

Summary Report #1 (Tasks 1-3)
2016 Alabama Statewide Freight Plan

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1.0 Introduction

This interim delivery summarizes activities conducted to date under Tasks 1, 2 and 3 of the scope of work to develop the 2016 Alabama Statewide Freight Plan (Freight Plan). The first three tasks, as outlined in the scope of services, are as follows:

- Task 1: Review all MAP-21 and other federal and state laws and regulations pursuant to preparation of a statewide freight plan.
- Task 2: Review all Title VI programs, processes, and procedures, and summarize state and MPO activities in a section entitled, "Title VI in the Preparation of the Statewide Freight Plan."
- Task 3: Develop a public involvement process for the Plan, consistent with state and federal requirements, and to include reengaging the Statewide Freight Advisory Committee.

The scope of services outlines this interim deliverable as follows:

- Summary Report 1: Includes draft Mission and Vision statements, MAP-21 requirements, regulatory authority, Title VI program compliance, and public involvement process compliance, which also includes progress toward reviving a Statewide Freight Advisory Committee. (Tasks 1-3)

In addition, several activities preparatory to subsequent tasks were also initiated. Most specifically, these activities relate to travel demand modeling and the identification of freight flows, as well as freight ITS technologies and applications.

2.0 Mission and Vision Statements

The draft mission statement and associated goals for the Alabama Statewide Freight Plan are presented below. These will guide ALDOT in developing a coordinated freight policy that meets the needs of the state while adhering to FHWA policy.

Mission Statement: To promote the efficient and safe movement of goods in a manner that increases economic competitiveness and promotes environmental responsibility throughout the State of Alabama.

- Goal 1: Ensure a state of good repair along priority freight corridors through the state
- Goal 2: Improve reliability and reduce congestion on the priority freight corridors
- Goal 3: Promote and enhance both the human and natural environment while enhancing the performance of the priority freight network
- Goal 4: Improve economic benefits by supporting public and private sector investment in the statewide freight network
- Goal 5: Promote the safety and security of the freight infrastructure

Based on the goals listed above, related performance measures will be developed for utilization in the project identification and prioritization process.

Vision Statement: The State of Alabama desires a safe, robust freight transportation system that supports the economic vitality of the State's residents and businesses, provides increased transportation mobility and accessibility, and facilitates the efficient, integrated and safe movement of goods throughout the state.

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3.0 MAP-21 Requirements and Regulatory Authority

3.1 National Freight Goals

MAP-21 establishes a policy to improve the condition and performance of the national freight network to provide the foundation for the United States to compete in the global economy and achieve the following goals (§1115; 23 USC 167):

- Invest in infrastructure improvements and implement operational improvements that:
 - Strengthen the contribution of the national freight network to the economic competitiveness of the United States
 - Reduce congestion
 - Increase productivity, particularly for domestic industries and businesses that create high-value jobs
- Improve the safety, security, and resilience of freight transportation
- Improve the state of good repair of the national freight network
- Use advanced technology to improve the safety and efficiency of the national freight network
- Incorporate concepts of performance, innovation, competition, and accountability into the operation and maintenance of the national freight network
- Improve the economic efficiency of the national freight network
- Reduce the environmental impacts of freight movement on the national freight network

3.2 National Freight Plan Requirements

In the absence of FHWA rulemaking, the goals for the National Freight Network, performance measures for the overall transportation network, and requirements of the National Freight Plan [§1115; 23 USC 167(f)(1)] provide the best policy guidance to ALDOT in moving forward with freight planning activities.

- Assess the condition and performance of the national freight network
- Identify highway bottlenecks that cause significant freight congestion
- Forecast freight volumes
- Identify major trade gateways and national freight corridors
- Assess barriers to improved freight transportation performance
- Identify routes providing access to energy areas
- Identify best practices for improving the performance of the national freight network and mitigating the impacts of freight movement on communities
- Provide a process for addressing multistate projects and strategies to improve freight intermodal connectivity

3.3 Interim Guidance for Statewide Freight Plans

Section 1118 of MAP-21 encourages each state to develop a comprehensive statewide freight plan for guiding state freight transportation investments. Specific elements recommended by MAP-21 include:

- Identify significant freight system trends, needs, and issues with respect to the state
- Describe freight policies, strategies, and performance measures that will guide freight-related transportation investment decisions

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- Describe how the plan will improve the ability of the state to meet national freight goals established under section 167 of title 23, United States Code
- Show evidence of consideration of innovative technologies and operational strategies, including intelligent transportation systems that improve safety and efficiency of freight movement
- Consideration of improvements that may be required on routes on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate roadway condition
- An inventory of facilities with freight mobility issues, such as truck bottlenecks, within the state, and a description of the strategies the State is employing to address those freight mobility issues

3.4 Enhanced Federal Share and Project Eligibility

MAP-21 allows the USDOT to increase the maximum federal share up to 95 percent for projects on the Interstate System, and up to 90 percent for other projects that are consistent with Section 1116(a) and (c) under 23 U.S.C. 167. Projects must be identified in a State Freight Plan and demonstrate improvements to freight movements, including making progress to freight performance targets established by a state pursuant to 23 U.S.C. 150(d).

Eligible projects for increased funding under MAP-21 are identified within Section 1116(c) under 23 U.S.C. 167 and listed below:

- Construction, reconstruction, rehabilitation, and operational improvements directly relating to improving freight movement high crash location (segment or intersection)
- Intelligent transportation systems and other technology to improve the flow of freight
- Efforts to reduce the environmental impacts of freight movement on the primary freight network
- Geometric improvements to interchanges and ramps,
- Railway-highway grade separation
- Truck-only lanes
- Climbing and runaway truck lanes
- Truck parking facilities eligible for funding within Section 1401 under 23 USC 137
- Real-time traffic, truck parking, roadway condition, and multimodal transportation information systems
- Improvements to freight intermodal connectors
- Improvements to truck bottlenecks

Since the enhanced match funds come from the same pool of FHWA dollars that ALDOT receives for all its projects statewide, there is currently no interest by ALDOT leadership in exercising the enhanced match option. However, the projects identified through the planning process would be eligible for this match in the event of a policy change.

3.5 Plan Ability to Meet National Freight Goals

In the absence of FHWA policy in developing freight performance measures or guidance to the states with respect to development of their individual State Freight Plans, ALDOT must rely on the National Freight Goals and National Freight Plan to provide guidance in meeting the overall objectives of MAP-21. With that said, there are several items already in the current scope of services that lend to meeting MAP-21 goals:

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- Assessment of freight conditions throughout the state to reinforce and/or re-evaluate the importance the National Freight Network of in the movement of goods and commodities
- Continued identification of improvements to alleviate congestion and/or operational deficiencies throughout the state that impact freight movement and coordination with implementing agencies (ALDOT, MPOs, et. al.) to prioritize improvements that alleviate these needs
- Establishing criteria for the Statewide Freight Network that are consistent to those of the National Freight Network
- Soliciting specific economic development sector input from FAC members to understand potential emerging industries and associated freight movement trends

4.0 Title VI

Title VI refers to the entirety of statutory, regulatory, and other directives related to the prohibition of discrimination in federally-funded programs, including the requirements to address Environmental Justice (EJ). As a recipient of federal funding, ALDOT considered and incorporated Title VI requirements and Environmental Justice principles during the development of the Statewide Freight Plan.

4.1 Environmental Justice Legislation

Title VI created the foundation for future Environmental Justice regulations. The Civil Rights Act of 1964, 42 USC 2000d, et seq. 42 USC 2000d prohibits exclusion from participation in any federal program on the basis of race, color, or national origin, age, sex, disability, or religion. The implementing regulations of Title VI are found at 49 CFR 21 and 23 CFR 200. In particular, 23 CFR 200.5(p) includes other civil rights provisions of federal statutes and related authorities that prohibit discrimination in programs and activities receiving federal assistance.

The National Environmental Policy Act of 1969 (NEPA) addresses both social and economic impacts of EJ. NEPA stresses the importance of providing safe, healthful, productive, and aesthetically pleasing surroundings for all Americans, and provides a requirement for taking a “systematic, interdisciplinary approach” to aid in considering environmental and community factors in decision making. Other significant legislation includes:

- **Rehabilitation Act of 1973** (29 USC 794) is the law prohibiting discrimination on the basis of a disability, and in terms of access to the transportation planning process.
- **The Civil Rights Restoration Act of 1987** further expanded Title VI to include all programs and activities of Federal aid recipients, sub-recipients, and contractors whether those programs and activities are federally funded or not.
- **Americans with Disabilities Act of 1990** (42 U.S.C. 12131), which prohibits discrimination on the basis of disability by public entities and applies to all services, programs, and activities provided or made available by public entities.
- **Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations** was signed by President Clinton in 1994. This piece of legislation directed every Federal agency to make Environmental Justice part of its mission by identifying and addressing all programs, policies, and activities that affect human health or the environment so as to identify and avoid disproportionately high and adverse effects on minority and low income populations. Federal, state, local, and tribal agencies must be proactive when it comes to determining better methods to serve the public who rely on transportation systems and services to increase their

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quality of life. Transportation agencies that take a more proactive approach to the implementation of Title VI will reduce potential conflicts while simultaneously complying with other legislation.

- **Order on Environmental Justice** (DOT Order 5610.2) was issued by the United States Department of Transportation (DOT) in April 1997. DOT Order 5610.2 summarized and expanded upon the requirements of Executive Order 12989 to include all policies, programs, and other activities that are undertaken, funded, or approved by the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), or other USDOT components.
- **FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations** (DOT Order 6640.23) was issued by the FHWA in December 1998. DOT Order 6640.23 mandated the FHWA and all its subsidiaries to implement the principles of Executive Order 12898 and DOT Order 5610.2 into all of its programs, policies, and activities.
- **Implementing Title VI Requirement in Metropolitan and Statewide Planning** was issued jointly by the FHWA and FTA in October 1999. This memorandum provides clarification for field offices on how to ensure Environmental Justice is considered during current and future planning certification reviews. The intent of this memorandum was for planning officials to understand that Environmental Justice is equally as important during the planning stages as it is during the project development stages.
- **Executive Order 13166: Improving Access to Services for Persons with Limited English Proficiency** was signed by President George W. Bush in 2000. The Executive Order requires Federal agencies to examine the services they provide, identify any need for services to those with limited English proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them. A subsequent Department of Justice policy document set forth compliance standards for LEP populations under the Title VI of the Civil Rights Act of 1964.

4.2 Environmental Justice Principles

The Statewide Freight Plan will work to uphold the following FHWA EJ principles to improve transportation decision making:

- Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations
- Ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- Prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations
- Make better transportation decisions that meet the needs of all people
- Design transportation facilities that fit more harmoniously into communities
- Enhance the public involvement process, strengthen community-based partnerships, and provide minority and low-income populations with opportunities to learn about and improve the quality and usefulness of transportation in their lives
- Improve data collection, monitoring, and analysis tools that assess the needs of, and analyze the potential impacts on, minority and low-income populations
- Partner with other public and private programs to leverage transportation agency resources to achieve a common vision for communities
- Avoid disproportionately high and adverse impacts on minority and low income populations

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- Minimize and/or mitigate unavoidable impacts by identifying concerns early in the planning phase and providing offsetting initiatives and enhancement measures to benefit affected communities and neighborhoods

4.3 Title VI in the Preparation of the Statewide Freight Plan

Based on the principles listed above, the following steps can be made to ensure the 2016 Alabama Freight Plan furthers the overall intent of the EJ legislation:

- Gather input from MPO representatives on the FAC to guide the development of the plan on specific EJ issues along significant freight corridors
- Conduct a high-level assessment (Census data survey) of proposed improvement areas to identify if potential EJ issues exist

ALDOT will continue to explore additional opportunities throughout the planning process.

5.0 **Peer Review of Freight Plans and Policy**

A review of peer freight plans was undertaken to provide useful information that may influence potential modifications to the Alabama Statewide Freight Plan. This review also serves to assist ALDOT in being more compliant with the latest MAP-21 legislation while continuing to meet the needs specific to the state. For the purpose of this analysis, the following plans from adjacent states were surveyed:

- *Florida Mobility and Trade Plan (FMTP)*, Florida Department of Transportation (FDOT)
- *Georgia Statewide Freight and Logistics Plan*, Georgia Department of Transportation (GDOT)
- *Mississippi Statewide Freight Plan*, Mississippi Department of Transportation (MDOT)
- *Tennessee Statewide Multimodal Freight Plan*, Tennessee Department of Transportation (TDOT)

Within these plans, the following elements were surveyed:

- Goals and objectives developed to influence the overall direction of the plan
- Overview of the development of performance measures used to evaluate potential freight projects
- Procedures implemented for project prioritization

In addition to reviewing the contents of these plans, interviews were conducted with the key staff from FDOT, GDOT, MDOT, and TDOT who led these efforts.

5.1 Florida Mobility and Trade Plan (FMTP)

Completed in June 2013, the *Florida Mobility and Trade Plan (FMTP)* is a two-part document that contains a Policy Element and an Investment Element. The Policy Element serves to establish specific freight policy for the state based on other policies throughout the state and established freight needs, and document consistency with MAP-21 in order to meet FHWA criteria for State Freight Plans. The Investment Element calls out funding strategies and identifies a specific list of prioritized freight projects for the state.

5.1.1 *Goals and Objectives*

The FMTP has the following objectives:

- Objective 1: Capitalize on the freight transportation advantages of Florida through collaboration on economic development, trade, and logistics programs

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- Objective 2: Increase operational efficiency of goods movement
- Objective 3: Minimize costs in the supply chain
- Objective 4: Align public and private efforts for trade and logistics
- Objective 5: Raise awareness and support for freight movement investments
- Objective 6: Develop a balanced transportation planning and investment model for all forms of transportation
- Objective 7: Transform FDOT's organizational culture to include consideration of supply chain and freight movement issues

The Policy Element of the FMTP includes a comparison of these objectives to the goals of MAP-21.

The FMTP also identified the role of the State of Florida in planning for freight:

- Identification of significant freight system trends, needs and issues with respect to the State
- Description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the State
- Description of how the plan will improve the ability of the State to meet the national freight goals established under Section 167 of Title 23, United States Code
- Evidence of consideration of innovative technologies and operational strategies, including Intelligent Transportation Systems, that improve the safety and efficiency of freight movement
- In the case of routes on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment and timber vehicles) is projected to substantially deteriorate the condition of roadways, description of improvements that may be required to reduce or impede the deterioration
- Inventory of facilities with freight mobility issues, such as truck bottlenecks, within the state
- Description of the strategies the State is employing to address those freight mobility issues

5.1.2 Performance Measures

FDOT's Statistics Office developed the *Florida Multimodal Mobility Performance Measures Source Book*, which is a collection of current and historical data and analysis describing the performance of Florida's transportation system. It is intended to be the primary source of mobility performance measure results for the State of Florida. Mobility is broadly defined as the movement of people and goods, and there are four dimensions related to travel:

- Quantity – How much freight is moved and how many people are served
- Quality – How good or bad the travel experience is
- Accessibility – Ease in engaging in activities
- Utilization – How much of the transportation system is used/available

Measures are structured to four areas: highway, aviation, rail, and seaport.

5.1.3 Project Prioritization

The FMTP has a detailed prioritization process based on their objectives. The prioritization process consists of five steps:

- Development of Florida freight project prioritization criteria
- Rating of projects according to selected criteria

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- Incorporation of criterion importance weighting
- Compilation of project scores and prioritization grouping
- Evaluation of return on investment

Projects are evaluated based on the following 27 criteria:

- Addresses a specific transportation challenge for an Enterprise Florida identified targeted industry
- Improves access to/from an existing or developing freight hub
- Improves Intermodal Logistics Center's (ILCs) export capability/capacity
- Supports/strengthens the unique niche of a seaport, airport, spaceport, rail freight terminal, or Intermodal Logistics Center (ILC)
- Is in response to an identified market need
- Is on a facility designated as the Florida Freight Network
- Eliminates a freight bottleneck
- Provides a dedicated freight facility or freight shuttle that restores capacity for freight movement
- Uses Information Technology Systems (ITS) technology to improve system operations
- Improves a truck parking situation
- Improves safety and security at rest stops/layover areas/other facilities
- Stimulates use of marine highways/short-sea shipping
- Reduces empty backhaul movements to cut shipping costs
- Improves access to Compressed Natural Gas (CNG)/Liquefied Natural Gas (LNG) or other alternative fuels
- Minimizes costs through the entire supply chain to support manufacturing
- Private funding (applicant to provide percentage of private funding proposed)
- Is in a local freight plan (applicant must cite the local freight plan and any applicable project priority)
- Is consistent with a statewide modal plan (applicant must cite the statewide modal plan and any applicable project priority)
- Supports an emerging freight facility (spaceport, marine highway, etc.)
- Benefits taxpayers (applicant to provide detailed list of benefits)
- Provides significant intermodal benefits (multiple freight modes)
- Total cost (applicant to provide detailed total project cost estimate)
- Funding status (applicant to provide the current status of any non-FDOT sources of revenue committed or eligible—full/partial/eligible/unfunded)
- Timing and readiness (applicant to provide project status)
- TIP/STIP inclusion (applicant must cite the plan)
- Dependency (applicant to provide list of any associated projects)

5.2 Georgia Statewide Freight and Logistics Plan

Completed in 2012, the *Georgia Statewide Freight and Logistics Plan* was primarily a strategy to increase the efficiency of goods movement based on projected growth to promote economic development. Although developed prior to MAP-21, GDOT has since completed in-house revisions to the plan that have resulted in its recognition by FHWA as being compliant with MAP-21.

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5.2.1 Goals and Objectives

The Plan does not call out specific goals and objectives. However, given its purpose of evaluating and prioritizing improvements to improve the overall economy of the state and prioritizing major corridors, it is inherently consistent with MAP-21.

5.2.2 Performance Measures

There are no specific performance measures except benefit cost. The plan used the following methodologies to identify needed projects throughout the state:

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	GDOT statewide travel demand model
Highway Projects – Improve interstate interchanges	“Off-model” analytical technique
Highway Projects – Develop urban “bypasses”	GDOT statewide travel demand model
Highway Projects – Add capacity to rural freight corridors	GDOT statewide travel demand model
Highway Projects – Develop safety projects	“Off-model” analytical technique
Air Cargo Projects	Qualitative descriptions from discussions with airport staff

5.2.3 Project Prioritization/Evaluation Procedures

Basically, the plan uses a benefit cost analysis to evaluate all project types. Highway projects were grouped into packages based on geographic location along priority highway corridors in the state.

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

- Long-haul interstate corridors
- Interstate interchanges
- Urban bypasses
- Smaller urban and rural freight corridors
- Highway safety projects

5.3 Mississippi Statewide Freight Plan

The *Mississippi Statewide Freight Plan* (MSFP) was completed in February 2015. It is the first plan completed by the state and was developed in response to the MAP-21 legislation.

5.3.1 Goals, Objectives and Performance Measures

The MSFP goals, objectives and performance measures are tied specifically to national freight policy goals noted in MAP-21 and Mississippi’s overall transportation goals within its statewide transportation plan (MULTIPLAN 2035). The MSFP also demonstrates how they are directly linked to one another to meet the overall objectives of MDOT and FHWA, as demonstrated below.

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MDOT Statewide Plan Goals	MDOT Statewide Freight Goals	MDOT Freight Objectives	MDOT Freight Performance Measures
Economic Development: Provide a transportation system that encourages and supports Mississippi's economic development	Improve economic benefits of the statewide freight network	Increase public investment to facilitate freight system improvements that generate jobs and enhance Mississippi's competitive position	Statewide annual funds invested by MDOT for freight-related projects through its Multi-Modal Transportation Improvement Program
Accessibility and Mobility: Improve accessibility and mobility for Mississippi's people, commerce and industry	Improve reliability and reduce congestion on the priority freight corridors	Provide reliable and predictable travel times along identified freight corridors by reducing time delays	Annual hours of truck delay (AHTD) on the MFN Tier I and Tier II highway corridors
Safety: Ensure high standards of safety in the transportation system	Protect the safety and security of freight infrastructure	Reduce the number and rate of freight-movements related fatalities and injuries	Statewide annual crashes, injuries, and fatalities involving heavy trucks
			Statewide annual highway-rail incidents involving heavy trucks at at-grade rail crossings
Maintenance and Preservation: Maintain and preserve Mississippi's transportation system	Maintain the MS freight network infrastructure in a state of good repair	Continuously improve infrastructure conditions that affect freight bottlenecks and reliability issues	Percentage of the MFN highway pavement in good condition based on the International Roughness Index (IRI)
			Number of posted weight-restricted highway bridges on the MS Freight Network
			Statewide percent of rail network supporting 286k weight limits
			Channel depth for MS coastal ports (maintain authorized depth) and river ports (response time to recover to 12' minimum depth after a drought or flood)
			Volume to capacity ratio (V/C) on the airports serving MFN: (Jackson-Evers International Airport (JAN) and Gulfport-Biloxi International Airport (GPT) (capacity includes the total storage space for air cargo, ramp space and capacity in tonnage; volume refers to cargo volumes in tonnage)
Environmental Stewardship: Ensure that transportation system development is sensitive to Human and Natural Environmental Concerns	Protect and enhance the environment while enhancing the freight network performance	Implement freight-specific environmental stewardship programs to reduce impact of freight movement in the state's communities	Statewide annual number of hazmat spills across the MFN.
			(Future measure) Designated MS nonattainment areas for all criteria pollutants.

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5.3.2 Project Prioritization/Evaluation

In order to provide a rationale for the identification and prioritization of projects, MDOT established principles for consideration that were consistent with the overall goals and objectives of the plan. They are as follows:

- **Safety Improvements** – MDOT’s overall departmental goals place very high priority on public safety. Freight safety projects directed at high-crash locations or sections of road or railroad have promise of returning high public safety benefits relative to project cost and directly reflect MDOT’s priority for protecting public safety.
- **Investment (Infrastructure) Preservation** – Overall MDOT goals also place high priority on infrastructure investment preservation. Failure to provide adequate maintenance for infrastructure preservation invariably leads to higher future costs, as routine maintenance is replaced by much more costly reconstruction. Poor infrastructure condition also affects freight carrier operating costs, in terms of vehicle/rolling stock maintenance and travel time.
- **Operational Efficiency Enhancement** – MDOT has an active program for implementing high-tech traffic management strategies based on ITS technologies. Elements such as Weigh-in-Motion truck weight stations lower regulatory costs and improve freight carriers operations. Enhanced deployments with additional commercial vehicle applications, such as real-time travel information to avoid delays and increase reliability, can be cost-effective when incorporated into broader regional applications.
- **Reliability Enhancement** – For freight carriers, reliability is directly related to capacity and levels of congestion. Congestion occurs at a corridor level, affecting both commercial carriers and the general traveling public, and is a function of highway or rail line capacity and restrictions that are presented by vertical or horizontal clearance for freight vehicles. Congestion also occurs in focused bottlenecks such as congested highway interchanges, intermodal yards, or “last-mile” access to major freight generators or intermodal facilities such as ports. Of the various freight improvement strategies, reliability enhancement driven by increased capacity is generally the most expensive and time-consuming to implement.

Input from the MSFP Freight Advisory Committee also played a role in the project identification and prioritization process.

5.4 Tennessee Statewide Freight Plan

The *Tennessee Statewide Multimodal Freight Plan* is still in draft form and has not yet been released to the public. It is the first plan completed by the state and was developed in response to the MAP-21 legislation. The plan is expected to be finalized in late summer. While the plan is still in draft form, TDOT staff did participate in the peer review interviews, as detailed in the next section.

5.5 Implications for Alabama Statewide Freight Plan

The following can be gleaned from the review of the statewide freight plans of adjacent states.

5.5.1 *Florida Mobility and Trade Plan*

- Plan objectives are consistent with the overall intent of MAP-21 and should be considered for the development of the overall vision of prioritization criteria utilized by the ALDOT plan.

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- The FMTP provides a wide menu of potential measures that can be implemented for freight assessment over time.
- The “Quantity, Quality, Accessibility, and Utilization” preliminary framework is a solid basis for developing performance measures for the ALDOT plan.

5.5.2 *Georgia Statewide Freight and Logistics Plan*

- The most important takeaway from the Georgia plan is the utilization of high-level assessment to develop the performance measures for the state, which appears to be in line with the data available for the ALDOT effort.
- The improvement types utilized by GDOT may also serve as a useful means of project organization.
- The travel demand model was a key tool in the project evaluation process.

5.5.3 *Mississippi Statewide Freight Plan*

- MDOT’s methodology of linking the freight goals, objectives, and performance measures should be considered for the ALDOT update. Through demonstrating this linkage, ALDOT provides a clear understanding of how the plan meets the needs of the state while adhering to the overall policy direction of FHWA.
- Developing a project identification and prioritization process that is directly related to the plan provides a transparent rationale for stakeholders and policy makers.

5.6 Peer Review Interview Results

In order to supplement the review of the plans listed above, interviews were conducted with key staff from the respective DOTs. Interviewees included:

- FDOT – Ed Lee
- GDOT – Tom McQueen, Stanton Reecy
- MDOT – Trung Trinh
- TDOT – Bob Rock

Interviewees were asked specific questions to guide the discussion, as listed below:

- How have the results of the freight plan impacted DOT practices and/or programs? Is your state implementing the 90-95% match on specific freight improvements?
- What data sources did you find were the most intuitive for identifying and assessing your statewide freight network?
- Briefly describe the level of coordination with the MPOs throughout the state. What type of information (if any) did they provide as assistance in the effort?
- How effective was engaging the private sector in the planning process? Which participants were the most active? What type of information did they provide?
- What were some of your biggest challenges in completing your plan?
- How was Title VI incorporated into your plan?

It should also be noted that the interviewees agreed to assist ALDOT with any additional questions or inquiries during plan development.

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A summary of the input received is provided below. The notes from each of the individual interviews is appended to this document.

- In all of the peer states, the freight plan has resulted in overall shifts in their respective work programs with regard to project prioritization. In Florida, several additional actions have taken place, including:
 - Assignments have been made to agencies throughout the State government to facilitate the plan's recommendations given their respective responsibilities (workforce training, job placement, etc.) based on the implementation guide within the FMTP.
 - FDOT established the full-time positions of District Freight Coordinators to assist in addressing more regional and localized freight issues.
 - FDOT has instituted an internal educational program that consists of courses taught by private sector logistics professionals.
 - FDOT has integrated more freight-related measures, design standards and practices in their overall work program.
- All of the peer states are moving forward with pursuing the increased federal share (90-95% match) for freight related projects. Their rationale was primarily to provide more flexibility for allocating their state funds. With that said, concerns have been raised in Mississippi and Tennessee on how the higher utilization of these FHWA funds may potentially impact their overall work programs.
- MDOT is currently in the process of incorporating freight measures into the overall project prioritization process for the state as a result of the plan.
- All of the states utilized the IHS Transearch Global Insights data for their planning efforts.
- FAF data was referenced as a secondary data source by FDOT and GDOT. It was not utilized for the MDOT effort due to the use of HPMS data from a regional perspective.
- TDOT also utilized data from the American Transportation Research Institute (ATRI) for truck travel information.
- All of the peer states involved their respective MPOs at varying levels. GDOT, MDOT, and TDOT included all of the MPOs within their respective FACs. GDOT also conducted interviews with and presented to various MPOs throughout the state. While FDOT doesn't have a designated FAC, MPOs were engaged several different ways:
 - At the beginning of the process, listening sessions were held throughout the state (Tampa, Miami, etc.) to gather input from both public and private sector interests.
 - Stakeholder Working Group meetings were held at plan development milestones that allowed any interested party, including MPO staff, to call in and participate.
 - Visioning sessions were held throughout the state to gauge both public and private opinions on where Florida and their perspective regions will be in 2050 in order to provide FDOT direction in developing its recommendations. Roughly 100 people from MPO staff and advisory councils participated in the event.
 - Individual meetings and/or briefings were also held with individual MPOs as needed.
- The most valuable contribution from the MPOs is input with respect to bottleneck locations.
- All of the peer regions had active coordination with the private sector. All had FAC representatives from various rail, trucking, and logistics professionals. In Florida, additional visioning sessions and working group meetings were held with private sector interests.

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- In general, input from the trucking industry sometimes was perceived as a bit fragmented given the proprietary nature of their data, but was supplemented with publicly-available data from FHWA.
- To some degree, all peer states faced a challenge in developing consensus for a prioritized freight improvement list amongst the different stakeholders and interests.
- Another major challenge faced by most peer states was keeping the study at a statewide scope and not delving into details in specific urbanized areas, such that MPOs can take their detailed look at freight movement in their areas, especially in freight-intensive MPOs. The exception was Florida, whose plan also focused in detail on last mile connections.
- Title VI was not specifically addressed in any of the plans from the peer states; however, all of the interviewees reiterated a commitment from their respective states to comply with Title VI during the implementation of their projects, programs, and policies.

6.0 Public Involvement Process and the Statewide Freight Advisory Committee

6.1 Purpose, Role and Charge

The public involvement process for the 2016 Alabama Statewide Freight Plan will focus outreach efforts on a broad base of public and private sector stakeholders directly involved in all modes of freight transportation—trucking, rail, ports, inland waterways, pipeline, and aviation. A significant portion of freight transportation in Alabama is a private sector enterprise, with improvements and investments made by each operator to address its specific needs and business goals. Aside from its primary charge of maintaining the highway transportation system, ALDOT's role is to support the operators to the best of its ability, within the limits of its authority and means.

In accordance with MAP-21 recommendations, a Freight Advisory Committee (FAC) composed of a cross section of public and private sector experts and stakeholders, will be established. The charge of the freight advisory committee will be:

- Advising ALDOT on freight-related issues, priorities, and funding
- Providing a forum for discussion of freight-related decisions
- Communicating and coordinating regional priorities to all parties
- Promoting the exchange of information between public and private sectors
- Participating in the development of the 2016 Alabama Statewide Freight Plan

Coordination with the FAC will be key at the following milestones:

- Review of Draft Freight Network, including modal and intermodal resources
- Review of Freight Improvement Strategies and known Performance Measures
- Review of Draft 2016 Alabama Freight Plan

6.2 FAC Composition

As a whole, the FAC membership will have direct knowledge of and connections with all freight modal networks (roadway, rail, air, and water), and represent users/shippers and policymakers from both the public and private sectors. As is the case historically and with other ALDOT modal plans, the role of the FAC will be advisory only. The consultants will also maintain a general stakeholders list that includes a much broader representation of relevant freight and interested organizations and/or individuals.

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A preliminary draft list of entities to be represented on the FAC was compiled and reviewed with ALDOT staff. In preparing the preliminary list of FAC invitees, the consultant team reviewed the membership of the Statewide Freight Advisory Committee originally established for the 2010 Alabama Statewide Freight Study and Action Plan, as well as the stakeholder list for the recently completed 2014 Alabama Rail Plan. In addition, the consultant team also researched the composition of other states' FACs for their recently completed or underway State Freight Plans. During the discussions with ALDOT staff, it was determined that 15-20 organizations would be targeted for invitation on the FAC.

A final list of invitees was prepared and submitted to ALDOT staff for concurrence. That list includes:

- State agencies and Tribal governments
 - Alabama Department of Economic and Community Affairs
 - Alabama Public Service Commission
 - Alabama Department of Public Safety
 - Poarch Band of Creek Indians
- Regional governments
 - Birmingham MPO (Regional Planning Commission of Greater Birmingham)
 - Mobile MPO (South Alabama Regional Planning Commission)
 - Florida-Alabama TPO
- Ports/Intermodal/Trucking
 - Alabama State Port Authority
 - International Intermodal Center, Port of Huntsville
 - Alabama Trucking Association
- Rail
 - Alabama Railway Association
 - CSX Transportation, Inc. (Class I railroad)
 - Norfolk Southern Corporation (Class I railroad)
 - Genesee & Wyoming, Inc. (Class II and III railroads)
- Industry
 - Chamber of Commerce Association of Alabama
 - Business Council of Alabama

After review and approval by ALDOT staff, an invitation letter, on ALDOT letterhead and signed by Mr. Jilla, was sent by US mail to the recommended member organizations. Several days later, a follow-up invitation identical in content to the letter was sent via email to those whose email address was available. The initial contact was addressed to the head of each organization (director level), except in a few instances where a more appropriate contact was known (e.g., regional director level). The invitation requested that each organization provide the name and contact information for a specific FAC designee. Each organization will be represented by only one individual on the FAC, although additional contacts will be added to the stakeholders list to be kept abreast of Freight Plan development activities.

Of the initial 16 organizations invited to participate on the FAC, 9 have responded to date. Telephone contact is currently underway with the organizations who have not responded.

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6.3 FAC Meeting #1

The initial FAC meeting is scheduled for Thursday, June 25 at 1:30 PM at the ALDOT Central Office. An internal JRWA/ALDOT team meeting preparatory to the FAC meeting is scheduled for Wednesday, July 17.

Items to be covered during the initial FAC meeting include:

- Review project purpose and FAC role
- Receive comments on preliminary Statewide Freight Network and input on localized freight mobility and economic development factors
- Review and comment on preliminary Freight Plan goals and performance measures
- Discuss key points/elements of freight improvement strategy

6.4 Fact Sheet and Website

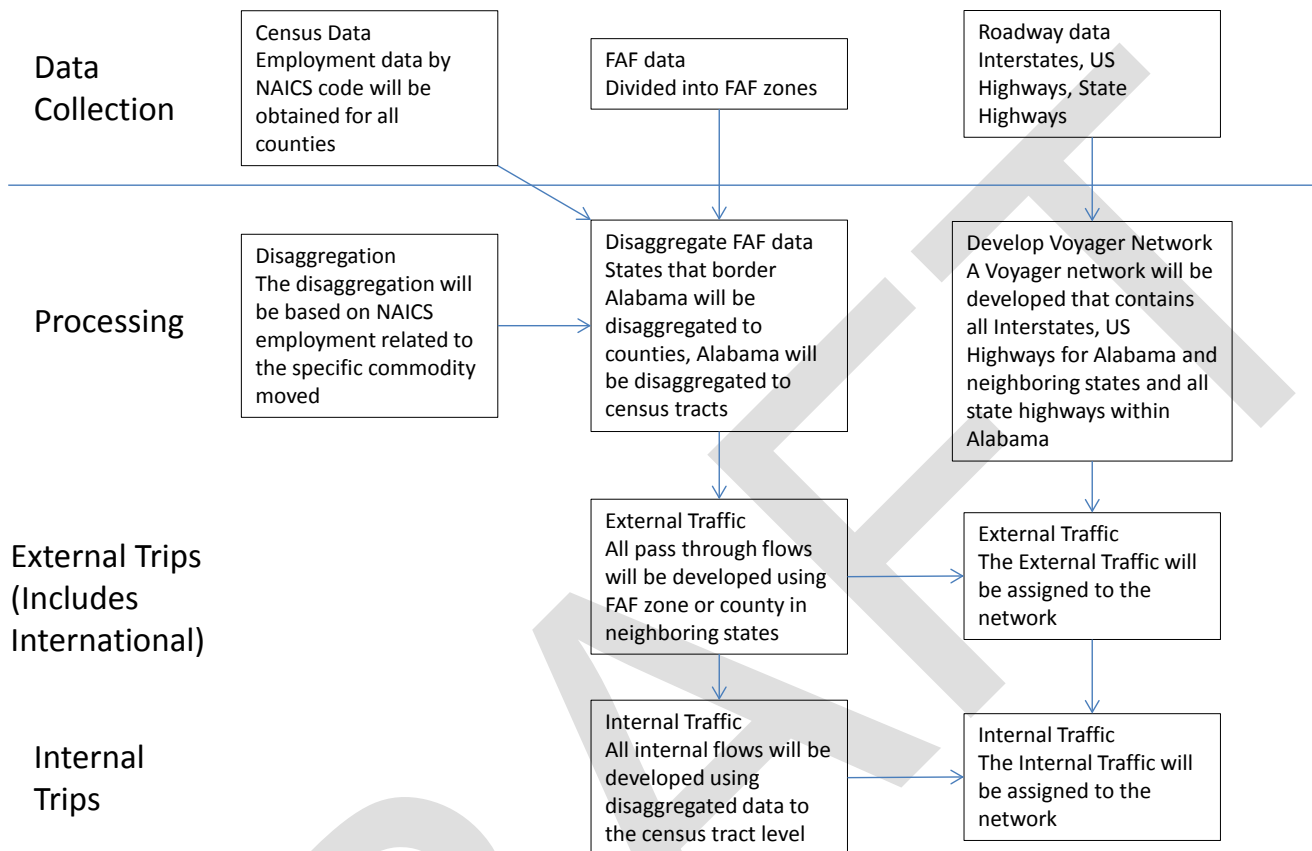
A general fact sheet for the Freight Plan effort was developed and submitted to ALDOT staff for review. The content of the fact sheet will serve as the initial information about the Statewide Freight Plan effort on ALDOT's Freight Planning webpage (<http://cpmsweb2.dot.state.al.us/TransPlan/FreightPlanning/Default.aspx>). Additional materials prepared during plan development, including network maps, meeting materials and draft interim deliverables, will also be made available for posting on the website.

In addition, an ALDOT email address has been established for stakeholders and the general public to provide comments and request to be kept informed: PLAN@DOT.STATE.AL.US. The email will be accessed from a link on the Bureau of Transportation Planning and Modal Programs website main page, with appropriate text to direct visitors to the Freight Planning site and available plan materials. Emails sent to this email address will be automatically distributed to Victor Jordan and Bryan Fair at ALDOT and Carla Bamatraf with the consultant team.

7.0 Statewide Modeling Effort Overview

The statewide freight modeling process is outlined in the following graphic. The process will focus on the disaggregation of Freight Analysis Framework, Version 3.5 data into county and census tracts using employment data obtained from the Business Census. The roadway network will be developed using Interstates, US Highways and Alabama Highways. The individual commodities will be assigned to the network independently and aggregated to determine the total freight volume projected for each roadway.

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8.0 Alabama 2012 Freight Flow Characteristics

The data presented in this section represents the 2012 snapshot of freight flow in Alabama. The forecast (future year) freight flow and comparison of freight activity is being developed and will be included in a later summary report. Additionally, a comparison of future trends will also be added at a later date as the statewide freight model focuses on the forecast of freight.

The total number of freight tonnages for 2012 which related to the state of Alabama is 515,498.5612 kilo tons. The number includes not only domestic freight flow, but also imported and exported freight flow in Alabama. It is necessary to classify the total tonnage according to the specific characteristics. This summary report sets up certain standards and classifies the total freight tonnage as specific types of freight tonnage. All of the numbers of freight movements herein are extracted from Freight Analysis Framework version 3.5.

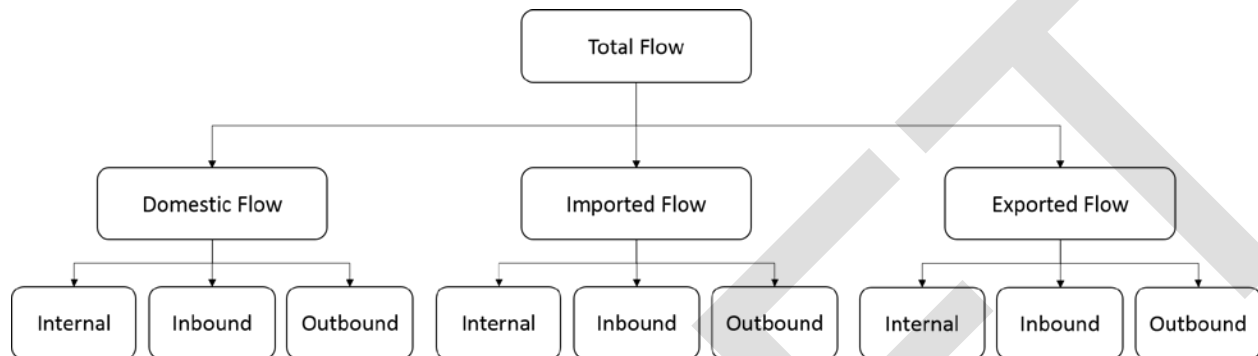
8.1 Criteria

The freight flow can be assorted as domestic freight flow and international freight flow. International freight flow can be further classified as imported freight flow and exported freight flow. The term “domestic freight flow” is defined as the freight flow produced and/or consumed in the state of Alabama. The term “imported freight flow” is defined as internationally imported freight cargoes to the U.S. with the final destination in the state of Alabama; “exported freight flow” means that the freight flow originated from the U.S and the freight volume was exported via Alabama.

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Each classified flow can then be divided as internal flow, inbound flow, and outbound flow based on freight activities in Alabama. “Internal flow” means that the freight flows within Alabama. “Inbound flow” is defined as freight flow that originated from out-of-state and is destined to Alabama. On the other hand, “outbound flow” is defined as freight flow that originated from Alabama and is destined to out-of-state.



8.2 Overview

Table 1: Overall Freight Activities in Alabama

Type	Freight Flow in Alabama	Ratio
Total	515,498.5612	
Domestic	466,272.5893	90.45%
Imported	26,114.0954	5.07%
Exported	23,111.8765	4.48%

The total freight flow in Alabama is 515,498.5612 kilo tons. The domestic freight flow is 466,272.5893 kilo tons, or approximately 90 percent of total freight volume. International trade freight volume (imported and exported) occupies only less than 10 percent of total freight volume in Alabama.

Table 2: Freight Tonnage by Activity Type

Type		Volume	Ratio
Total		515,498.5612	100%
Domestic	Internal	252,184.3574	48.92%
	Inbound	120,937.7716	23.46%
	Outbound	93,150.4603	18.07%
Exported	Internal	13,676.2080	2.65%
	Inbound	5,065.3511	0.98%
	Outbound	4,370.3174	0.85%
Imported	Internal	13,765.8408	2.67%
	Inbound	7,354.8885	1.43%
	Outbound	4,993.3661	0.97%

Approximately half of freight flow related to the state of Alabama is domestic internal flow. In other words, half of freight volume is produced and consumed in Alabama.

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8.3 Domestic Freight Flow

Domestic freight flow indicates the freight volume is produced and consumed in the U.S. The freight volume is not exported or imported with international trade partners.

8.3.1 Domestic Internal Freight Flow

Domestic internal freight flow represents that the freight volume is produced and consumed in the state of Alabama. The volume is not imported and exported with other states and international trade partners. The freight volume is only transported within Alabama.

Table 3: Domestic Internal Freight Volume

Origin/Destination	Birmingham	Mobile	Remainder of Alabama
Birmingham	54,726.3366	974.392	17,242.7788
Mobile	356.3935	11,114.7382	2,092.5327
Remainder of Alabama	13,898.0161	3,063.7063	148,715.4632

The Table 3 shows the origin/destination freight flow matrix (O/D matrix).

Table 4: Domestic Internal Freight Volume by Modes

Origin	Birmingham			Mobile			Remainder of Alabama		
Destination	BIRM	MOB	REM	BIRM	MOB	REM	BIRM	MOB	REM
Truck	46,389.95	584.58	16,962.74	349.04	10,138.00	1,894.59	11,837.72	2506.99	145,548.11
Rail	5,674.11	371.49	44.99	0.00	111.14	184.23	1,998.43	426.76	1,682.58
Water	0.00	0.74	2.33	0.00	65.72	0.31	0.00	56.92	1.60
Air	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple and Mail	55.97	15.92	71.79	1.95	2.11	2.14	20.56	41.55	722.33
Pipeline	0.01	0.54	0.41	5.36	770.04	10.13	0.66	4.83	24.53
Other and Unknown	2,606.30	1.12	160.51	0.04	27.72	1.14	40.65	26.66	736.32
No Domestic Mode	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Truck is the most used freight shipping mode in Alabama.

Table 5: Top 10 Internal Freight Flow by Commodity Types (kilo tons)

Origin	011 (Birmingham)*			012 (Mobile)*			019 (Remainder of Alabama)*			Total	Ratio
Destin.	011	012	019	011	012	019	011	012	019		
25**	3,348.66	0.01	2.17	0.01	1,828.61	175.27	2,491.69	500.26	67,286.69	75,633.36	29.99%
12	11,197.08	337.92	3,183.50	0.11	723.99	0.67	409.65	40.44	20,162.06	36,055.42	14.30%
31	6,801.43	91.57	1,599.51	38.07	1,318.79	211.73	1,325.70	384.47	11,500.20	23,271.48	9.23%
15	14,298.05	0.00	2,573.69	0.00	2.63	0.00	3,112.99	217.67	610.47	20,815.50	8.25%
41	3,725.23	219.36	1,528.33	207.34	1,276.45	624.97	1,303.36	622.75	5,697.82	15,205.63	6.03%
26	607.48	2.10	1,115.12	8.62	428.33	239.45	783.13	393.82	7,545.76	11,123.81	4.41%

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Origin	011 (Birmingham)*			012 (Mobile)*			019 (Remainder of Alabama)*			Total	Ratio
Destin.	011	012	019	011	012	019	011	012	019		
19	2,472.79	0.54	345.27	5.58	182.05	35.50	539.48	106.63	4,241.17	7,929.02	3.14%
17	2,204.01	2.25	1,315.25	0.00	0.95	0.00	14.68	0.01	3,738.70	7,275.84	2.89%
11	1,423.86	1.14	90.43	0.05	1,451.98	8.19	583.58	1.65	1,301.95	4,862.83	1.93%
32	897.97	57.03	484.71	14.51	214.85	38.64	604.16	100.95	2,236.88	4,649.69	1.84%

* 011 represents Birmingham Area, 012 represents Mobile Area, and 019 represents remainder of Alabama. These numbers represent FAF zone system. Hereafter, FAF3 zones in Alabama are represented as the numbers.

** The numbers mean 2-digit Standard Classification of Transported Goods (SCTG) classes used by the 2007 US Commodity Flow Survey (CFS). Following table shows SCTG codes matching with commodities.

The most transported commodity in Alabama is logs. On the other hand, coal is the most heavily transported commodity in the Birmingham area.

Table 6: FAF3 Commodity Classes

SCTG	Commodity	SCTG	Commodity	SCTG	Commodity
01	Live animals/fish	15	Coal	29	Printed products
02	Cereal grains	16	Crude petroleum	30	Textiles/leather
03	Other agricultural products	17	Gasoline	31	Nonmetal mineral products
04	Animal feed	18	Fuel oils	32	Base metals
05	Meat/seafood	19	Natural gas and petroleum products	33	Articles-base metal
06	Milled grain products	20	Basic chemicals	34	Machinery
07	Other food stuffs	21	Pharmaceuticals	35	Electronics
08	alcoholic beverages	22	Fertilizers	36	Motorized vehicles
09	Tobacco products	23	Chemical products	37	Transport equipment
10	Building stone	24	Plastics/rubber	38	Precision instruments
11	Natural sands	25	Logs	39	Furniture
12	Gravel	26	Wood products	40	Misc. mfg. products
13	Nonmetallic minerals	27	Newsprint/paper	41	Waste/scrap
14	Metallic ores	28	Paper articles	43	Mixed freight
				99	Commodity unknown

Source: THE FREIGHT ANALYSIS FRAMEWORK VERSION 3, A Description of the FAF3 Regional Database and How It Is Constructed.

Table 7: Freight Volume Produced and Consumed in Alabama (kilo tons)

Type		011 (Birmingham)	012 (Mobile)	019 (Remainder of AL)
Produced	Tonnage	59,926.4405	9,037.3609	13,7858.7769
	Ratio	28.97%	4.37%	66.66%
Consumed	Tonnage	58,419.2816	10,509.1808	13,7894.1159
	Ratio	28.25%	5.08%	66.67%

Approximately 29 percent of freight volume is produced in the Birmingham area, and 67 percent in the Remainder of Alabama area. Even though the Mobile area is the most important international trade area, it only represents around 5 percent of domestic internal freight volume produced or consumed.

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8.3.2 Domestic Inbound Freight Flow

Domestic inbound freight flow means that the freight volume produced in the U.S. except Alabama is transported to the Alabama region and consumed.

Table 8: Top 10 Domestic Inbound Freight Flow by Origins (kilo tons)

Origin	Volume	Ratio
Georgia	17,120.6685	14.16%
Mississippi	11,726.3081	9.70%
Kentucky	9,454.5202	7.82%
Wyoming	9,451.7770	7.82%
Texas	7,910.8874	6.54%
Tennessee	7,716.4595	6.38%
Florida	6,166.2708	5.10%
Louisiana	5,444.5901	4.50%
Minnesota	4,492.1587	3.71%
Illinois	4,479.3044	3.70%
Sub-Total for Top 10	83,962.9447	69.43%
Grand Total	120,937.7716	100.00%

The state of Georgia transports the largest volume of freight to Alabama. Most of the top ten are states adjacent to Alabama or located on Midwest region.

Table 9: Top 10 Inbound Freight Flow by Commodity Types (kilo tons)

SCTG/Commodity	Volume	Ratio
15 (Coal)	19,089.3006	15.78%
19 (Natural Gas and Petroleum Products)	11,473.1138	9.49%
41 (Waste/Scrap)	9,992.6167	8.26%
20 (Basic Chemicals)	7,735.7936	6.40%
32 (Base Metals)	7,145.5926	5.91%
02 (Cereal Grains)	6,445.8691	5.33%
12 (Gravel)	5,128.8139	4.24%
17 (Gasoline)	5,069.7074	4.19%
31 (Nonmetal Mineral Products)	4,827.2155	3.99%
26 (Wood Products)	4,275.9996	3.54%
Sub-Total for Top 10	81,184.0228	67.13%
Grand Total	120,937.7716	100.00%

Coal is the largest commodity Alabama receives from other states, with natural gas and petroleum products ranking second. Coal accounts for approximately 81 percent of the commodities from Wyoming, which is roughly 40 percent of the total imported coal from out-of-state.

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Table 10: Domestic Inbound Freight Flow by Modes

Mode	Volume	Ratio
Truck	49,792.98	41.17%
Rail	37,043.73	30.63%
Water	11,326.34	9.37%
Air	18.349	0.02%
Multiple and Mail	10,618.11	8.78%
Pipeline	11,330.27	9.37%
Other and Unknown	807.99	0.67%
No Domestic Mode	0	0.00%

Truck is the most used transportation for inbound freight flow, followed by rail. Most coal is transported by rail mode.

8.3.3 Domestic Outbound Freight Flow

Domestic outbound freight flow represents domestic freight flow produced in Alabama and consumed out-of-state.

Table 11: Domestic Outbound Freight Flow by Destinations (kilo tons)

Destinations	Volume	Ratio
Georgia	15,709.9349	16.87%
Mississippi	11,783.1483	12.65%
Tennessee	8,843.4208	9.49%
Florida	7,419.2324	7.96%
Texas	6,598.4990	7.08%
Louisiana	3,828.2383	4.11%
South Carolina	3,635.8122	3.90%
California	3,544.5580	3.81%
North Carolina	3,303.2209	3.55%
Illinois	3,019.7194	3.24%
Sub-Total for Top 10	67,685.7842	72.66%
Grand Total	93,150.4603	100.00%

The state of Georgia is also the biggest partner for the domestic outbound freight flow.

Table 12: Domestic Outbound Freight Flow by Commodity Types (kilo tons)

SCTG/Commodity	Volume	Ratio
32 (Base Metals)	11,918.8627	12.87%
31 (Nonmetal Mineral Products)	10,496.9304	11.34%
19 (Natural Gas and Petroleum Products)	91,60.9392	9.89%
27 (Newsprint/Paper)	8,212.3933	8.87%
20 (Basic Chemicals)	7,993.2875	8.63%

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SCTG/Commodity	Volume	Ratio
26 (Wood Products)	6,251.9798	6.75%
25 (Logs)	3,844.3221	4.15%
12 (Gravel)	3,830.4181	4.14%
33 (Articles-Base Metal)	3,275.1879	3.54%
43 (Mixed Freight)	2,249.1261	2.43%
Sub-Total for Top 10	67,233.4471	72.60%
Grand Total	92,606.1838	100.00%

In contrast with the inbound freight flow, base metal is the biggest exporting commodity in Alabama to out-of-state.

Table 13: Domestic Outbound Freight Flow by Modes

Mode	Volume	Ratio
Truck	56,296.2772	60.44%
Rail	21,542.0067	23.13%
Water	2,151.1767	2.31%
Air	20.0649	0.02%
Multiple and Mail	4,670.4061	5.01%
Pipeline	7,438.9398	7.99%
Other and Unknown	1,031.5889	1.11%
No Domestic Mode	0	0.00%

Truck is the most used transportation for outbound freight flow. Approximately 60 percent of outbound freight volume is transported by trucks.

8.4 Imported Freight Flow

Imported freight flow can be classified as two categories. The first is the freight imported via the Port of Mobile or other international trade facilities in Alabama and consumed in Alabama. The second is freight imported via international trade facilities in other states and finally transported to Alabama. For example, freight imported through the Los Angeles/Long Beach (LA/LB) port and transported by domestic mode to Alabama would be the second category.

8.4.1 Imported Freight Flow via Alabama

Table 14: Imported Freight Flow via Alabama by Trade Partners (kilo tons)

Zone*	Volume	Ratio	011 (Birmingham)	012 (Mobile)	019 (Remainder of AL)
801 (Canada)	109.9676	0.59%	0	109.9676	0
802 (Mexico)	856.6593	4.57%	0	856.6593	0
803 (Rest of Americas)	11,831.9250	63.07%	0.0326	11,831.8920	0.0004
804 (Europe)	1,418.2599	7.56%	0.0006	1,373.6690	44.5903
805 (Africa)	2,438.1354	13.00%	0	2,438.1354	0
806 (Southern-Central-Western Asia)	793.6042	4.23%	0	793.6042	0

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Zone*	Volume	Ratio	011 (Birmingham)	012 (Mobile)	019 (Remainder of AL)
807 (Eastern Asia)	1,141.7863	6.09%	0	1,141.7863	0
808 (South-Eastern Asia and Oceania)	168.8692	0.90%	0	168.8692	0

* These numbers indicate international trade partners. Following table shows area codes matching with regions.

The table shows that 803 area (Rest of Americas) is the biggest importing trade partner with Alabama. Also, almost all imported freight arrives at the Mobile area. From this, it can be assumed that one of the biggest international trade facilities, the Port of Mobile, is in the Mobile area.

Table 15: FAF3 International Analysis Zone Codes

Zone	Context
801	Canada
802	Mexico
803	Rest of Americas
804	Europe
805	Africa
806	Southern-Central-Western Asia
807	Eastern Asia
808	South-Eastern Asia and Oceania

Table 16: Imported Freight Flow Ratio via Alabama by Trade Partners and by Modes

Transportation	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania
Truck	0.001%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Rail	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Water	0.585%	4.566%	63.072%	7.322%	12.997%	4.230%	6.086%	0.900%
Air	0.000%	0.000%	0.000%	0.238%	0.000%	0.000%	0.001%	0.000%
Multiple and Mail	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pipeline	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Other and Unknown	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
No Domestic Mode	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

Approximately 99.8 percent of imported freight volume uses waterway. As mentioned before, the Mobile area has the Port of Mobile, one of the biggest international trade facilities in the U.S.

Table 17: Imported Freight Flow via Alabama by Commodity Types (kilo tons)

SCTG/Commodity	Volume	Ratio
15 (Coal)	10,551.8214	56.25%
16 (Crude Petroleum)	3,820.3578	20.37%
32 (Base Metals)	792.3793	4.22%

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SCTG/Commodity	Volume	Ratio
19 (Natural Gas and Petroleum Products)	704.2893	3.75%
13 (Nonmetallic Minerals)	675.4040	3.60%
27 (Newsprint/Paper)	571.2841	3.05%
14 (Metallic Ores)	450.8367	2.40%
20 (Basic Chemicals)	202.5434	1.08%
26 (Wood Products)	173.4836	0.92%
33 (Articles-Base Metal)	152.3693	0.81%
Sub-Total for Top 10	18,094.7689	96.46%
Grand Total	18,759.2069	100.00%

The major imported commodities in Alabama are coal and crude petroleum. They equal almost 77 percent of the total imported freight volume.

Table 18: Top 10 Imported Freight Flow via Alabama by Final Destinations

Final Destination	Volume	Ratio
Alabama	13,765.8408	73.38%
Florida	1,236.3985	6.59%
Mississippi	1,211.5869	6.46%
Georgia	889.0947	4.74%
Pennsylvania	269.8580	1.44%
Ohio	209.7162	1.12%
Missouri	177.7989	0.95%
Connecticut	176.5324	0.94%
Texas	165.1552	0.88%
New Jersey	135.0756	0.72%
Sub-Total for Top 10	18,237.0572	97.22%
Grand Total	18,759.2069	100.00%

Approximately 73 percent of imported freight volume is consumed in Alabama, with only 27 percent transported to other states. The freight volume transported to the top 10 destinations is roughly 97 percent of total volume.

8.4.2 Imported Internal Freight Flow via Alabama

Imported internal freight flow represents the freight flow imported via international trade facilities in Alabama and consumed in Alabama.

Table 19: Imported Freight Volume by Area

Destination	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania
011 (Birmingham)	0	0	0	0.0005	0	0	0	0
012 (Mobile)	60.2068	799.9337	8271.372	520.5487	2256.587	785.5099	938.2966	88.7956

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Destination	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania
019 (Remainder of AL)	0	0	0	44.5903	0	0	0	0

Table 20: Imported Freight Volume by Final Destinations and by Modes

Mode	011 (Birmingham)	012 (Mobile)	019 (Remainder of AL)	Total	Ratio
Truck	1,874.0846	1,807.6800	665.4484	4347.213	31.58%
Rail	5,227.2512	303.7116	16.7695	5,547.7323	40.30%
Water	13.8004	24.2991	43.5942	81.6937	0.59%
Air	0	0	0	0	0.00%
Multiple and Mail	0.0322	1.1406	11.4519	12.6247	0.09%
Pipeline	0	460.3229	1,291.0723	1,751.3952	12.72%
Other and Unknown	0.1254	4.6424	8.6722	13.44	0.10%
No Domestic Mode	0	2,011.7419	0	2,011.7419	14.61%
Total	7,115.2938	4,613.5385	2,037.0085	13,765.8408	

The most used transportation for imported freight flow is rail, although truck also occupies roughly 32 percent. Most of imported coal is transported by rail from Mobile to Birmingham, and coal equals approximately 97 percent of total freight volume heading to Birmingham from Mobile.

8.4.3 Imported Outbound Freight Flow via Alabama

Table 21: Imported Outbound Freight Flow via Alabama (kilo tons)

Final Destinations	Volume	Ratio
Florida	1,236.3985	24.76%
Mississippi	1,211.5869	24.26%
Georgia	889.0947	17.81%
Pennsylvania	269.8580	5.40%
Ohio	209.7162	4.20%
Missouri	177.7989	3.56%
Connecticut	176.5324	3.54%
Texas	165.1552	3.31%
New Jersey	135.0756	2.71%
Michigan	124.5995	2.50%
Sub-Total for Top 10	4,595.8159	92.04%
Grand Total	4,993.3661	100.00%

More than half of imported freight volume via Alabama is transported to adjacent states including Florida, Mississippi, and Georgia.

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Table 22: Imported Outbound Freight Flow via Alabama by Modes (kilo tons)

Transportation	Volume	Ratio
Truck	3,509.1112	70.28%
Rail	812.7153	16.28%
Water	0.0023	0.00%
Air	0.0116	0.00%
Multiple and Mail	602.2922	12.06%
Pipeline	57.4522	1.15%
Other and Unknown	11.7813	0.24%
No Domestic Mode	0	0.00%

Approximately 70 percent of the imported freight volume is transported by truck, with 16 percent transported by rail.

Table 23: Imported Outbound Freight Flow via Alabama by Commodity Types (kilo tons)

SCTG/Commodity	Volume	Ratio
15 (Coal)	2,846.3585	57.00%
32 (Base Metals)	652.9732	13.08%
27 (Newsprint/Paper)	450.4635	9.02%
13 (Nonmetallic Minerals)	231.8991	4.64%
14 (Metallic Ores)	186.2367	3.73%
20 (Basic Chemicals)	164.4068	3.29%
33 (Articles-Base Metal)	143.2774	2.87%
26 (Wood Products)	113.6719	2.28%
16 (Crude Petroleum)	57.4522	1.15%
24 (Plastics/Rubber)	34.1865	0.68%
Sub-Total for Top 10	4,880.9258	97.75%
Grand Total	4,993.3661	100.00%

Coal represents the majority of imported freight via Alabama, with base metals a distant second.

8.4.4 Imported Freight Flow via Other States to Alabama

Imported freight flow via other states to Alabama indicates that the freight volume is imported via other states and transported to Alabama by domestic modes.

Table 24: Imported Inbound Freight Flow by Trading Partners (kilo tons)

Importing Partners	Volume	Ratio
801 (Canada)	1,463.5416	19.90%
802 (Mexico)	2,720.6132	36.99%
803 (Rest of Americas)	1,305.4661	17.75%
804 (Europe)	535.9660	7.29%
805 (Africa)	372.7942	5.07%
806 (Southern-Central-Western Asia)	121.8184	1.66%

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Importing Partners	Volume	Ratio
807 (Eastern Asia)	757.4669	10.30%
808 (South-Eastern Asia and Oceania)	77.2221	1.05%

Mostly the freight volume imported from Canada and Mexico is transported to Alabama via other states.

Table 25: Imported Inbound Freight Flow by Foreign Modes (kilo tons)

Foreign Modes	Volume	Ratio
Truck	436.6789	5.94%
Rail	1,101.5231	14.98%
Water	5,777.1024	78.55%
Air	0.7686	0.01%
Multiple and Mail	38.8139	0.53%
Pipeline	0	0.00%
Other and Unknown	0.0016	0.01%
No Domestic Mode	0	0.00%

Similar to Alabama, most freight volume is transported to the U.S. by waterway mode. However, freight imported from adjacent countries such as Canada and Mexico is mostly transported by truck or rail.

Table 26: Imported Inbound Freight Flow by Domestic Modes (kilo tons)

Domestic Modes	Volume	Ratio
Truck	3,205.1484	43.58%
Rail	1,949.9894	26.51%
Water	130.5040	1.77%
Air	0.7347	0.01%
Multiple and Mail	1,769.7973	24.06%
Pipeline	294.4500	4.00%
Other and Unknown	4.2647	0.06%
No Domestic Mode	0	0.00%

Approximately 70 percent of the imported inbound freight volume is transported by truck or rail mode. In addition, the freight transported by multiple modes ratio is more than 24 percent, which is relatively high.

Table 27: Imported Inbound Freight Flow by Domestic Transit Area

Domestic Transit Area	Volume	Ratio
Florida	2,065.2428	28.08%
South Carolina	1,310.0690	17.81%
Texas	842.4849	11.45%
Minnesota	648.4236	8.82%
Louisiana	579.1122	7.87%
California	562.5410	7.65%
Michigan	342.5851	4.66%
Georgia	275.4570	3.75%

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Domestic Transit Area	Volume	Ratio
North Dakota	229.9263	3.13%
Washington	137.8697	1.87%
Sub-Total for Top 10	6,993.7116	95.09%
Grand Total	7,354.8885	100.00%

Florida is the biggest imported freight transit area to Alabama.

8.5 Exported Freight Flow

Exported freight flow means the freight flow exported to foreign countries. Similar to imported freight, the flow can be classified as two categories. The first category is freight flow exported via Alabama, including the freight produced in Alabama and produced out-of-state. The other category is freight produced in Alabama that is exported via out-of-state trade facilities.

8.5.1 Exported Freight Flow via Alabama

Table 28: Exported Freight Flow via Alabama by Trade Partners (kilo tons)

Trade Partners	Volume	Ratio	11 (Birmingham)	12 (Mobile)	19 (Remainder of AL)
801 (Canada)	54.7590	0.29%	0	54.7590	0
802 (Mexico)	3,945.4271	21.05%	0	3,945.4271	0
803 (Rest of Americas)	3,709.3054	19.79%	0	3,709.3054	0
804 (Europe)	5,986.2241	31.94%	0	5,949.7936	36.4305
805 (Africa)	1,613.0326	8.61%	0	1,612.9429	0.0897
806 (Southern-Central-Western Asia)	1,206.9499	6.44%	0	1,206.9499	0
807 (Eastern Asia)	1,981.8686	10.57%	0	1,981.8686	0
808 (South-Eastern Asia and Oceania)	243.9924	1.30%	0	243.9924	0

The Europe area is the biggest trade partner of Alabama, with approximately 32 percent of exported freight volume that predominantly uses the Mobile area in Alabama. Then, 21 percent of the freight is exported to Mexico, and roughly 20 percent to other America countries.

Table 29: Exported Freight Flow Ratio via Alabama by Trade Partners and Foreign Modes (kilo tons)

Mode	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania
Truck	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Rail	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Water	0.292%	21.052%	19.792%	31.747%	8.606%	6.440%	10.575%	1.302%
Air	0.000%	0.000%	0.000%	0.194%	0.000%	0.000%	0.000%	0.000%
Multiple and Mail	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pipeline	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Other and Unknown	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
No Domestic Mode	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

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Almost 99.8 percent of exported freight volume is transported by waterway via the Port of Mobile.

Table 30: Top 10 Exported Freight Flow via Alabama by Commodity Types (kilo tons)

SCTG/Commodity	Volume	Ratio
15 (Coal)	9,408.8335	50.20%
19 (Natural Gas and Petroleum Products)	2,594.0223	13.84%
02 (Cereal Grains)	1,730.0995	9.23%
27 (Newsprint/Paper)	1,218.2152	6.50%
20 (Basic Chemicals)	804.9085	4.29%
05 (Meat/Seafood)	682.3744	3.64%
26 (Wood Products)	598.5276	3.19%
03 (Other Agricultural Products)	556.0477	2.97%
28 (Paper Articles)	273.6392	1.46%
22 (Fertilizers)	205.5291	1.10%
Sub-Total for Top 10	18,072.1970	96.43%
Grand Total	18,741.5591	100.00%

More the 50 percent of exported inbound freight volume is coal.

Table 31: Top 10 Exported Freight Flow via Alabama by Domestic Freight Origins (kilo tons)

Domestic Freight Origins	Volume	Ratio
Alabama	13,676.2080	72.97%
Ohio	1,566.5683	8.36%
Florida	429.4106	2.29%
Kansas	361.5928	1.93%
Georgia	303.7568	1.62%
Texas	288.1917	1.54%
Connecticut	279.7684	1.49%
Louisiana	244.8309	1.31%
Washington	240.1154	1.28%
Massachusetts	236.1958	1.26%
Sub-Total for Top 10	17,626.6387	94.05%
Grand Total	18,741.5388	100.00%

Approximately 73 percent of exported freight volume is originated in Alabama. Ohio is the biggest customer for exporting facilities in Alabama.

8.5.2 Exported Internal Freight Flow via Alabama

Exported internal freight flow represents the freight flow exported via Alabama to international trade facilities.

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Table 32: Exported Internal Freight Flow by Departing Area

Origin	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania
011 (Birmingham)	0	0	0	0	0	0	0	0
012 (Mobile)	47.6831	2,974.92	3064.119	4,934.847	633.1802	1,059.035	723.2934	202.6106
019 (Remainder of AL)	0	0	0	36.4305	0.0897	0	0	0

Most of exported freight volume uses the Port of Mobile. Only rare freight volume uses other areas.

Table 33: Exported Internal Freight Flow by Produced Area (kilo tons)

	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania	Total
011	0.7765	75.3765	1,689.9993	1,568.352	181.5192	876.5908	0.8025	0.665	4394.0820
012	46.2898	2,667.191	97.4212	115.5033	47.7448	1.8516	320.991	120.0705	3417.0631
019	0.6168	232.3522	1,276.6989	3,287.422	404.0059	180.5925	401.4999	81.8751	5865.0629

The table shows the exported freight O/D matrix. For example, a total of 4,394.082 kilo tons of freight is produced in the Birmingham area, then approximately 1,700 kilo tons of freight is exported to the Rest of America countries.

Table 34: Exported Internal Freight Flow by Domestic Modes (kilo tons)

Area\Mode	Truck	Rail	Water	Air	Multiple	Pipeline	Other/ Unknown	No Domestic Mode
011 (Birmingham)	3,649.985	743.9965	0	0	0.0656	0	0.0352	0
012 (Mobile)	2,930.101	73.7384	122.7454	0	249.193	34.6551	6.6303	0
019 (Remainder of AL)	1,518.226	4,344.539	1.1468	0	0.6799	0	0.4711	0
Total	8,098.312	5,162.274	123.8922	0	249.9385	34.6551	7.1366	0

More than half of freight flow in Alabama is transported to the Port of Mobile by trucks. The main commodity which is transported by rail from the Remainder of Alabama is coal, and it is approximately 95 percent of total railroad freight volume.

8.5.3 Exported Inbound Freight Flow via Alabama

Exported inbound freight flow means that the freight produced in other states is transported domestically to Alabama and exported via Alabama international trade facilities.

Table 35: Exported Inbound Freight Flow by Origins

Freight Origins	Volume	Ratio
Ohio	1,566.5683	30.93%
Florida	429.4106	8.48%
Kansas	361.5928	7.14%

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Freight Origins	Volume	Ratio
Georgia	303.7568	6.00%
Texas	288.1917	5.69%
Connecticut	279.7684	5.52%
Louisiana	244.8309	4.83%
Washington	240.1154	4.74%
Massachusetts	236.1958	4.66%
New York	221.2828	4.37%
Sub-Total for Top 10	4,171.7135	82.36%
Grand Total	5,065.3405	100.00%

Nearly one-third of exported inbound freight flow from Alabama originates in Ohio.

Table 36: Exported Inbound Freight Flow by Domestic Mode

Domestic Mode	Volume	Ratio
Truck	1,785.3783	35.25%
Rail	681.4574	13.45%
Water	3.9272	0.08%
Air	0.0018	0.00%
Multiple and Mail	2,580.1443	50.94%
Pipeline	0	0.00%
Other and Unknown	14.4421	0.29%
No Domestic Mode	0	0.00%

Table 37: Exported Inbound Freight Flow by Commodity Types

SCTG/Commodity	Volume	Ratio
02 (Cereal Grains)	1,730.0943	34.16%
05 (Meat/Seafood)	672.8964	13.28%
03 (Other Agricultural Products)	550.3261	10.86%
27 (Newsprint/Paper)	434.9129	8.59%
20 (Basic Chemicals)	395.2620	7.80%
26 (Wood Products)	285.6681	5.64%
15 (Coal)	215.8375	4.26%
32 (Base Metals)	193.9591	3.83%
22 (Fertilizers)	192.9883	3.81%
28 (Paper Articles)	166.6644	3.29%
Sub-Total for Top 10	4,838.6091	95.52%
Grand Total	5,065.3511	100.00%

Approximately one-third of exported inbound freight flow from Alabama travels by truck, while approximately half goes by multiple modes. The largest portion of exported inbound freight from Alabama is cereal grains, followed by meat/seafood and other agricultural products.

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8.5.4 Exported Freight Flow via Other States from Alabama

Exported freight flow via other states from Alabama indicates that the freight produced in Alabama is transported from Alabama by domestic modes and exported via other states.

Table 38: Exported Outbound Freight Flow by Domestic Destination (kilo tons)

Domestic Destination	Volume	Ratio
Texas	1,171.7294	26.81%
Georgia	661.2966	15.13%
New York	595.6755	13.63%
Michigan	519.9130	11.90%
South Carolina	297.9475	6.82%
North Dakota	228.9990	5.24%
Louisiana	204.2686	4.67%
Florida	185.4617	4.24%
California	181.1881	4.15%
Mississippi	87.7590	2.01%
Sub-Total for Top 10	4,134.2384	94.60%
Grand Total	4,370.3174	100.00%

Table 39: Exported Outbound Freight Flow O/D matrix

Origin	801 Canada	802 Mexico	803 Rest of Americas	804 Europe	805 Africa	806 S-C-W Asia	807 Eastern Asia	808 S-E Asia & Oceania
Texas	0.1881	752.1739	28.1087	336.0334	0.5225	3.9663	48.8274	1.9091
Georgia	0.0032	0.4216	33.4425	287.1296	19.6237	71.486	218.0867	31.1033
New York	568.9198	0.2767	0.0079	26.4483	0	0.0086	0.0142	0
Michigan	519.1992	0.0123	0	0.5291	0	0.0445	0.1211	0.0068

Approximately 70 percent of freight volume via Texas is exported to Mexico. Also, New York and Michigan have inland borders with Canada and, therefore, most of exported freight to Canada uses these two states as transit areas.

Table 40: Exported Outbound Freight Flow by Domestic Modes

Domestic Mode	Volume	Ratio
Truck	1,751.9595	40.09%
Rail	1,743.5779	39.90%
Water	0.0059	0.00%
Air	1.7241	0.04%
Multiple and Mail	824.5997	18.87%
Pipeline	0.0575	0.00%
Other and Unknown	48.3928	1.11%
No Domestic Mode	0	0.00%

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Truck mode and rail mode transport approximately 40 percent of exported freight each.

Table 41: Exported Outbound Freight Flow by Commodity Types

SCTG/Commodity	Volume	Ratio
20 (Basic Chemicals)	626.6382	14.34%
36 (Motorized Vehicles)	619.7994	14.18%
27 (Newsprint/Paper)	608.1614	13.92%
32 (Base Metals)	357.0744	8.17%
28 (Paper Articles)	261.4965	5.98%
14 (Metallic Ores)	229.7829	5.26%
13 (Nonmetallic Minerals)	218.1392	4.99%
24 (Plastics/Rubber)	210.8990	4.83%
26 (Wood Products)	198.4042	4.54%
03 (Other Agricultural Products)	123.1470	2.82%
Sub-Total for Top 10	3,453.5422	79.02%
Grand Total	4,370.3174	100.00%

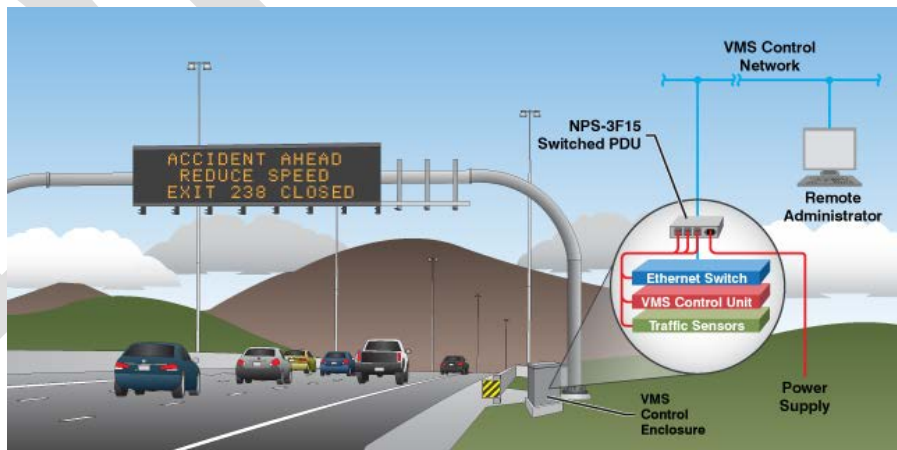
Basic chemicals, motorized vehicles and newsprint/paper are the most exported commodities in Alabama.

9.0 Freight ITS

There are numerous criteria which can be applied to categorize freight ITS. Freight ITS can be classified by performance dimensions, such as safety and security, effectiveness and efficiency, and environmental performance. On the other hand, freight ITS can be classified as nine systems by operation types (MirzabeikiVahid 2013). In this abstract, the nine classified Freight ITS are introduced in the following.

9.1 Traffic Control and Monitoring Systems

The systems are developed to control and manage traffic flow by providing information of traffic conditions on networks, such as incidents, congestions, and/or travel speeds. The information is generally provided by Variable Message Signs (VMS), radio, or Internet. The systems can be helpful to manage fleets, ports, and terminal operations.



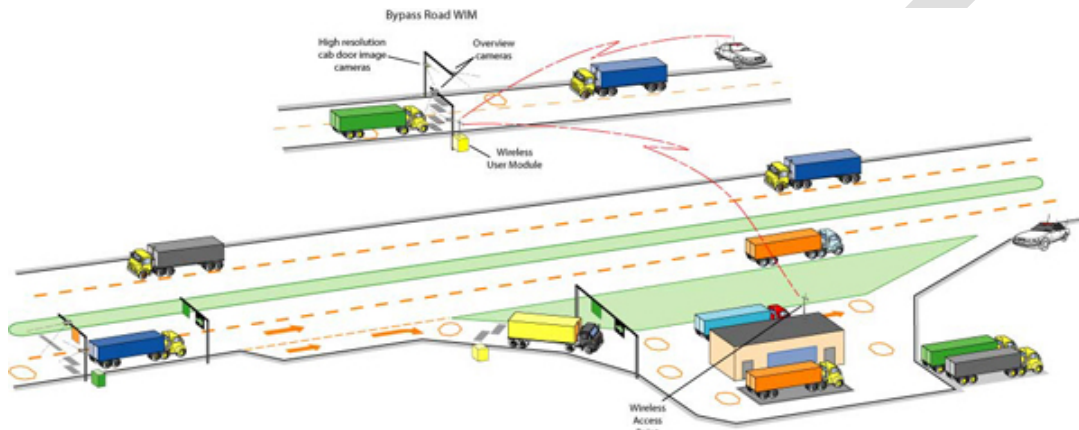
<https://www.wti.com/userimages/traffic-app-vms-648.png>

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9.2 Weigh-in-Motion (WIM) Systems

The systems are used to control and weigh vehicles to increase transportation safety and reduce damages on the road. WIM can be used to enforce over-weighted vehicles and to collect truck information, such as truck volumes and truck types, for assisting in pavement design and management.



<http://media.mt.com/dam/Industrial/Terminals/96351.jpeg>

9.3 Delivery Space Booking Systems

The delivery space booking systems help to book the parking space for a specific vehicle to load or unload freight during a specific time period. The systems are helpful to reduce fuel consumption, environmental impacts and network congestion, specifically in urban area. In addition, the systems can be used for intermodal terminals to improve efficiency performance.



(Patier, et al. 2014)

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9.4 Vehicle Location and Condition Monitoring Systems

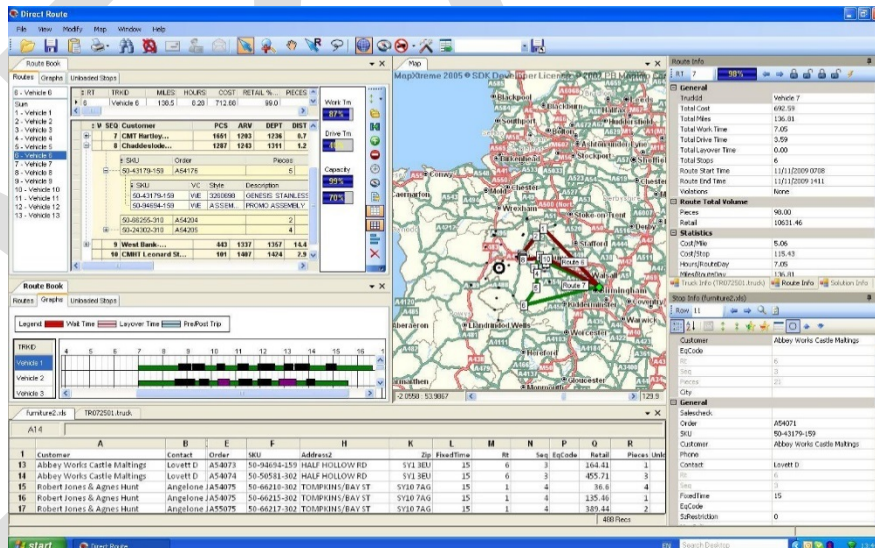
The systems provide real time information of vehicle's location. The typical sensor installed on the vehicle or the container is Global Positioning System (GPS) and GPS transmits location information via satellite. The systems are used in improvements of fleet management, hazardous material transport, and freight security. In addition, the systems allow to estimate expecting arrival time or delay time using the information.



<http://www.gpscommander.com/wp-content/themes/GPSCommander/images/gps-vehicle-tracking-splash.jpg>

9.5 Route Planning Systems

Route planning systems are utilized in planning transportation routes in response to traffic condition, such as congestion, road works, or incidents.



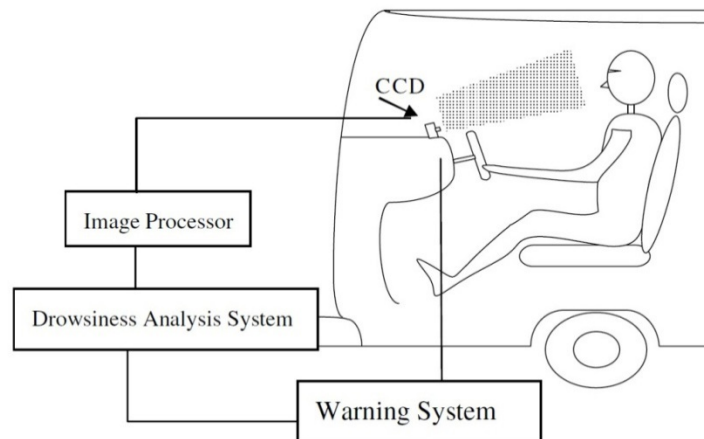
<http://www.autologic-systems.co.uk/>

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9.6 Driving Behavior Monitoring and Control Systems

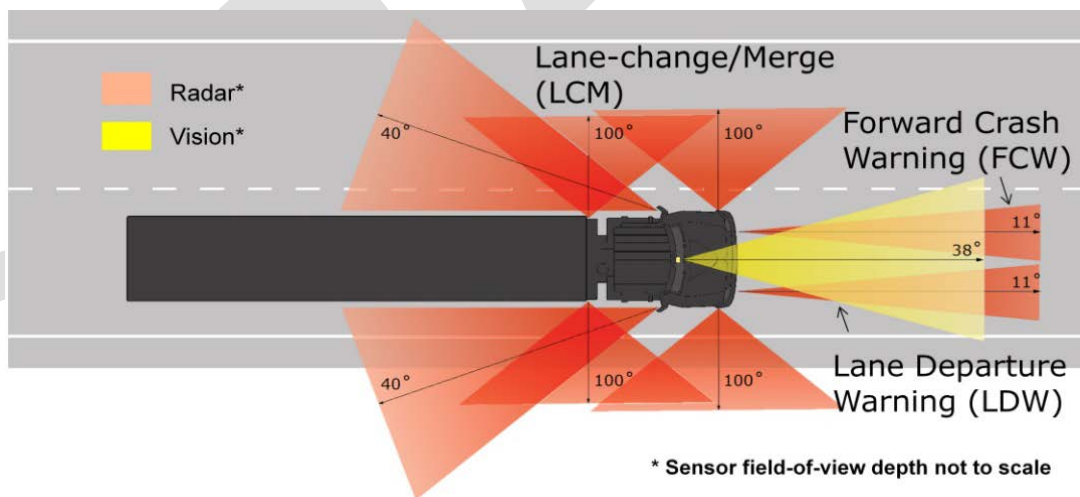
The systems are used to identify driving behaviors such as travel speed, acceleration, or drowsy driving. The system analyzes driving condition and feedback information to reduce fuel consumption and improve driving safety.



(WuJian-Da, ChenTuo-Rung 2008)

9.7 Crash Preventing Systems

The systems use technologies such as sensors to reduce the probability of accidents. Sensors installed on the truck give a driver warning message when the truck gets too close to some object like a passenger car.



(Nodine and Najm 2012)

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9.8 Freight Location Monitoring Systems

Using Radio Frequency Identification (RFID), the systems record and control the freight movements. With automatic identification systems, users are able handle large numbers of RFID tags at the same time and to decrease the number of errors.



<http://www.scobielogistics.com/wp-content/uploads/RFID-diagram-Vehicle-Tracking-v2.jpg>

9.9 Freight Status Monitoring Systems

The systems measure the physical attributes of goods, such as temperature, humidity, impact level, light level and vibration level using the installed sensors. The systems can control freight conditions for perishable foods, medicine or hazardous materials, and also improve safety and security of transported goods.