Nashville Regional Freight and Goods Movement Study
Phase II

Scope of Work

Submitted to:
Nashville Area MPO

Submitted by:
Wilbur Smith Associates

The objective of the Phase II Nashville Regional Freight and Goods Movement Study is to build upon the findings and recommendations from the Phase I study and further develop a set of tools to help the MPO identify and prioritize projects for its Long Range Transportation Plan that accommodate and enhance the mobility of goods. Since this is the second phase of the Nashville Regional Freight Study, The WSA Team has structured its approach around expanding the data collection efforts and recommendations developed from the Phase I study. **Figure 1** depicts the study progress to date.

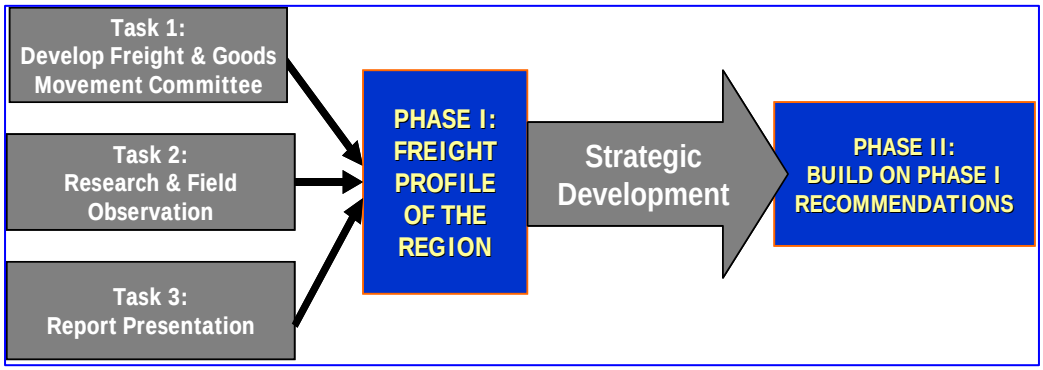

Figure 1: Phase I Study Development

Phase II will focus on developing the following results:

Develop a freight model to forecast freight activity and truck movements for the region.

- Support ongoing Freight Advisory Committee activities; the FAC will be involved throughout the study, and possibly beyond, to provide feedback toward the study, and to help the MPO itself as it plans for future transportation needs.

- Identify potential strategies, some of which can be implemented immediately after the current study, and others to be refined in subsequent phases.

- Identify a set of project scoring criteria that would enable the MPO to implement its identified goals, objectives, and policies.

- Develop a set of tools to analyze each potential project for the identified project scoring criteria.

- Identify specific projects to be considered for the Long Range Transportation Plan.

The final result will provide cost effective projects that focus on improving the movement of freight from a total supply chain perspective. Establishing a robust plan that is focused on satisfying the needs of the freight transportation industry and improving the flow of goods throughout the region assists public officials in making policy decisions that support attracting new businesses to the region.

The Wilbur Smith Associates (WSA) Team understands the importance of this study and we have assembled the most qualified and committed individuals in the region to help the

Nashville Area MPO with this effort. The successful implementation of the plan is paramount to the region's ability to maintain an economic competitiveness and provide economic opportunities for its residents.

Task 1: Develop Consultant Coordination Plan

Purpose: This task will establish an effective management approach and project coordination for The Nashville Regional Freight Study. This specific management approach is based on practical experience and best practices which will be tailored to this specific project.

Approach:

General Project Coordination: The project manager will coordinate with Task Leaders at least bi-weekly, and if needed daily, to ensure that any potential issues that may arise are identified early so that the project proceeds as planned. Project progress reports will be provided in detail on a monthly basis and will include, but not be limited to, a summary of activities completed in the previous reporting period and identification of activities anticipated for the next period. The project schedule will be updated monthly to reflect progress on assignments.

Budget Control: Wilbur Smith Associates uses an in-house project management software that provides automated cost control and project management information, which will aid in tracking project costs and budget status. This system effectively identifies budget discrepancies and helps alleviate potential budget issues throughout the course of the project.

Project Management Plan: A Project Management Plan (PMP) will be prepared at the start of the project to identify work organization, program, outreach plan, responsibilities, coordination and communication procedures; team meetings, document format, report format, technical memorandum schedules, graphic production standards, and other important operational information pertaining to the team activities.

Project Schedule: WSA uses a variety of tools for developing project schedules, such as Microsoft Project, or more straight forward tools such as Excel or Powerpoint. This proposal provides an overall schedule for tasks and deliverables. However, a more detailed schedule will be provided upon notice to proceed.

Quality Assurance/Quality Control Program: Quality Assurance/Quality Control (QA/QC) on a project of this magnitude is central to a successful work plan. We propose a very formal approach to quality management, one based on WSA's comprehensive experience in the management of a large multi-disciplinary team. Effective quality management is accomplished by the systematic utilization of three key elements:

1. Quality-oriented personnel;

2. Comprehensive quality assurance program to verify compliance with prescribed procedures; and
3. Well-planned project quality control procedures.

The QA/QC plan will be incorporated as apart of the Consultant Coordination Plan. As a fundamental element throughout the project, this plan will outline QA/QC activities that will be implemented, and included a scheduled time frame though MS project or Excel and used as a working document to organize, plan, and implement project measures goals and outcomes. This effort will be lead by the WSA project manager though coordination with the Nashville MPO project manager.

The WSA team has successfully worked with each of the firms and individuals on previous projects, therefore, ensuring a clear understanding of processes and expectations. The overall QA/QC plan will focus on the following:

- Identifying the requirements of each deliverable (content, formatting etc.);
- Listing the project deliverables to be produced;
- Coordinating with MPO staff on project needs; and
- Adhering to the budget and project timeline.

Key to the QA/QC plan is to ensure that all of inputs into the study and model are relevant and accurate. Since the study and model will rely on information from quantitative data resources as well as qualitative feedback (from private sector), protocols will be established to ensure that data and feedback is precise. The protocols can include the source of data (public vs. private), frequency, magnitude and relevance. The ultimate outcome is to:

- Ensure the accuracy of data and research content; and
- Validate information from data resources and stakeholders.

All feedback will be taken from stakeholders and verified by the WSA team through follow-up conversation, site visits and additional research efforts. Once verified by the project team, these data elements will be presented to the MPO projected manager and the Freight Advisory committee if necessary for incorporation into the study or used as data points for input into the freight model (**Figure 2**).

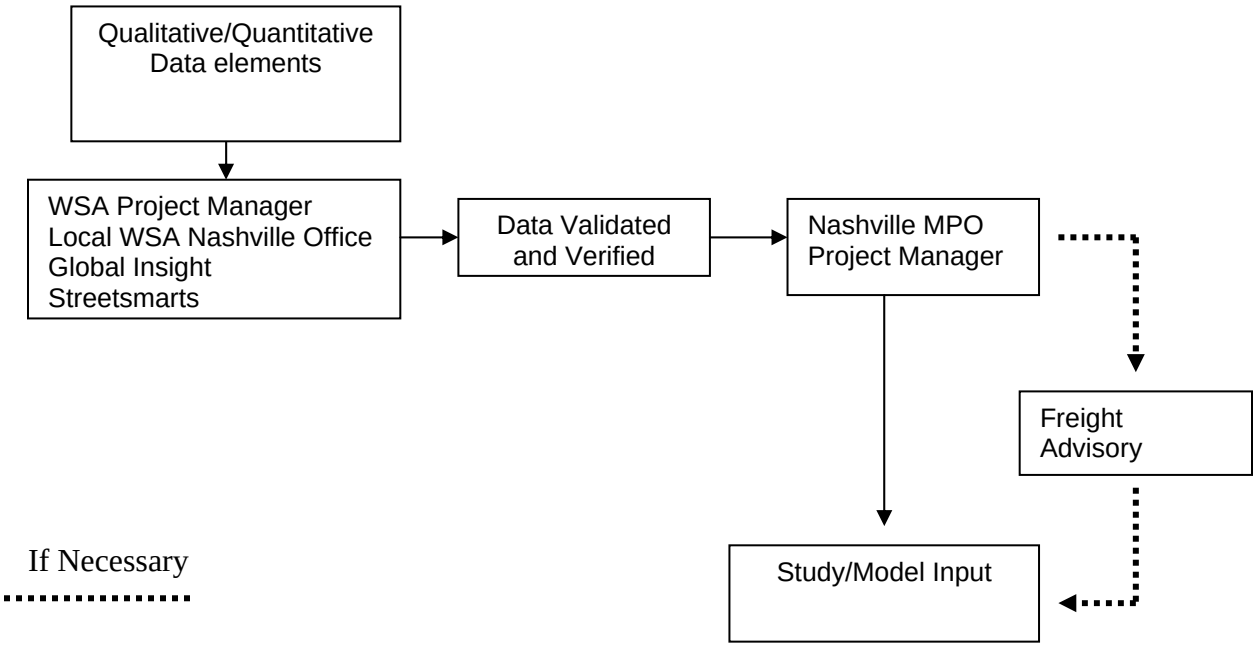

Figure 2: QA/QC Data Verification

Wilbur Smith Associates is committed to excellence in each of these three elements. The personnel nominated for the WSA Team are not only technically and managerially well qualified, but they are also oriented to quality management. Each has demonstrated a commitment to quality on past related projects.

Progress Reports: The PMP will outline the timing and format for progress reports. At a minimum, we will include:

- Activities, ongoing or completed, during the reporting period;
- Activities planned for the following month;
- Problems encountered and actions to remedy them; and
- Overall statuses, including a tabulation of percent complete by task, management and schedule showing study progress, and supporting documentation.

Project Meetings: The PMP will outline the timing of all anticipated meetings with the MPO Project Manager, and the Freight Advisory Committee. The WSA team will produce the support material needed for the meetings, as well as taking all meeting notes, summarizing the discussions, and outlining decisions and action items.

Study Control/Scheduling: A detailed project schedule will be prepared as part of the PMP at the beginning of the project and reviewed with the Nashville MPO Project Manager prior to proceeding with the major tasks. The schedule will indicate tasks, subtasks, critical dates, milestones, deliverables, and review requirements. Progress will be reviewed monthly and should these reviews indicate a substantial change in progress, the schedule will then be reviewed with the MPO Project Manager.

Subconsultant Management: The WSA Team Project Manager will prepare subcontracts for subconsultants, monitor subconsultant staff activities and adherence to schedules, review, and recommended approval of subconsultant invoices. WSA has successfully worked with each of the firms on the team on pervious projects; therefore all consultants involved are familiar with the project structure and task responsibilities.

Deliverables *(Consultant Coordination Plan)***:** A detailed consultant coordination plan that describes all management activities and schedules will be developed.

Task 2: Develop Public participation and Stakeholder Involvement Plan

Purpose: The purpose of this stakeholder outreach and public involvement task is to support the MPO and the participating agencies with all public and private sector outreach efforts regarding this Freight Study effort.

Approach: The goal of this task is to strengthen the current Freight Advisory Committee, educate policymakers and the public on the role of freight in the region's economy and ultimately integrate freight into the MPO planning process. The main goal of the FAC is to provide insight into the study's progress and activities, and provide feedback on freight related issues that affect the Nashville region.

It is our understanding that the FAC will already be established by the time of the study kickoff. However, if desired, the WSA team can utilize its contacts in the freight community to entice other stakeholders to get involved with the study. Utilizing the committee through every step of the project will help legitimize the study results and strengthen public and private sector interaction.

With the FAC already established, the WSA team will call and explain the details of the study, what is expected of each of the committee members, and the benefits of being involved. We will then solicit input from other key business groups that are instrumental to the region.

For example, since 87 percent of the freight moving through the Nashville region moves by truck, organizations such as the Tennessee Trucking Association can play a vital role in providing collaborative efforts for this study. Other groups such as the Middle Tennessee Council of Supply Chain Management Professionals Organization will provide a link toward identifying key stakeholders in the region. Lastly, as we begin to talk with these stakeholder groups, we will inquire about other stakeholders to which we

should be reaching out to which often uncovers some of the most valuable contributors to a study of this caliber.

One of the key components of a planning study such as this (as well as being a SAFETEA-LU requirement), is public involvement. Often, the general public can provide much needed insight into the locations of heavy commodity flow routes and specific locations where trucks and other freight related vehicles have difficulty maneuvering. In addition, the general public does not always fully understand the economic significance that freight possesses, therefore, this study can serve as a tool to educate the general public about the needs and importance of the freight community.

The WSA team will hold two public meetings during the course of the study geared toward getting valuable feedback and educating them on the importance of freight and goods movement. A "Freight Issues and Opportunities" public meeting will be held within the first 3 months of the study with the goal of gaining input from the public on the issues they feel should be addressed during the course of the study and ideas on opportunities they feel could be utilized to address those issues.
A second public meeting will be held toward the conclusion of the study. This session will serve as an opportunity for the general public to view study results and recommendations and to provide feedback. This feedback will be incorporated into the final document and any necessary changes that result from the meeting will be addressed.

All public meetings will be scheduled in accordance with the adopted Public Participation Plan of the MPO.

Deliverables *(Public/Private Stakeholder Plan)***:** A detailed stakeholder and public involvement plan.

Task 3: Identify Existing Trends and Conditions(Data Collection)

Purpose: The ability to identify existing trends and conditions will be through the development of a data and information collection plan. This particular plan will addresses two primary needs. First, is the update of the findings and conclusions from the study's first phase to affirm their validity three years later, supplement or change them as necessary, and refresh their strategic guidance for regional freight planning. Second is preparation of a body of material that can feed the regional freight model as it is developed in this second phase study, and as it is used and maintained in subsequent years.

Approach: The first stage will be the collection of existing information from public sector studies and reports. The WSA team will review existing literature and studies which have impacted the area. State DOT plans (such as the I-40/81 study and LRTP), freight corridor studies, MPO freight plans or studies, and freight related projects will be reviewed. This literature review will be the launching point for the study. At a minimum, the reports to be reviewed will be:

- Nashville Area MPO Freight Study Phase I
- TDOT Long Range Transportation Plan
- Tennessee Rail System Plan
- Tennessee Airport System Plan
- Latin America Trade and Transportation Study
- I-40/I-81 Corridor Study
- Rules and Regulation for Overweight and Over Dimensional Movements

The plans, reports and material cited will be reviewed for their relevance to conditions and planning in Nashville, and recent developments researched which may update their implications. The Crescent Corridor initiative now in the works at Norfolk Southern is one example of the value of updating information pertaining to freight related activities in the region, because it formulates an east/west route on a different alignment than contemplated by the Tennessee Rail Plan. Next, coordination with at least two important ongoing studies will be established with their project managers: the first is the TDOT I-40/I-81 Corridor project, and the second is the strategic infrastructure plan by the Memphis Regional Chamber. The latter is being conducted by a Global Insight/Wilbur Smith team, and features analysis of major market trends affecting logistics opportunities in Tennessee, as well as interviews with prominent companies engaged in goods distribution whose views will be meaningful for Nashville. Finally, a meeting of the Freight Advisory Committee should be convened to probe immediate concerns and current views of the issues cited in the first phase report.

With these elements as a foundation, information will be assembled in three ways, following a combined approach:

- *Field Interviews & Observation* – Personal interviews will be conducted with stakeholders representing a cross-section of the regional economy and goods movement functions. They will include the health care, publishing, electronics, automotive, and distribution industries, as well as motor, rail, water and air carriers, and logistics firms. Those who were reached during Phase I can be interviewed in a summary manner that is intended to focus on changes that have occurred since the previous study and current perspectives; the others will be engaged more thoroughly about their operations, needs, and concerns. Traffic volumes and expectations, service requirements, performance obstacles and bottlenecks, and "quick start" opportunities will be among the subjects explored. Approximately thirty interviews will be carried out through a mixture of in-person visits and telephone discussions. Physical conditions will be observed and documented by the study team in the course of this work, particularly examining operating challenges and access efficiency, with idea of looking ahead to the needs assessment.

- *Local Data Collection* – Field interviews will produce points of view about planning, policy, and strategic issues; in addition, they will yield one set of inputs for traffic volumes and patterns. Another set of inputs will be developed through local data collection efforts. The first and primary effort will be on-the-ground

surveys managed by team partner StreetSmarts, who specialize in such work. Format options include cordons, truck or fuel stop locations, and terminal surveys (including intermodal terminals). Less intrusive means probably will be favored, but the study team will prepare a selection of methods and sites, and decide among them in cooperation with the client. Information collected will include origins and destinations, routes, temporal factors, and equipment characteristics. A secondary effort proposes selective deployment by the client of portable traffic counters closely situated at the approaches to major freight generators and consumers, a number of which were identified in Phase I work. This has a two-fold purpose: it should yield truck traffic estimates by which to calibrate the regional freight model, and it should be repeatable in future years to maintain currency in the model and capture changes in the freight market.

- *Database Processing* – The Tennessee DOT will make available to MPOs across the state a current TRANSEARCH freight flow database, which is produced by team member Global Insight. An earlier edition was used in the Phase I study. The new version will capture county-to-county modal and commodity flows for base year 2006 and forecast year 2035, and it contains both overhead (external-external) and Nashville-based traffic. Using this resource as a starting point, two steps of further processing will be applied to the data to prepare it as an input to the regional model. First, county traffic within the MPO region will be broken down into 5-digit zipcode flows, utilizing input from field interviews and local data collection, in addition to proprietary information collected by Global Insight. Second, traffic generation and consumption estimates will be created for business establishments in the Harris Info Source data set. These will be based again on field interviews and local data collection as well as on TRANSEARCH volumes, and they will be constrained to align with the 5-digit zipcode commodity activity. Each of these steps has been undertaken successfully by the study team in previous urban freight studies, and each will be executed for the base year and the forecast year. If desired, intermediate year volumes can be created from the original Global Insight freight forecasts (which are not merely interpolations), and made available for **Task 4**.

Deliverable *(Technical Memo #1)*: Technical Memo #1 will provide detailed commodity flow information. All information gleaned from **Task 2** such as private and public sector insights on regional freight movements will be incorporated in Technical Memo#1

Task 4: Determine Projected Freight Flows for MPO Planning Horizon Years

Purpose**:** An instrumental deliverable of the freight study is the development of a tool to estimate future levels of freight movements in the Nashville region. This task will design the model recommended in the "Nashville Area Freight and Goods Movement Study Phase I". The WSA team understands the MPO's desire to develop an integrated freight model; therefore, the following approach to the freight model will produce the following results:

- Estimate changes in heavy truck traffic volumes and routing associated with major infrastructure projects and alignments within the metropolitan area.
- Provide a defensible basis for estimating changes in pavement wear and the life cycle of infrastructure on major facilities within the MPO.
- Provide a comprehensive, quantitative and geographical understanding of the internal and external sources and routing of traffic through the Nashville Area.

WSA is proposing to develop a Macro / Micro Framework for the integrated model design. The macro portion of the model is the area outside of the Nashville Region that includes the full extent of the United States and addresses the larger macro economic movements. Conversely, the micro model corresponds to the Nashville region model area. The point of integration between the two models is the external stations that connect the Nashville region to the rest of the country(**Figure 3**).

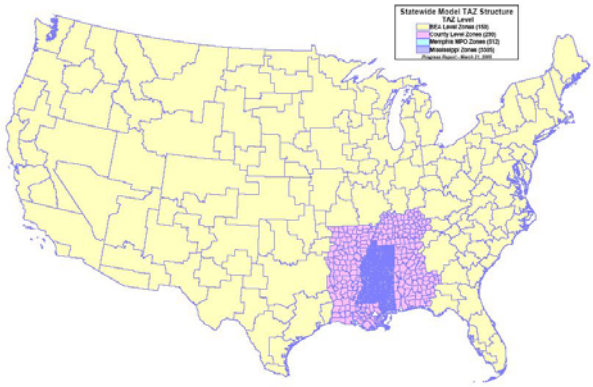

Figure 32: Example of Macro / Micro Zone Structure (Mississippi Statewide Model)

The functioning of the model will be coordinated with MPO model staff to ensure that additional inputs required for the freight model are prepared in such away that they are consistent with standards and naming conventions used through the Travel Demand Model. It is anticipated that in order to make model runs as efficient as possible for the modeling staff, options will be included in the interface to either include a new run of the freight model to generate new demand, or to instead use existing trip tables from a prior run.

Movement Types

As outlined in the original scope of services, WSA proposes to generate freight movements organized by geography and commodity groups. The movements will include:

- Inbound to the Region
- Outbound from the Region
- Through Movements
- Internal Movements by Vehicle Type (Light, Medium and Heavy)

The following flow chart shows the general model structure.

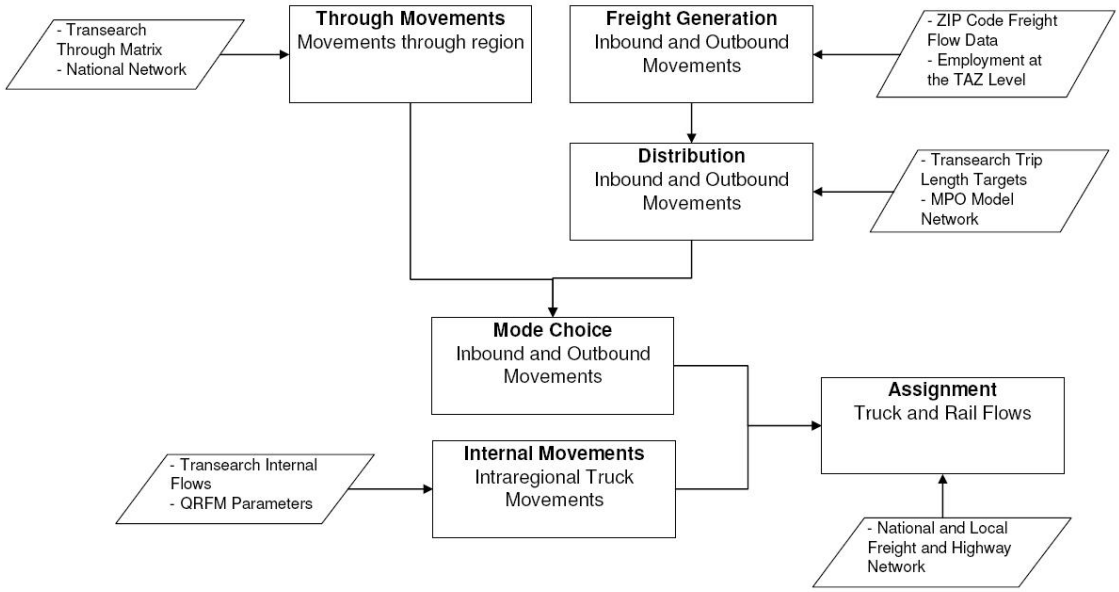

Figure 3. Freight Model Structure

Inbound and outbound movements will be further stratified by commodity groupings that have similar generation characteristics based on employment and facilities. The final commodity groups will be based on a review of the TRANSEARCH data using statistical analysis to find groupings that have similar rates of generation and consumption by employee. Work on similar models has resulted in the following commodity groupings based on the major STCC groups (**Table 1**)

Table 1. Example of STCC Commodity Groupings

STCC2	DESC	GROUP
1	Agricultural Production & Livestock	1
8	Primary Forest Products	1
9	Fresh Fish or Marine Products	1
10	Metallic Ores	1

STCC2	DESC	GROUP
11	Coal	1
13	Crude Petroleum or Natural Gas	1
14	Nonmetallic Minerals	1
19	Ordnance or Accessories	8
20	Food or Kindred Products	3
21	Tobacco Products	3
22	Textile Mill Products	4
23	Apparel or Related Products	4
24	Lumber or Wood Products	5
25	Furniture or Fixtures	5
26	Pulp, Paper or Allied Products	5
27	Printed Matter	5
28	Chemicals or Allied Products	6
29	Petroleum or Coal Products	6
30	Rubber or Misc. Plastics	4
31	Leather or Leather Products	4
32	Clay, Concrete, Glass or Stone	7
33	Primary Metal Products	7
34	Fabricated Metal Products	7
35	Machinery	8
36	Electrical Equipment	8
37	Transportation Equipment	8
38	Instruments, Photo Equip, Optial Eq	8
39	Misc. Manufacturing Products	8
40	Waste or Scrap Materials	9
41	Misc. Freight Shipments	9
42	Shipping Trailers/Containers	9
43	Mail or Contract Traffic	9
44	Freight Fowarder Traffic	9
45	Shipper Association Traffic	9
46	Misc Mixed Shipments	9
47	Small Packaged Freight Shipments	9
48	Waste Hazardous Materials	11
49	Hazardous Materials or Substances	11
50	Secondary Traffic	10

Transfer Between Modes

An important consideration in developing a commodity based freight model is the interaction between the modes and movement types. This is especially relevant to transfer of commodities between rail, water, air to trucks or visa-versa. WSA is well aware of these issues and plans to address them specifically because they have an important impact on movements in the region. The TRANSEARCH Database provides a good starting point for this with the secondary movements and drayage being identified as unique movements. These movements will be supplemented with data gathered during the study and used in the model.

Geographic Inputs

In order to integrate the Goods Movement Model with the MPO Model, it will be necessary to develop a national zone and network zone structure that will feed the movements into the five county Nashville MPO model region. This model structure is often referred to as a Macro / Micro framework. Wilbur Smith has applied this framework in statewide models including the Louisiana and Mississippi Statewide Models.

Macro / Micro Framework

The Macro portion of the model is a national level zone structure and network. The zone structure will be consistent with the zones as defined in the TRANSEARCH database. It is expected that within Tennessee, the zones will be defined at the county level, and as moving away from the state will increase to Bureau of Economic Analysis regions. The national network will include rail and highway facilities with increased accuracy within the state of Tennessee as compared to the remainder of the country.

The micro component to the model framework is the Nashville MPO region. The micro component is the point of integration between the Goods Movement Model and Nashville MPO Travel Demand Model.

Geographic Interface

The interface between the Macro and Micro components will require modification of the existing MPO Travel Demand Model. The connection point between the Macro Network will be the identified external stations in the Travel Demand Model Network. TransCAD's macro language (GISDK) will be utilized to facilitate a seamless connectivity between the two networks, but will not require that the MPO maintain a national network and zone structure as part of the Travel Demand Model.

Model Components – Inbound / Outbound Movements

The Inbound / Outbound Movements will be generated based on commodity movements in terms of tonnage. The choice of mode for these movements will be based on a mode choice model that will also include the through movements.

Freight Generation

Freight generation is the equal to trip generation in the passenger model. For each movement type, unique models will be applied for the production end and consumption end of the freight's movement. The commodity groupings discussed above will be used to further stratify the movements. The production and consumption models will be estimated using zonal employment and possibly other variables where possible including square footage of warehouse and distribution centers.

Inbound and outbound movements will be treated separately. For inbound movements, the production end of the trip will be in zones outside the region. The consumption end of the trip will be inside the region. The outbound movements will produced inside the region and consumed outside the region.

Freight Distribution

The distribution of inbound and outbound movements is the connection between the production and consumption end of the trips. As with passenger distribution models, a gravity model will be used. Gravity models use the productions, attractions, and a relative impudence between trip ends to link productions and attractions. The impendence function used will be calibrated using the TRANSEARCH database and will be specific to movement types and commodity groups.

Through Movements

A key factor in freight movements in the Nashville Region is the significant portion of through movements in the region, for both highway and rail. To fully understand the impact of freight in the region, it is crucial to properly estimate these movements. The TRANSEARCH database provides the best source of information on commodities moving through the region. The TRANSEARCH database will be used to develop a trip table of total commodity movements that will be fed into the Mode Choice model so as to be sensitive to infrastructure changes in highway and rail.

Mode Choice

The inbound, outbound and through movements are generated in terms of commodity tonnage movements. The Mode Choice model converts the commodity movements to

truck and rail movements. Further, the Mode Choice model converts the mode movements to vehicles (trucks, trains, air and water freight). The Mode Choice model will be calibrated using the TRANSEARCH database. From the database, the choice between modes by commodity group by zone to zone interchange will be combined with information about the travel time, cost, and availability and quality of service for each mode from the network. In addition, Shortline rail operations will be included in the field work and the model. The TDOT Transearch data comes with a rail network that extends to shortlines and will depict their traffic by commodity. With that as a starting point:

- All Nashville Area shortlines will be contacted during field work. Some may recently have been interviewed by TDOT for the I-40 project; if so, we will gain access to this information and, if it is reasonably thorough, aim for a simple telephone update for this study. Otherwise we expect to see all shortlines on site. From these discussions, we will a) supplement the Transearch data, which are based on the STB Carload Waybill Sample, for traffic elements like local volume that the Sample does not collect; b) understand the railroad's view of its business opportunities by commodity, which we will use in calibrating traffic forecasts; c) as with other stakeholder interviews, probe the carrier's perceptions of regional freight issues.

- Shortline rail flows – like all rail traffic data – will be taken down to 5-digit zipcodes for the Nashville Area during Task 3, and supplemental data from field work will be incorporated. Traffic interchanged with Class I rail will be distinguished from traffic local to the shortline, since the former acts as a feeder service dependant on the Class I, and the latter is a full service operation.

- The model then will project shortline traffic based on commodity activity and mode choice, observing the distinction between interchange and local volume, and adjusting for the railroad's expectations for business.

External shifts – such as network changes contemplated by the State Rail Plan, or by Class I carriers – will be evaluated as part of the strategic development in Task 3, and applied to the model as special scenarios.

Lastly, the model will consider water and air moves. Freight models are fundamentally multimodal because the freight market functions interactively across every form of carriage, with the same shipper often utilizing a portfolio of options. Consequently, each of these modes are important and all will be taken into account.

- Water options are a competitive advantage for the Nashville Area, producing a positive effect on transportation prices and aiding business attraction, since many rival regions lack this mode. In Ingram Barge, Nashville is home to one of the nation's leading waterway carriers as well.
- Freight service from the Nashville International Airport – either as belly cargo in the many scheduled passenger aircraft or as chartered or otherwise dedicated

freight movement – is critical for the attraction and retention of high service manufacturing, distribution, and service industry to central Tennessee. The interplay between Nashville International and the integrated cargo hubs four hours away in Memphis and Louisville is important to understand for long range facility planning.

- Both water and air activity will be explored in field work with shippers and modal operators. In addition, the parallel study for the Memphis Chamber will focus sharply on preference factors and business opportunities for these two modes, each of which has a prominent position in that market.

For model purposes, the water and air modes have two major components: internal/external and external/internal flows by barge and plane, and associated truck drayage to and from river and port facilities. Each of these components is captured in the TDOT Transearch data (including drayage to external points). Commodity information is presented for the river and air flows and can be used to drive the model; drayage data do not necessarily include commodities, but they can be extrapolated where absent. Local traffic by water is negligible and by air nonexistent. Through traffic by water also is out of the picture, but through traffic by air will need to be explored in a site interview with the airport authority. Since hubbed air cargo is not presented in Transearch yet can be an important aspect of airport facility demand, its significance needs to be established and volume accounted for in the model as necessary.

Local Movements

Local freight movements will be generated based on vehicle type and will be a vehicle generation model. Movements will include light / commercial vehicles, medium duty truck movements, and heavy duty truck movements. Based on the TRANSEARCH database, heavy truck movements will be stratified by commodity groups internal to the region.

Assignment Integration

The traffic assignment step of the Travel Demand Model will be the key point of the integration between the truck and passenger movements in the region. The ultimate design of the assignment model can take one of several forms discussed below.

National Assignment Model

Under this structure, the inbound, outbound, through movements, and local truck and passenger movements are all assigned simultaneously using a national network that includes the entire Nashville MPO Model network inside the region. This methodology allows for diversion to different entry and exit points in the region for inbound, outbound and through movements based on local congestion and large scale infrastructure projects

that are going on outside the region, but may have a local impact. The drawbacks to this approach are increased processing time given the increased network. A further disadvantage is that the freight model would need to be run for each model run.

Macro / Micro Assignment Model

This structure requires a two tier assignment. The first tier would concentrate on assigning the inbound, outbound and through movements to the national network. The assignment would be based on the best path for the movement and would not assume congestion in the network. From this assignment a set of trip tables would be created that would be based on the Travel Demand Models zone structure including external stations. The externals would be the point at which the through movements and inbound / outbound movements interact with the Nashville Region from the rest of the country.

Incorporation of Trucks in the Assignment Model

The advantage integrating the freight model with the travel demand model is the assignment model is improved. The advantages can be seen in the following areas:

- Improved capacity impact. Using passenger car equivalents for heavy trucks, the truck impact on congestion can be better estimated.
- Given the hilly nature of the Nashville region, the terrain can be included into the assignment by varying the PCE value for heavy trucks on those links.
- Improved air quality modeling with better understanding of truck flows in the region.
- Ability to test various freight specific projects including truck only facilities, truck tolled lanes, and truck prohibitions.

Data Requirements

Several data sources will be utilized in the development of the model, and include:

- Nashville Area MPO Travel Demand Model: The MPO Model uses employment categorized as retail and non-retail. For purposes of estimating freight movements it is necessary to have employment at a more detailed level. The Harris Info Source Selectory database will be used to develop TAZ level estimates of employment by major SIC category. An alternative and more preferable source of employment data is the ES-202 database of employers in the region. The MPO model will be referenced for model geography including zone structure and network design.

- Commodity flow data: TRANSEARCH data will be used as the source of commodity flows and their interaction with the Nashville Region. TRANSEARCH, a product of Global Insight, provides information on the origin, destination, commodity by STCC, and mode of freight movements across the country.

- Freight Analysis Framework Version 2 (FAF2): The FAF2 is a national commodity flow database that includes major commodities and mode of shipment. It can be a useful reference to consider the Nashville Region in the larger national and international context.

- Tennessee Statewide Travel Demand Model: Tennessee is fortunate enough to have a statewide model in place. Because of the national and statewide nature of freight movements, the statewide model will be referenced for consistency and a source of inputs for outside the region including network geography, zone structures, and employment estimates.

Model Validation

The development of the model will be an iterative process that will first begin with calibration of model parameters using the TRANSEARCH database, employment and other sources of data identified for model development. Once an operational model is complete, the total demand (trip tables) and truck volumes will be compared to other sources including national data regarding freight flows and regional truck counts. The model will be adjusted until it replicates existing conditions within acceptable margins of error. The actual validation criteria applied to the truck flows is similar in approach to validating passenger movements, but the criteria are adjusted to account for unique characteristics of trucks. One common validation criteria used for passenger validation is to look at the %RMSE by volume group **(Figure 4**). The RMSE to volume group relationship is based on the notion of the amount of volume necessary to require an additional lane. Trucks take up capacity based on PCE, and thus require additional lanes at faster rates than cards. Thus, the allowable %RMSE for a given truck volume is lower for general traffic. Therefore, when validating the truck volumes, the volumes are converted to PCE values and the appropriate volume group is applied.

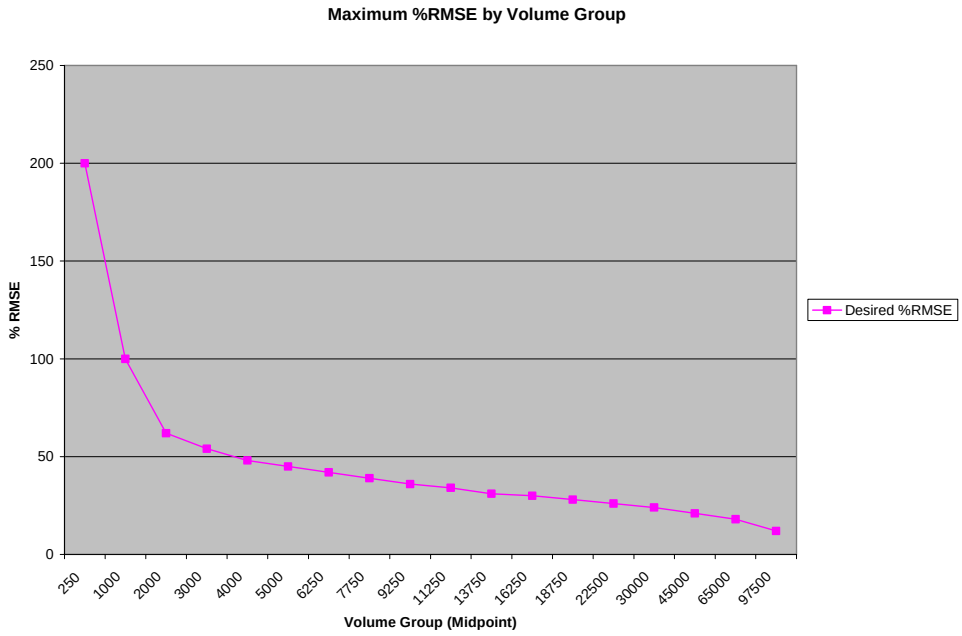

Figure 4: % RSME by Volume Group

Validating the model using truck counts is only one method that WSA proposes to use. Following are examples of other data sources that may be identified during the study that can be used to help validate the truck model. These data sources are also relevant when considering updating the model to a new base year.

- Establishment volumes from field interviews, such as a) inbound and outbound truck activity at various distribution centers; and b) freight tonnage reported at the airport.
- Traffic data that may emerge from parallel studies, such as truck drayage between Nashville and the Memphis airport and intermodal terminals, which the Memphis Chamber study should yield

Pocket volumes from portable counters placed at the approaches to industrial parks and used to estimate the total activity of establishments in the pocket. (This could be regarded as another form of ground count.) Once it is able to replicate existing conditions, the model will be considered validated, and can be used for forecasting.

Forecasting Freight Flows

The process to forecast freight movements in the Nashville Region will be a straightforward process. As inputs, it will require the following inputs:

- Employment by major SIC category at the MPO zone level;
- Network improvements;
- Export and Import tonnage estimates at the external stations; and
- Through movements.

The final two data requirements require the use of forecasted TRANSEARCH data as the basis for national freight forecasts. Interim years can be established by either using specific year data from TRANSEARCH, or interpolating between the base year and forecast data.

In developing the freight model as an integrated component of the MPO Travel Demand Model, consideration must be given as to how to keep the freight component up to date and validated. Under ideal conditions, the MPO would have access to updated TRANSEARCH datasets when an update to the model was being undertaken. This would allow for the generation models to be validated against new commodity totals. The models could be adjusted, if necessary to match new levels of production and consumption and then used in the forecasting process.

Without the TRANSEARCH datasets for a new base year, alternative data sources must be identified and used to ensure the freight model is still valid. Data that will need to be collected will include traffic level data, and possibly commodity flow data.

Traffic data in the freight model has three aspects: point volumes, in the form of establishment estimates of inbound/outbound activity; pocket volumes, in the form of flows to, from, within and through narrow geographic areas (like 5-digit zipcodes or TAZs); and network volumes, in the form of modal facility assignments. This allows model updates to be approached from one or more angles: with targeted establishment interviews for key generators, with surveys or portable counters for important pockets, and with conventional roadside monitoring. Air volumes can be checked through the airport authority, and rail and water trends can be checked from STB and Army Corps of Engineers data sources, even if new Transearch data are unavailable from TDOT.

Though the TRANSEARCH Database is the preferred data source, alternative sources of data do exist that can be used in a re-validation of the model.

As part of the model design, and training to be provided by WSA, guidance will be included on how to update the freight model given a model update in the future including data requirements and potential sources.

Deliverable *(Technical Memo # 2):* Technical Memo # 2 will describe the development of the freight model and display the results produced.

Task 5: Evaluate Region's Capacity to Meet Future Demands

Based on the results of the analysis performed in the previous tasks and freight model, an evaluation of the freight network will take place to include congestion at connections between major highways, rail, and truck terminals, deficient/posted bridges; poor track conditions and inadequate pavement structures. Functional obstacles can include narrow

bridges, narrow pavements, lack of turning lanes, and inadequate clearances (vertical and horizontal); poorly located or designed terminals with outdated loading/unloading equipment. Other constraints include tight intersection turning radii and signage.
Key areas of freight system performance to be assessed in the targeted areas will include:

Capacity

WSA will assess the degree to which localized development areas will experience delay, limitations in reliability, mobility and overall freight level of service due to increasing travel demands for the given infrastructure by mode.

Safety

Key driver, vehicle, and roadway factors associated with shifts in the ratio of commercial trucks to passenger vehicles associated with development of localized business clusters are expected to influence crash rates and severity. Underlying measures of crash risk for heavy trucks and potential countermeasures for existing and emerging safety threats will be identified for each sub-area.

Environmental/ Land-Use Issues

Potential environmental issues that may be associated with industrial development in targeted areas will be examined through localized performance measures. This assessment will consider both the typical environmental concerns of increasing truck traffic (such as air quality and noise), but also industry-specific environmental concerns such as special requirements for the transport of hazardous materials or other environmentally sensitive freight operations.

The capacity, safety, environmental, and development assessment of each of the areas will result in a well defined set of key problem issues for freight performance in each element.

Deliverables (*Tech Memo# 3*): These elements will be incorporated in a Technical Memo a around key issues supported by detailed information regarding regional network roles, economic importance, and freight infrastructure operational needs.

Task 6: Develop Recommendations to Address Future Demand

Purpose: At this point in the project, the project team will have defined the extent to which goods movement is expected to expand in the region, the constraints in the system, as well the economic and infrastructure impacts. This task will facilitate a process for narrowing (screening) a broad range of projects, programs and strategies to accommodate goods movement expansion, as well as to analyze the effectiveness of a core set of likely alternatives.

Approach: The primary approach is to start with the full range of possible alternatives, regardless of their perceived merit. The study process through the previous tasks will no doubt produce a great deal of strategies, including infrastructure projects, as well operational, legislative and policy based projects. Many will come from stakeholders, both private and public; some strategies will be identified by the Freight Advisory Committee in coordination with participating and contributing agencies. This is where a streamlined process for evaluating and screening is critical, offering a fair and transparent means for working through the solutions, until the ones that bear greatest merit and/or opportunity are identified and supported.

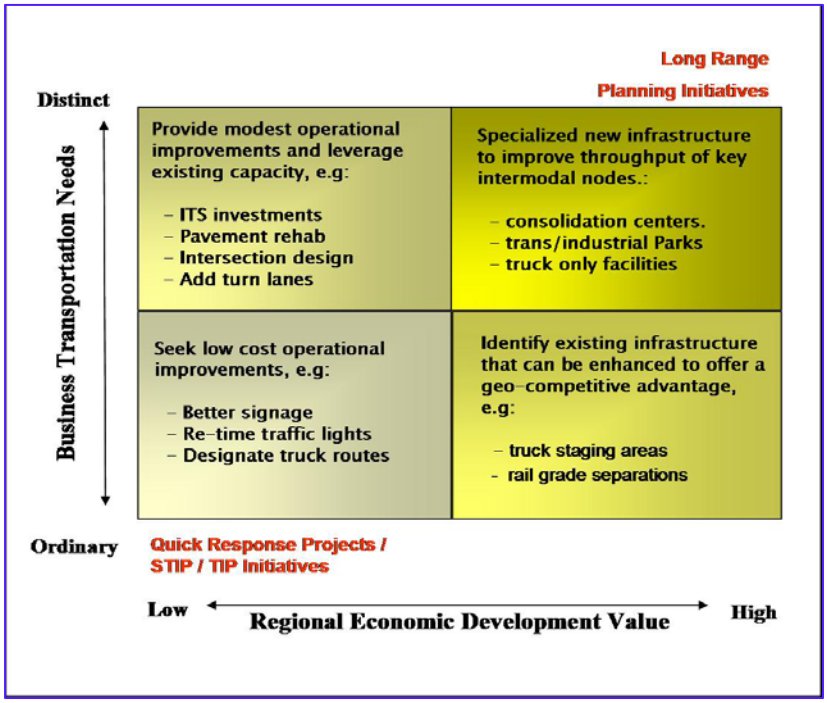

Figure 5: Project Identification Template

The WSA Team will propose a general framework and provide different strategies for improving goods movement that coincides with the horizon years chosen for the next Long Range Transportation Plan Update. Strategic policy based strategies will be proposed for safety, ITS implementation and other freight transportation infrastructure needs. Other strategies may involve inter-agency coordination on issues such as safety enforcement, land use planning, and economic development. **Figure 5** shows an example of the process for identifying freight projects.

Deliverables (*Tech Memo# 4*): These recommendations will be incorporated in Technical Memo # 4, and will be identifiable able by project type and timeline for implementation.

Task 7: Evaluate Candidate Projects for the Long-Range Transportation Plan

This task is the critical first step toward defining the overall framework for the alternatives analysis. In other words, what will be evaluated, and by what measures will they be determined as feasible.

The key to this task is for the WSA Team to work with the MPO Project Manager and the Freight Advisory Committee to define the variables that will go into the screening process. The variables are what provide the definitional framework for what the strategies are and the measures used to determine feasibility.

The variables will be based on best practices from previous and ongoing studies and will serve as the means for screening the alternatives. For this reason, it is likely that we will recommend a standard set of criteria that generally reflect the following objectives: improving the mobility, reliability and efficiency of goods movement in the region. It is likely that many of the alternatives that are part of the subset (for further analysis) made it through the initial screening process.

In order to effectively measure the impacts of the recommendation, an analysis of the benefits and costs for projects will be considered. These benefits should consist of the following:

Private Sector Benefits

Private shipper cost savings to include estimated savings. For example:

- Direct truck operations cost savings (including driver wages and benefits, fuel and other vehicle operating costs, improved reliability of deliveries), logistics cost savings, reflecting the time sensitivity and value of given commodities or commodity groupings. While such savings may be difficult to value in all cases, the logistics "literature" typically utilizes some combination of transportation delay, the time value of money, and the value of commodities. This analysis will focus on commodities that are known to be most time sensitive, such as high value added electronic components, perishable agricultural commodities, internet retailing, and others.

- Incidence of shipper cost savings – i.e., extent to which shipper cost savings are retained by private transportation providers, passed back to shippers, or passed forward to final customers in the form of lower prices. Market structures for individual commodity groups will be utilized as a basis for this allocation. The extent of competition within each market segment will be a guide to which savings are retained or passed on. For example, rail cost savings are more likely to be retained than truck cost savings, due to the relative lack of competition among rail providers compared with trucking firms.

Longer term economic development impacts, measured in terms of increased regional employment, personal income, business earnings, and the secondary or multiplier effects associated with these. The longer term economic impacts of improved freight transport will reflect the potential for development of sectors that would most benefit from enhanced goods movement, including:

- Existing manufacturing firms such as those that are directly served by rail, which could benefit from enhanced rail services, improved connectivity, new rail sidings, or enhanced load bearing capacity

- Firms that would benefit from improved intermodal connections, and as a result, improved connectivity to and from the national Class I rail network

- Warehousing and distribution firms

Public Sector Benefits

To the extent that goods movement analyses indicate diversion of freight from truck to rail, public benefits would encompass:

- Reduced highway congestion, resulting in travel time savings for vehicles (both auto and truck) remaining on the highway network

- Improved highway safety (fewer truck-related accidents), and reduced highway maintenance costs, due to less highway wear and tear associated with trucks

- Reduced truck related air pollution (a major issue considering the Nashville Area MPO air quality status)

- Fiscal impacts of longer term economic development impacts – e.g., increased personal income results in increased regional consumer spending, and thus increased local and state sales tax revenues

After recognizing the specific benefits that may exist for each project, a benefit cost analysis of these various freight improvement options will be conducted utilizing conceptual costs for the various infrastructure improvement options, and the benefits identified in this task. The benefit-cost analysis will be conducted over a thirty year time frame, and the net present value and benefit-cost ratio for various investment options will be derived.

Deliverables *(Technical Memo # 5)*: Technical Memo #5 will describe the results of the benefit cost analysis, focusing on the distribution of benefits between the public and private sector and provide overall costs and funding streams for each proposed project recommendation.

Task 8: Final Report and Executive Summary

The WSA Team will produce a final report that encompasses all technical memos and analysis. An executive summary that concisely describes key components from each technical memo will be created. This full color executive summary will be developed to promote understanding and support from policymakers and the general public. This final report and executive summary will serve as an action plan for the MPO to use to implement proposed recommendations.