interstate highways help explain why Tennessee's massive investments in non-interstate highway lane-miles have not increased the market share of travel on non-interstate major roads. Nearly three quarters (74%) of Tennessee's population lived in close proximity to the interstate system in 2010. Over the 20-years, population has been concentrated inside the 10-mile bands on either side of an interstate (see table 1). Density has continued to climb at a rate greater than the remainder of the state outside of the 10-mile bands. Population infill is most pronounced in 2-10 mile zones from the nearest interstate highway ramp. See map 1.

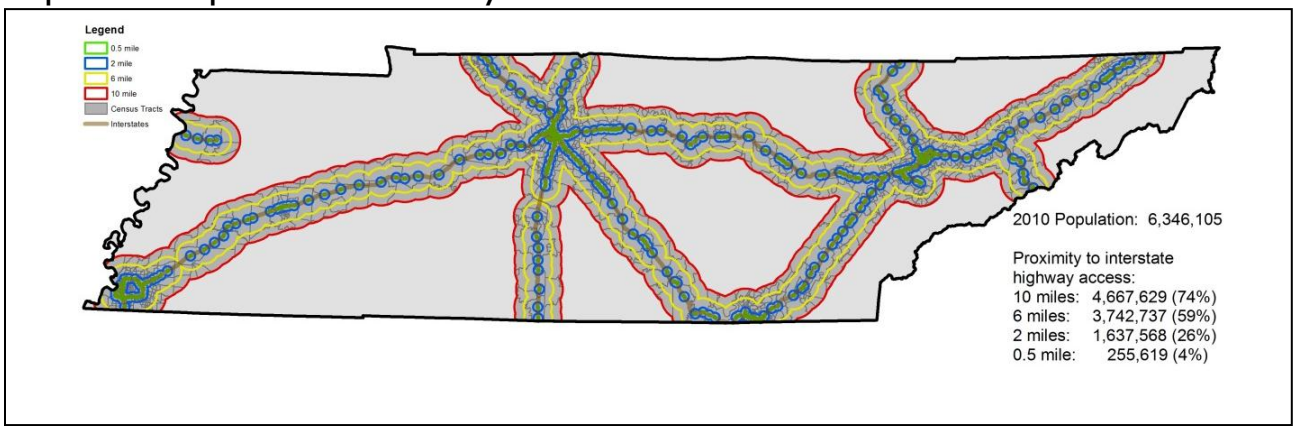
[5] U.S. Dept. of Transportation, *Highway Statistics 1990,* p. 183, Table HM-60, accessed from http://isddc.dot.gov/OLPFiles/FHWA/013263.pdf
[6] U.S. Dept. of Transportation, *Highway Statistics 2010,* Table HM-60, accessed from http://www.fhwa.dot.gov/policyinformation/statistics/2010/hm60.cfm
[7] U.S. Dept. of Transportation, *Highway Statistics 1990,* p. 193, Table VM-2.
[8] U.S. Dept. of Transportation, *Highway Statistics 2010,* Table VM-2.

**Table 1. Population by distance from the nearest interstate ramp, Tennessee, 1990 and 2010**

| Range* of Distance to Interstate Ramp | Area (sq.mi.) | Population 1990 | Density 1990 | Population 2010** | Density 2010 | Increase |
|---|---|---|---|---|---|---|
| **0-0.5 miles** | 237 | 233,966 | 987 | 255,619 | 1,079 | 9% |
| **0.5-2.0 miles** | 2,276 | 1,135,078 | 499 | 1,381,949 | 607 | 22% |
| **2.0 -6.0 miles** | 7,902 | 1,508,634 | 191 | 2,105,169 | 266 | 40% |
| **6.0 -10.0 miles** | 6,592 | 657,128 | 100 | 924,892 | 140 | 41% |
| **Outside 10 miles** | 25,136 | 1,342,379 | 53 | 1,678,476 | 67 | 25% |

***These ranges of distances are exclusive, meaning that they do not include ranges nearer to an interstate ramp.**
**** The total population of all five zones is 6,346,105, Tennessee's 2010 Census Bureau count.**
**Source: TACIR analysis using GIS software and US Census Bureau data for 1990 and 2010**

**Map 1. 2010 Population in Proximity to Interstates**




**Source: TACIR analysis using GIS software and US Census Bureau data for 1990 and 2010**

## *A New Perspective on the Problem Yields Promising Results*

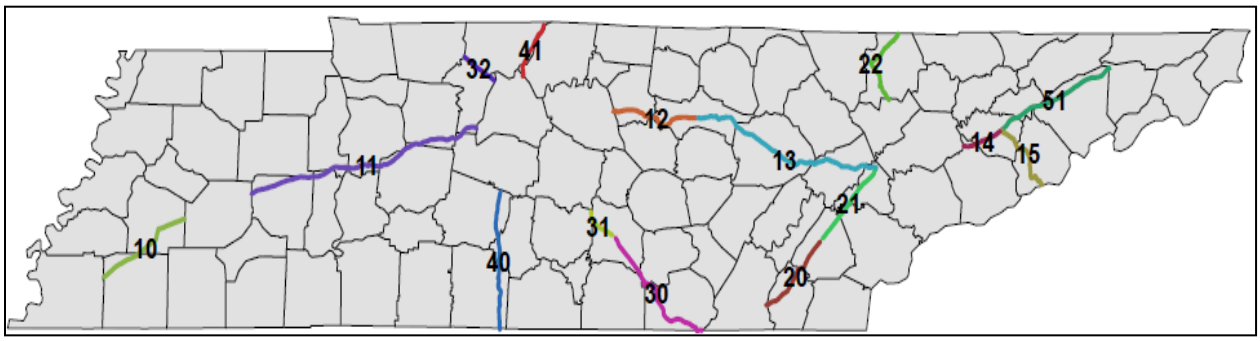
Faced with huge costs for upgrading our 4-lane rural interstate highways—costs so large that other state transportation priorities could be overwhelmed—it would be prudent to examine the problem from a different perspective. By disaggregating components of interstate highway travel demand it is possible to identify opportunities for managing travel demand, conserving remaining interstate capacity, and prioritizing corridor transportation improvements. Since the "patient" is the interstate highway system, we may be able to provide a better diagnosis of the problems by determining how much travel demand is internal to Tennessee and how much of it is a pass-through, external, truly interstate component.

Internal and external components can then be disaggregated further into separate car or light truck and heavy truck components to broaden the search for solutions.

The state's truck-freight flows will increasingly influence our intercity mobility. Tennessee is a focal point in the National Interstate Highway System and has an expanding role as a national truck-freight conduit. A 1998 Oak Ridge National Laboratory study[9] found that, based upon the 1993 National Commodity Flow Survey, Tennessee ranked 5th among the 50 states in "through" truck freight. It also ranked 7th in the nation for total ton-miles of truck shipments, with 30.5 billion ton-miles. Nine years later another estimate based upon the 2002 National Commodity Flow Survey again placed Tennessee 7th among states in total ton-miles of truck-freight movements with 85.7 billion ton-miles.[10] This estimate placed Tennessee first among the 50 states for "through" truck freight with 42.2 billion ton-miles

It seems intuitive that most of Tennessee's "through" truck freight will be concentrated on the interstate highway system. But Tennessee's truck-freight model, which includes coverage of national freight flows, provides a clearer understanding of the distribution of those freight movements over the state's highway network. The TDOT Statewide Travel Demand Model, the first of its kind, created in 2004-2005, which integrates car and heavy truck forecasts, is a useful tool for assessing the effect of interstate "through" trucks on internal and intercity mobility in Tennessee. For this research, TACIR contracted with Atkins International, developer of the Tennessee Statewide Travel Demand Model, to perform separate car/light truck and heavy truck traffic assignments to the highway network. These assignments were further disaggregated into 3 categories of trips: internal-to-Tennessee trips (or internal to internal trips), pass-through trips (or external to external trips), and trips which had either an origin or a destination outside of Tennessee (internal to external trips or vice-versa). As an example of the type of analysis which is possible using this disaggregated approach, heavy truck travel demand markets for 2030 for major interstate highway corridors are shown below in Map 2 and Figure 1.

**Map 2. Interstate Sections of Heavy Truck Demand Markets, 2030 Forecast**

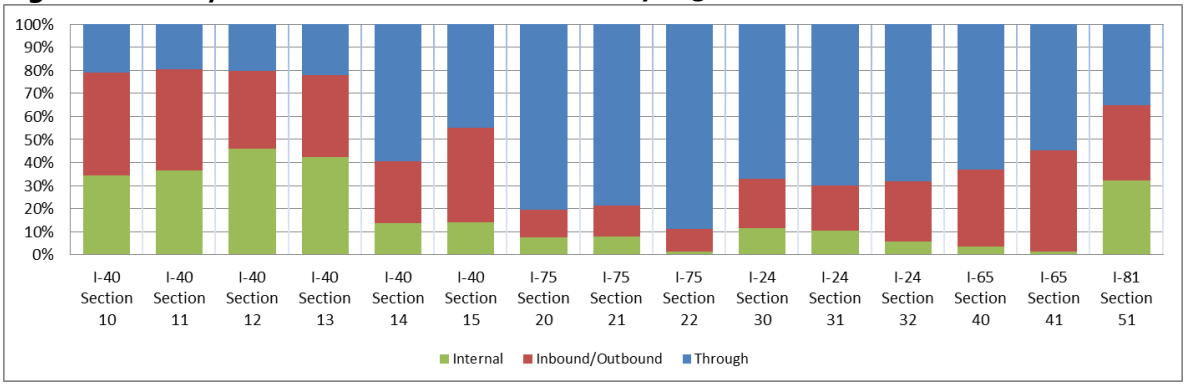



**Source:** TACIR analysis of traffic assignment shape files produced by Atkins International under contract to TACIR

[9] *Estimating State-Level Truck Activities in America*, p. 69, Table 1. Accessed on May 4, 2012 from http://ntl.bts.gov/data/letter_am/chin.pdf

[10] U.S. Department of Transportation, *Ton-Miles of Truck Shipments by State: 2002 Map and Data Table,* accessed from http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/tonmiletrckstat2002.htm

**Figure 1. Heavy Truck Travel Demand Markets, 2030 Forecast**




**Source:** TACIR analysis of traffic assignment shape files produced by Atkins International under contract to TACIR

TACIR analysis, using the TDOT Statewide Travel Demand Model, found that for I-40 between Memphis and Knoxville, approximately 80% of year 2030 heavy truck trips are directly connected to the Tennessee economy as either internal-internal trips or as internal-external (or vice versa). At the same time, there will be a much lighter load of through truck traffic between Memphis and Knoxville of approximately 20% heavy trucks per day. In sharp contrast, the I-75 corridor carries over 80% through truck trips, which are relatively disconnected from the Tennessee economy. See figure 1 and map 2.

## *A Strategic Focus on Rural Interstate Corridors*

> "For freight the primary function of the nation's highway system is to link the economies of individual states together to form an integrated national economy."[11]

Maintaining a robust national economy is clearly one of the fundamental purposes of the federal government. Our state government has a similar fiduciary responsibility for maintenance of the state's economy and reinforcing the transportation linkages, that tie our cities together into an integrated economy. The competition among states to keep current jobs and attract new jobs will remain intense and the performance of Tennessee's transportation system cannot lag behind neighboring states.

Analysis of the disaggregated travel demands of our interstate corridors has revealed that some corridors have a much stronger connection to the state's internal economy, while other corridors serve more as national transportation conduits. The distinctions among corridor transport functions suggest that state-level priorities and policy options could be tailored for each major cross-state, interstate corridor.

Observations about the dominant travel markets of individual interstate corridors must be considered a preliminary analysis. Analysis by TACIR staff is based upon Atkins International traffic assignments using the TDOT 2005 statewide travel demand model. New model runs

[11] *Estimating State-Level Truck Activities in America*, p. 63. Accessed on May 4, 2012 from http://ntl.bts.gov/data/letter_am/chin.pdf

based on updated state population projections are needed and should incorporate the more recent trends in household travel behavior and the results of the 2012 National Commodity Flow Survey.

Investment options for corridors serving extremely heavy travel demands external to Tennessee (conduit corridors) will be different, but not mutually exclusive, from the options that might be exercised in corridors of particular importance to the internal mobility of the state (state GDP corridors). Using a travel-market-driven approach would be helpful in prioritizing corridor improvements, recognizing that the urgency for financing new capacity is greatest in those corridors most important for internal mobility and for the import and export functions of in-state business. Investments in corridors heavily oriented to external travel demands might be deferred longer, in conjunction with operational improvements to squeeze the last remaining ounces of usable capacity out of existing pavement.

## Conduit Corridor Strategies:

- Federal discretionary funding would be appropriate for corridors heavily oriented to national or regional travel demand markets rather than in-state travel demand markets. Tennessee's history of low rates of return of highway user taxes from the federal level may make this case easier to make.[12].

- Interstate tolling has new incentives under the recently enacted Map-21.[13] These new incentives are calculated to enhance private sector investments in the transportation system and offers the benefit of having large numbers of out-of-state road users contribute to financing improvements. However, new state authorizing legislation would be required and tolling proposals in other states have stirred significant controversy.

- Operational and truck flow enhancements to conserve roadway capacity could be used to squeeze the last remaining capacity out of existing interstate lanes through smaller scale investments such as intelligent transportation systems, comprehensive help—truck coverage, and speed limit enforcement. The benefit/cost ratios of such projects are very attractive but traffic congestion would likely be delayed only a few years. Larger scale investments, such as lane additions and truck climbing lanes would cost Tennesseans but largely benefit highway users external to the state.

## State GDP Corridor Strategies:

- Diversions of freight and passengers to rail have the same financial benefit as road tolling, in that users (rail passengers and rail shippers) pay directly for transportation services. This stream of revenue can be attractive to private investors, but they need a

[12] http://www.gao.gov/assets/520/511454.pdf (accessed May 4, 2012).
[13] *Guidance on Section 129 General Tolling Program Memorandum.*
http://www.fhwa.dot.gov/map21/guidance/guidetoll.cfm

high level of confidence in the forecasts of freight diversion from trucks or the number of rail passengers who would use a new service. To justify state investment, project benefits must accrue as much as possible within Tennessee. State GDP corridors offer the best opportunity for capturing these benefits associated with diversion of freight and passengers to rail.

- Flexible federal funding programs, restructured by MAP-21, encourage greater investment focus on the national highway system and, in particular, the interstate highways. State GDP corridors provide an even greater level of priority for investment. As Georgia did in its Interstate System Plan, Tennessee could increase its investment of federal funds on rural interstates to match the proportion of statewide VMT carried by rural interstate highways.

- Debt financing of highway improvements would need to be approached very carefully in Tennessee because of the long-standing "pay-as-you-go" financing policy and because of the heavy emphasis that has existed for decades on maintaining top credit ratings. Because of this conservative fiscal policy, Tennessee could structure bond sales to take advantage of historically low interest rates. The I-40 corridor from Memphis to Knoxville, the interstate corridor most heavily oriented to the in-state economy, would provide the greatest return on investment from debt financing.