Georgia Department of Transportation
Office of Planning

Georgia Statewide Freight and Logistics Plan, 2010-2050

Task 5 Report

Freight Improvement Project Recommendations

final
report

prepared for

Georgia Department of Transportation and the Georgia Center of Innovation for Logistics

prepared by

Cambridge Systematics, Inc.

Georgia

December 2011

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date

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1.0 Introduction

This report describes the freight improvement project recommendations developed as part of the Freight & Logistics Plan. This report represents the documentation of work conducted for Task 5 in the Plan.

Freight improvement projects discussed in this chapter were identified through stakeholder outreach, reviewing recent transportation plans, and needs analysis conducted as part of earlier tasks in this study. These projects were then analyzed individually and the highest priority projects were grouped into packages. These packages were further analyzed using an economic impact tool and the results of this analysis were used to develop a list of priority freight packages that comprise the freight program for the State of Georgia.

The projects described in this chapter cut across all modes and regions in Georgia. Projects were identified by a variety of public sector and private sector stakeholders.

This report is structured as follows:

Chapter 1 – Introduction. This chapter describes the purpose of this report and describes how it is structured.

Chapter 2 – Identifying Potential Freight Improvement Projects. This chapter describes the freight improvement projects that were considered across each of the freight modes: marine ports, rail, highway, and air cargo. Additionally, the source of improvement projects is discussed.

Chapter 3 – Project Evaluation. This chapter describes the individual project evaluation process applied to the projects identified in Chapter 2.

Chapter 4 – Grouping Priority Freight Projects into Packages. This chapter describes how projects were selected to by priority freight projects, and how individual projects were grouped together into packages. The packaging process is most relevant for the highway mode.

Chapter 5 – Economic Benefits of Freight Packages. This chapter estimates the economic benefits of the freight packages identified in Chapter 4. Economic benefits were generated in terms of economic output and/or increased jobs and returns on investment are generated.

Chapter 6 – Summary Freight Recommendations. This chapter compiles the priority freight packages into a single framework and provides information on funding options for the freight program.

2.0 Identifying Potential Freight Improvement Projects

Projects to consider in this plan came primarily from three sources:

- Outreach to the private sector – including surveys of the private sector conducted in 2010 and input from the Plan's Private Sector Advisory Committee;
- The Plan Development Committee which includes the Georgia Department of Transportation Office of Planning and well as Intermodal Programs, the Governor's Office, the Georgia Center for Innovation in Logistics; the Federal highway Administration; and
- Previous freight-related reports conducted in Georgia including the Georgia Statewide Strategic Transportation Plan, the GDOT Statewide Transportation Plan, and Metropolitan Planning Organization Long Range Transportation Plans.

The projects considered for additional analysis are categorized by mode as follows:

- Port improvement projects
- Rail improvement projects
- Highway improvement projects which can be further sub-classified as long-haul corridors, interstate interchange improvements, controlled-access bypass facilities, smaller urban and urban freight highways, and safety projects.
- Air Cargo improvement projects

2.1 Port Improvement Projects

The Port of Savannah is a critical facilitator of international trade. It provides access to global customers for companies based in Georgia. It also provides internationally produced goods to the shelves of stores across the State. Continued growth of the Georgia economy combined with continued growth in international trade has the potential to increase port traffic from its current 2.9 million annual TEUs to over 16 million annual TEUs in 2050.

To most efficiently move these goods, the Savannah River will need to be deepened from 42 feet to 48 feet. This will allow the Port of Savannah to accommodate the increasingly larger cargo and vessel types calling the U.S. East

Coast. The frequency of these larger ships will grow dramatically after the Panama Canal completes its own deepening and widening project in 2014.

The deepening of the Savannah Harbor was mentioned by the Private Sector Advisory Committee as the most important freight-related project in Georgia. It also enjoys broad support from elected officials across the state.

Regardless of the status of port deepening, the Garden City terminal at the Port of Savannah is projected to reach capacity around 2020. The states of Georgia and South Carolina are working together to develop a new port in Jasper County to accommodate the continued container growth from 2020 to 2050. This project is considered to be a long-term marine port need in the Freight & Logistics Action Plan.

2.2 Rail Improvement Projects

Railroads are a key feature of Georgia's freight landscape. Atlanta is the hub for southeast rail operations for both Class I railroads in the eastern half of the U.S. – CSX and Norfolk Southern. For the Port of Savannah, rail is used to connect with shippers across the State. Atlanta metro is the top intermodal rail trading partner for the Port of Savannah shipping and receiving 33% of the total intermodal rail containers through the port. Roughly half of the carload rail traveling through the port connects with Georgia destinations outside of Atlanta. Carload rail includes bulk commodities such as timber/wood products, broilers (frozen chickens), peanuts, cotton and kaolin. Increased economic activity in Georgia will drive additional demand for freight rail services. These demands will outstrip current capacity and require improvements in freight rail infrastructure to ensure that freight rail continues to be a cost-effective modal option for Georgia shippers.

Freight rail improvement projects were considered in three categories:

- Recent and Current Investments by Class I Railroads;
- Specific projects needed to address current deficiencies; and
- Conceptual projects considered as part of a long-term rail program to capture future growth opportunities

Recent and Current Initiatives by Class I Railroads

Norfolk Southern (NS) recently initiated Phase I of their Crescent Corridor improvement project to provide better intermodal rail services between the Northeast, the Mid-Atlantic, and the Southeast. Phase I includes the development of new intermodal railyards in the Charlotte and Memphis regions. As part of Phase II of this program, the Crescent Corridor will increase intermodal rail travel speeds for the rail line running between Charlotte, Atlanta, and Birmingham. Phase III will include enhancements to the Austell intermodal rail yard. Developing the Crescent Corridor is considered one of the freight improvement project supported in the Freight & Logistics Action Plan.

It is important to note that while there is not a corresponding "Crescent Corridor-type" initiative for CSX, over the last decade, they have made significant improvements in its rail line in Georgia. Their recently completed southeast strategy included over $1 billion of improvements in their Atlanta-Birmingham rail line and their north-south rail line that includes their Waycross classification yard and connects Georgia with Florida and the Midwest.

Current Deficiencies – Class I Railroads and Shortline Railroads

Current deficiencies in Georgia's rail network are detailed in the Rail Modal Profile conducted as part of Task 3 of this Plan. The deficiencies include sections of rail track with substandard weight limits and vertical clearances.

The industry standard railcar weight for bulk commodities such as grain, lumber, coal, and paper products, has trended in recent years from 263,000 pounds to 286,000 pounds (referred to colloquially in the industry as 286K). While most of the primary Class I rail lines have achieved 286K capability, many short line railroads in Georgia are not capable of handling 286K railcars. Railcar weight limits for Georgia's Class I and short line railroads, as available, are illustrated in Figure 2.1. Upgrading lightweight rail track to 286K is a key freight rail improvement project in this Plan.

The CSXT Cartersville Subdivision, a branch connecting the CSXT Etowah Subdivision with the NS Cedartown Subdivision which is located in northwest Georgia, is the only segment of the CSXT network in Georgia that is not 286K-capable. The NS network is primarily capable of accommodating 286K railcars as well. Exceptions are limited to the Moores Subdivision in Augusta and the Dublin Subdivision, which is approximately 35 miles of track that connects the NS Savannah Subdivision near Sandersville and the Georgia Central near Dublin. Several short line railroads lack 286K capacity, and weight limit data for several other of Georgia's short line railroads remain unknown.

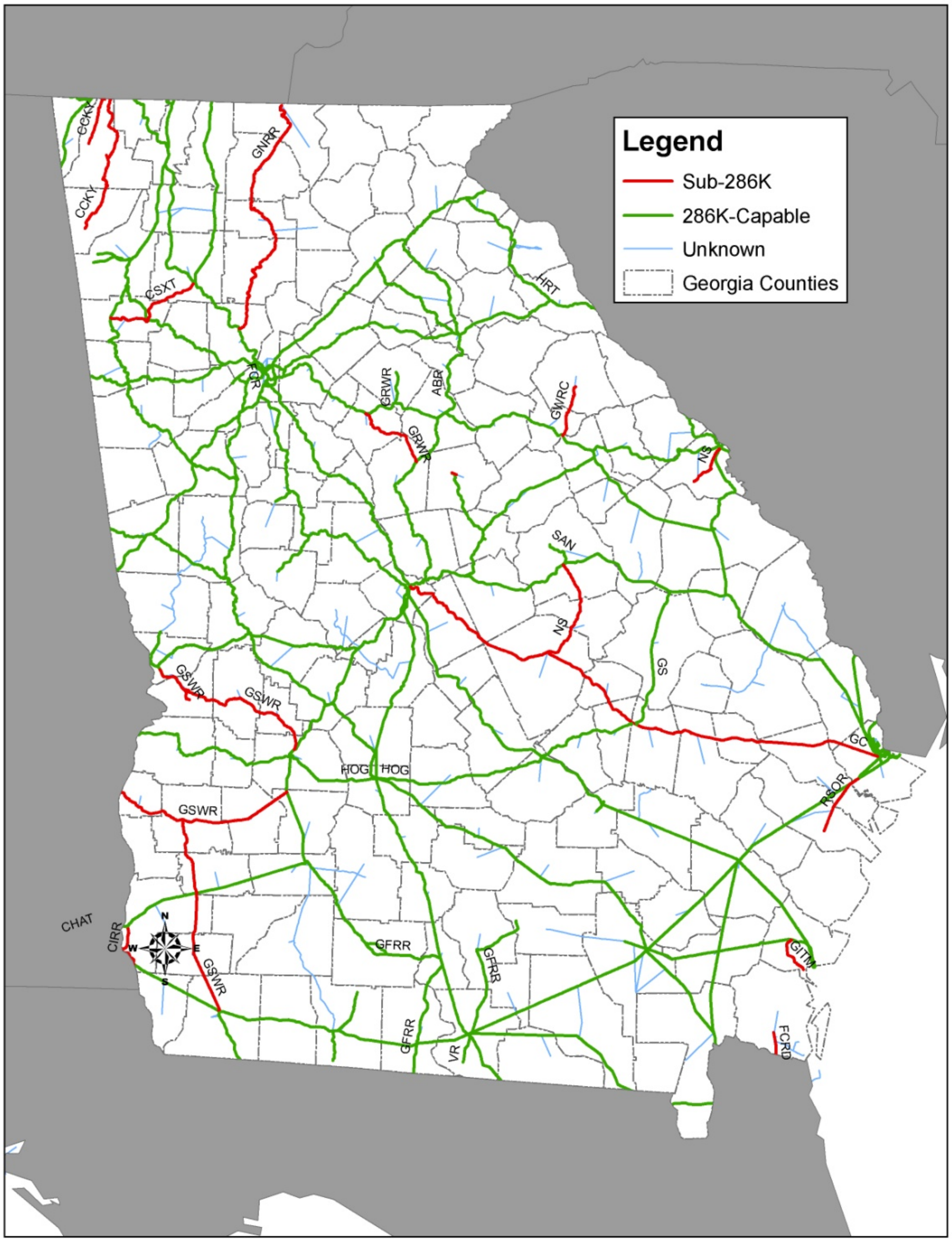
Much of Georgia's rail infrastructure was originally built to accommodate rail cars with a height of 15 feet. With the general adoption of larger railcars, most notably tri-level auto carriers and double-stack intermodal cars, vertical height standard requirements have grown to upwards of 20 feet, and the defined height for fully unrestricted clearance was raised to 22' 6". A minimum height of 20' 8" can accommodate a pair of stacked domestic containers (each 9'6" high), and has become a defacto minimum standard for vertical clearance for main lines handling intermodal traffic. Due to bridges and other obstructions, many rail lines in Georgia do not meet this requirement. Vertical clearances on CSXT, NS and many of the State's short line railroads are mapped in Figure 2.1. Increasing vertical height clearance to the 20' 8" minimum standard for vertical clearance is another freight rail improvement project in this Plan. Vertical clearances for the Georgia rail network is shown in Figure 2.2.

95 percent of all mainline trackage, including Class I and short line railroad trackage, in the State of Georgia are single-track. Main Class I routes have passing sidings at regular intervals, which allow trains moving in opposite directions or at different rates of speed to pass one another. While this arrangement is effective for traffic volumes that have historically occurred over Georgia's main lines, as traffic increases and/or there is a greater mix of different types of trains, full double track becomes a necessity. Double tracking key rail segments in the state is a freight rail improvement project recommended as part of this Plan.

In addition to the number of main line tracks, another important attribute affecting main line capacity is the type of traffic control system. Railroads in Georgia primarily make use of three different signal systems to control traffic movements on their systems. These are Manual, Automatic Block Signals (ABS), and Centralized Train Control (CTC). CTC systems permit the dispatcher to remotely manage train movements by controlling signal indications and train routing over a geographic jurisdiction such as a subdivision or terminal area. CTC is layered on top of an ABS system, which provides occupied block protection. Implementation of CTC leads to considerable capacity improvements, and is almost always taken as a first less costly step when traffic increases call for increased line capacity. The coverage of CTC systems will need to increase to manage increased volumes and increased double tracking across the state. This will increase the efficiency of rail operations in terms of average speeds and total travel times between origins and destinations.

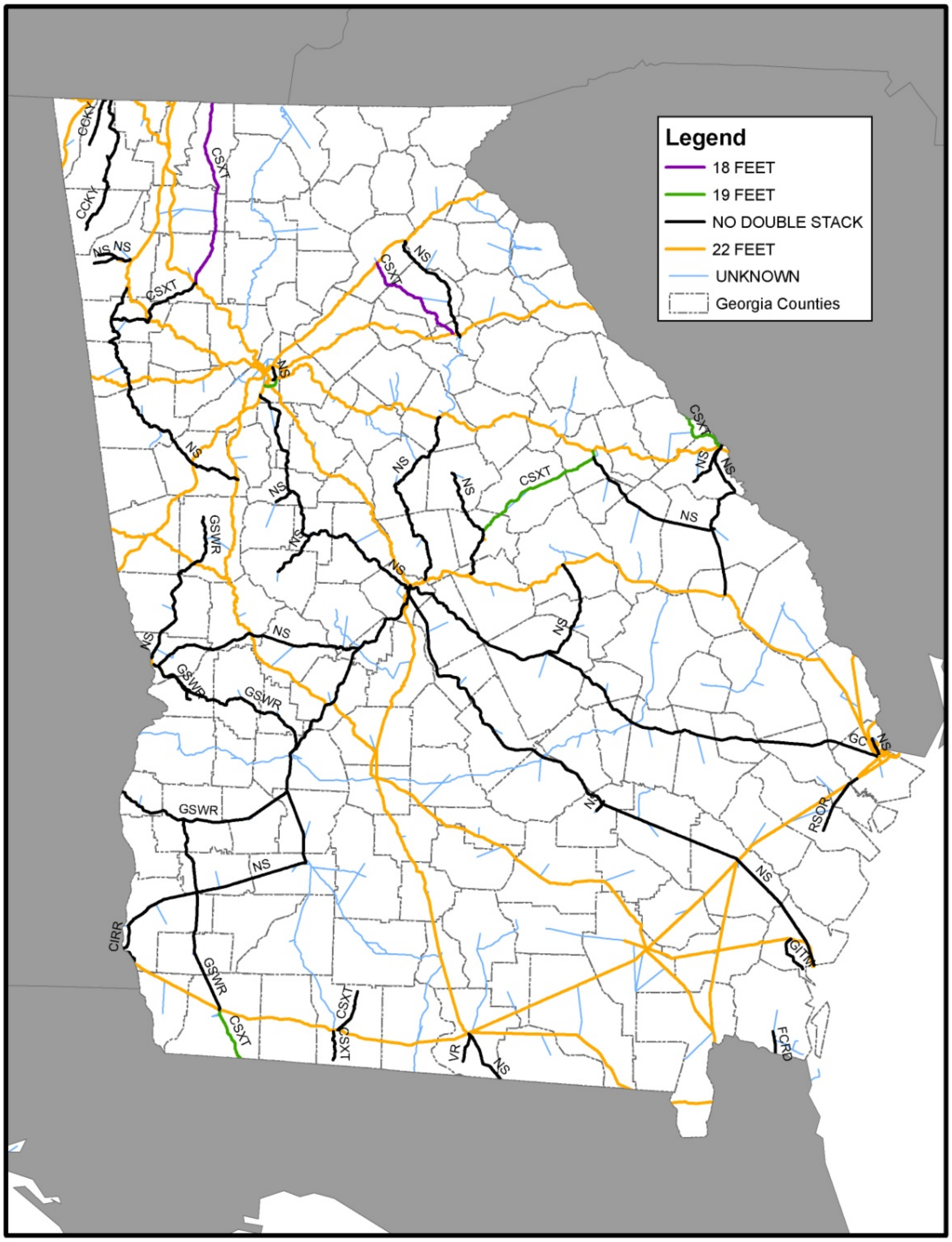
These rail improvements taken together represent a series of steps that would begin to address the rail system bottlenecks identified in this Plan. These bottlenecks are shown in Figure 2.3 with the rail track in red the priority rail track in need of improvements to accommodate future demand.

Figure 2.1 Rail Line Weight Limits – Class I and Shortline Railroads



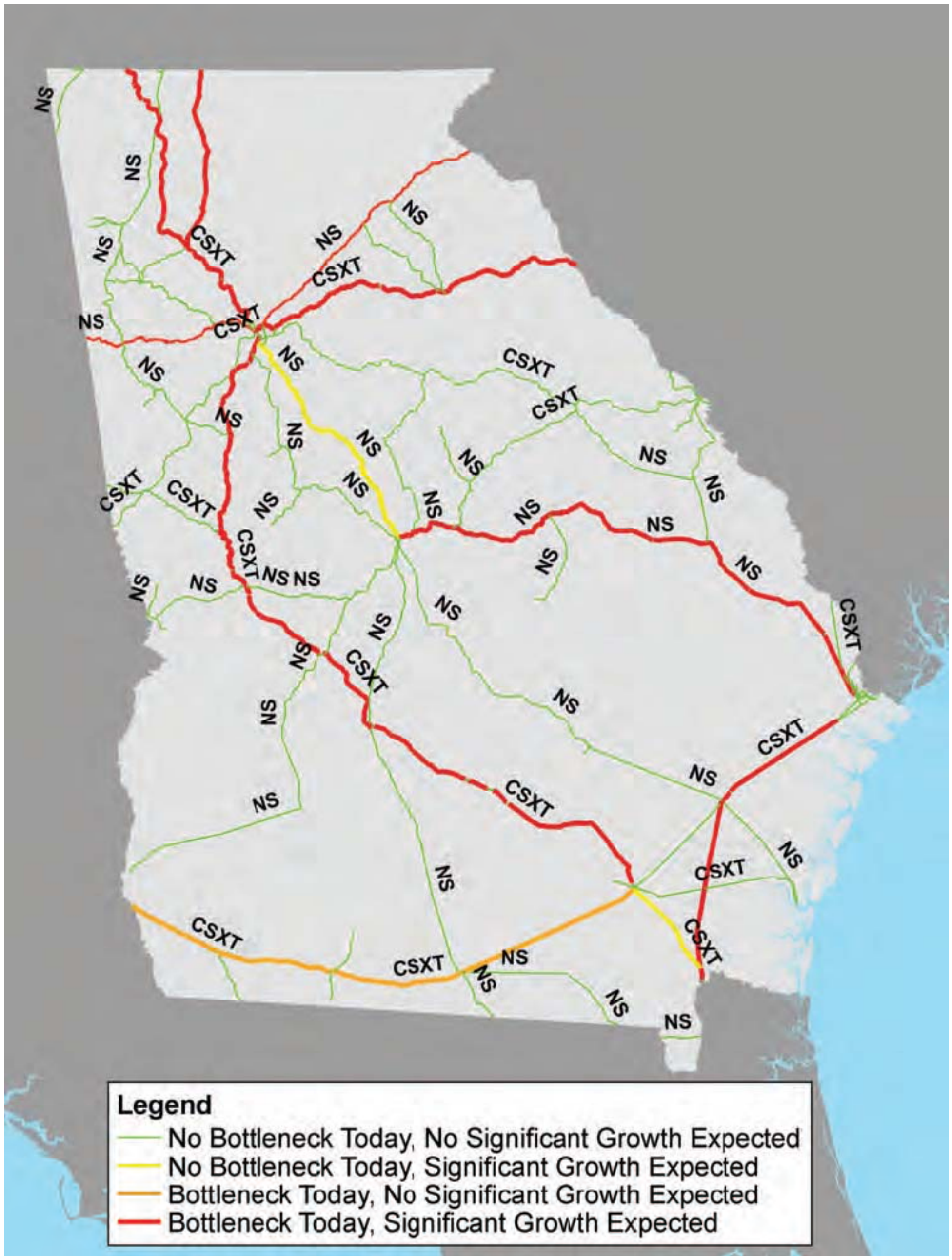
Source: Interviews with Class 1 railroads, American Shortline Railroad Association, consultant analysis.

Figure 2.2 Vertical Clearance Heights – Class I and Shortline Railroads



Source: Interviews with Class 1 railroads, American Shortline Railroad Association, consultant analysis.

Figure 2.3 Rail System Throughput Bottlenecks – Class I Railroads



Source: Interviews of Class 1 railroads, consultant analysis.

Long-Term Rail Program

Improving the deficiencies mentioned would be part of a long-term rail program to ensure that future growth can be captured by the Class I and shortline railroads. Determining specific projects out to the 2050 horizon year is outside of the normal planning process for Class I and shortline railroads and therefore individual projects over this period are not specified as part of this Plan. However, the 2007 American Association of Railroads (AAR) developed the National Rail Freight Infrastructure Capacity and Investment Study which provides a sense of the magnitude of the infrastructure issues facing the railroads over the long-term.

The AAR study estimated that an investment of $148 billion would be needed nationally for freight rail infrastructure expansion between 2007 and 2035. An estimate of the costs to make these long range improvements in Georgia was developed by adjusting the AAR report timeline to the 2012 to 2050 timeline of the Freight & Logistics Action Plan and then factoring down the costs based on the amount of rail track in Georgia relative to the rest of the U.S. Putting a reasonable lower and upper bound on this process gives us an estimate of between $4 billion and $6 billion of rail capacity enhancements needed in Georgia between 2012 and 2050 to accommodate likely future demand in the state.

These costs include the following improvements in the system:

- Line haul expansion
- Major Bridges, Tunnels, and Clearance
- Branch Line Upgrades
- Intermodal Terminal Expansion
- Carload Terminal Expansion; and
- Service Facilities

The AAR report estimates that 70 percent of the total national costs are for line haul expansion and 14 percent of the national costs are for major bridges, tunnels and clearances. These two categories are likely the largest categories of freight rail improvements needed in Georgia over the long term as well.

2.3 Highway Improvements

Five types of highway improvement projects were identified as part of this Plan:

- Long-haul interstate corridors
- Interstate interchanges
- Urban bypasses

- Smaller urban and rural freight corridors
- Highway safety projects

Long-Haul Interstate Corridors

Due to the long distance nature of a large component of truck trips, long-haul interstate corridors in Georgia are particularly important for trucks and the overall movement of goods. Earlier analysis of the interstate system using the GDOT statewide travel demand model indicated that there will be significant long-haul bottlenecks on the highway system in 2050 if no highway improvements are made to the system as truck and auto traffic volumes continue to grow.

Long-haul interstates are considered to be the segments of the interstate that are in between urban regions with the minimum number of lanes for the interstate. For example, the I-75 Atlanta-Tennessee long-haul corridor is the interstate segment between Atlanta and Chattanooga that is only six lanes. The urban portion of the corridor in the Atlanta region that is more than six lanes is not part of the long-haul corridor. Similarly, the I-75 Atlanta-South Carolina long-haul corridor is the interstate segment between Atlanta and the Georgia-South Carolina state line that is only four lanes. The list of the long-haul corridors examined was:

- I-75 Atlanta-Tennessee
- I-85 Atlanta-South Carolina
- I-20 Atlanta-South Carolina
- I-75 Atlanta-Macon
- I-75 Macon-Florida
- I-16 Macon-Savannah
- I-85 Atlanta-Alabama
- I-20 Atlanta-Alabama
- I-95 South Carolina-Florida

Interstate Interchanges

Interstate interchanges are often the source of operational and capacity issues in the highway system. For trucks, traveling across interstate interchanges can be particularly problematic due to the increased time required to change speeds and operational issues created as large vehicles merge. Additionally, the longer average trip length of trucks results in the average truck trip encountering more interstate interchanges than other vehicles. Therefore, improving road geometry and bottlenecks at interstate interchanges is beneficial to all vehicles, but particularly beneficial for truck mobility.

The American Transportation Research Institute compiles an annual list of the 250 most congested truck bottlenecks in the country and these locations are typically at interstate interchanges. In 2010, four of the most congested truck bottlenecks were located on I-285 in the Atlanta metropolitan region. These included the I-285 interchanges with I-85 and I-75 north of downtown Atlanta, and the I-285 interstate interchanges with I-20 east and west of downtown Atlanta.

Outside of the Atlanta region, the I-16/I-75 interchange was cited by private sector stakeholders as particularly problematic. Travel from both I-75 southbound to I-16 eastbound and travel from I-16 westbound to I-75 northbound are problematic from an operational perspective. For example, this interchange features a left lane, single lane egress that creates significant lane changes for trucks and autos. The freight importance of this interchange is that it connects the Port of Savannah to the Atlanta metropolitan region, and it is used by thousands of trucks per day. In the Savannah region, interstate interchanges at I-95/I-16 and I-95/SR 21 were identified in the Chatham County Interstate Needs Analysis & Prioritization Plan as being major issues for both trucks and autos. The I-95/I-16 interchange is used by many port trucks traveling to inland destination south of the port. The I-95/SR 21 is used by port trucks traveling to inland destinations north of the port. It is also heavily utilized by suburban commute traffic creating significant truck-auto conflicts.

Table 2.1 Georgia's Most Congested Highway Bottleneck Locations

Congestion Ranking Relative to other U.S. Bottlenecks	Location Description
9	Atlanta, GA: I-85 at I-285 (North)
20	Atlanta, GA: I-75 at I-285 (North)
42	Atlanta, GA: I-20 at I-285 (West)
58	Atlanta, GA: I-20 at I-285 (East)

Source: ATRI List of Top Bottleneck Locations, 2010.

Urban Bypasses

While 75 percent of the total freight tons in Georgia have an origin and/or a destination in the state, there are 25 percent of freight tons that are "through trips" with both trip ends outside the state. Nearly 9,000 trucks per day travel through the state along I-95. Almost 5,000 trucks per day travel through the state on I-75. Another 6,000 trucks per day travel east-west through the state using I-85 and I-20. This through freight traffic contributes to congestion on both the highway and rail networks in Georgia. It also contributes to wear and tear of the physical infrastructure and adds emissions. Developing alternative paths that can be utilized for this traffic may reduce travel time and preserve existing infrastructure for freight traffic that is directly tied to economic activity in the State.

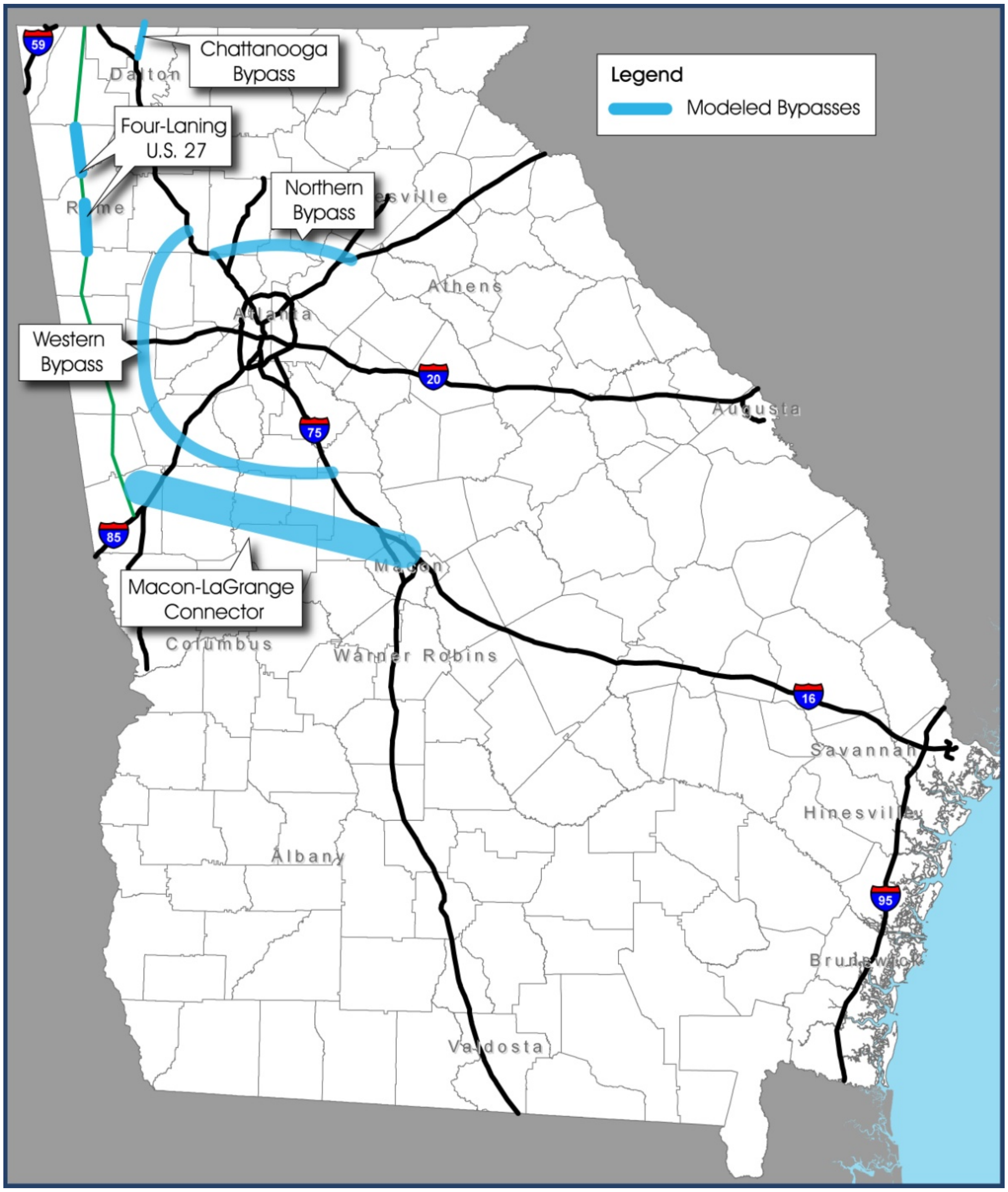
This led to the consideration of potential bypasses around urban areas as a possible freight improvement project. Additionally, the Private Sector Advisory Committee also identified traveling around Atlanta as a major impediment to the free flow of freight. Based on this input several urban bypasses were added to the evaluation list as shown in Figure 2.4. These include:

- A western Metro Atlanta bypass connecting I-75 roughly 30 miles north and south of the current I-285;
- A Macon-LaGrange connector along with 4-laning the remaining 2-lane pieces of U.S. 27 north of LaGrange to form an outer Atlanta metro western bypass; and
- A northern Atlanta metro bypass connecting I-75 and I-85 roughly 20-25 miles north of I-285.

Additionally, it was mentioned by the private sector that if highway bypasses are considered to be feasible, then rail bypasses should also be considered, since the additional right-of-way required may be minimal.

A potential east bypass around Chattanooga was also analyzed; its genesis stems from three previous planning efforts: the Tennessee DOT I-75 Corridor Feasibility Study, the Cleveland (Tennessee) MPO Long Range Transportation Plan, and the Chattanooga Regional Freight Study.

Figure 2.4 Alternative Bypasses Tested Using Model



Smaller Urban and Rural Freight Corridors

Smaller urban and rural freight corridors are important to the State to ship goods between from lower density population locations to key freight consumption and production locations. They are also important features to encourage economic development. To facilitate economic development the Governor's Road Improvement Program (GRIP) was initiated in 1989. Over the past two decades, the Georgia DOT has implemented a significant portion of GRIP. In total, GRIP includes 3,273 miles of roadway, 68 percent of which is open or under construction.

A review of the GRIP network and an analysis of key corridors was undertaken as part of this Plan This analysis indicates that there are three GRIP corridor improvement projects, still to be completed, that should be considered high-priority freight projects. The first project is completing the four-laning of U.S. 84. This corridor currently has over 2,000 trucks per day along some portions making it one of the highest truck volume corridors in Georgia off of the Interstate system, and it serves east-west freight traffic originating at the port facilities in Brunswick and Savannah.

The second project is four-laning U.S. 133 between Albany and Valdosta. This corridor provides connectivity for freight flows from the recently-expanded military facilities in the Albany region to I-75 in Valdosta. Additionally, this corridor is part of the infrastructure connecting freight flows moving from both Columbus and LaGrange to Florida.

The third corridor is four-laning U.S. 441 between I-85 and I-16. This corridor provides alternative access between Central Georgia and I-85 which allows the shippers in Central Georgia to more easily connect to markets in the I-85 corridor in the Carolinas, Mid-Atlantic, and Northeast. This corridor also provides an alternative route from the Port of Savannah to the Atlanta region that allows for truck drivers to avoid I-75, if needed.

Highway Safety Projects

An analysis was conducted of truck-involved crashes in Georgia that identified head-on collisions involving trucks to be the most severe vehicle crashes. These types of crashes occur most frequently in smaller urban and rural locations that have relatively high truck volumes and no median barrier protection between opposing traffic flows. Improving median barriers in these instances could be a cost-effective means of reducing the severity of these crashes and improving freight corridors in smaller urban and rural areas.

2.4 Air Cargo Projects

Air cargo projects were identified through stakeholder outreach at the three largest airports in Georgia in terms of air cargo – the Hartsfield-Jackson Atlanta International Airport, the Southwest Georgia Regional Airport in Albany and the Savannah/Hilton Head International Airport. Dialogue with these airports identified the following air cargo needs:

- Development of an additional air cargo warehouse building at the Atlanta airport
- Lengthen airport runway at the Albany airport

3.0 Project Evaluation

A wide range of analysis tools and estimation techniques were utilized to determine the traffic impacts of projects identified for the Freight & Logistics Plan. Table 3.1 lists the tools used for each project category.

Table 3.1 Methodology for Evaluating Individual Projects

Project Category	Methodology or Tool Used to Evaluate Individual Projects
Marine Port Projects	Recent reports
Rail Projects – Crescent Corridor	Previous analysis
Rail Projects – Other improvements	Top-down estimate using previous reports
Highway Projects – Add capacity to long-haul interstates	Georgia DOT statewide travel demand model
Highway Projects – Improve interstate interchanges	"Off-model" analytical technique
Highway Projects – Develop urban bypasses	Georgia DOT statewide travel demand model
Highway Projects – Add capacity to rural freight corridors	Georgia DOT statewide travel demand model
Highway Projects – Develop safety projects	"Off-model" analytical technique
Air Cargo Projects	Qualitative descriptions from discussions with airport staff

This chapter is structured to describe the analysis of projects in each of the categories listed in Table 3.1. The sections of this chapter are:

- Section 3.1 – Analysis of Marine Port Projects.
- Section 3.2 – Analysis of Rail Projects.
- Section 3.3. – Highway Projects Analyzed Using Georgia Travel Demand Model.
- Section 3.4 – Highway Projects Analyzed Using Off-Model Techniques.
- Section 3.5 – Analysis of Air Cargo Projects.

3.1 Analysis of Marine Port Projects

Two port-related projects are considered as part of this plan: 1) the Savannah Harbor Expansion Project and 2) Development of the Jasper Ocean Terminal.

Savannah Harbor Expansion Project (Deepening)

The U.S. Army Corp of Engineers recently completed the Savannah Harbor Expansion Project (SHEP) Draft General Re-evaluation Report[1] (GRR). The study conducted an extensive analysis of the engineering alternatives, environmental impacts, and economic costs and benefits of deepening the Savannah Harbor and shipping channel.

As part of the study, the U.S. Army Corps of Engineers created a new analysis model to predict the impact of deepening at various depths, particularly suited for Savannah. To develop this model, input from the Corps' economics experts in navigation at the Institute for Water Resources, plus input from industry experts to evaluate the sophisticated nature of container ship operations were utilized. The Institute for Water Resources and industry experts worked together to identify the aspects of container ship operations that impact vessel loading and operating characteristics. This was used to evaluate vessel operations under each of the proposed channel deepening alternatives being studied. Additionally, the Corps' revised model inputs to estimate the impact of the Panama Canal expansion on the industry's switch to more efficient vessels.

The draft GRR described that a deeper shipping channel allows larger and fewer ships to move the same amount of goods at a lower transportation cost. Fewer, larger ships also would lessen congestion in the harbor, according to the GRR. A deeper channel means larger ships can enter and leave with less delay waiting for high tides.

The Corps of Engineers calculates that the nation will receive $71.6 million to $116 million in annual net benefits depending on the depth. The economic study evaluated benefit years 2015 through 2065. For example, at a 47-foot depth, the construction and environmental mitigation costs are $570 million (approximately) with an annual national benefit of $116 million. For the 48-foot "Maximum Authorized Depth," the construction and environmental mitigation costs are $606 million with an annual national benefit of $115.7 million. However, at this greater depth, it is believed that there are significant regional economic benefits that will accrue to Georgia that make this depth preferable.

In total, a transportation cost savings of $2.8 billion was estimated in the draft GRR. This reduction represents a national economic development (NED) gain because when transportation costs are reduced, those dollars are available for productive use elsewhere in the economy. Those savings may also be passed on to the consumer through lower prices in the goods purchased.

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[1] Source: http://www.sas.usace.army.mil/shexpan/SHEPreport.html.

Develop Jasper Ocean Terminal

Evaluation of the impacts of this project was conducted for "An Update on the Jasper Ocean Terminal" which was developed in March of 2011 by the Georgia Ports Authority and the South Carolina Ports Authority. This report estimated that $9 billion in tax revenue would accrue to Georgia and South Carolina from the development of the Jasper Port. This estimate was based on the assumption that taxes and jobs scale with port volume. It also assumes that higher container density and efficient operations will lead to increased port utilization of existing port facilities. The Phase 1 construction of the new terminal is estimated to translate into 900 direct and indirect jobs from 2020 to 2025 to install the necessary infrastructure including roads, bridges and utilities. The impacts of this new terminal will be particularly beneficial for Jasper County, which is one of the poorest counties in South Carolina featuring a 20% poverty rate.

3.2 Rail-Related Improvement Projects

The rail-related improvement projects analyzed as part of this plan include one specific project (Norfolk Southern's Crescent Corridor) and a generalized set of improvements needed to accommodate future freight rail demand in the state. This section describes how the benefits of each of these improvements were estimated.

Crescent Corridor

The Crescent Corridor consists of a series of rail tracks that extend as far northeast as New York and New Jersey, though the mid-Atlantic with the southern termini in Memphis and New Orleans (Figure 3.1). According to a 2009 presentation that Norfolk Southern made to the Atlanta Regional Commission, the improvements include 300 miles of new passing track and double track by full development, new or expanded terminals in 11 markets, and $2.5 billion in new investments through full corridor development. The fully developed line will be the nation's most direct intermodal rail route between the Northeast and the South.

In Georgia, the Crescent Corridor improvements include enhancements to the rail track connecting Atlanta to the South Carolina state border and improvements to the rail track connecting Atlanta to Birmingham parallel to I-20. The Phase 1 improvements in Georgia include line haul capacity improvements which would result in increased train speeds in the corridor. The full build-out of the Crescent Corridor would occur in Phases 2 and 3. In Georgia, the full build-out would include improvements to track capacity and railyard enhancements and would result in trains along these lines travelling at close to 55 miles per hour. The cost for all of the improvements in Georgia are estimated to total $84.3 million.

To estimate the amount of traffic generated by this improved service, two key data sources were utilized. Global Insight TRANSEARCH database was used to determine mode split by commodity. Trucking shipment data was used to define 88 market lanes. This analysis identified that the southeast to northeast market is dominated by truck traffic. Figure 3.2 shows that 15 percent of the long-haul traffic in these trade lanes goes by rail. This is much lower than the rail mode share for other trade lanes.

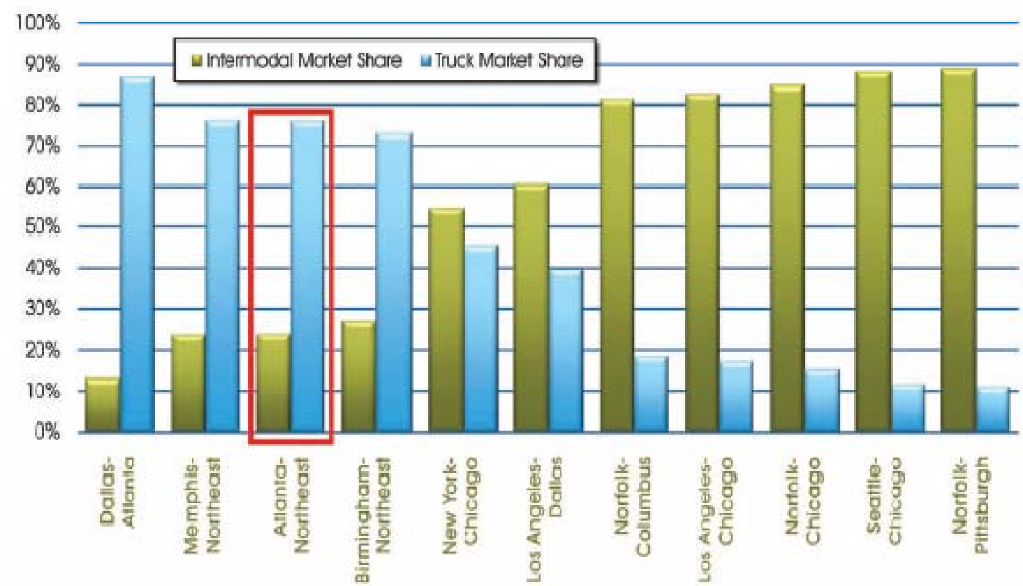
Improvements to this corridor could allow a higher percentage of the freight in this corridor to shift to rail allowing for significant potential savings in terms of logistics costs, travel time savings, safety improvements, fuel savings, emissions savings, and pavement wear and tear. Based on a Norfolk presentation to the Atlanta Regional Commission in June of 2010, the estimated total monetized public benefits from these improvements are $2 billion annually.

The development of new intermodal terminals is also considered to be a significant economic benefit to the region. An economic impact analysis of the Crescent Corridor was conducted for six proposed new terminals and estimated that the cumulative economic impact from 2009 to 2030 was $40 billion representing a 16:1 return on investment relative to the $2.5 billion in initial investment in the Crescent Corridor. It should be noted that none of the six new terminals included in this analysis were located in Georgia as reflected in Figure 3.1. Therefore, the economic benefits of the Crescent Corridor for Georgia will be somewhat reduced, however, expansion at the existing Austell intermodal railyard is included in the overall Crescent Corridor initiative.

Figure 3.1 Norfolk Southern Crescent Corridor

Source: Norfolk Southern Presentation to Atlanta Regional Commission, June 2010

Figure 3.2 Mode Share for Select Trade Lanes



Source: Norfolk Southern Presentation to Atlanta Regional Commission, June 2010

General Rail Improvements Needed in Georgia

As mentioned in Chapter 2, improving general rail deficiencies should be part of a long-term rail program to ensure that future growth in freight movement can be captured by rail. This section will expand on the issues discussed in Chapter 2. As previously noted, specific rail improvement projects out to the 2050 horizon year is outside of the normal planning process for railroads, these projects were similarly not specified as part of this Plan.

As previously discussed, existing literature developed by the railroads can provide estimates of the benefits of investments in freight rail. The 2007 AAR National Rail Freight Infrastructure Capacity and Investment Study estimated that an investment of $148 billion would be needed nationally for freight rail infrastructure expansion between 2007 and 2035. As discussed in Chapter 2, prorating these costs to the 2012 to 2050 timeline of the Freight & Logistics Action Plan and to the state of Georgia gives us an estimate of between $4 billion and $6 billion of rail capacity enhancements needed in Georgia as part of this Plan.

These costs include the following improvements in the system:

- Line haul expansion;
- Major Bridges, Tunnels, and Clearance;
- Branch Line Upgrades;
- Intermodal Terminal Expansion; and

- Carload Terminal Expansion.

The methodology used in the AAR study to estimate rail line capacity and investment requirements was to use the following steps:

- Dividing the continental U.S. Class I railroad network into primary corridors;
- Establishing current corridor volume in freight and passenger trains per day for each primary corridor, based on 2005 Surface Transportation Board Carload Waybill data, the most recent comprehensive information available;
- Estimating current corridor capacity in trains per day for each primary corridor, based on current information;
- Comparing current corridor volume to current corridor capacity;
- Estimating future corridor volume in trains per day, using U.S. DOT's Freight Analysis Framework Version 2.2 forecasts of rail freight demand in 2035 by type of commodity and by the origin and destination locations of shipments moving within the U.S. and through international land and port gateways;
- Comparing the future corridor volume to current corridor capacity;
- Determining the additional capacity needed to accommodate future train volumes at an acceptable level of service reliability;
- Identifying the rail line and signal control system improvements required to provide the additional capacity; and
- Estimating the costs of the improvements.

The study estimates the need for expansion of Class I railroad carload terminals, intermodal yards, and railroad-owned international gateway facilities by analyzing the projected increases in the number of railcars and intermodal units (containers and truck trailers) handled at major facilities and comparing them to current handling capacity. Expansion costs are estimated using unit costs per railcar or intermodal container, or estimated using recent and comparable terminal expansion project costs. Estimates of the cost of expanding service and support facilities such as fueling stations were provided by the railroads based on the anticipated changes in the number and type of trains.

Finally, the study estimates the capacity and investment requirements for secondary mainlines, branch lines, and short line and regional railroads by updating information from a prior study of short line system investment needs commissioned by the American Short Line and Regional Railroad Association.

To estimate the benefits associated with these improvements, the 2003 AASHTO Freight Rail Bottom Line Report was utilized. This report suggests that an additional investment of $53 billion to upgrade from a constrained investment scenario to a base case scenario yields $173 billion in reduced highway needs and reduced shipper costs. These benefits can be translated into a return on investment in generalized rail improvements of roughly 3.3.

3.3 Highway Projects Analyzed Using Statewide Travel Demand Model

Network Coding

The Georgia statewide travel demand model was used to evaluate projects that added mainline highway capacity. These projects included testing scenarios of adding capacity to long-haul interstate corridors, new limited access urban bypass routes, and improving capacity on smaller urban and rural freight corridors. The definitions of these projects are provided in Chapter 2. The existing and added capacity for each of these projects is shown below Table 3.2. The map of bypasses is shown in Figure 3.3.

The full list of GRIP corridors is shown in Figure 3.4. The most freight-intensive corridors from this list were selected based on a combination of truck volumes and feedback from outreach efforts. The specific four-laning enhancements considered as part of this plan were on the following highway segments:

- U.S. 84 between U.S.1 and U.S. 441;
- SR 133 between Albany and Valdosta;
- Portions of U.S. 280;
- U.S. 441 between I-16 and I-85; and
- Final section of the Fall Line Freeway

Table 3.2 Capacity-Expansion Projects Model Coded Improvements

		Number of Lanes		
Type	Project Name	Existing	Added	Total
Long Haul	I-75 Atlanta-Chattanooga	6	2	8
Long Haul	I-75 Atlanta-Macon	6	2	8
Long Haul	I-85 Atlanta-SC Line	4	2	6
Long Haul	I-85 Atlanta-AL Line	4	2	6
Long Haul	I-75 Macon-FL Line	6	2	8
Long Haul	I-16 Macon-Savannah	4	2	6
Long Haul	I-20 Atlanta-AL Line	4	2	6
Long Haul	I-20 Atlanta-SC Line	4	2	6
Long Haul	I-95 (entire stretch)	6	2	8
Smaller Urban and Rural Freight	U.S. 84	2,4	2	4
Smaller Urban and Rural Freight	SR 133	2	2	4
Smaller Urban	U.S. 280	2,4	2	4

Type	Project Name	Number of Lanes		
		Existing	Added	Total
and Rural Freight				
Smaller Urban and Rural Freight	U.S. 441 from I-16 to I-85	2,4	2	4
Smaller Urban and Rural Freight	Fall Line Freeway	2	2	4
Bypass	Western Bypass	0		
Bypass	Macon-Lagrange-US27 4-laning	0-4	2,4	4
Bypass	I-75 Bypass Around Chattanooga	0	6	6
Bypass	Northern Bypass	0	4	4

Note: As GRIP-designated corridors, only portions of the highways were four-laned.

Figure 3.3 Alternative Bypasses Tested Using Model

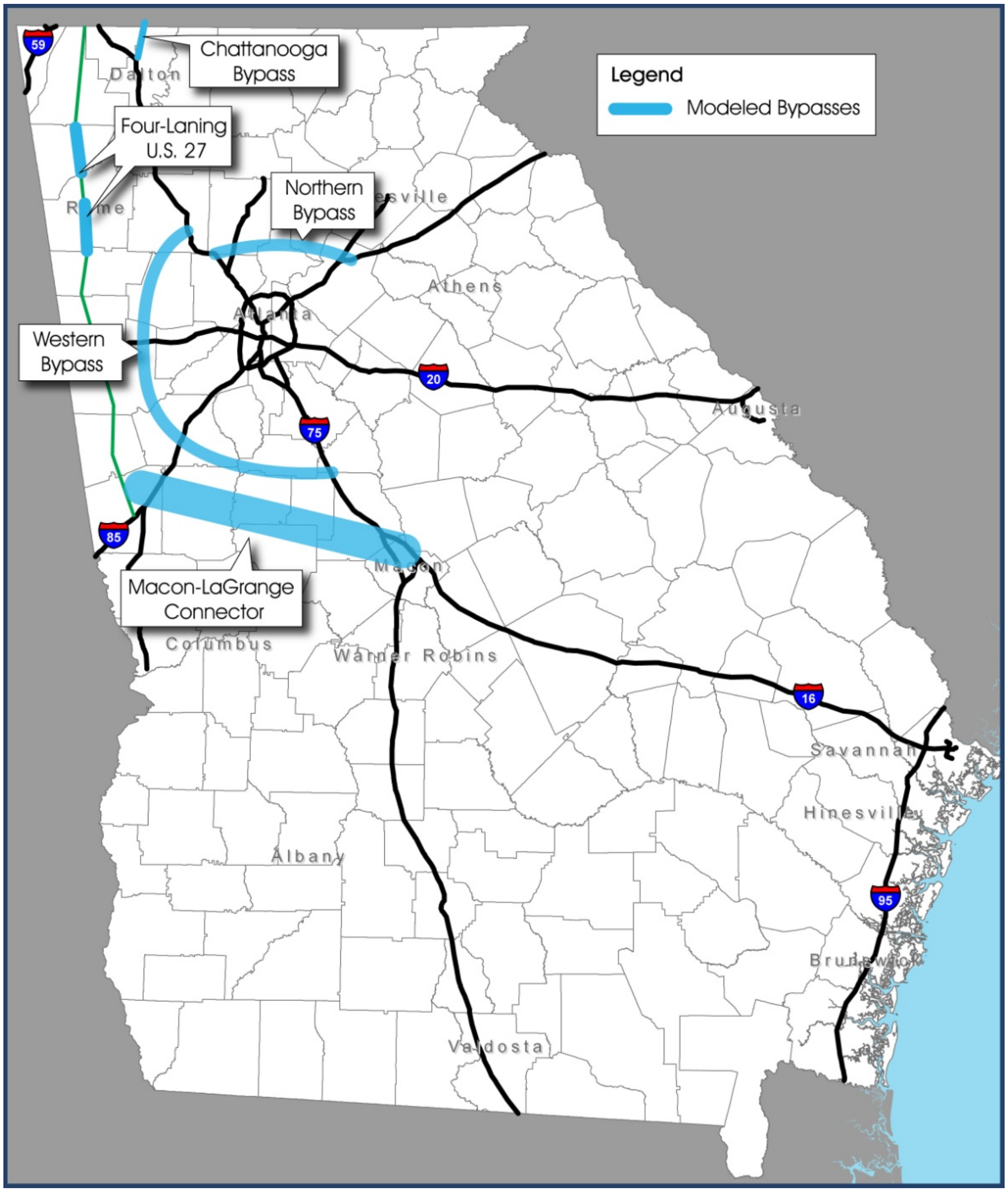
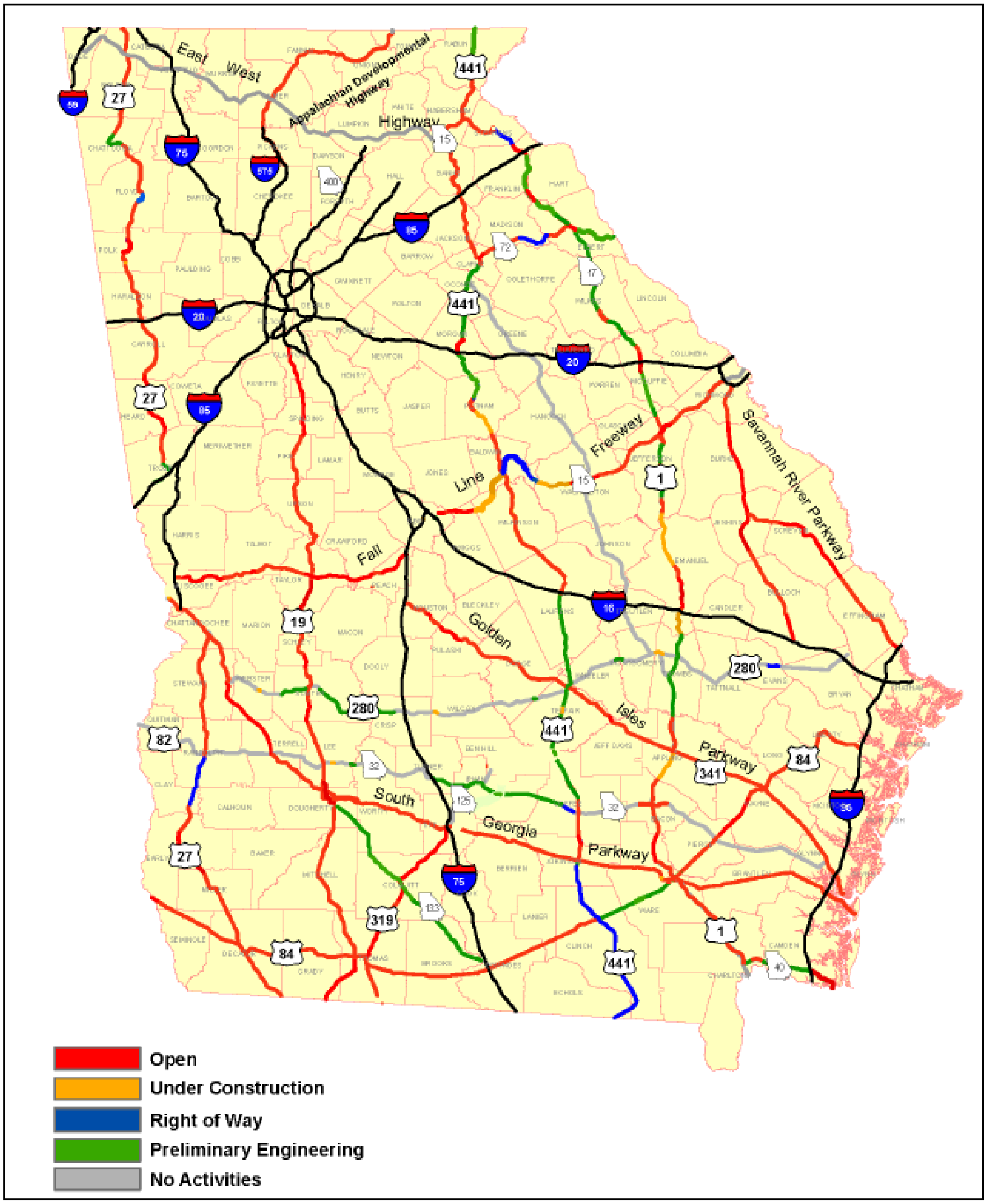


Figure 3.4 Map of GRIP Corridors



Source: GDOT GRIP Factsheet – October 2011.

Growth Scenarios

The projects were run under two growth scenarios: a medium and a high truck growth scenario. The medium truck growth scenario assumed the truck growth rate to be 2.0 percent annually between 2012 and 2050. This 2.0 percent growth rate is consistent with the TRANSEARCH freight flow forecast utilized in earlier sections of this Plan. Under the medium truck growth scenario, the container growth at the Port of Savannah was capped based on the capacity of the Garden City Terminal.

For the high truck growth scenario, the annual truck growth rates were increased to 4.0 percent. This growth is extremely rapid, but consistent with the growth of Atlanta in the 1980s and 1990s. The unconstrained growth rate for containers in the Savannah complex were incorporated into the high truck growth scenario. This equates to container growth rate at 4.5 percent per year from 2012 to 2050.

Model Run Features

The key output variables of concern for the model were vehicle miles traveled (VMT) and vehicle hours traveled (VHT) between 2020 (the base year) and 2050 (the horizon year). Changes in VMT and VHT for 2020 and 2050 between build and no build options were used to derive benefits for each of the alternatives. To estimate total changes over the time period of concern, estimates of the changes in VMT and VHT were generated for each year between 2020 and 2050.

The statewide travel demand model forecast years are 2020, 2040, and 2060. To develop 2020 model results, the change in VMT and VHT for 2020 between the no build and build scenarios could be used directly. To develop 2050 traffic impact estimates, the model results for 2040 and 2060 were generated and straight-line interpolation was used such that the midpoint of these two values was used as the estimate for 2050. This was done for both the build and the no build scenarios. The change in VMT and VHT could then be calculated for both 2020 and 2050. Straight-line interpolation was then used to estimate the change in VMT and VHT for years in between 2020 and 2050. All projects were assumed to be open for traffic in 2020 for purposes of this analysis.

The long-haul interstate corridor capacity enhancements were run in the model as a bundle to best identify the systemwide benefits of long-haul capacity improvements. For these model runs, the traffic impacts of the improvements were primarily based on the traffic impacts that occurred on the corridor. Traffic impacts that did not occur on the interstate corridors were allocated to corridors based on their individual improvements of VHT and VMT. The accuracy of this process was confirmed by also running I-85 from Atlanta to South Carolina individually and comparing it to the bundle results. The traffic impact results were similar for both methods.

Each bypass route and smaller urban and rural freight improvement was run as a separate project. The model versions utilized for this analysis were the December 2010 and April 2011 versions. The Statewide Freight & Logistics Plan was the first GDOT project to utilize the travel demand model for planning purposes. Therefore, ongoing dialogue between the consultant team and GDOT modeling staff was utilized to interpret results and ensure realistic outputs were utilized in post-processing analyses.

Travel Demand Model Results

Table 3.3 shows the changes in VMT and VHT for both autos and trucks in 2050 for the medium growth scenario for each of the capacity enhancement alternatives. Table 3.4. shows the changes in VMT and VHT for the high growth scenario. This table shows the traffic impact for each of the alternatives, but it cannot be used by itself to evaluate the overall performance of a project.

As expected, the reductions in VMT and VHT were much greater for the high growth scenario relative to the medium growth scenario. This is largely due to the existence of much more delay in the high growth scenario that can be reduced through the freight improvement projects.

Table 3.3 Results of Changes in VHT and VMT
Medium-Growth Scenario

		2050 Change			
		Auto		Truck	
Improvement Type	Project	VMT	VHT	VMT	VHT
Long Haul	I-75 Atlanta-Chattanooga	138,809	-86,285	58,563	-6,789
Long Haul	I-75 Atlanta-Macon	61,354	-46,779	27,976	-4,915
Long Haul	I-85 Atlanta-SC Line	127,392	-144,707	36,616	-11,134
Long Haul	I-85 Atlanta-AL Line	83,349	-89,444	11,202	-8,776
Long Haul	I-75 Macon-FL Line	122,791	-46,559	43,720	-7,322
Long Haul	I-16 Macon-Savannah	14,143	-5,901	-595	-1,610
Long Haul	I-20 Atlanta-AL Line	99,162	-108,319	16,339	-5,750
Long Haul	I-20 Atlanta-SC Line	140,369	-141,514	22,206	-9,371
Long Haul	I-95 (entire stretch)	174,359	-66,016	42,514	-11,189
Long Haul	All Interstate Long Haul Projects	961,728	-735,523	258,540	-66,857
Smaller Urban and Rural Freight	U.S. 84	-232,014	-8,766	-37,844	-1,704
Smaller Urban and Rural Freight	SR 133	-494,953	-17,999	-83,416	-3,429
Smaller Urban and Rural Freight	U.S. 280	-158,859	-4,932	-41,269	-1,424
Smaller Urban and Rural Freight	U.S. 441 from I-16 to I-85	-140,784	-12,271	-24,569	-2,344
Smaller Urban and Rural Freight	Fall Line Freeway	55,042	-4,417	27,681	-120
Bypass	Western Commercial Corridor	2,317,908	-166,586	267,142	-25,894
Bypass	Macon-Lagrange-US27 4-laning	-950,862	-71,530	-317,624	-14,465
Bypass	I-75 Bypass Around Chattanooga	-443,894	-25,708	-62,488	-3,806
Bypass	Northern Bypass	1,917,686	-362,302	45,506	-11,855

Table 3.4 Results of Changes in VHT and VMT
High-Growth Scenario

		2050 Change			
		Auto		Truck	
Type	Project	VMT	VHT	VMT	VHT
Long Haul	I-75 Atlanta-Chattanooga	116,314	-55,122	311,383	-10,316
Long Haul	I-75 Atlanta-Macon	53,404	-35,970	208,170	-10,316
Long Haul	I-85 Atlanta-SC Line	124,972	-158,939	159,777	-43,880
Long Haul	I-85 Atlanta-AL Line	82,661	-98,067	108,695	-27,928
Long Haul	I-75 Macon-FL Line	122,396	-42,940	367,355	-14,695
Long Haul	I-16 Macon-Savannah	56,716	-18,312	133,671	-27,841
Long Haul	I-20 Atlanta-AL Line	106,704	-100,828	64,154	-21,463
Long Haul	I-20 Atlanta-SC Line	113,921	-179,602	148,519	-28,649
Long Haul	I-95 (entire stretch)	73,910	-106,015	143,125	-66,188
Long Haul	All Interstate Long Haul Projects	850,997	-795,795	1,644,849	-251,275
Smaller Urban and Rural Freight	U.S. 84	454,274	-13,382	194,823	-6,054
Smaller Urban and Rural Freight	SR 133	156,906	-27,477	377,828	-12,181
Smaller Urban and Rural Freight	U.S. 280	95,751	-7,529	412,498	-5,060
Smaller Urban and Rural Freight	U.S. 441 from I-16 to I-85	361,939	-18,732	255,090	-8,326
Smaller Urban and Rural Freight	Fall Line Freeway	554,749	104,656	368,918	-348
Bypass	Western Commercial Corridor	2,051,030	-180,237	1,699,576	-97,319
Bypass	Macon-Lagrange-US27 4-laning	-724,081	-109,197	-907,286	-51,389
Bypass	I-75 Bypass Around Chattanooga	-345,474	-30,561	-227,556	-18,919
Bypass	Northern Bypass	1,711,610	-433,260	204,014	-24,635

Estimation of User Benefits

The first step in developing benefit-cost ratios is generating an estimate of the benefits from implementing each project. Factors considered for benefit calculations is a reduction in several cost factors associated with owning and operating a vehicle. These cost factors are:

- Travel time costs;

- Travel time reliability costs;
- Safety costs;
- Vehicle operating costs;
- Emissions costs; and
- Pavement damage costs.

Travel Time Costs

Travel time savings is the monetized benefit of less time spent traveling on the roads. Travel time savings is calculated for three trip types: trucks, business travel and commuter travel. The calculation of travel time savings is based on estimating the opportunity cost to the road-user of an alternative use of time. Opportunity cost is a function of trip purpose, wage rates, and amount of time saved.

Reduction in daily freight transportation cost is valued as the product of freight transportation cost per hour and the daily change in travel time or delay. Transportation cost per hour of $58.57 is utilized for truck travel for this study[2].

For personal auto travel, travel time savings is valued as the product of hourly wages and changes in VHT. Average wage rate for Georgia reported by the Bureau of Labor Statistics (BLS) is employed for this analysis.

For business related auto travels, annual value of travel time savings is equivalent to value of daily travel time saving annualized over 260 working days. Daily value of travel time savings is estimated as the product of traveler's hourly wage and daily travel time savings. Average hourly wage of $49.15 associated with management level positions in Georgia, as reported by the Bureau of Labor Statistics (BLS) is utilized for this analysis.

$$\Delta V_t^{Bu\sin ess} = W_t^{Bu\sin ess} \ x\ \Delta VHT^{Bu\sin ess}{}_t \ x\ 260$$

Where,

ΔVHT_t = Change in daily travel time

$W_t^{Buisness}$ = Average wage rate in Georgia, reported by the Bureau of Labor Statistics

$\Delta V_t^{Bu\sin ess}$ = Annual monetized value of business related travel time savings

For commuters, the value of travel time savings is computed similar to the method used for estimating benefits for business travelers. The only difference

[2] Levinson et al (2005), Value of Time for Commercial Vehicle Operators in Minnesota.

stems from the application of wage rate. For commuters, statewide average hourly wage of $10.23, reported by the Bureau of Labor Statistics is used.

$$\Delta V_t^{Commute} = W_t^{Commute} \ x \ \Delta VHT^{Commute}{}_t \ x \ 260$$

Where,

$\Delta V_t^{Commute}$ = Monetized value of commute related travel time savings

$W_t^{Commute}$ = Average hourly wage in Georgia (from Bureau of Labor Statistics)

$\Delta VHT^{Commute}{}_t$ = Daily change in commute related vehicle-hours traveled

Travel Time Reliability Costs

Travel time reliability is used to represent the amount of variability in travel times in the highway system. The 2010 GRTA Metro Atlanta Performance Measures report was used to generate travel time reliability savings. Estimates of the non-recurrent incident rate at 30 percent and average buffer time index of 32 percent for the Atlanta metropolitan region were taken from this report. This generated travel time reliability of 9.6 percent of travel time.

Safety Costs

Frequency of accidents and value of accidents are the two factors used to estimate safety costs. Reductions in overall crash rates and crash severity result in savings to industries and households. Savings in the loss or disability of workers, damage to property, and insurance rates are some ways in which crash reductions are expected to lower the overall costs of doing business of the region's firms and increase the disposable income for commuters.

For trucks, changes in safety costs between each build alternative are calculated using the estimated changes in VMT, accident rates and dollar values of accidents. Value of accidents reported by the Georgia Department of Transportation (GDOT) and analysis of 2005-2008 crash date reported provided accident rates utilized for this analysis (Table 3.5).

Table 3.5 Value of Accident and Accidents Rates by Severity

		Accident Rate Per Million VMT	
Accident by Severity	**Value ($)**	**Auto**	**Truck**
Fatal	5,800,000	0.012	0.031
Injury	333,500	0.688	0.628
Property Damage	4,400	1.915	1.908

Source: Georgia Department of Transportation, GDOT 2005-2008 Crash Data, Cambridge Systematics Analysis.

Estimation of safety costs for personal travel is similar to that used for freight transportation. For personal vehicles, benefit annualization vary by trip purpose: business and commute related personal travels are annualized over 260 working days, while nonwork related is annualized over 365 days.

Vehicle Operating Costs

Changes in vehicle operating costs are estimated as a product of fixed cost per mile and changes in vehicle-miles traveled. Change in vehicle operating costs is estimated separately for fuel and non-fuel and summed (Table 3.6).

Because of the unpredictable nature of gasoline prices, many benefit estimation models simply leave the fuel price constant in forecast years. This analysis follows the same practice and allowed future price to be set at the current average economic price of $ 4.0 and projecting it to grow at the same rate as the Consumer prices Index (CPI) reported by the Bureau of Labor Statistics (BLS).

Non-fuel VOC comprises the wearing-out of expandable items on the vehicle. A constant wear-out rate is a reasonable assumption given data limitations and the unpredictability of future wear-out rates. In view of this, a per mile cost on non-fuel operating costs for both truck and personal vehicle from Barnes and Langworthy (2003), updated to 2011 dollars are employed for this analysis.

Table 3.6 Vehicle Operating Costs Inputs

Vehicle Type	Fuel Cost Per Gallon ($)[3]	Fuel Consumption Per Mile	Non-fuel Cost Per Mile[4]
Auto	4	19.12[5]	0.15
Truck	4	6.5[6]	0.30

Source: Environmental Protection Agency, Barnes and Langworthy (2003), Cambridge Systematics Analysis.

Change in the fuel component of vehicle-operating cost for truck travel is expressed below:

$$\Delta VOC_t^{fuel} = FC \ x \ FE^{Truck} \ x \ \Delta VMT^{Truck}{}_t \ x \ 365$$

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[3] Average market price less Federal and State taxes.

[4] Barnes and Langworthy (2003), updated to 2011 dollars.

[5] Emission Facts: Average Annual Emissions and Fuel Consumption Cars and Light Trucks. Average data for passenger cars and auto are used for the analysis.

[6] Barnes and Langworthy (2003). Used midpoint of 5.8 to 7.2 miles per gallon for the analysis.

Where:

ΔVOC^{fuel}_{t} = Change in annual fuel cost component of vehicle-operating costs

FC = Fuel cost per gallon (less taxes/subsidies)

FE = Fuel consumption per mile

ΔVMT_t = Daily change in vehicle-miles traveled

Annual change in non-fuel costs of freight transportation is estimated as:

$$\Delta VOC_t^{Non-fuel} = NFC \ x \ \Delta VMT_t^{Truck} \ x \ 365$$

Where NFC = non-fuel cost per mile for trucks

Thus, total change in vehicle-operating costs for freight transportation can be expressed as:

$$\Delta VOC_t^{TR} = \Delta VOC_t^{Fuel} + \Delta VOC_t^{Non-fuel}$$

For person auto operating costs, assuming 260 working days a year, fuel and non-fuel vehicle-operating costs for yearly-passenger travel (auto) can be expressed as follows:

$$\Delta VOC_t^{fuel} = FC \ x \ FE \ x \ \Delta VMT^{Auto}{}_t \ x \ 260$$

$$\Delta VOC_t^{Non-fuel} = NFC \ x \ \Delta VMT_t^{Auto} \ x \ 260$$

Hence, annual changes in vehicle-operating costs were expressed as follows:

$$\Delta VOC_t^{Auto} = \Delta VOC_t^{fuel} + \Delta VOC_t^{Non-fuel}$$

Emissions Costs

Air pollutant emissions include carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOC), particulate matters (PM), and oxides of Sulfur (SOx). These emissions react with other pollutants in the atmosphere, especially NOx and VOC, to form Ozone. VOC, SOx, and NOx, also react to form particulates. These pollutants cause damage to human health and can damage property as well. Some of the mobile source pollutants of concern are diesel particulate matter (PM) and volatile organic compounds (VOCs).

For truck emission savings, change in emissions costs is estimated as the product of emission cost per mile and change in vehicle-miles traveled. Emission cost per mile is the sum of per-miles costs of individual pollutants. Per-mile cost of individual pollutants can is estimated as cost per emission type multiplied by emission per mile (Table 3.7).

Table 3.7 Emission Cost Inputs

Emission Type	Cost By Emission Type ($/ton)[7]	Grams of Emissions Per Mile[8]	
		Auto	Truck
NOx	3	0.911	0.0036
Sox	16,000	0.0077	0.022
PM	16,800	0.0179	0.41
CO2	21.4[9]	411.1	1345.4
VOC	1,700	0.23	0.23

Source: Tiger III from U.S. DOT, MOVES Model Inputs, Executive Order 12866.

The emission costs are computed for freight transportation and total personal travel separately and then summed together. The equations that govern these calculations are:

$$\Delta EC_t = \Delta VMT_t^{TR} \; x \sum_{i=1}^{n} (EC_i \; x \; EP_i) \; x \; 365$$

Where

ΔEC_t = Annual change in emission cost per mile

ΔVMT_t^{TR} = Change in vehicle-miles between build and no-build scenarios

EC = Emission cost of emission type

EP = Emission per mile

For personal auto travel, the emission costs is

$$\Delta EC_t = \Delta VMT_t^{Auto} \; x \sum_{i=1}^{n} (EC_i \; x \; EP_i) \; x \; D$$

Where,

ΔVMT_t^{TR} = Change in vehicle-miles between build and no-build scenarios

[7] Costs of pollutants from U.S. DOT Tiger III Cost Standards. http://www.dot.gov/tiger/application-resources.html#BCAG

[8] Source of emission factors from MOVES Model standard factors for the U.S., retained by Cambridge Systematics.

[9] Cost of CO2 is from social cost of carbon for regulatory impact analysis under Executive Order 12866. http://www.epa.gov/OMS/climate/regulations/scc-tsd.pdf

D = number of working days: commute and business trips (260 days) and nonwork trips (365 days)

Pavement Damage Costs

Pavement damage is proportional to the weight of wheel axles that utilize the roadway. Therefore, trucks cause much more pavement damage per mile than autos. The Federal Highway Administration's Highway Cost Allocation Study estimates a pavement maintenance price of $0.01 per automobile VMT, and $0.031 per 40,000 pound truck VMT.[10]

Construction and Operations & Maintenance Costs

The cost to develop a roadway includes capital and operation and maintenance costs. The relevant costs for this Plan are construction costs and incremental operation and maintenance costs. All projects are assumed to have a five-year construction period (2015-2019) and operation commencement in 2020, and 30-year life span such that there is no residual value of the assets by 2050.

Table 3.8 provides development costs for all of the capacity enhancement highway projects.

Table 3.8 Construction and Operation and Maintenance Cost by Projects
Millions of 2011 Dollars

Type	Project	Capital Cost	Annual OM Cost	Total OM Cost	Total Project Cost
Long Haul	I-75 Atlanta-Chattanooga	$ 2,700	$ 19	$ 570	$ 3,270
Long Haul	I-75 Atlanta-Macon	$ 1,086	$ 17	$ 510	$ 1,596
Long Haul	I-85 Atlanta-SC Line	$ 1,157	$ 15	$ 450	$ 1,607
Long Haul	I-85 Atlanta-AL Line	$ 1,177	$ 13	$ 390	$ 1,567
Long Haul	I-75 Macon-FL Line	$ 1,000	$ 28	$ 840	$ 1,840
Long Haul	I-16 Macon-Savannah	$ 1,900	$ 54	$ 1,620	$ 3,520
Long Haul	I-20 Atlanta-AL Line	$ 800	$ 10	$ 300	$ 1,100
Long Haul	I-20 Atlanta-SC Line	$ 2,945	$ 23	$ 690	$ 3,635
Long Haul	I-95 (entire stretch)	$ 1,620	$ 18	$ 540	$ 2,160
Long Haul	All Interstate Long Haul Projects	$ 14,385	$ 211	$ 6,330	$ 20,715
Smaller Urban and Rural Freight	U.S. 84	$ 55	$ 2	$ 60	$ 115
Smaller Urban and	SR 133	$ 278	$ 10	$ 300	$ 578

[10] http://www.fhwa.dot.gov/policy/otps/costallocation.htm.

Type	Project	Capital Cost	Annual OM Cost	Total OM Cost	Total Project Cost
Rural Freight					
Smaller Urban and Rural Freight	U.S. 280	$ 996	$ 16	$ 480	$ 1,476
Smaller Urban and Rural Freight	U.S. 441 from I-16 to I-85	$ 189	$ 4	$ 120	$ 309
Smaller Urban and Rural Freight	Fall Line Freeway	$ 86	$ 3	$ 90	$ 176
Bypass	Western Commercial Corridor	$ 3,135	$ 35	$ 1,050	$ 4,185
Bypass	Macon-Lagrange-US27 4-laning	$ 483	$ 12	$ 360	$ 843
Bypass	I-75 Bypass Around Chattanooga	$ 800	$ 13	$ 390	$ 1,190
Bypass	Northern Bypass	$ 2,663	$ 13	$ 390	$ 3,053

Source: TPRO, GDOT Costing Tool, GRIP Factsheets.

Discount Rate

Discount rate measures the cost of a dollar in the future relative to a dollar available in the current time. The opportunity cost is valued at 2.9 percent for this Plan. The annual benefit and costs associated with the projects are discounted at 2.9 percent to present 2011 dollars.

Benefit-Costs Analysis

Since VHT and VMT values are available for the years 2020 and 2050, benefits are determined for these two years separately, the benefits for intermediate years are then determined using linear interpolation. The benefits for the 30 years are then accrued by determining the net present value (NPV) for year 2020. The formula to generate these values are provided below.

$$NPV = P\left(\frac{1-(1+r)^{-(n-1)}}{r}\right) +$$

Where P = benefit of year 2020

r = discount rate (2.9%)

n = number of years between 2020 and 2050 (30 years)

The NPV generated will be in 2020 dollar terms, and therefore need to be brought back to 2011, or real present value terms, using this formula:

$$NPV_{2011} = NPV_{2020}\left(\frac{1}{(1+r)^{n-1}}\right)$$

Where r = discount rate (2.9%)

n = number of years between 2011 and 2020 (9 years)

A ratio of the present value of benefits to the present value of costs is the benefit-cost ratio (BCR). A BCR greater than one means the benefits associated with the project outstrips the associated cost, hence the investment is viable. The BCR can simply be calculated by dividing the NPV with total project cost for each project. Table 3.9 shows the results of the BCA calculation for the medium truck scenario, and Table 3.10 shows the results for the high truck scenario. Note that the B/C ratio for the Fall Line Freeway alternative is negative due to the increased vehicle operating costs outweighing the congestion and safety benefits for the added roadway segment.

Table 3.9 B/C Analysis for Capacity Expansion Projects
Medium-Growth Scenario

Type	Project	Benefit (2011) – Millions	Capital Cost – Millions	Total OM Cost – Millions	B/C
Long Haul	I-85 Atlanta-SC Line	$ 2,913	$ 1,157	$ 457	1.81
Long Haul	I-20 Atlanta-AL Line	$ 1,651	$ 800	$ 287	1.52
Long Haul	I-85 Atlanta-AL Line	$ 2,060	$ 1,177	$ 382	1.32
Long Haul	I-75 Atlanta-Macon	$ 1,977	$ 1,086	$ 508	1.24
Long Haul	I-20 Atlanta-SC Line	$ 3,305	$ 2,945	$ 685	0.91
Long Haul	I-95 (entire stretch)	$ 1,779	$ 1,620	$ 536	0.83
Long Haul	I-75 Macon-FL Line	$ 1,174	$ 1,000	$ 833	0.64
Long Haul	I-75 Atlanta-Chattanooga	$ 1,409	$ 2,700	$ 555	0.43
Long Haul	I-16 Macon-Savannah	$ 978	$ 1,900	$ 1,619	0.28
Smaller Urban and Rural Freight	U.S. 84	$ 657	$ 55	$ 66	0.63
Smaller Urban and Rural Freight	SR 133	$ 1,648	$ 278	$ 289	0.63
Smaller Urban	U.S. 441 from	$ 537	$ 189	$ 134	0.62

and Rural Freight	I-16 to I-85				
Smaller Urban and Rural Freight	U.S. 280	$ 19	$ 996	$ 489	0.01
Smaller Urban and Rural Freight	Fall Line Freeway	$ (150)	$ 86	$ 90	(0.85)
Bypass	Macon-Lagrange-US27 4-laning	$ 4,459	$ 483	$ 361	5.29
Bypass	I-75 Bypass Around Chattanooga	$ 3,506	$ 800	$ 394	2.94
Bypass	Northern Bypass	$ 2,821	$ 2,663	$ 385	0.93
Bypass	Western Commercial Corridor	$ 2,897	$ 3,135	$ 1,057	0.69

Table 3.10 B/C Analysis for Capacity Expansion Projects
High Growth Scenario

Type	Project	Benefit (2011) – Millions	Capital Cost – Millions	Total OM Cost – Millions	B/C
Long Haul	»I-75 Atlanta-Chattanooga	$ 3,234	$ 2,700	$ 555	0.99
Long Haul	»I-75 Atlanta-Macon	$ 1,998	$ 1,086	$ 508	1.25
Long Haul	»I-85 Atlanta-SC Line	$ 12,011	$ 1,157	$ 457	7.44
Long Haul	»I-85 Atlanta-AL Line	$ 6,599	$ 1,177	$ 382	4.23
Long Haul	»I-75 Macon-FL Line	$ 3,690	$ 1,000	$ 833	2.01
Long Haul	»I-16 Macon-Savannah	$ 4,569	$ 1,900	$ 1,619	1.30
Long Haul	»I-20 Atlanta-AL Line	$ 5,166	$ 800	$ 287	4.75
Long Haul	»I-20 Atlanta-SC Line	$ 6,915	$ 2,945	$ 685	1.91
Long Haul	»I-95 (entire stretch)	$ 16,955	$ 1,620	$ 536	7.86
Smaller Urban and Rural Freight	U.S. 84	$ 168	$ 55	$ 66	2.00
Smaller Urban	SR 133	$ 1,668	$ 278	$ 289	2.45

and Rural Freight							
Smaller Urban and Rural Freight	U.S. 280	$	98	$	996	$	489	15.27
Smaller Urban and Rural Freight	U.S. 441 from I-16 to I-85	$	(33)	$	189	$	134	(6.00)
Smaller Urban and Rural Freight	Fall Line Freeway	$	(2,746)	$	86	$	90	(0.44)
Bypass	Western Commercial Corridor	$	10,283	$	3,135	$	1,057	0.07
Bypass	Macon-Lagrange-US27 4-laning	$	12,879	$	483	$	361	7.42
Bypass	I-75 Bypass Around Chattanooga	$	8,863	$	800	$	394	2.06
Bypass	Northern Bypass	$	6,288	$	2,663	$	385	(2.29)

3.4 Highway Projects Analyzed Using Off-Model Analysis

This section discusses the projects that could not be analyzed using the statewide travel demand model. A range of off-model techniques was used to estimate the traffic impacts of these projects. Benefits were then calculated for these alternatives using the same methodology as for the projects that were modeled. Highway projects that were analyzed using off-model techniques were interstate interchange improvement projects, a truck-friendly lane alternative on SR-6 in Atlanta, and safety-related projects.

Interchange Improvements

Interchange improvements were analyzed using off-model techniques that expanded upon existing data and previous interstate interchange analysis. For each interstate interchange, current congestion levels were estimated based on current truck and auto volumes combined with vehicle speed data provided in the ATRI Freight Performance Measurement database. The amount of delay reduction at each interchange was estimated based on a sample of previous simulation runs conducted at similar interstate interchanges.

The changes in delay under build and no build conditions were used to generate benefits in a similar fashion as for the modeled projects. The benefits were then combined with estimated costs to determine benefit-cost ratios for each project.

Table 3.11 B/C Analysis Results of Interchange Improvement Projects

	2020 Change		2050 Change					
Project	Auto VHT	Truck VHT	Auto VHT	Truck VHT	Benefit (2011) – Millions	Capital Cost – Millions	Total OM Cost – Millions	B/C
Atlanta, GA: I-285 at I-85 (North)	-11,988	-2,396	-29,098	-5,815	$1,955	$200	$120	6.11
Atlanta, GA: I-75 at I-285 (North)	-8,016	-1,774	-19,457	-4,306	$1,411	$200	$120	4.41
Atlanta, GA: I-20 at I-285 (West)	-4,015	-1,331	-9,746	-3,230	$ 974	$382	$229	1.59
Atlanta, GA: I-20 at I-285 (East)	-3,890	-840	-9,441	-2,040	$672	$109	$65	3.85
Macon, GA: I-16 at I-75	-87	-23	-210	-55	$17	$ 291	$174	0.04
Savannah, GA: I-95 at I-16	-154	-53	-373	-129	$ 39	$73	$44	0.33
Atlanta, GA: I-285 at I-85 (South)	-1,106	-364	-2,685	-884	$ 267	$240	$144	0.69
Atlanta, GA: I-75 at I-285 (South)	-1,756	-493	-4,262	-1,196	$ 372	$240	$144	0.97
Savannah, GA: I-95 at SR 21	-128	-47	-310	-113	$ 34	$ 73	$ 44	0.29

SR 6 Truck-Friendly Lanes

Roadway access to and from intermodal rail yards is critical to ensure reliability of goods movements for the supply chain. In the Atlanta region, most intermodal yards are closely located to interstates, and therefore interstate improvement solutions can help address access issues to/from these intermodal yards. One exception is the Austell intermodal terminal, which connects to I-20 using SR 6. This highway has high volumes of both truck and auto traffic as it is also used by commuters in the suburban city of Austell to get to Atlanta. Operational improvements recommended for this roadway include[11]:

- Improve signal timing to improve truck travel time reliability
- Separation of truck and automobile traffic
- Reduce truck stops and eliminate "dilemma zones".
- Reduce truck rollovers at intermodal center access.
- Improve visibility of traffic control and guidance for autos.

These listed benefits do not easily lend themselves to quantification using a benefit-cost ratio. However, based on the current poor level of service of SR-6 and the key intermodal facility located on it, this is a significant freight

[11] 2011 SR 6 Truck Friendly Lanes Study

improvement project that is recommended for inclusion into the Statewide Freight & Logistics Plan.

Highway Safety Improvements

Across the median crashes are generally high in severity and can easily occur on long stretches of highways where there are minimal physical barriers between the two directions of travel. In such cases, installation of median barriers may be one safety improvement to consider to reduce the severity of crashes.

To quantify the benefit of improving median barriers, the methodology outlined in the study *Median Treatment Study on Washington State Highways* is used.[12] The benefit of the median barrier will be the reduced societal costs of crashes. Safety values obtained from GDOT are again used to quantify the cost of crashes by severity category.

The savings in cost is calculated by assuming that the severity of post-installation crashes will reduce from fatal to injury crashes. While the WSDOT study breaks down cost by different injury categories, for our purposes only one injury and fatality cost is used. This means that savings from several injury to light injury costs are not accounted for, and that our estimate of safety savings is likely to be a conservative one.

The next step is to determine the number of crashes that run across the roadway. For this, the GDOT crash database from 2005 to 2008 are used, and crashes under first harmful event of "colliding with motor vehicle in motion in other roadway" are counted. It is found that there are 1,334 property-damage-only crashes, 618 injury crashes, and 27 fatal crashes. Within the 618 injury crashes, there are 35 severe injury crashes and 583 injury crashes. Safety savings were then calculated from the 27 fatal crashes only. The annual benefit resulting from the reduced crash costs is $35,898,875.

The cost of the installation of three median barrier types was obtained from GDOT, along with their annual maintenance costs. These figures are shown in Table 3.12 below.

Table 3.12 Costs for Median Barrier Improvements

Type of Barrier	Construction Costs (Per Mile)	Annual Maintenance Costs (per Mile)
Cable Barrier	73,920	1,880
Guardrail	79,200	270
Concrete Barrier	1,056,000	43

[12] Source: http://www.wsdot.wa.gov/research/reports/fullreports/516.1.pdf

The next step is to identify the highway sections where installing the barriers will have the most significant impact. GDOT's 2009 Roadway Classification file is used to act as a general guide to determine the mileage of highways. The criteria used (adopted from the WSDOT study) to determine sections of highway that are recommended to install barriers include the following:

- AADT greater than 5,000 vehicles
- Median width of less than 50 ft
- Speed limit of greater than 45 mph
- Roadways with no median or with only curb median

This generated 2,740 miles of roadway in Georgia. Note that this value is a general estimation since the RC file has missing data, and the criteria used are approximate. Manual verification needs to be conducted to determine sections of highways eligible for barrier installation, in the event that a more detail B/C analysis is to be performed.

B/C Ratio calculation

The B/C ratio can be calculated using this formula from the WSDOT study:

$$BC\ Ratio = \frac{(Benefits * 13.59)[present\ worth\ factor]}{cost_I + cost_M\ * 13.59\ [present\ worth\ factor]}$$

Table 3.13 B/C Estimation for Median Barrier Installation

	Construction Costs (Per Mile)	Annual Maintenance Costs (per Mile)	Cost Construction ($ millions)	Cost Main ($ millions)	Benefit-Cost Ratio
Cable Barrier	73,920	2,371	202	6.5	1.72
Guardrail	79,200	340	217	0.9	2.18
Concrete Barrier	1,056,000	54	2,893	0.1	0.17

Georgia Towing and Recovery Incentive Program (TRIP)

TRIP is a quick clearance incentive program to pay heavy-duty recovery companies a monetary bonus for removing commercial vehicle incidents from the traffic stream within 90 minutes. Prior to the implementation of this program, clearance of commercial vehicle incidents could often take several hours which would cause significant delay for vehicles using the roadway where the incident occurred.

The TRIP program operates on I-285, all interstates inside the perimeter including GA-400 and GA-166. It also operates for 5-10 miles on radial interstate segments just outside of I-285 on most interstates. In its first full year, this program successfully reduced incident clearance time for commercial vehicle incidents by two-thirds. This faster incident clearance time improves highway operations for both trucks and autos that use the roadway. Expanding this program to cover a larger portion of the Atlanta metropolitan region will extend the geographic scope of these benefits.

3.5 Air Cargo Related Improvements

Add Warehouse Capacity at Hartsfield-Jackson Atlanta International Airport

To accommodate future air cargo growth at the Atlanta airport, air cargo staff have identified the need to develop more warehouse space on airport property. This project will allow for additional short-term storage of goods in between flight arrivals/departures and truck arrivals/departures at the airport. As air cargo volumes continue to increase at the Atlanta airport, more of these types of facilities will be needed. The cost for this facility was estimated at $10 to $15 million based on discussions with air cargo staff at the Atlanta airport.

Extend Southwest Georgia (Albany) Airport Runway

This project is described in the 2010 Southwest Georgia Airport Masterplan. The estimated cost for the runway extension is just under $5 million. The benefits cannot be easily quantified until changes in air cargo volumes materialize at this airport. However, extending the runway can improve current operations and serve as a business retention/recruitment vehicle for southwest Georgia.

4.0 Freight Packages

The previous chapter described the analysis of several projects using the statewide model and off-model techniques. This chapter identifies which of those projects will become priority freight projects based on this analysis along with feedback from our stakeholder group and technical analysis conducted for the modal profiles.

After identifying priority freight projects, the projects are grouped into packages to develop sets of projects that are complementary and will benefit key truck flow patterns in the state.

4.1 Identifying Priority Freight Projects

Table 4.1 provides a list of the alternatives analyzed in this Plan along with whether or not the project became a priority freight project and the rational for its designation. Projects that are marked as priority are then grouped into modal and geographic packages in the next section.

Table 4.1 Identification of Priority Freight Projects

Project Category	Project	B/C Ratio (or other benefit)	Priority Freight Project?	Rationale
Port	Savannah Harbor Expansion Project	$2.8 billion in transportation cost savings	Y	High return on investment, stakeholder input makes this the top freight priority in the state
Port	Develop Jasper Port	$9 billion in tax receipts	Y	High return on investment, needed to maintain Savannah growth momentum
Rail	Develop systemwide rail improvements	3.30	Y	High B/C ratio. Need to accommodate future rail growth
Highway – Long Haul	I-85 Atlanta-SC Line	1.81	Y	High B/C ratio. High truck volumes.
Highway – Long Haul	I-20 Atlanta-AL Line	1.52	Y	High B/C ratio. High truck volumes
Highway – Long Haul	I-85 Atlanta-AL Line	1.32	Y	High B/C ratio. High truck volumes
Highway – Long Haul	I-75 Atlanta-Macon	1.24	Y	High B/C ratio. High truck volumes
Highway – Long Haul	I-20 Atlanta-SC Line	0.91	N	Low B/C ratio. Long-term capacity sufficient
Highway – Long Haul	I-95 (entire state)	0.83	N	Low B/C ratio. Long-term capacity sufficient
Highway – Long Haul	I-75 Macon-FL line	0.64	N	Low B/C ratio. Long-term capacity sufficient
Highway – Long Haul	I-75 Atlanta-TN Line	0.43	N	Low B/C ratio. Long-term capacity sufficient
Highway – Long Haul	I-16 Macon-Savannah	0.28	N	Low B/C ratio. Long-term capacity sufficient
Highway- Smaller Urban and Rural Freight	U.S. 84	0.63	Y	High B/C ratio. Important truck route

Project Category	Project	B/C Ratio (or other benefit)	Priority Freight Project?	Rationale
Highway- Smaller Urban and Rural Freight	SR 133	0.63	Y	High B/C ratio. Important truck route
Highway- Smaller Urban and Rural Freight	U.S. 441	0.62	Y	High B/C ratio. Important truck route
Highway- Smaller Urban and Rural Freight	U.S. 280	0.01	N	Low B/C ratio.
Highway- Smaller Urban and Rural Freight	Fall Line Freeway	-0.85	N	Low B/C ratio
Highway – Bypass	Macon – LaGrange-U.S. 27 4-laning	5.29	Y	High B/C ratio. Additional east-west capacity needed
Highway – Bypass	I-75 Bypass Around Chattanooga	2.94	Y	High B/C ratio. Concurrency with existing plans.
Highway – Bypass	Northern Bypass	0.93	N	Low B/C ratio. Autos received most benefits.
Highway – Bypass	Western Bypass	0.69	N	Lower B/C ratio than Macon-Lagrange connector with U.S. 27
Highway – Interchange	Atlanta, GA: I-285 at I-85 (North)	6.11	Y	High B/C ratio. Key truck interchange.
Highway – Interchange	Atlanta, GA: I-285 at I-75 (North)	4.41	Y	High B/C ratio. Key truck interchange.
Highway – Interchange	Atlanta, GA: I-285 at I-20 (West)	1.59	Y	High B/C ratio. Key truck interchange.
Highway – Interchange	Atlanta, GA: I-285 at I-20 (East)	3.85	Y	High B/C ratio. Key truck interchange.
Highway – Interchange	Atlanta, GA: I-285 at I-85 (South)	0.04	N	Low B/C ratio.
Highway – Interchange	Atlanta, GA: I-285 at I-75 (South)	0.33	N	Low B/C ratio.
Highway – Interchange	Macon, GA: I-75 AT i-16	0.69	Y	Stakeholder feedback indicated that this is an important interchange
Highway – Interchange	Savannah, GA: I-95 at I-16	0.97	Y	Important connector to Savannah Port
Highway – Interchange	Savannah, GA: I-95 at SR 21	0.29	Y	Important connector to Savannah Port
Highway – Operational	SR-6 Truck Friendly Lanes	n/a	Y	Concurrency with planning efforts for Atlanta regional planning agency
Highway – Operational	Improvements to Median Barriers	n/a	Y	Low cost safety improvement alternative
Highway – Operational	Expand TRIP Program	n/a	Y	Highly successful program in reducing incident clearance times
Air Cargo	Build additional warehouse in ATL	Additional air cargo storage capability	Y	Stakeholder feedback indicated this to be the priority air cargo project in Atlanta
Air Cargo	Extend runway at ABY	Additional air cargo aircraft capabilities	Y	Stakeholder feedback indicated this to be the priority air cargo project in Albany

4.2 Grouping Highway Projects into Packages

Highway projects were grouped into packages based on geographic location along priority highway corridors in the state. The most significant freight flows in the state based on truck tonnage and key freight facilities can be ranked into the following seven corridor categories:

1. Savannah-to-Atlanta Corridor
2. Atlanta-to-Tennessee Corridor
3. Atlanta-to-South Carolina Corridor
4. Macon-to-Florida Corridor
5. Atlanta-to-Alabama Corridor
6. Through Freight Corridors
7. Smaller Urban and Rural Freight Corridors

Figure 4.1 shows the first five of these corridors. A map of the smaller urban and rural freight corridors is shown in Figure 4.2. Table 4.2 shows the recommended projects in each of the corridors.

Table 4.2 Projects Included in Each of the Highway Corridors

Corridor	Projects Included
Savannah-to-Atlanta	I-75 btwn Atlanta metro and Macon metro, Interchanges: I-75@I-16, I-95@I-16, I-95@SR21, last mile connectors
Atlanta-to-Chattanooga	Interchange: I-75@I-275 North
Atlanta-to-South Carolina	I-85 btwn Atlanta metro and SC, Interchange: I-85@I-285 North, I-20@I-285 East
Macon-to-Florida	No highway improvement projects recommended
Atlanta-Alabama	I-20 btwn Atlanta metro and Alabama, I-85 btwn Atlanta metro and Alabama, Interchange: I-20@I-285 West
Through Freight Corridors	Chattanooga Bypass, Macon-Lagrange Connector, U.S. 27 4-Laning
Smaller Urban and Rural Freight Corridors	4-laning of U.S. 84, U.S. 441, SR 133, Safety improvements off the interstate system

Figure 4.1 Map of Significantly Highway Corridors

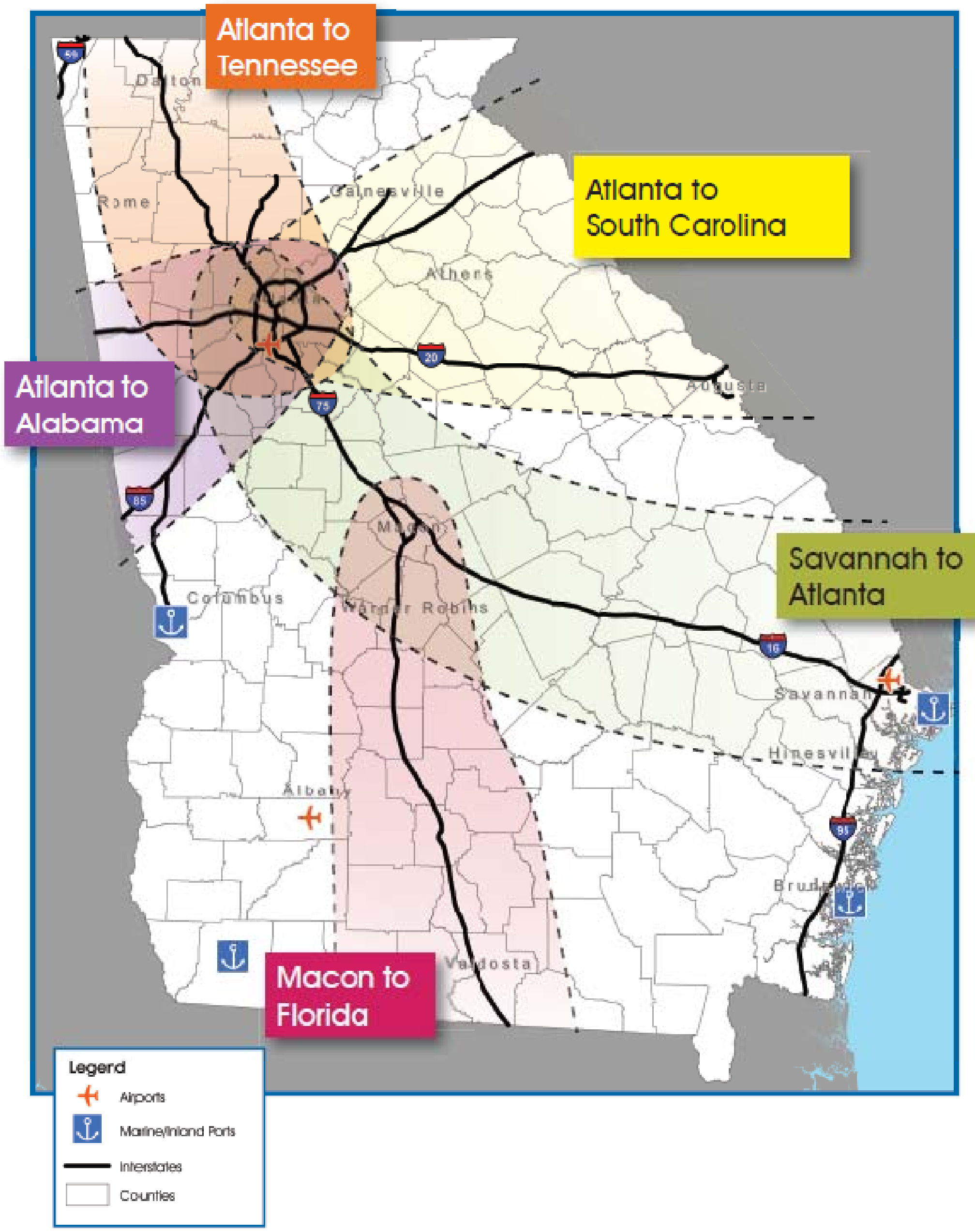
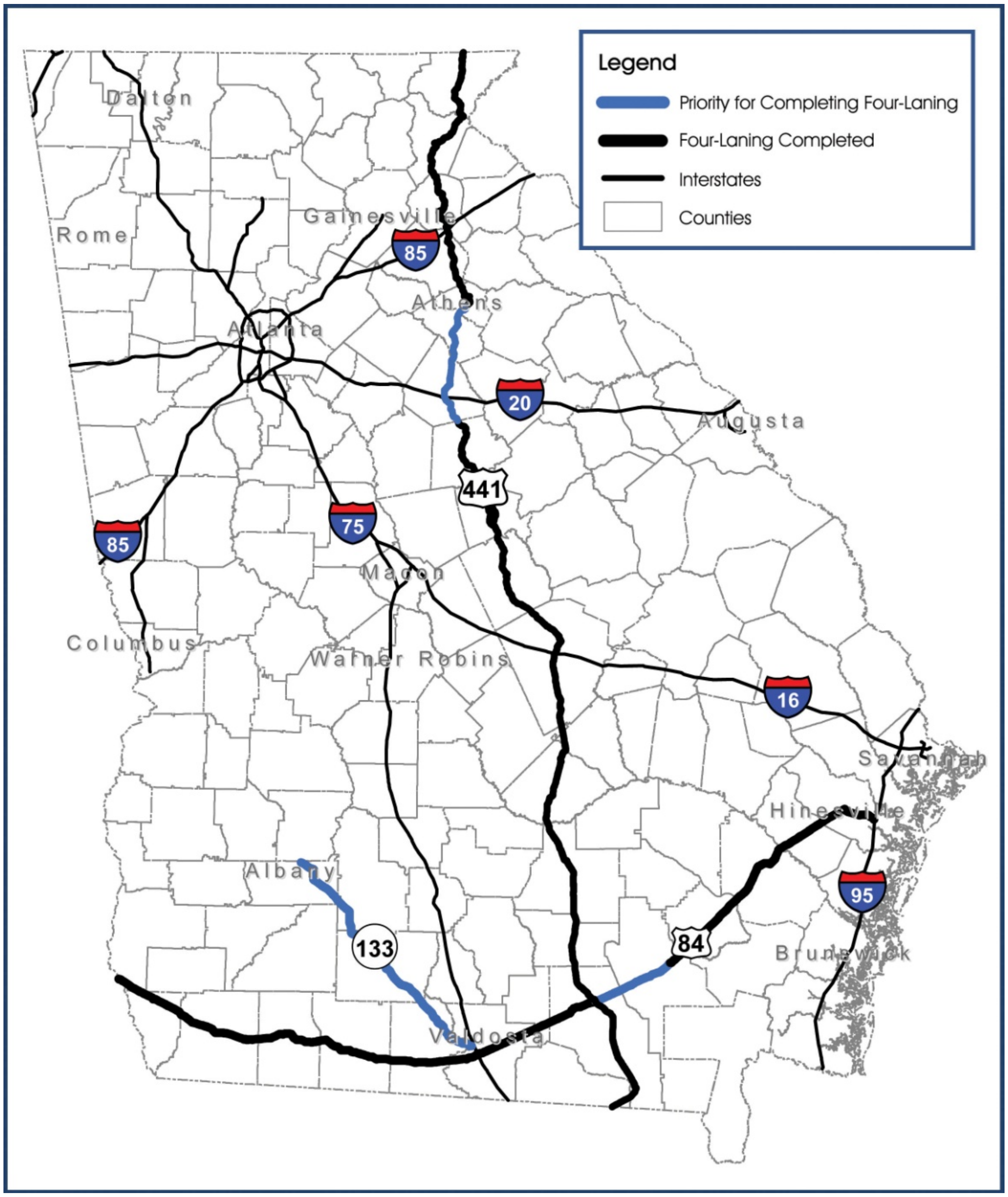


Figure 4.2 Map of Smaller Urban and Rural Freight Corridors



5.0 Economic Impact Analysis

5.1 Overview of Methodology

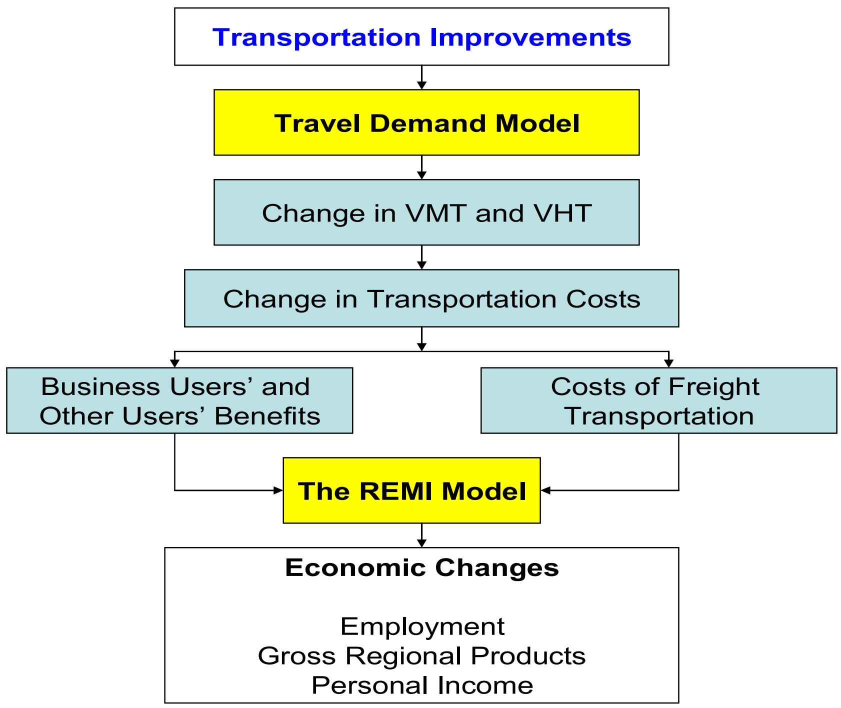
The tool used to model the economic impact of highway improvement projects and to calculate the return on investment is the REMI Transight Macroeconomic Simulation Model. The fundamental structure of the REMI model incorporates detailed inter-industry transactions of intermediate goods in the production process, and interrelated final demand feedbacks that captures the dynamic relationship between income and spending. The REMI model is appropriate for analyzing the regional economic impacts of the investment packages because the model accounts for how relationships between prices, costs of doing business, and demographic variables interact with other important economic variables such as employment, gross regional product, and personal income to influence economic performance.

To estimate the economic impact of the investments, travel efficiency gains are mapped to households and businesses, depending on the beneficiary. Travel efficiency gains arising from personal travels (commute and nonwork related trips) are disaggregated into explicit (out-of-pocket) and implicit gains (savings). Explicit gains associated with safety, vehicle operating costs and travel time are mapped to households. In accordance with U.S. Department of Transportation guideline, only half of the travel time gain are mapped to households. These gains serve as input into REMI as changes in consumer spending in order to estimate total impact due to households.

Similarly, travel efficiency gains arising from business related trips (trucks and business related auto trips) are mapped to industry. The gains or savings mapped to industry is further distributed across various industries in Georgia based on each industry's dependency on transportation usage. Each industry's dependency on transportation usage is equivalent to its transport cost relative to output, and it is estimated as the product of transportation cost per dollar of output and the industry's output. For this study, transportation cost per dollar of output provided by the Transportation Satellite Accounts (TSA) in conjunction with 2009 output provided by REMI are utilized to estimate the relative cost of transportation across industry. Industry related savings serve as input into REMI as changes in business cost. The resulting total impacts are expressed as changes in employment, gross state product (GSP), and personal income.

Economic impact is measured as changes in economic activity in a given region, arising from a project or a change in policy. It can be expressed in various economic variables including sales (output), employment, and personal income (earnings). Reduction in transportation cost and improved connectivity to domestic and international markets arising from roadway capacity expansion increases output of firms (especially export oriented manufacturing industries) and increases demand for key factors of production including labor, materials, equipment, and supporting downstream activities which are supplied by other local and non-local firms. This chain of activities leads to local economic contraction through increased employment, personal income, and business profits. Generally, total assessment of economic impacts comprises estimation of three impact types, namely direct, indirect and induced. The relationship between the Travel demand model, REMI and the various input and output variables are shown in Figure 5.1.

Figure 5.1 Analytical Framework for Benefit-Cost and Total Economic Impact Analyses for Proposed Corridor Investments



Direct Impacts

Direct impacts associated with roadway capacity improvement are the direct effects of changes in output (sales) or production cost, and spending in key economic industries including wholesale and retail trades, manufacturing, and transportation and logistics. For instance, the direct effect of improved roadway to a manufacturing firm is the reduction in crew and inventory costs.

To estimate the economic impact of the proposed study, the user benefits are disaggregated into explicit and implicit benefits. The explicit benefits are mapped to the beneficiaries. This implies that explicit benefits accruing to commute and non-work related personal travels are mapped to households, while those associated with truck and business related personal travels (changes vehicle operating costs, safety cost, and travel time) are mapped to industry.

Explicit cost mapped to industry is further distributed across industry based on each industry's transportation usage, determined by transport cost relative to output. This is estimated as the product of transportation cost per dollar of output and the industry's output. For this study, transportation cost per dollar of output provided by the Transportation Satellite Accounts (TSA) in conjunction with 2009 output for Georgia provided by REMI are utilized to estimate the relative cost of transportation across industry. The equation below provides the basis for distributing the explicit benefits across industry. Each industry's share of benefit represents change in cost of doing business (or production cost)

$$\Delta V_i = \Delta V^{Total} \; x \; \frac{C_i Q_i}{\sum_i^n C_n Q_n}$$

Where,

ΔV_i = Cost change associated with industry i

ΔV^{Total} = Industry cost change (aggregate)

C_i = Transportation cost per dollar of output, reported by the Transportation Satellite Account

Q_i = Output of industry i (2009 output reported by REMI)

The explicit cost savings across industry serves as input into as a reduction in production cost for economic simulation and estimation of economic impacts.

Similarly, changes in explicit benefits associated with personal travels (except business related) are mapped to households. These changes are entered in REMI as changes in consumer spending for simulation and estimation of economic impacts.

Indirect and Induced Impacts

As business sale increases, demand for key input materials also increases in tandem, and vice versa. Therefore, the indirect impact associated with increased business sale (output) is estimated or referred to as increase in demand (purchases) for key input materials by local firms who are the direct suppliers to these businesses. For example, increased construction activities increase the demand (purchases) for steel, concrete, timber, fuel etc. Consequently, spending on factors of production stimulate expansion of businesses downstream of the production chain. Accordingly, changes in output, employment, and income arising from these expansions are considered to be indirect impacts.

Direct and indirect impacts are the sources of induced impacts, and it normally constitutes the largest portion of total impacts. Changes in output, employment, and income, stemming from household consumption of goods and services are induced impacts. Similar to indirect impacts, increase or decrease in personal consumption also lead to increase or decrease in business sales (output). This chain of activities also translates into changes in employment, and income.

Output from REMI simulation provides total economic (direct, indirect and induced) impact associated with the project.

5.2 Summary of Results for Highway Corridor Packages

The economic impacts in terms of job growth and Gross State Product (GSP) growth for each package of projects are shown in Table 5.1 below. In addition, the return on investment (ROI) is also calculated as the ratio between total long term economic benefit and total cost. It tells us, for one unit of cost, how many units of long term benefits can we get.

Table 5.1 Summary of Economic Impact Analysis Results

Corridor	Projects Included	Cost ($Millions)	Increase in GSP ($Millions)	Increase in Employment (Annual)	ROI
Savannah-to-Atlanta	I-75 btwn Atlanta and Macon, Interchanges: I-75@I-16, I-95@I-16, I-95@SR21, last mile connectors	$1,950	$9,100	2,426	4.7
Atlanta-to-Chattanooga	Interchange: I-75@I-285 North	$200	$90	39	0.4
Atlanta-to-South Carolina	I-85 btwn Atlanta and SC, Interchange: I-85@I-285 North	$1,400	$7,200	1,901	7.3
Macon-to-Florida	No highway improvement projects recommended	n/a	n/a	n/a	n/a
Atlanta-Alabama	I-20 between Atlanta metro and Alabama, I-85 btwn Atlanta and Alabama, Interchange I-20@I-285 West	$ 2,000	$9,800	2,443	4.0
Chattanooga Bypass	Chattanooga Bypass	$800	$6,400	1,681	10.7
Macon Lagrange U.S. 27 4-Laning	Macon Lagrange U.S. 27 4-Laning	$ 480	$11,300	2,738	18.0
Smaller Urban and Rural Freight Corridors	U.S. 84, SR 133, portions of U.S. 441	$522	2,180	508	4.2

6.0 Summary Freight Recommendations

By investing $18-20 billion over the next 40 years in new Interstate capacity, new rail terminals and line haul capacity, improved Interstate interchanges, limited access bypasses, and high volume rural freight corridors, the State could generate over $77 billion in additional economic output and thousands of new jobs. The table below lists the recommended projects in this plan. Table 6.1 lists the project categories for each mode along with costs and benefits.

These benefits include the economic benefits that will accrue from the two large port improvement projects: deepening the Savannah Harbor and building a new port in Jasper. The Savannah Harbor Expansion Project General Reevaluation Report has estimated that the harbor deepening will result in over $2 billion in transportation cost savings. The March 2011 Jasper Ocean Terminal Update estimated that the new port would generate over $9 billion in additional tax revenue and over one million jobs to Georgia and South Carolina. These benefits are only a portion of the total economic benefits that the port improvement projects will bring to the State of Georgia.

Table 6.1 Summary of Recommended Improvements

Mode	Projects and Project Categories Included	Cost ($Millions)	Increase in GSP ($Millions) or Other Benefits
Port	Deepen Savannah Harbor	550	$2,800 billion in transportation cost savings
	Develop Jasper Port	4,000	$9 billion in additional tax receipts for Georgia and South Carolina
Rail	Develop Crescent Corridor	4,000 to 6,000	13,200 to 19,800
	Improvements to other terminals and main lines		
Highways	Add capacity to select long-haul corridors	9,542	52,480
	Improve congested interstate interchanges		
	Develop key bypass routes		
	Improve key smaller urban and rural freight corridors		
	Improve last-mile connectors in Savannah and Atlanta		
	Highway Safety Improvements		
Air Cargo	Add warehouse capacity in Atlanta	15 to 20	Additional air cargo capabilities
	Lengthen airport runway in Albany		
TOTALS		18,017 to 20,112	65,680 to 72,280

Note: Increase in GSP does not include benefits from marine port or air cargo improvements

6.1 Funding Freight Improvement Projects

Identifying funding for freight projects is a challenge. There are a variety of potential sources that differ somewhat for each of the freight modes:

- Nationally, several port-related projects have been funded by the Harbor Maintenance Trust Fund. However, the appropriations from this fund have been inadequate to fund the full range of national port needs. Therefore, major harbor deepening projects such as the proposed Savannah harbor deepening have more often been funded through general funds at the Federal and state level. The State of Georgia has committed a portion of the funds required for deepening the harbor, while the remainder of these funds are expected to be provided by the Federal government based on the national need to expand the export and import capabilities of the Savannah port complex.
- The vast majority of freight railroad projects will be funded by the private sector. However, the initial round of the American Recovery and

Reinvestment Act (ARRA) provided over $100 million for the development of the Crescent Corridor primarily focused on developing new intermodal rail yards in Birmingham and Memphis. A handful of other freight-related projects were also funded through the ARRA program. There may be the potential for future Federal grant related sources to be targeted towards freight rail as well, particularly as improvements are made to accommodate passenger rail service on freight rail lines.

- Highway projects that benefit freight are eligible for the same funds as other highway program projects. They often require a financial plan that includes a variety of funding sources. Many states utilize a mix of motor fuel taxes, sales taxes, parking fees, license tag fees, registration fees, tolls, and public-private partnerships to fund highway projects. However, as noted in the GDOT Statewide Strategic Transportation Plan, Georgia's share of non-motor fuel tax revenues has historically been relatively low compared to other states in the U.S. Recently, Georgia's State Legislature passed the Transportation Investment Act (TIA) of 2010 which has the potential to increase funding for transportation in Georgia by over $18 billion over the next 10 years. This is discussed below in more detail.
- Air cargo projects are also paid for through a combination of Federal, state, and local funding. Development of on-airport warehouse building facilities are typically paid for by the airport operators (e.g., the City of Atlanta for the Atlanta airport) and then reimbursed through rental contracts over time. Runway extensions, such as the one needed in Albany, are funded through a combination of FAA and local funding. However, outside sources of funding are also possible, and can accelerate projects that are considered to be critical.

Several of the projects on these lists coincide with the recommended freight improvement projects listed in this Freight & Logistics Action Plan. Therefore, the passage of TIA throughout the State will also be a key driver in the implementation of many projects recommended by the Freight & Logistics Action Plan.

Transportation Investment Act of 2010

In response to historically low levels of funding for transportation projects in Georgia, the Georgia State Legislature passed the Transportation Investment Act (TIA) of 2010. This plan creates 12 special tax districts in Georgia, and gives each district the ability to levy a one percent sales tax for up to 10 years to fund transportation projects in its region. The sales tax must be approved by majority vote in each district based on an election scheduled to be held in July of 2012. The money raised in each district must be used on transportation projects in the district. It is estimated that if the TIA project lists are passed in all 12 Georgia districts that over $18 billion of new transportation funding will be generated over the next 10 years.

Each of the 12 districts has identified a list of projects that will be included on the ballot later this year. Approximately $500 million of the projects on the TIA project lists overlap with the recommended freight improvement projects from the Freight & Logistics Action Plan. The passage of the TIA project lists throughout the State will accelerate the implementation of the Freight & Logistics Action Plan. However, the vast majority of the funding for these recommendations will need to come from other sources.

6.2 Potential Freight & Logistics Action Plan Timeline

Based on feedback from the private sector, information from previous studies, and the return-on-investment analysis discussed earlier in this report, a potential timeline for the Freight & Logistics Plan was developed. The timeline is shown below in Table 6.2.

Table 6.2 Potential Freight & Logistics Action Plan Timeline

		2012-2020	2021-2030	2031-2040	2041-2050
Marine Port Improvements	Deepen Savannah Harbor	○			
	Develop Jasper Port		○		
Rail Improvements	Line Haul Expansion	○	○	○	○
	Intermodal and Carload Terminal Expansion	○	○	○	○
	Increase Weight Limits and Vertical Clearances	○	○		
Interstate Interchange Improvements	I-285 @ I-75 North		○		
	I 285 @ I 85 North	○			
	I-285 @ I-20 West	○			
	I-285 @ I-20 East		○		
	I-75 @ I-16 in Macon	○			
	I-95 @ I-16 in Savannah	○			
	I-95 @ SR 21 in Savannah	○			
Long-Haul Highway Corridor Improvements	I-85 between Atlanta Metro and South Carolina	○	○		
	I-75 between Atlanta Metro and Macon metro			○	
	I-85 between Atlanta Metro and Alabama				○
	I-20 between Atlanta Metro and Alabama				○
Highway Bypasses	Chattanooga Metro Bypass		○		
	Macon-LaGrange – U.S. 27			○	
Rural and Smaller Urban Highway Corridor Improvements	Complete 4-laning U.S. 84	○			
	4-laning SR 133 from Albany to Valdosta		○		
	4-laning U.S. 441 fro I-85 to I-16		○		
	Safety Improvements	○			
Air Cargo Improvements	Additional Air Cargo Warehouse at Atlanta Airport	○			
	Extend Runway at Southwest Georgia Airport in Albany	○			

1.0 Highlights of Freight & Logistics Plan

Over the course of the development of the Georgia Statewide Freight & Logistics Plan, several themes have been identified and reinforced in regards to the importance of goods movement in Georgia. These themes can be used to guide future policy and funding discussions regarding the Freight & Logistics Action Plan. It can also be used to guide the incorporation of freight and logistics into future work conducted by GDOT, the Georgia Department of Economic Development, and other state agencies. These highlights include the following:

- Georgia has a world-class freight infrastructure that is critical to the State's economic competitiveness. This infrastructure was developed through several decades of outsized investment by both the public and private sector. Over the last 20 years, this investment has decreased, and this has in part been a contributor to the economic stagnation of Georgia relative to the rest of the U.S. since 2000.

- By investing $18-$20 billion over the next 40 years in freight improvement projects, the State could generate over $65 billion in additional economic output and thousands of new jobs. This is consistent with the conclusion of the GDOT Statewide Strategic Transportation Plan and the Investing in Tomorrow's Transportation Today "IT3" initiative.

- The deepening of the Savannah Harbor is the top freight priority for Georgia. The importance of this project for Georgia's economic competitiveness was reinforced both through technical analysis conducted by the U.S. Army Corps of Engineers and several rounds of input from the private sector as part of the Freight & Logistics Action Plan.

- The vast majority of goods moved in Georgia are carried by truck. Interstate mobility is the critical need for Georgia's trucking industry, and adding capacity to I-85 between the Atlanta metropolitan region and the South Carolina border is the greatest need in the State's long-haul corridor network.

- Freight rail is funded and operated by the private sector, but the efficiency of its operation has a tremendous impact on the competitiveness of shippers in Georgia. Improvements in the State's rail track and rail terminals are needed over the long haul to continue to move goods effectively using the rail mode.

- Air cargo moves a very small fraction of the overall tonnage in the State. However, it is typically high-value, time-sensitive goods that can form a critical link in shipper supply chains. Georgia will need to maintain adequate access to air cargo facilities to ensure that this mode operates effectively.

- Funding the Freight & Logistics Action Plan will be a challenge. The recently enacted Transportation Investment Act of 2010 will allow for Georgia's general public to vote on a list of projects that includes a portion of the recommended freight improvement projects identified in the Freight & Logistics Action Plan. However, the vast majority of recommended freight improvement projects will require alternative funding sources.