Memphis Regional Freight Infrastructure Plan

Prepared For:

Greater Memphis Chamber

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Introduction and Executive Summary

The Memphis Regional Freight Infrastructure Plan (Plan) was created in 2008–09 on behalf of The Greater Memphis Chamber (Chamber) and its members. The goal of this plan was to identify the capabilities and capacities of the region's current freight infrastructure systems and recommend strategic projects that have the most potential to integrate these systems with emerging global supply-chain requirements.

The Chamber has been a leader in promoting Memphis as a major transportation and logistics center. With the world's largest air-cargo airport, service by five Class I railroads, 490 trucking terminals, the nation's fourth-largest inland water port, and 11 Interstate and U.S.-designated highways, the region has emerged as a national distribution hub with almost 160 million square feet of warehouse space, and 42,000 acres of industrial parks.

This Plan helps prioritize future regional freight infrastructure investments and funding requests to ensure that Memphis remains a dominant national transportation hub. It complements a number of prior studies that guided logistics-based development in the region, namely "The Memphis Economic Development Plan"[1] and "From America's Distribution Center to America's Aerotropolis,"[2] which provided a framework for airport-based development. These two reports, together with the recommendations from this Plan, form an integrated framework to assist the Chamber, and its stakeholders, in fulfilling its economic development mission and exploit the region's attractiveness as an international logistics hub.

Development of the Memphis Regional Infrastructure Plan was led by IHS Global Insight, Inc. and conducted by a team of firms with extensive experience in infrastructure planning and evaluation. The Plan consists of four parts:

- **Chapter 1: Memphis in the Global Supply Chain (IHS Global Insight, Inc.).** This chapter presents IHS Global Insight's forecast of global trade, describes a profile of international trade in the region, and discusses trends in international trade in relation to Memphis.

- **Chapter 2: Infrastructure Inventory (University of Memphis Center of Intermodal Transportation Studies).** Current capacity of freight infrastructure in the region.

- **Chapter 3: Infrastructure Assessment (Wilbur Smith Associates).** Capacity analysis of the region's air, rail, water, and highway freight infrastructure.

- **Chapter 4: Infrastructure Recommendations (Team).** Thirty freight infrastructure recommendations, including five key projects with strategic value to the region.

Development of the Regional Freight Infrastructure Plan also included interviews with over 50 freight stakeholders in the region and entailed a 16-county study area, as shown on the map below. A similar assessment of the region's telecommunications infrastructure was also conducted by Design Nine Associates, Inc. and presented in a separate report[3].

[1] "MEMPHISED – Memphis Area Economic Development Plan", Greater Memphis Chamber, May 2009
[2] "From America's Distribution Center to America's Aerotropolis", Executive Summary, John D. Kasarda, Kenan Institute of Private Enterprise, April 2008
[3] Memphis Area Infrastructure: Telcom and Broadband Recommendations, Design Nine, Inc., July 2009.

THE MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE PLAN STUDY AREA

Source: CIFTS

CHAPTER 1: MEMPHIS IN THE GLOBAL SUPPLY CHAIN

The Plan first examines the role Memphis plays in the global supply chain by reviewing IHS Global Insight's current world trade forecast, profiling the region's international land and water freight in the region, and examining global supply chain trends that may impact Memphis.

The Global Economic Outlook

- The world is experiencing an economic recession (defined as world GDP growth less than 2%) and expected to begin recovery in late 2009. Container trade will grow faster than world GDP, but not at the double-digit growth rates experienced earlier. Trade volumes similar to pre-recession levels will not reoccur until 2016, at the earliest.
- Global economic growth will be uneven. Developed countries in North America, Europe, and Japan will experience very slow growth (less than 2%), while Latin and South America, non-Japan Asian countries, and Eastern Europe will see economic growth between 4% and 8%. Latin and South American economies in particular will rebound faster and stronger with supply-chain "near-sourcing" being considered in these areas.
- ***Implications for Memphis:*** The return of pre-recession freight volumes that could affect Memphis freight infrastructure will not occur in the near term, offering opportunities to add capacity. Trading countries of particular interest to Memphis will be China, Viet Nam, Singapore, Mexico, Central America, and Brazil.

Profile of Memphis International Land and Water Trade Flows

- In 2007, Memphis originated or terminated 11 millions tons of land and water international freight, worth over $23 billion. The region is a net importer of trade, particularly in terms of value. One-quarter more international freight volume terminates in the region, and over twice as much in terms of value.
- The Pacific Rim is the major originator of Memphis import traffic, primarily through the Ports of Los Angeles and Long Beach. Much of Memphis exports move south to New Orleans, with higher-value commodities moving east to Europe.
- Compared with other Midwest inland ports, Memphis ranks fourth in international tons handled and third in value. Major competitors are Dallas and Atlanta, with Memphis poised to overtake Dallas in terms of international freight volumes in the near future.
- ***Implications for Memphis:*** China's dominance in U.S. container imports will continue and Los Angeles/Long Beach will remain primary entry points for containers to Memphis (although North and South Atlantic ports will see increases from Panama Canal expansion discussed below). The region's larger share of higher value import traffic needs to continue and be encouraged. These commodities generate additional value added logistics activity in terms of cross docking, repackaging, and distribution. The imbalance of import to export trade in the region means availability of empty container and trailer equipment for repositioning and backhaul.

Emerging Trends in International Trade

- ***Panama Canal Expansion.*** Post-Panamax ships (those with capacity greater than 4,000 20-foot equivalent units (TEUs) will constitute over 60% of the container fleet by 2012. Expansion of the Panama Canal, expected to be completed in 2015, will allow these ships to call on U.S. Gulf and East Coast ports directly from Asia. Instead of making multiple port calls in the East Coast, many of these large ships will transship in the Caribbean to smaller vessels.

  Implication for Memphis: Up to one-fourth of the West Coast's current container traffic may shift to the East and Gulf Coast as a result of Panama Canal Expansion. Deep water Gulf and Atlantic ports, especially Houston, Savannah, New York and New Jersey, and Norfolk will benefit from

this shift as well as inland hubs such as Dallas, Atlanta, and Columbus. Gulf ports near Memphis lack sufficient intermodal infrastructure to grow substantially.

MEMPHIS INTERNATIONAL CONTAINER TRANSIT TIMES VIA EAST AND WEST COAST PORTS

Source: Inland Supply Chain Trends and the Implications on North American Distribution Markets," Greg Arnold, ProLogis, FHWA Talking Freight Series, July 2009.

- ***Suez Canal**:* Production of certain high-valued imports will shift from China to other areas of Southeast Asia, making the Suez Canal an attractive trade lane to East Coast U.S. ports.

  Implication for Memphis: Shifts in Suez Canal traffic will have little near-term impact on Memphis. Over the medium term, growth in Suez container traffic will increase port activity at New York and New Jersey, and Norfolk, benefiting supply chains in New York; northern New Jersey; Allentown, Pennsylvania; and Columbus, Ohio. The Port of Halifax could see gains, but they will be modest due to its distance from major markets.

- ***Increased Rail Usage:*** The global recession caused shifts to lower-cost rail and water modes. As the world economy recovers, intermodal rail will maintain its increased share as suppliers continue to use rail for its cost efficiencies. Truck will be utilized for the "last mile" pick-up and delivery portion of the supply chain.

  Implications for Memphis: Intermodal rail has the potential to impact Memphis similar to that of FedEx Corporation (FedEx). Over $500 million has been invested by the rail industry in rail intermodal infrastructure in the region, and will significantly bolster the city's attractiveness as a national distribution hub.

- ***Shorter Supply Chains:*** Higher transportation costs and uncertain energy prices will encourage U.S. manufacturers to reevaluate their extended supply chains, particularly sourcing in the Pacific

Rim. One expected result will be for manufacturers to move plant operations and sourcing vendors closer to consumption, particularly Mexico and the Americas.

***Implications for Memphis*:** Increased sourcing from Mexico and the Americas could negatively affect Memphis, since other inland centers, notably Dallas and Kansas City, are closer and have strong Midwest rail connections from border towns of Juarez and Monterrey, Mexico.

- ***Multi-Modalism:*** Global supply chains are "fragmenting" as shippers and receivers look for greater flexibility and cost savings near ports of entry or inland ports to transfer or mix products. Warehousing, cross-docking, and trans-loading are becoming critical links as more companies repack, cross-dock, or consolidate containers and smaller shipments into 53-foot domestic containers for ultimate delivery to customers.

  ***Implications for Memphis*:** Memphis will benefit from this growing logistics trend because of its large network of consolidators and warehouses near Memphis International Airport ("MEM"). These facilities will begin expanding near intermodal terminals in the region.

- ***Declining Air Freight***. Faced with increasing fuel costs, the global recession, and new security regulations, many shippers and carriers are switching away from air freight to less-expensive modes. Air shippers and forwarders are increasingly beginning to rely on expedited motor-carrier services for portions of their shipments that formerly traveled by air.

  ***Implications for Memphis*:** Air freight will continue to be a critical supply chain component for shippers of time-sensitive, high-value goods, and FedEx will remain a significant economic driver in the region. Continued shifts by FedEx into ground transportation could eventually result in use of intermodal as rail reliability improves.

CHAPTER 2: MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE INVENTORY

An inventory of the Memphis region's freight inventory was conducted by the Center for Intermodal Freight Transportation Studies (CIFTS) at the University of Memphis. Details of this inventory are catalogued on a web-based site available to Memphis Chamber members.

- ***Memphis Highway Infrastructure:*** There are 840 miles of Interstate and U.S. designated highways in the region. 88% of the freight traveling in Memphis uses at least one of the region's three major highways: I-55, I-40, and US-78. Two new Interstates are planned to be added to highway infrastructure.

- ***Memphis Airport Infrastructure:*** The region has nine airports capable of supporting air freight. Memphis International, the world's largest cargo airport, handled approximately 4.2 million tons of air freight in 2007.

- ***Memphis Railroad Infrastructure:*** Memphis is only one of five United States cities with service by five Class I railroads[4]. The industry has spent over $500 million in the region on new or upgraded rail infrastructure in recognition of its growing importance as a major rail hub.

- ***Memphis Water Infrastructure:*** The region has 99 port terminals on the Mississippi River. Some 62 of these ports are within the Port of Memphis, the fourth-largest inland port in the United States. In 2007, Memphis water infrastructure handled approximately 21 million tons of international and domestic freight.

[4] The other cities with Class I rail service by five Class I railroads are St. Louis, New Orleans, Kansas City, and Chicago.

- ***Memphis Pipeline Infrastructure:*** Over 1,200 miles of freight pipelines are in the study area, primarily moving natural gas and crude oil.

- ***Memphis Intermodal Infrastructure:*** There are 19 freight intermodal terminals in the region: four rail intermodal terminals, 12 located on the Mississippi River for transfer between water, rail, or truck, and three air and truck terminals at Memphis International Airport.

- ***Memphis Truck Infrastructure:*** Some 490 truck terminals are located within the study region. A total of 70% of these are in Shelby County, and 42% have sales of over $1 million.

- ***Memphis Warehouse Infrastructure:*** The Memphis region supports 956 warehouses with just under 160 million square feet of usable space. 157 are within five miles of an interstate.

- ***Memphis Industrial Park Infrastructure:*** There are 136 industrial parks in the study region totaling over 42,000 acres.

CHAPTER 3: MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE EVALUATION

The region's freight infrastructure for each of the four major freight modes (air, water, rail, and highway) was evaluated to determine its capacity to handle future freight volumes in light of global supply chain trends. Based on this analysis, modal objectives were formulated to guide the selection of infrastructure recommendations.

Memphis Highway Infrastructure Objective: *Intraregional Connectivity*

Memphis has significantly more freight that originates and terminates in the region than metropolitan areas of similar size. Increases in intermodal local freight traffic and a trend toward multiple modes in supply chains means the region's highway system needs to support "connectivity" between major freight nodes in the region, including:

- Rail intermodal terminals
- Memphis International Airport
- The International Port of Memphis
- Memphis freight shippers and receivers
- Public and private warehouses and industrial parks
- Major truck terminals.

Highway infrastructure improvements need to include both physical betterments (i.e., lane widening, interchange improvement) and utilization of "intelligent" transportation-system technology in key freight corridors.

Memphis Air Freight Infrastructure Objective: *Aerotropolis Expansion*

Only minimal improvements in the region's physical infrastructure are required to accommodate future air-cargo demand. However, air-ground cargo transfers in the region are often impeded by congested roadways in the airport environs. Emphasis on airport “connectivity,” as delineated in the Memphis Aerotropolis Plan,[5] should be the region's air infrastructure priority to support increasing logistics activity near the airport, especially in light of growing intermodal supply chain activity.

[5] "From America’s Distribution Center to America’s Aerotropolis", Executive Summary, John D. Kasarda, Kenan Institute of Private Enterprise, April 2008

Memphis Rail Freight Infrastructure Objective: *Intermodal Growth*

Intermodal rail traffic in Memphis is expected to double to over 2 million containers and trailers from 2007-2035, putting tremendous stress on the region's highway network to support higher levels of local trucking generated by this increased intermodal activity. Rail-infrastructure improvements need to focus on accommodating the region's growing intermodal truck traffic and minimize potential congestion in the areas surrounding intermodal terminals.

Memphis Water Infrastructure Objective: *Rail/Truck Accessibility*

The region's water infrastructure shows sufficient capacity to support projected river freight activity in the region, projected to grow 3.3% annually to 2015. The Plan's water infrastructure evaluation, however, found road and rail access to certain river terminals—particularly Frank C. Pidgeon Industrial Park, the Port of Helena, and the Port of Cates Landing—needs improvement. Additionally, dredging to maintain adequate river channel depth along waterways in the region is an ongoing priority.

CHAPTER 4: MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE RECOMMENDATIONS

Using the Plan's modal objectives and stakeholder interviews, 30 infrastructure recommendations were developed, including five key infrastructure recommendations considered critical to support the region's continued prominence as "America's Aerotropolis." Specific recommendations by state and a list of key stakeholder interviews are included at the end of this Chapter. Key infrastructure recommendations are discussed below.

1) Lamar Avenue Corridor Improvements

Lamar Avenue (U.S. 78) is one of the region's most significant, and most congested, freight corridors, serving as an arterial highway for both interstate and local freight. The corridor is the region's major link to the southeast United States (more specifically, Birmingham, Alabama,) and supports a highly dense local network of truck terminals, warehouses, industrial development, and the BNSF intermodal terminal off of East Shelby Drive/SR 175. It is also a key arterial for air freight to and from Memphis International Airport. In fact, the concentration of freight facilities along Lamar is a prime example of the Aerotropolis concept in the Memphis Aerotropolis Plan.

To address capacity and access issues on Lamar Avenue, this recommendation proposes a series of physical improvements to this corridor, as well as utilization of Intelligent Transportation System (ITS) technology as described in this Plan. This recommendation will be part of a current study by Cambridge Systematics to recommend options that alleviate congestion on the corridor, including synchronized signals, extension of I-22 from the Mississippi state line to I-240, rerouting traffic around the corridor by way of Interstate 69 and 269 or other roads, and creating grade-separated interchanges at key intersections to provide limited access. The impact on economic development and on existing businesses will also be included in the Cambridge Study.

2) Holmes Road Corridor Improvements

Holmes Road (Holmes) runs just south of the Memphis International Airport (MEM), beginning at U.S. Highway 61 and intersecting other major arterials including Lamar Avenue and Interstate 55. The western portion of Holmes is primarily residential, with industrial/commercial use closer to the Lamar Avenue intersection. This corridor has become an important east/west connection for freight with truck traffic estimated to constitute 20% of total vehicular traffic by 2026[6]. It has also a critical infrastructure

[6] City of Memphis Project Site, http://www.holmesroadexpansion.com

component of the Aerotropolis logistics plan to stimulate logistics based economic development in the region.

The lack of an intersection at Holmes and I-55 inhibits industrial development around MEM and would alleviate growing congestion in the corridor. Moreover, infrastructure improvements on Holmes could offer an alternative route for freight congestion on East Shelby Drive. This recommendation proposes a series of physical improvements to this corridor as outlined in The Holmes Road widening project in the MPO Transportation Plan and the utilization of Intelligent Transportation System technology as described in this Infrastructure Plan.

3) Interstate 40/Interstate 55 Interchange Modifications

Interstates 40 and 55 are important connectors to local freight generators in West Memphis (particularly the UP intermodal terminal in Marion, Arkansas, and several national trucking terminals) and critical components of the national Interstate network. Where these two interstates join in West Memphis, Arkansas, together with interchanges with local highways 77 and 191, is one of the region's most significant freight bottlenecks.

This recommendation proposes a detailed engineering study to determine the most appropriate solution for the I-40/I-55 and I-40/I-55/Highway 77/Highway 191 intersections in West Memphis, AR. Interchange access for I-55 and I-40 is located close to the split of these highways, causing significant weaving and changing of lanes multiple times to properly enter and exit. The I-40/I-55/Highway 77/Highway 191 intersection, west of the I-40/I-55 split, is even more complicated, involving the convergence of four major roadways. This study could potentially result in the complete redesign of the I-40/I-55 split and the I-40/I-55/Highway 77/Highway 191 intersection. Alternatively, an arterial highway could be constructed along the Union Pacific rail right of way that parallels I-40 and I-55 where the two interstates merge in West Memphis.

4) Construction/Completion of I-69/I-269

Interstate 69 (I-69), dubbed the "NAFTA superhighway," will be a new north-south interstate between the Mexican and Canadian borders to address increased freight traffic associated with NAFTA. In Tennessee, the proposed Interstate would enter the state at Fulton, Kentucky, and continue southwest to Memphis, replacing and bypassing the existing U.S. Route 51, serving Union City, Dyersburg (where it will intersect Interstate 155), Ripley, Covington, and Millington. Currently, a 21-mile section of I-69 exists in the Memphis area, sharing its alignment with I-40, I-240, and I-55. I-269 is part of the larger I-69 system, and begins near the interchange of Interstate 55 and State Route 304 in Hernando, Mississippi, extends north to the intersection of US 51 and State Route 385 in Millington, Tennessee, and connects to I-69 north of Memphis.

I-69 and I-269 offers the region improved national connectivity with Canada and Mexico and provides significant local benefits to the region. It increases highway accessibility and stimulates economic development in the largely rural Eastern Tennessee counties and provides greater highway access to eastern Shelby County and north Mississippi. More importantly, it helps alleviate congestion caused by through freight traffic by diverting this traffic around the city and away from central Memphis.

5) Third Mississippi River Bridge Crossing

The justification for a third river bridge has been documented by multiple agencies and has been extensively studied by the Tennessee Department of Transportation (TDOT). The project is also identified by the Memphis and West Memphis MPO in their Long Range Transportation Plans. The analysis

conducted by the study supports the need for a third bridge, and recommends its construction upon completion of the Draft Environmental Impact Study.

FUTURE DEVELOPMENTS

This chapter has identified highway, rail, water, and air freight infrastructure recommendations to ensure Memphis maintains its position as "America's Aerotropolis" in the midst of changing global supply chain trends. As these recommendations are evaluated and implemented, they need to be reviewed within the context of the next "game changing" freight development in Memphis, namely the increasing impact of rail, particularly rail intermodal, on the region's freight infrastructure.

Recognizing the region's intermodal advantages, and its proximity to major consuming markets, Class I railroads have invested almost $424 million in intermodal terminal development in Memphis. This growing activity of intermodal rail traffic, and associated logistics and warehouse related development, has the potential to significantly transform the freight landscape in Memphis similar to the arrival of Federal Express in 1973. Logistics and warehouse related land use development, congestion, increased local/cross-town truck traffic, job creation, and grade crossing delays are some of the regional impacts that will occur from growing intermodal freight rail activity. Unlike other modes, freight rail infrastructure investment is primarily private, limiting the ability of public agencies such as the Memphis Urban Area Metropolitan Planning Organization (MPO) to adequately plan for these impacts. However, the experiences of public rail planning efforts in Chicago and Seattle can be instructive as to how Memphis can address expected increases in rail intermodal freight activity. The following recommendations are offered as potential mechanisms to better plan for this increased activity:

Staff Freight Rail Knowledge/Expertise. To better understand and coordinate growing rail activity in the region, knowledge of rail freight operations and management will be increasingly important as part of the staff competencies at public agencies in Memphis that guide and manage the region's infrastructure investments. It is recommended that the MPO and other public agencies work more closely with the University of Memphis Center for Intermodal Studies regarding additional staff training in rail freight.

Rail Freight Coordinating Committee. Similar to Memphis, Chicago has intermodal service by numerous Class I railroads with significant volumes of intermodal freight. Experience in Chicago demonstrates that coordination among rail carriers to ensure rail operations achieve maximum public benefits and minimum disruption is difficult. To guide and coordinate rail infrastructure within Chicago, the Chicago Transportation Coordination Office (CTCO) was created to coordinate each carrier's capital planning process. As rail intermodal activity grows in the region, Memphis needs a similar coordinating office in the development of its rail infrastructure

Corridor Planning. Intermodal development around the BNSF terminal on Lamar Avenue has shown the need for certain infrastructure planning to be conducted within a "corridor" framework encompassing major freight thoroughfares and multiple modes. This corridor concept is particularly relevant in Memphis. Besides Lamar Ave, this Plan identified Holmes Road and I-69/I-269 as major freight corridors in the region. Recent experience by the Seattle, WA MPO, the Puget Sound Regional Council, with its Freight Action Strategy for the Everett-Seattle-Tacoma Corridor (FAST Corridor) is an example of how a corridor planning framework can effectively guide and influence rail infrastructure investment. This type of planning approach should be considered as part of the current Cambridge Systematics Lamar Ave. Study as well as for Holmes Road and the I-69/I-269 corridor.

Freight Transportation Advisory Board. The importance of the region's infrastructure for efficient freight movement as well as economic development requires effective partnerships between the public and private sectors to properly plan infrastructure development. While Memphis has formed a number of these partnerships, especially through its Aerotropolis initiatives, it is recommended that

private sector involvement, particularly involving rail freight, be formally institutionalized in the region's freight planning process through the creation of a Freight Advisory Board. This board, composed of public agencies, shippers, and carriers, would be responsible for prioritizing and coordinating freight infrastructure development and would include representatives from all five Class I railroads serving the Memphis region.

Below are a number of other future developments that have potential to influence the region's freight infrastructure development in the future.

Integrated Logistics Centers. A natural extension of the region's expanding freight infrastructure is development of "integrated logistics centers." These centers are large, unified complexes where every component of the supply chain is operated and managed on one campus. Generally, logistics centers are located near intermodal terminals and include public cross-dock and warehouse activities, container storage yards, private distribution centers, container storage facilities, and logistics support services such as hotels, truck stops, office space, and retail. Such centers are being developed in Chicago (Joliet, Illinois, Centerpoint Intermodal Center), Dallas (the Alliance Gateway), and other locations. In Memphis, this mega-cluster of logistics activity has occurred around the Memphis International Airport due to the presence of Federal Express and is being encouraged by the region's Aerotropolis effort. With increased investment in the region's rail intermodal infrastructure as described in this Plan, Memphis has all the key ingredients to develop a second rail-based integrated logistics center near one or more of its intermodal terminals.

High-Speed Passenger Rail. While this Plan focuses on freight infrastructure, the growing importance of high-speed passenger rail that links major urban areas such as Memphis, and its development in conjunction with freight infrastructure, cannot be ignored. Consideration of high-speed rail in Memphis raises the larger issue of sharing future infrastructure development between passenger and freight. Shared facilities provide significant economies of scale, and the opportunity to leverages scarce funding for maximum benefit. Future transportation infrastructure improvements in the region need to be evaluated with this shared use in mind, starting with this Plan's key recommendation of a third Mississippi River Bridge that could include rail and highway right-of-way.

Container-on-Barge. There have been numerous studies in Memphis on expanding its river port system to provide the region with greater water access to world markets. One promising freight concept is "container-on-barge," that is, the transfer of international containers on and off barges traveling the Mississippi River to rail or truck. Memphis already has a small, but successful container-on-barge operation at the International Port of Memphis. The region should explore additional freight opportunities that take advantage of this unique component of its water infrastructure.

MEMPHIS REGIONAL INFRASTRUCTURE PLAN RECOMMENDATIONS BY STATE

Key Recommendations:

- Lamar Avenue/U.S. 78 Corridor Improvements
- Holmes Road Corridor Improvements
- Interstate 40/Interstate 55 Interchange Modifications
- Construction/Completion of I-69/I-269
- Third Mississippi River Bridge Crossing

Infrastructure Recommendations - Tennessee

- Lamar Avenue/U.S. 78 Corridor Improvements
- Holmes Road Corridor Improvements
- Completion of I-69/I-269*
- Third Mississippi River Bridge Crossing
- Improve Rail Access to Frank C. Pidgeon Industrial Park
- I-55 and Crump Boulevard Interchange Modification.
- Upgrade At I-55 And Mclemore Interchange And Access Road To President's Island
- SR 78 and Inland Port Highway Accessibility, Port of Cates Landing
- Reconstruct I-240 and Airways Boulevard interchange
- Complete East Shelby Drive intersection improvements: I-55 to Lamar Avenue
- Plough Boulevard and Winchester Road Interchange design completion
- Expansion of Millington Regional Jetport terminal building and construction of new t-hangers and storage hangers.
- Widen US 72 (Poplar Avenue) between SR 57 to Shelby Drive from 2 to 5 lanes
- Widen US 72 (Poplar Avenue) between Shelby Drive to SR 196from 2 to 4 lanes
- Widen SR 57 (Poplar Avenue) between SR 385 to Tchulahoma Road from 2 to 4 lanes
- Port of Cates Landing Access to CN
- Upgrade Tennken Railroad excepted tracks and rehabilitation of tracks and bridges to support 286k load limits
- Brownsville, TN Mega Site Rail Access
- Widen Hacks Cross Road to 4 lanes
- I-40/I-240 East Interchange Phase 2
- I-240 Midtown Widening and Interchange Improvement
- I-240 and Poplar Interchange Improvements

Infrastructure Recommendations - Mississippi

- Lamar Avenue/U.S. 78 Corridor Improvements
- Completion of I-69/I-269
- Construction of I-22
- Upgrade Mississippi Central Railroad to support 286,000-pound load limits Tunica Mega Site Rail Access

Infrastructure Recommendations - Arkansas

- Interstate 40/Interstate 55 Interchange Modifications*
- Third Mississippi River Bridge Crossing

- Construction Of Rail Marshalling Yard And Rail Access To Port Of Helena
- West Memphis Port Access to UP
- West Memphis Airport 10 Year Capital Plan

Chapter 1: Memphis in the Global Supply Chain

As "America's Distribution Center," Memphis plays a critical role in the nation's global supply chain. This section provides a context for the freight infrastructure evaluation and recommendations to follow. First, IHS Global Insight's current world trade forecast is reviewed to understand the impacts of the global recession. Second, international land and water flows in and out of Memphis are examined using IHS Global Insight's proprietary United States Inland Trade Monitor database. Last, emerging global supply chain trends are discussed with respect to their impact on Memphis as a national logistics and distribution hub.

THE GLOBAL ECONOMIC PICTURE

International trade is dependent on a variety of global economic and financial factors, particularly the economic health of the world's leading economies. To better understand how international trade will affect Memphis in the future, this section examines IHS Global Insight's near-term and long-term forecast of the global economy. The focus of this section is on container trade, which has the greatest potential for the Memphis region as a logistics hub.

Forecasts presented here are based on IHS Global Insight's World Trade Service (WTS). The World Trade Service provides historical and forecast trade volumes for all major trade partners in the world. It forecasts 77 commodities traded among 76 countries and regions by mode of transportation. Primary modes of transportation include air, overland, and maritime transport, all measured in metric tons, as well as in value. Maritime transport is further detailed for liquid bulk, dry bulk, general cargo and neo-bulk, and container trades. Container trade is measured in 20-foot equivalent units (TEUs[7]), as well as metric tons. Additional information on the WTS is provided in Appendix I.

THE WORLD ECONOMIC OUTLOOK

The world economic outlook darkened considerably in 2009. The sub-prime market crisis expanded from a contraction in the United States housing market to a global financial downturn. Signs of a global recovery are evident, though, and the current economic outlook for the United States and its dominant trading partners is summarized below.

MAJOR WORLD REGION ECONOMIC OUTLOOK
(IN BILLIONS OF US$ 2000)

	2008	2009	2010	2015	CAGR (2008–20)
U.S. GDP	$11,694	$11,717	$11,997	$13,911	2.55%
Europe GDP	$10,918	$11,053	$11,287	$12,628	2.12%
China GDP	$2,600	$2,833	$3,075	$4,431	7.89%
India GDP	$842	$907	$983	$1,440	7.47%
Emerging Markets GDP	$160	$170	$181	$239	5.86%

Source: IHS Global Insight World Industry Service

United States: IHS Global Insight expects U.S. GDP to rise approximately 2.4% between 2009 and 2010 as credit markets unfreeze and exports are aided by a historically low dollar. Over the following decade, GDP will grow at a compound annual growth rate of approximately 2.8%.

[7] Typically, containership capacity is expressed in 20-foot Equivalent Units (TEU), defined as the number of 20' x 8' x 8'6" containers that a ship can carry.

Europe: Together with other developed economies, the Eurozone economy will continue to face tight credit conditions; a persistently strong euro; slowing growth in key export markets; weaker equity markets; higher interest rates; and elevated oil, commodity, and food prices. IHS Global Insight expects these factors to continue to threaten economic growth in the region, with GDP recovering to approximately 2.1% by 2010. Between 2010 and 2020, the Eurozone will grow at an average annual rate of only 2.2%.

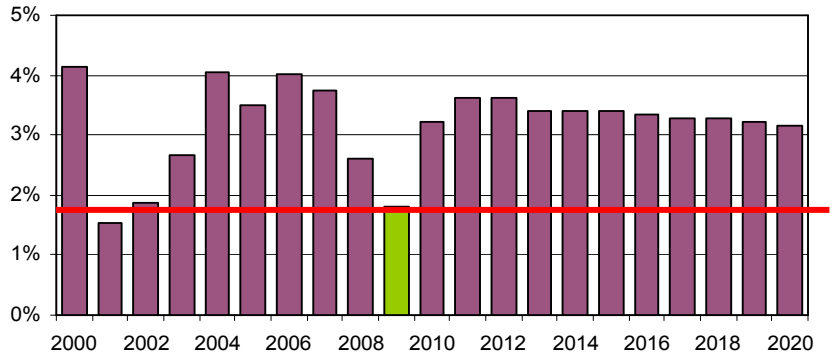
China: Demand for China's exports is still uncertain owing to a slow, prolonged global recovery and persistent Chinese currency appreciation, as well as recent increases in export tariffs. Export growth, particularly exports to the United States, has been trending downward since mid-2007. Nevertheless, even if double-digit economic growth has ended, IHS Global Insight expects China's economy to expand by 8.5% in 2010. Over the next decade, the annual rate of GDP growth will average approximately 7.7%.

India: The Indian economy is proving to be relatively insulated from global shocks, and is maintaining a thriving investment climate despite sub-prime market crises in other areas. IHS Global Insight forecasts growth to be 8.4% between 2009 and 2010. India is expected to continue growing at a healthy rate of 7.4% over the next decade. In fact, in this period of tight money, India is attracting more serious attention than China for the production of both low-end and high-end goods.

Other Emerging Markets: Booming international trade will especially benefit raw-material exporting economies and countries with undervalued currencies. As a result, some emerging markets in Latin America, Asia, and Africa will boast above-average growth rates as the global recovery begins to materialize. China's increasing demand for raw materials will allow these countries to continue growing at robust rates despite slower world economic growth. Although average annual growth rates for this group are expected to be 5.8% over the next decade, regional and country-level growth rates will vary widely.

Summary: IHS Global Insight projects real global GDP growth to rebound in 2010 and grow at above 3% over the following decade. Thus, despite numerous near-term threats to world economic growth, the global economy is expected to recover quickly, helped by the buoyancy of emerging markets. Major medium-term implications for international trade are a shift towards exports for the United States and a gradual slowdown in growth for China.

GLOBAL GDP GROWTH



Source: IHS Global Insight World Industry Service[8]

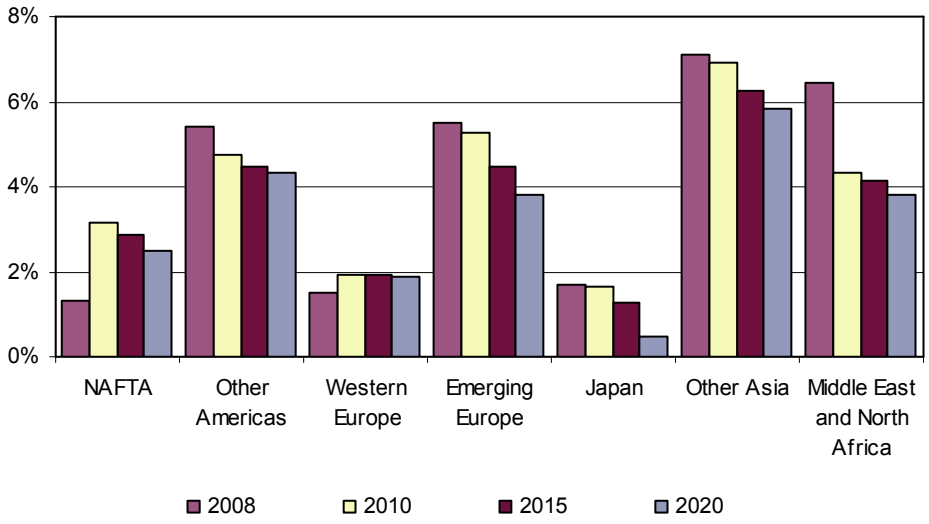
[8] Red line indicates the 2% threshold for GDP growth. Any consecutive year of less than 2% global GDP growth is defined as a recession by The International Monetary Fund.

REGIONAL ECONOMIC OUTLOOK

Trade between regions—including NAFTA, Western Europe, and Asia—is growing at different rates because the regions are expanding at differing rates. Growth rates in trade are highly correlated with growth in the overall economy.

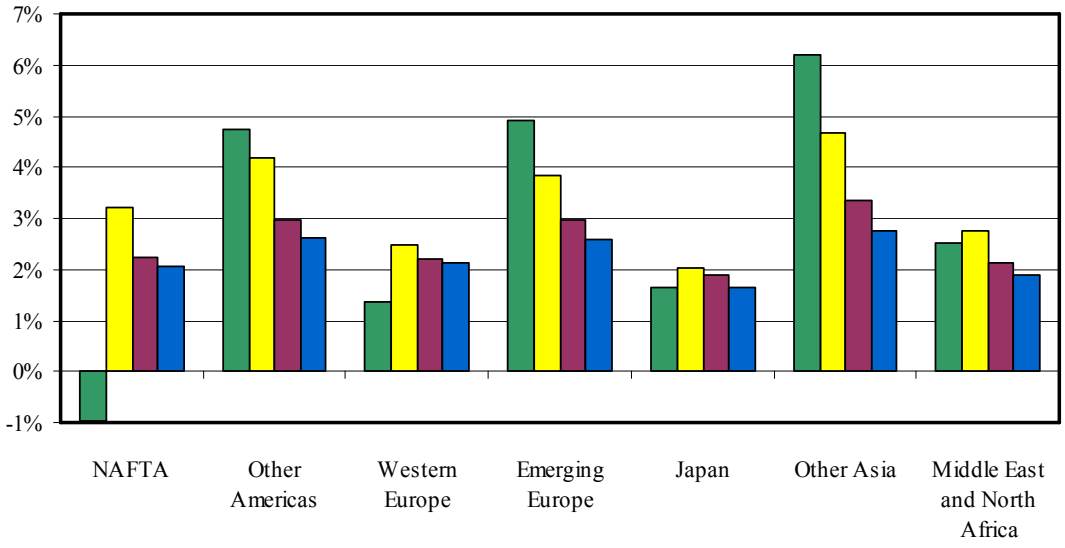
Emerging markets, especially in Asia, show the strongest economic growth. As a result, intra-Asian trade, as well as trade with the rest of the world, will grow substantially, albeit at a declining rate. A similar pattern can be seen in the emerging economies of Eastern Europe. Growth rates in the Middle East and Africa are expected to drop as the price of oil drops. In the Americas, NAFTA countries are the slowest growing, while the rest of the Western hemisphere will experience comparatively strong growth. Despite a few exceptions, Latin America, in particular, will become an area of sustained above-average growth and new investment over the next 10 years. As this chapter will show, supply-chain "near-sourcing" to the Americas and Mexico will be an emerging logistics trend, contributing to economic growth in this region.

MAJOR WORLD REGION ECONOMIC GDP GROWTH



Source: IHS Global Insight World Trade Service

TOTAL TRADE TONS IN 2007



Source: IHS Global Insight World Trade Service

As a result of differing global economic growth patterns, there will be a dramatic shift in global economic power that will profoundly influence trade patterns. By 2050, China is expected to surpass the United States as the country with the highest economic output, with India becoming third during that same time period. This implies that in the future, the emphasis on world output will continue to shift towards Asia and the Far East.

Brazil will be the fastest-growing economy in Latin America and the fifth-largest producer of economic output in the world (and one of the world's largest trading nations) by 2050. The emerging countries of Brazil, China, India, and Russia (the BRIC countries) are expected to continue their current above-average economic growth and surpass advanced economies such as the United Kingdom, France, and Germany by 2050.

COUNTRY GDP RANK (2000-50) IN BILLIONS OF REAL (2003) U.S. DOLLARS

2000	2010	2020	2030	2040	2050
United States	United States	United States	United States	United States	**China**
Japan	Japan	**China**	**China**	**China**	United States
Germany	Germany	Japan	Japan	**India**	**India**
United Kingdom	United Kingdom	Germany	**India**	Japan	Japan
France	**China**	United Kingdom	**Russia**	**Russia**	**Brazil**
Italy	France	**India**	United Kingdom	**Brazil**	**Russia**
China	Italy	France	Germany	United Kingdom	United Kingdom
Brazil	**India**	**Russia**	France	Germany	Germany
India	**Russia**	Italy	**Brazil**	France	France
Russia	**Brazil**	**Brazil**	Italy	Italy	Italy

Source: IHS Global Insight World Industry Service

CONTAINER TRADE AND WORLD GDP

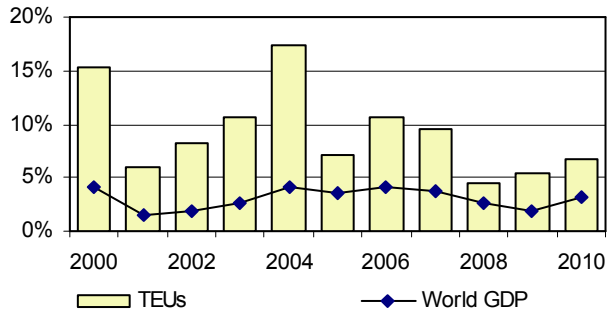
Historically, container trade has grown faster than the world economy, reflecting the increasing importance of international trade as a component of global growth. Although this trend is projected to continue, the ratio of container trade growth to world GDP growth has begun to decrease, and is expected to continue decreasing in the medium term, with container trade growing above 5% and world GDP growing above 3%. Double-digit percentage growth of container trade, a common occurrence since 2000, is not projected to be achieved again in the near future.

PERCENT CHANGE IN WORLD GDP AND TEUS

	2007	2008	2009	2010	2015
GDP	3.73%	2.61%	1.80%	3.22%	3.41%
TEUs	9.47%	4.48%	5.33%	6.72%	5.50%

Source: IHS Global Insight World Trade Service and World Industry Service

PERCENT CHANGE IN WORLD GDP AND TEUS (2000-20)



Source: IHS Global Insight World Trade Service and World Industry Service

Growth in global trade and GDP is expected to be relatively slow through early 2010, when the world economy will begin recovering from a recession. Regional variations in economic and trade growth are expected to persist, with emerging economies in Asia and Latin America leading they way in both. The historic relationship between growth in the wider economy and container trade will persist. Medium-term growth in trade will continue to drive container shipments around the world, resulting in a continued increase in container traffic flowing through Memphis.

UNITED STATES CONTAINER TRADE OUTLOOK

The amount of goods that the United States purchases and sells internationally is highly influenced by the state of the domestic economy, as well as the relative prices of traded goods. Within the context of the global economic outlook presented previously, this section discusses IHS Global Insight's forecast for the United States economy and its implication for United States trade. Similar to the previous section, the focus is on container trade.

U.S. GDP Growth

The United States is in the midst of a gradual recovery from a recession. Overall, IHS Global Insight projects U.S. GDP will recover in 2010 and grow at healthy, annualized quarterly rates between 2.4% and 3.4% over the next decade. Employment is expected to pick up after 2010, with the unemployment rate

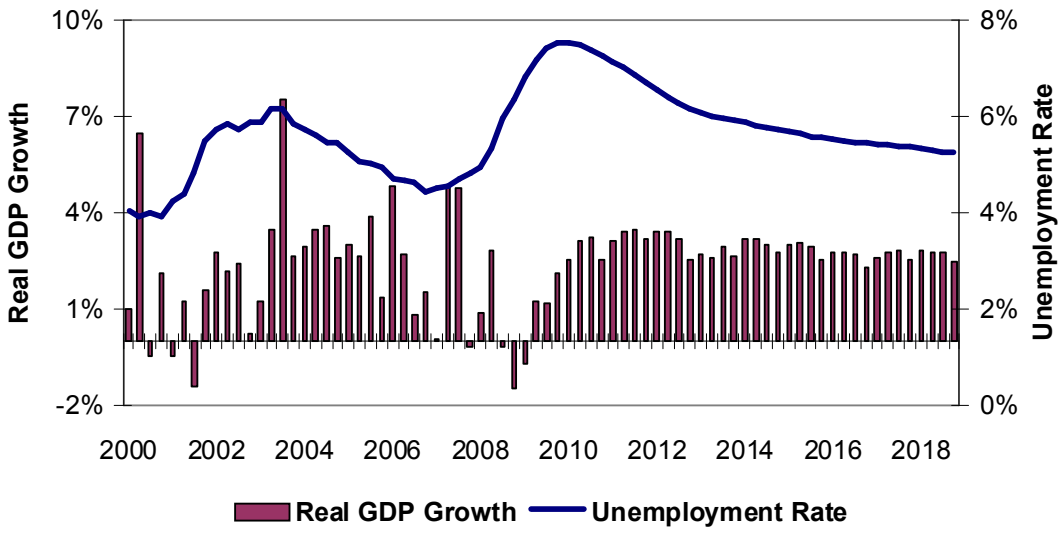
declining to 5.6% in 2015 and 5.2% by 2020. The path for the U.S. economy, however, is now highly dependent on the effectiveness of the new administration's stimulus package.

U.S. REAL GDP AND UNEMPLOYMENT ANNUAL GROWTH

	2007	2008	2009	2010	2015	2020
Real GDP Growth	3.73%	2.61%	1.80%	3.22%	3.41%	2.44%
Unemployment Rate	9.47%	4.48%	5.33%	6.72%	5.50%	5.24%

Source: IHS Global Insight World Industry Service

QUARTERLY PERCENT CHANGE OF REAL GDP AND UNEMPLOYMENT RATE (2000-20)

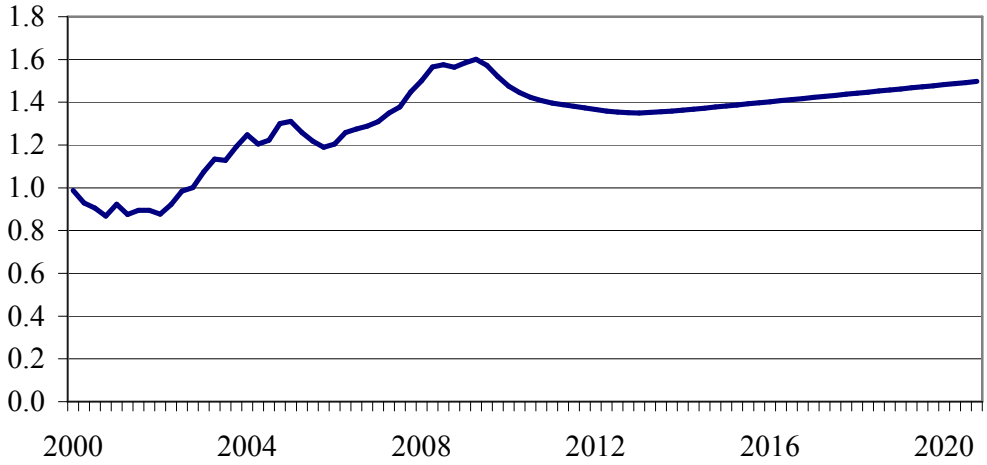


Source: IHS Global Insight World Industry Service

U.S. Dollar Appreciation

In the midst of the current slowdown, exports are one of the only factors supporting the U.S. economy, stimulated by the weak dollar. With demand for imported goods currently falling, the trade deficit is showing signs of improving, which should decelerate the dollar's fall. The dollar is not expected to rise quickly, though. It is more likely to show very modest gains over the next decade, and to remain weak compared with its level in 2004, when the decline in the dollar began.

U.S DOLLAR V.S. EURO (2000-20)



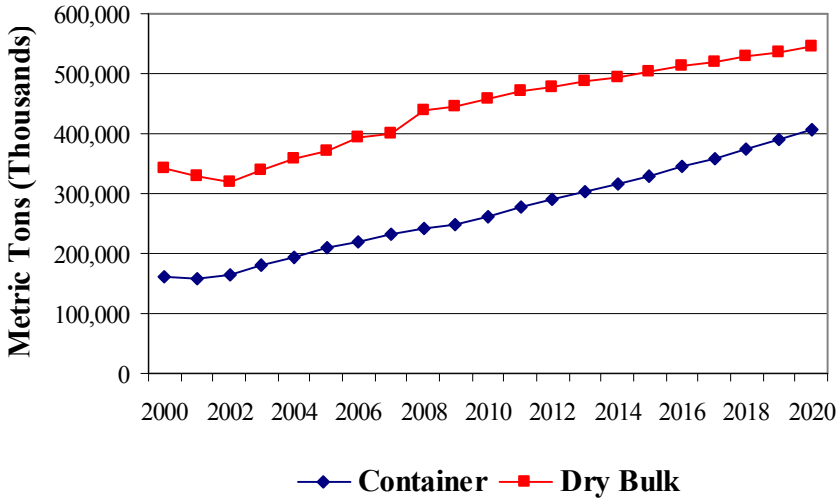
Source: IHS Global Insight Country Intelligence

U.S. TRADE FORECAST OVERVIEW

Memphis's role in international trade will be influenced by the composition and direction of overall U.S. trade with the rest of the world. This section discusses expected trends in U.S. foreign trade in light of IHS Global Insight's U.S. macroeconomic forecast.

The majority of U.S. imports and exports are dry bulk commodities. Although dry bulk commodities are expected to comprise more than half of total U.S. trade in tons by 2020, shipments of containerized (non-bulk) goods are rapidly capturing a larger share of total trade. Containerized trade will grow at a compound annual growth rate of about 4.5% between 2010 and 2020, compared with a growth rate of less than 2% for dry bulk trade. By 2020, containerized traffic will comprise approximately 43% of total trade, up from about 35% in 2008.

U.S. CONTAINERIZED AND DRY BULK TRADE (2000–20)



Source: IHS Global Insight World Trade Service

U.S. CONTAINER TRADE

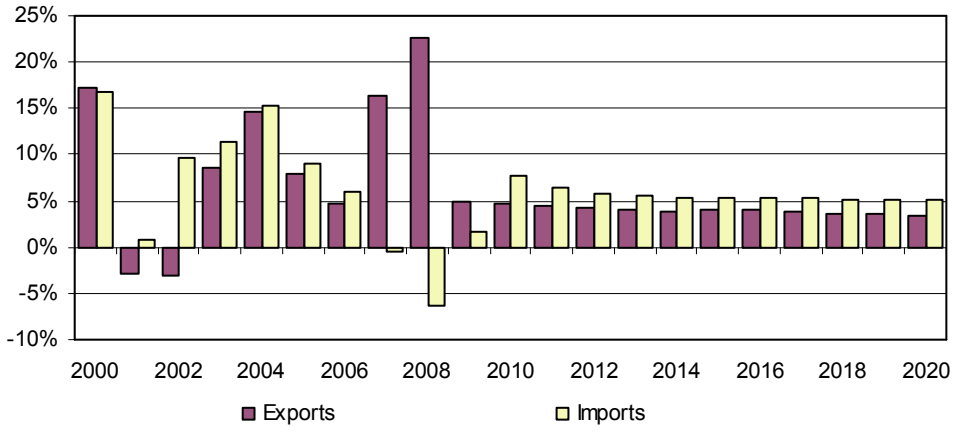
Containerized trade is the fastest-growing segment of U.S. foreign trade, and will have the greatest impact on Memphis and the region's role in the global supply chain. As discussed above, the recent slide in the dollar has caused a shift in growth towards exports in the United States. In fact, exports grew by 22.7% in 2008, whereas imports fell by 6.4%. This shift has occurred predominantly in containerized cargo, as the prices of dry bulk commodities have greatly increased in recent years. This trend of double-digit export growth is expected to reverse by late 2010, though, when import growth will exceed export growth once again.

PERCENTAGE CHANGE OF CONTAINER IMPORTS AND EXPORTS

	2007	2008	2009	2010	2015	2020
Exports	16.45%	22.66%	4.90%	4.78%	4.00%	3.43%
Imports	-0.55%	-6.36%	1.64%	7.75%	5.43%	5.07%

Source: IHS Global Insight World Trade Service

ANNUAL YEAR-ON-YEAR GROWTH IN U.S. CONTAINER IMPORTS AND EXPORTS (2000–20)

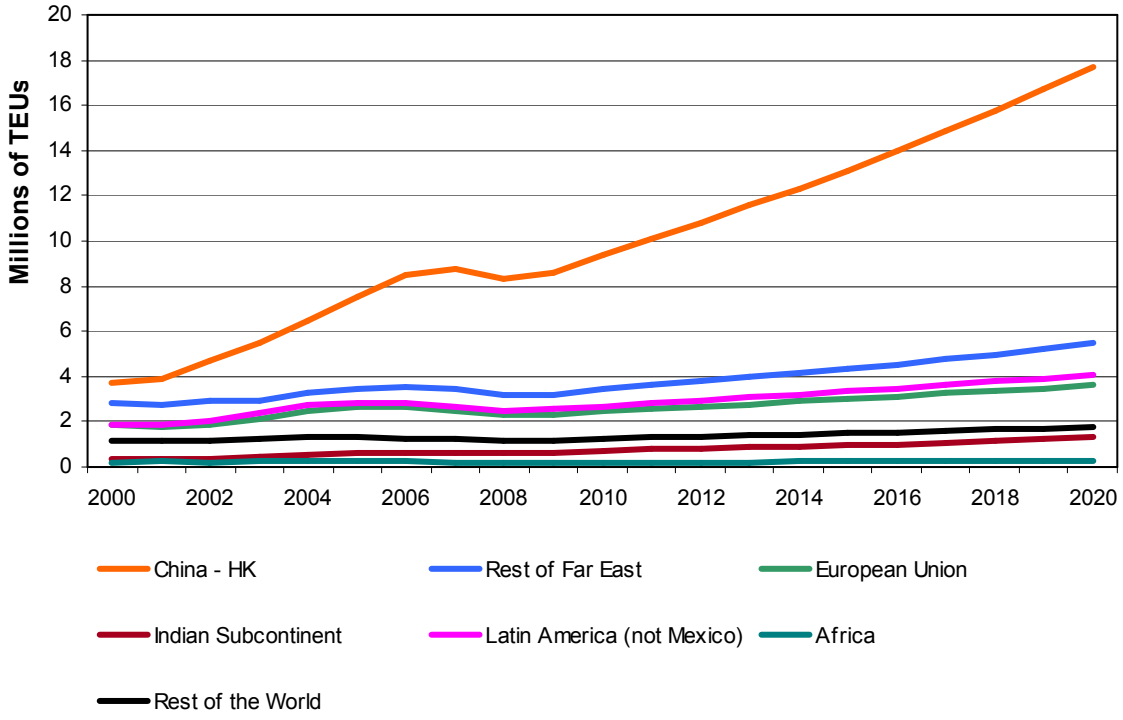


Source: IHS Global Insight World Trade Service

CONTAINER IMPORT FORECAST IN TEUS

Imports from China (including Hong Kong) comprise the largest portion of containerized imports, and are expected to grow at the fastest rate. Imports from China have been increasing at double-digit annual growth rates, but have fallen during the recent economic downturn, and are expected to start growing again at a brisk rate of about 6% through 2020. These imports are expected to increase from about one-third of all TEUs imported by the United States in 2000, up to one-half of all TEU imports by 2015. Imports from the rest of Asia are also expected to grow at a healthy annual rate of about 3.5%, surpassing 4 million TEUs around 2014. Latin America is expected to remain the third-largest exporting region to the United States.

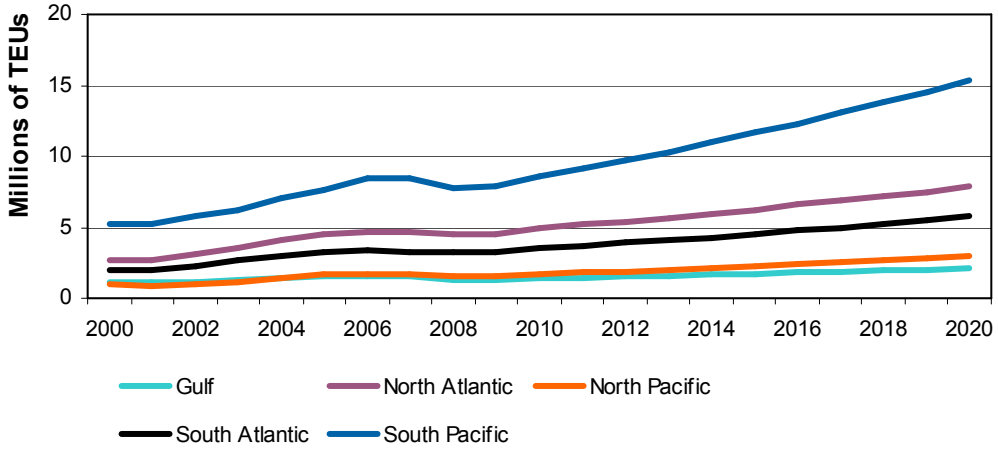
SOURCE OF U.S. CONTAINER IMPORTS (2000–20)



Source: IHS Global Insight World Trade Service

The growth of imports from Asia, particularly from China, will cause an increase in the volume of cargo arriving at the nation's West Coast ports. Despite a drop in traffic during the current economic downturn, the South Pacific coast, including the Ports of Los Angeles/Long Beach and Oakland, will experience the fastest increases in cargo. Although double-digit annual growth in Pacific container traffic is no longer the case, the number of containers passing through these ports is still expected to almost double by 2020, to reach approximately 15 million TEUs. This rise in South Pacific seaborne traffic may lead to increased congestion at the ports and along the east-bound rail and highway routes into the Midwest and Northeast United States. North Atlantic ports are also expected to grow although to a smaller extent.

U.S. IMPORTS OF CONTAINERS BY COAST (2000–20)

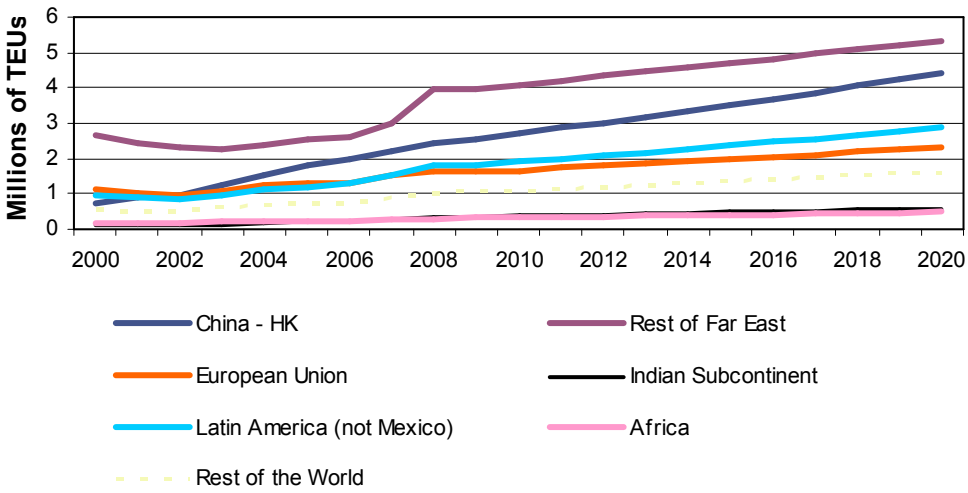


Source: IHS Global Insight World Trade Service

U.S. Container Export Forecast

Containerized exports have been steadily increasing thanks to the weakening dollar, and are expected to continue their rise, with the Far East and China being major destination regions. IHS Global Insight also projects U.S. container exports to Latin America to increase markedly. By 2010, Latin America will surpass the European Union as the third-largest destination for U.S. container exports.

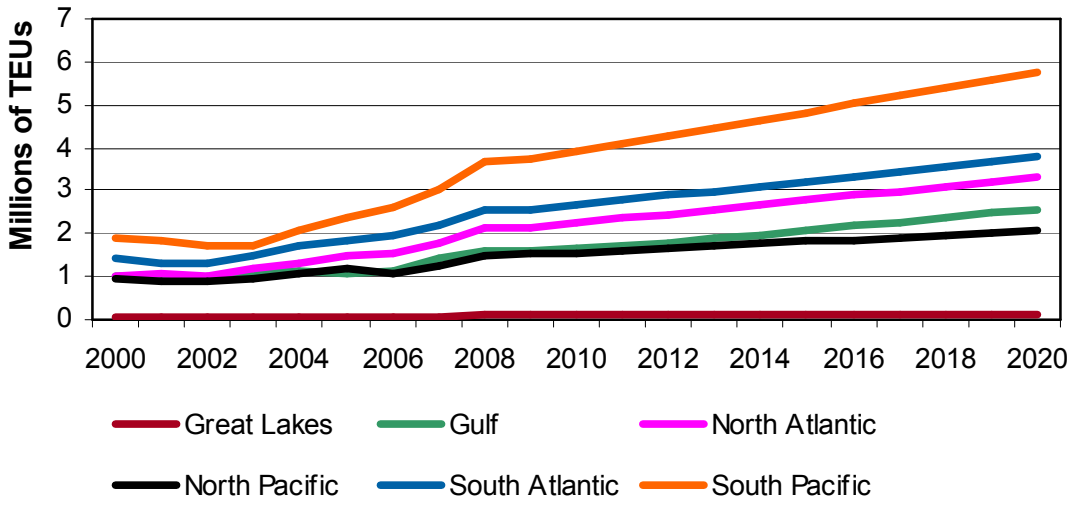
DESTINATION OF U.S. CONTAINER EXPORTS (2000–20)



Source: IHS Global Insight World Trade Service

Similar to imports, the majority of U.S. container exports leave the country through South Pacific coast ports. Approximately 29% of all containerized exports go through the Ports of Los Angeles/Long Beach alone. The South Atlantic coast has the second-highest volume of U.S. container exports due to growing containerized exports to Latin America.

U.S. EXPORTS OF CONTAINERIZED CARGO BY COAST (2000–20)



Source: IHS Global Insight World Trade Service

SUMMARY

The recent economic slow-down in the United States has caused a drop in imports, even from large trading partners such as China. Exports will continue to be invigorated by the fall in the dollar, however. Together with the rest of the economy, trade is expected to accelerate again in 2010, with imports once again outpacing exports by 2011. Trade volumes similar to pre-recession levels will not occur until 2016 at the earliest.

The composition of U.S. trade with the rest of the world will also be changing. Even at today's lower growth rates, trade in containerized cargo will continue to grow at a faster rate than dry bulk cargo. The growth in containerized cargo will be driven by imports, particularly from China and other Asian countries. Despite a few exceptions, Latin America, in particular, will also become an area of sustained above-average growth and new investment over the next 10 years.

Implications for Memphis: Given the renewed growth in container imports from China and other Asian countries, United States southern Pacific ports will continue to be the primary entry point for containers arriving in Memphis, although North and South Atlantic ports will also see increases in container traffic from expansion of the Panama Canal discussed later in this Chapter. Trading countries of particular interest to Memphis are: China, Vietnam, Singapore, Mexico, Central America, and Brazil.

INTERNATIONAL LAND AND WATER TRADE FLOWS IN MEMPHIS

This section reviews international land and water trade flows in the Memphis region. Land modes include truck and rail, while water includes freight river flows. Data is from IHS Global Insight's (IHS Global Insight) United States Inland Trade Monitor (USITM), a proprietary database that estimates international freight flows within the United States to and from U.S. ports. All USITM freight volumes are for 2007. Additional information on USITM is found in Appendix II.

OVERVIEW OF MEMPHIS INTERNATIONAL LAND AND WATER FREIGHT FLOWS

Approximately 11 million tons of international trade originated or terminated in the Memphis region in 2007, worth over $23 billion. Imports into the region outweigh exports: 55% of the region's trade volume and 80% of its value was from imported goods.

TOTAL INTERNATIONAL LAND AND WATER TRADE IN THE MEMPHIS REGION (2007)

	Imports	Exports	Total
Tons (Millions)	6.21	4.99	11.20
Value (US$ Billions)	$16.9	$6.3	$23.1

Source: IHS Global Insight United States Inland Trade Monitor

Rail is critical to the region in the handling of international freight. More than two-thirds of all international freight tons and 85% of its value move in and out of Memphis by rail, primarily containers via one of Memphis' five intermodal terminals.

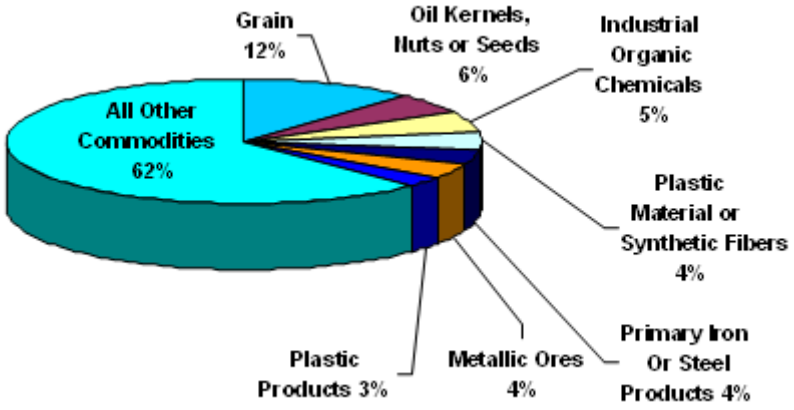
TOTAL INTERNATIONAL LAND AND WATER TRADE IN THE MEMPHIS REGION BY MODE (2007)

Mode	Tons (Millions)	Share	Value (US$ Billions)	Share
Rail	7.7	69%	$19.8	85%
Truck	0.9	8%	$2.8	12%
Water	2.6	23%	$0.5	2%
Total	11.2	100%	$23.1	100%

Source: IHS Global Insight United States Inland Trade Monitor

The dominant international trade commodity is grain, which accounts for about 12% of Memphis' international tons handled, followed by oils, nuts, seeds, and chemicals. Together these commodities constitute almost one-fifth of international trade in the region. A more detailed breakdown of trade commodities in Memphis can be found in Appendix VII.

TOTAL MEMPHIS INTERNATIONAL LAND AND WATER TRADE BY COMMODITY (TONS) 2007

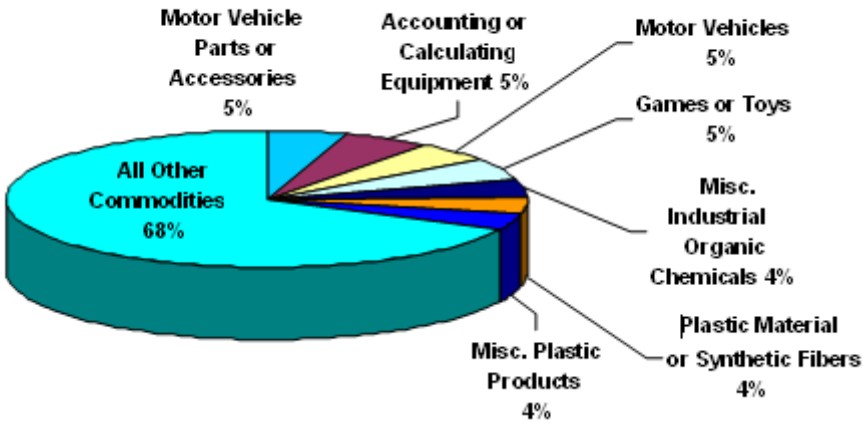


Source: IHS Global Insight United States Inland Trade Monitor

There are four commodity groups that dominate in Memphis in terms of value: motor vehicle parts, accounting or calculating equipment, motor vehicles, and games or toys. These four commodities constitute 20% of Memphis international trade by value. As car manufacturers like Toyota build manufacturing facilities in Midsouth portion of the country (i.e., Tennessee, Mississippi), the region is likely to see an increase in the international trade of motor vehicles and motor vehicle parts. The importance of commodities such as industrial organic chemicals and plastic material and synthetic fibers in the Memphis region lends support to the growing importance of biotech and other medical technology industries in the region. This diversity of import and export commodities protects Memphis from economic fluctuations in specific industries.

International freight in Memphis primarily enters and exits the United States through the Ports of Los Angeles and Long Beach, California and New Orleans, Louisiana. West Coast flows are mainly containers to and from Asian-rim countries, while New Orleans serves as the region's primary port for bulk exports traveling the Mississippi River. Southern Atlantic ports are used primarily for high-value export commodities. A more detailed breakdown of trade commodities can be found in Appendix VII.

TOTAL MEMPHIS INTERNATIONAL LAND AND WATER TRADE BY COMMODITY (VALUE) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

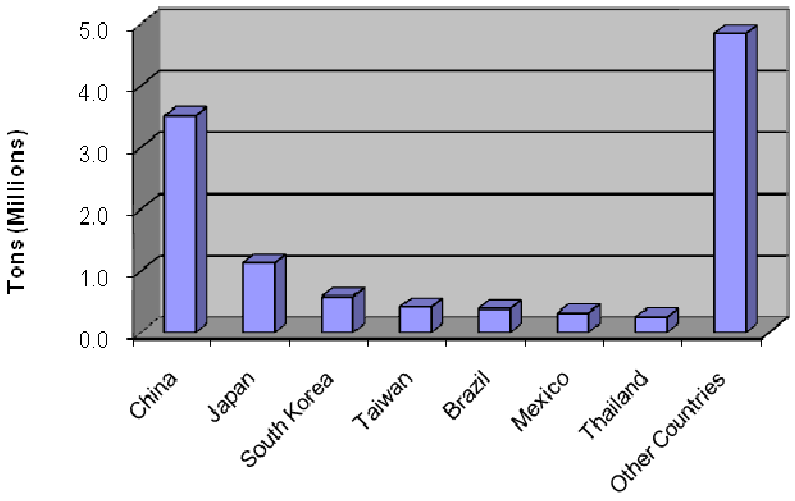
TOTAL MEMPHIS INTERNATIONAL LAND AND WATER TRADE BY U.S. PORT (TONS) – 2007

Source: IHS Global Insight United States Inland Trade Monitor

China represents approximately one-third of all international trade volume that terminates or originates in Memphis. The Far East, South America, and Europe regions, however, are all key trading partners with the area. This geographical diversity in trade is critical, since it makes Memphis much less susceptible to economic swings in any particular global area[9].

[9] Trade from Canada and Mexico are not included in these figures since IHS Global Insight's U.S. Inland Trade Monitor only estimates inland ocean trade. Most NAFTA trade enters the United States by truck and not from an ocean port.

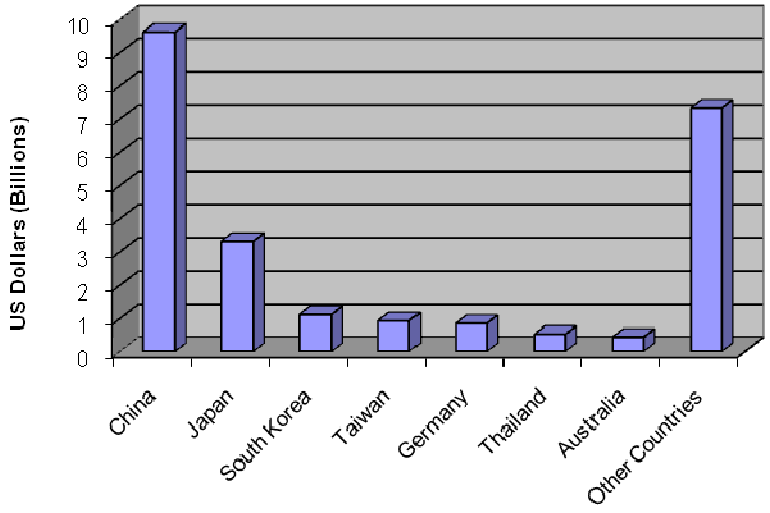
TOTAL MEMPHIS INTERNATIONAL LAND AND WATER TRADE BY COUNTRY (TONS) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

China constitutes approximately 39% of the international trade value in Memphis. It is interesting to note that although Mexico is one of the region's major trading partners (see above), it is not among the top-seven countries in terms of value of imports. This implies that goods flowing to the Memphis region from Mexico have relatively lower value per ton.

TOTAL MEMPHIS INTERNATIONAL LAND AND WATER TRADE BY COUNTRY (US$ VALUE) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

MEMPHIS INTERNATIONAL LAND AND WATER IMPORTS

In 2007, Memphis received approximately 6 million tons and over $16 billion worth of imports. Some 78% of these imports were transported via rail, primarily containers through the Ports of Los Angeles and Long Beach. Note that imports by water represent 13% of Memphis imported freight by weight but account for only 1% of its value, reflecting the bulk nature of Mississippi River traffic.

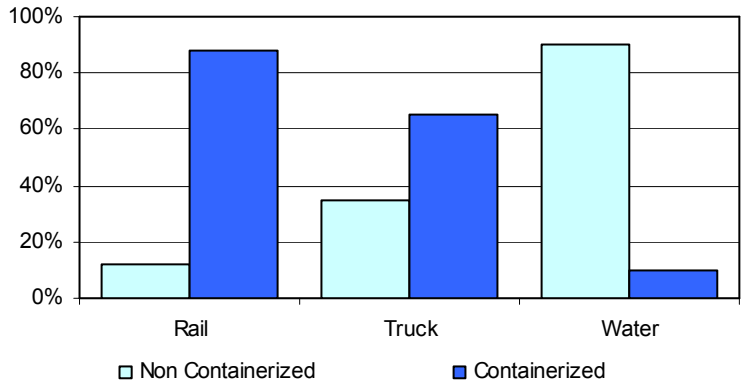
MEMPHIS LAND AND WATER IMPORTS BY MODE -2007

Mode	Tons (Million)	Share	Value (US$ Billion)	Share
Rail	4.82	78%	$14.48	86%
Truck	0.58	10%	$2.24	13%
Water	0.78	13%	$0.16	1%
Total	6.19	100%	$16.87	100%

Source: IHS Global Insight United States Inland Trade Monitor

Approximately 87% of rail imports into Memphis are containerized compared with 65% of truck imports. While the majority of water imports are bulk commodities, 10% is containerized, reflecting a greater use of containers even in traditional bulk freight modes.

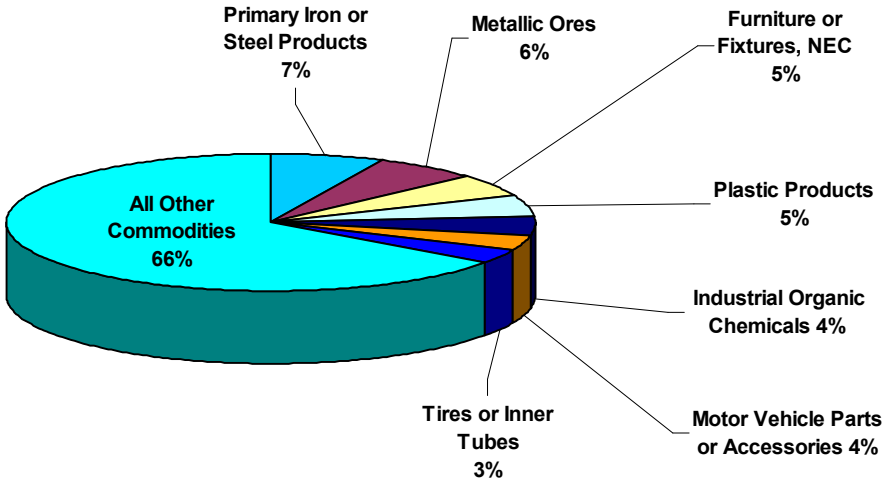
MEMPHIS LAND AND WATER IMPORT BY MODE (CONTAINERIZED VS. NON-CONTAINERIZED) - 2007



Source: IHS Global Insight United States Inland Trade Monitor

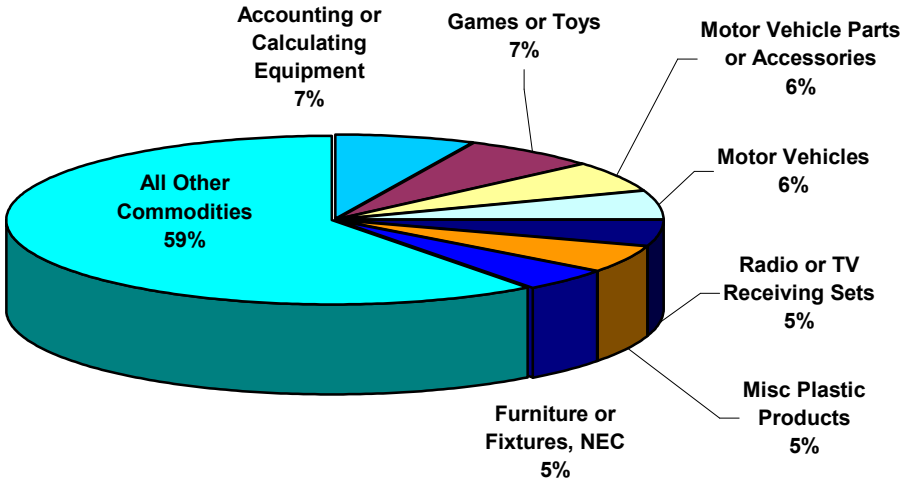
In terms of volume, bulk steel and metallic ores account for 13% of international import traffic. Steel imports are likely inbound ingots and other raw materials to the Nucor Steel plant on the Mississippi River. Motor vehicles, motor vehicle parts, and accessories represent approximately 12% of the region's imports by value, demonstrating the regions importance as an entry point for imports goods to the large number of automobiles plants near the region.

LAND AND WATER IMPORTS TO MEMPHIS BY COMMODITY (TONS) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

LAND AND WATER IMPORTS TO MEMPHIS BY COMMODITY ($ VALUE) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

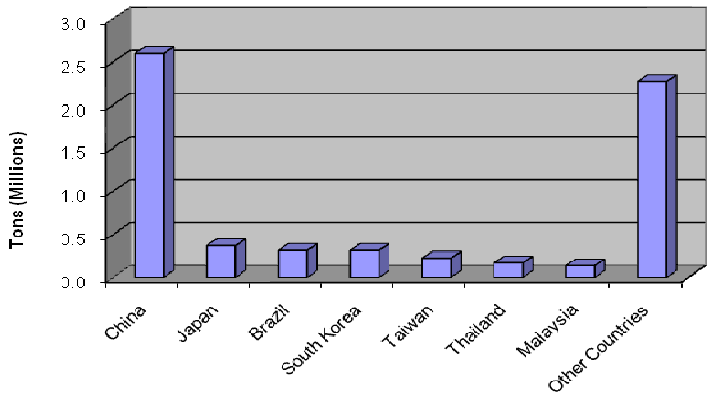
The Ports of Los Angeles and Long Beach and New Orleans handle 70% of the region's imports, reflecting both the high level of container imports from Far Eastern countries and the bulk nature of the region's water traffic.

LAND AND WATER IMPORTS TO MEMPHIS BY TOP PORTS (TONS) – 2007

Source: IHS Global Insight United States Inland Trade Monitor

The majority of imports to the Memphis region originate in the Far East. China alone accounts for 40% of all import tons in the Memphis region, followed by Japan, Brazil, and South Korea. Together the top seven countries account for 64% of all import tons in the Memphis region.

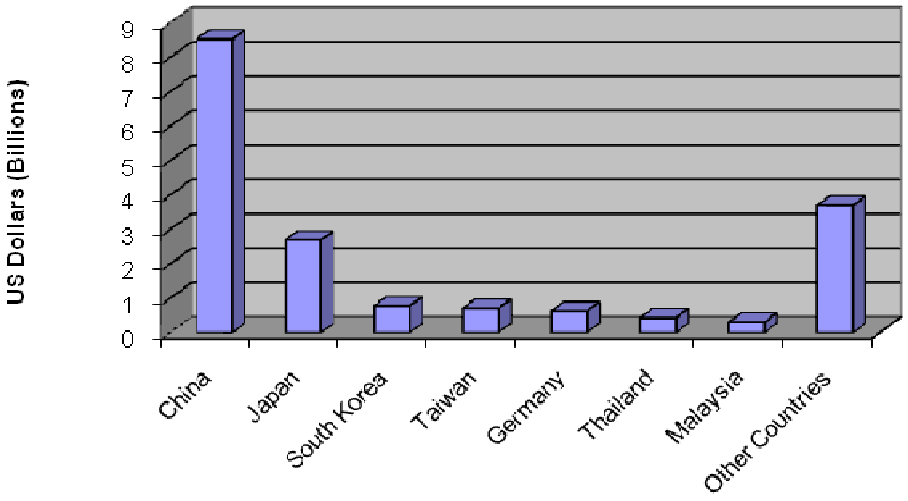
LAND AND WATER IMPORTS TO MEMPHIS BY COUNTRY OF ORIGIN (TONS) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

China dominates the import trade picture in dollar value terms as well as volume, overall China accounts for about 48% of all import value in the Memphis region. In dollar-value terms, Germany is the fifth-largest origin country for imports to the Memphis region. It is not among the top-seven origin countries in volume terms (see above), however, implying that Germany exports high-value goods to the Memphis region. The top-seven countries account for about 78% of all import value in the Memphis region.

LAND AND WATER IMPORTS TO MEMPHIS BY COUNTRY OF ORIGIN (US$ VALUE) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

MEMPHIS INTERNATIONAL LAND AND WATER EXPORTS

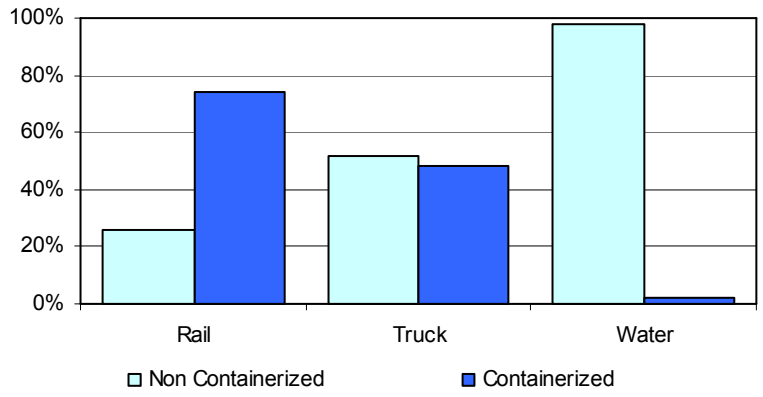
Export freight originating in Memphis in 2007 totaled almost 5 million tons and $6 billion in value. Similar to imports, the majority exports from Memphis moved via rail. Note that import tons by rail outnumber the export tons by about 20%—one of the primary reasons for the availability of empty containers in the region (a major benefit to local international exporters). Memphis is a net exporter of bulk commodities traveling via water: 38% of all exported tons are transported by water, compared with only 13% of imports.

LAND AND WATER EXPORTS FROM MEMPHIS BY MODE – 2007

Mode	Tons (Millions)	Share	Value (US$ Billions)	Share
Rail	2.84	58%	$5.29	85%
Truck	0.29	6%	$0.57	9%
Water	1.84	38%	$0.39	6%
Total	4.98	100%	$6.25	100%

Source: IHS Global Insight United States Inland Trade Monitor

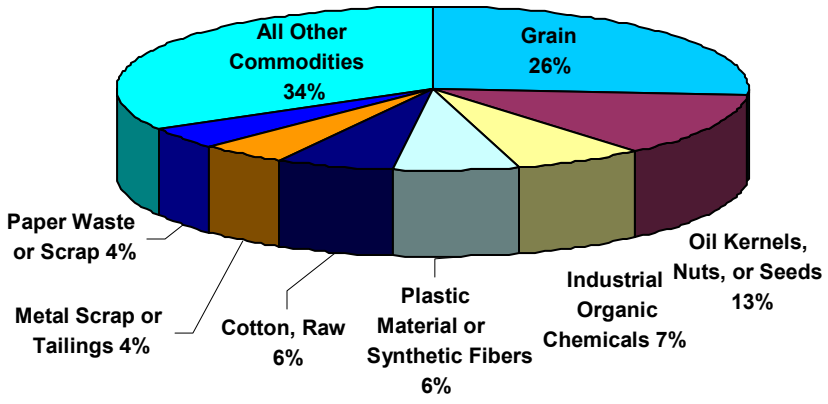
MEMPHIS LAND AND WATER EXPORTS BY MODE (CONTAINERIZED VS. NON-CONTAINERIZED) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

In line with imports, approximately 74% of all rail exports from Memphis are containerized. Truck exports are fairly balanced between containerized and non-containerized goods. The majority of water exports are bulk commodities. Grain and nuts and oil kernels account for about 40% of all exports from the Memphis region. These are primarily bulk commodities that move on the Mississippi River. By value, however, Memphis exports are much more varied, and demonstrate the diversity of export activity that occurs in the region. This diversity is advantageous for Memphis, since it is not tied to economic downturns in any one industry.

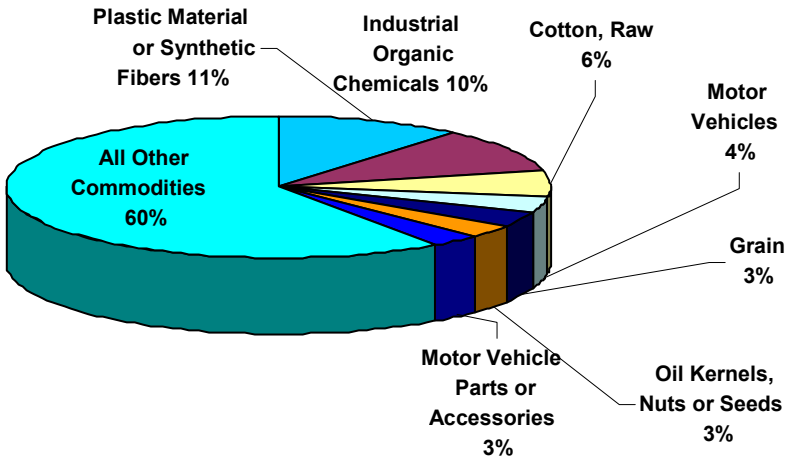
LAND AND WATER EXPORTS BY COMMODITY (TONS) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

Plastic material or synthetic fibers, industrial organic chemicals and motor vehicle industry related goods are among the top exports. The prominence of plastic material or synthetic fibers and industrial organic chemicals among the top export commodities in the region is likely due to the increasing presence of biotechnology industry in the Memphis region.

LAND AND WATER EXPORTS BY COMMODITY (US$ VALUE) - 2007



Source: IHS Global Insight United States Inland Trade Monitor

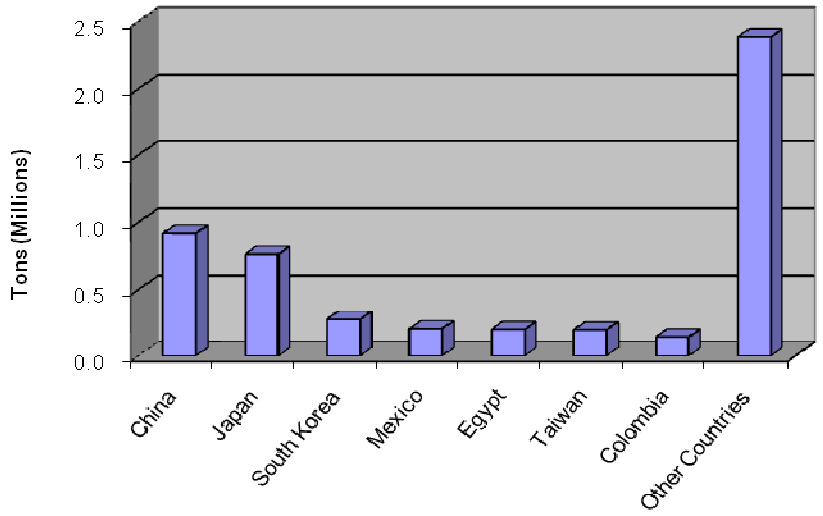
The port of New Orleans is the largest exit port for Memphis exports. Much of this is bulk trade. For exports, East Coast ports handle similar export volumes as the ports of Los Angeles and Long Beach, reflecting the importance of Europe and the Far East as export destinations for the region.

MEMPHIS LAND AND WATER EXPORTS BY PORT (TONS) – 2007

Source: IHS Global Insight United States Inland Trade Monitor

China, Japan, South Korea, and Mexico are the top destinations for exports that originate in the Memphis region. In terms of volume, Egypt is surprisingly the fifth-largest destination country for exports from the region, receiving grain and oil kernels. Exports from the Memphis region are distributed among numerous countries, with the "other countries" category accounting for the majority of export volumes from the region. In contrast with imports, the countries depicted below account for only half of all export tons from the Memphis region and 47% of the export value.

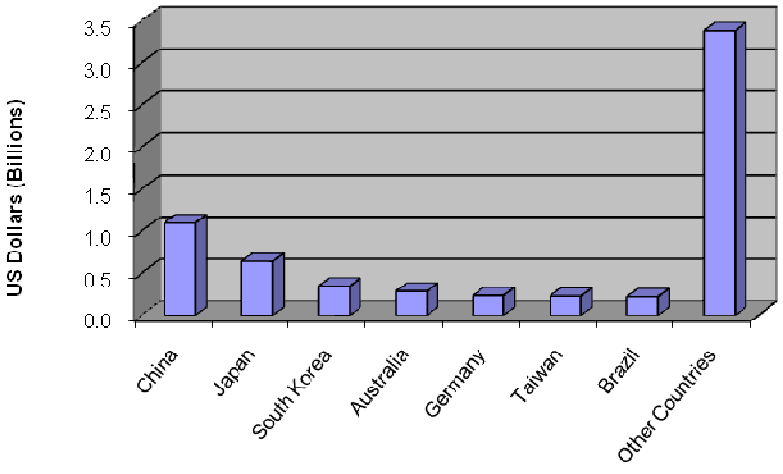
MEMPHIS LAND AND WATER EXPORTS BY DESTINATION COUNTRY (TONS) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

China, Japan, South Korea, and Australia are the top destination countries for exports from the Memphis region. Upon further review, motor vehicles, internal combustion engines, and tires or inner tubes were the most common commodities from the Memphis region to Australia. This provides further indications of the importance of the automotive industry as a key source of exports in the region.

MEMPHIS LAND AND WATER EXPORTS BY DESTINATION COUNTRY (US$ VALUE) – 2007



Source: IHS Global Insight United States Inland Trade Monitor

MEMPHIS INTERNATIONAL LAND AND WATER FREIGHT COMPARED WITH OTHER REGIONS

Memphis ranks fourth in terms of volume of originating or terminating international freight and third in terms of value. While Chicago dominates as the inland port for international freight, the Memphis region already ranks ahead of much larger cities such as Atlanta and poised to overtake Dallas as a global inland port. This is significant, since these three areas compete heavily with each other to attract warehouses and logistics-related companies. The Chamber needs to emphasize its unique logistics attributes vis-à-vis these other competing areas in its marketing efforts as "America's Distribution Center."

International Land and Water Trade Handled in the Memphis Region Compared with Other Major Markets – 2007

BEA	Tons (Millions)		BEA	Value (US$ Billions)
Chicago, IL	43.24		**Chicago, IL**	$78.50
St. Louis, MO	16.85		**Dallas, TX**	$32.00
Dallas, TX	13.15		***Memphis, TN***	*$23.10*
Memphis, TN	*11.20*		**Atlanta, GA**	$21.50
Atlanta, GA	9.24		**Kansas City, MO**	$16.60
Cincinnati, OH	5.91		**St. Louis, MO**	$10.70
Kansas City, MO	4.32		**Cincinnati, OH**	$6.10
Nashville, TN	1.18		**Nashville, TN**	$3.40

Source: IHS Global Insight United States Inland Trade Monitor

SUMMARY

- Memphis is a major inland distribution hub for land and water international traffic. In 2007, it originated or terminated over 11 millions tons of international freight worth over $23 billion. The region is a net importer of international land and water freight, particularly in terms of value. 25% more international freight terminates in the region in terms of volume and over twice as much in terms of value.

- Memphis ranks fourth in terms of land and water international tons handled and third in value compared with other regional inland ports. Its major inland logistics competitors are Dallas and Atlanta.

- **Import Trade**: Major import commodities include iron/steel and stone products by volume and auto parts by value. Rail handles 78% of the international imports in the region. The Pacific Rim is the major originating country with the Ports of Los Angeles and Long Beach as the primary port of entry.

- **Export Trade:** Exports from Memphis are much more diversified in terms of commodities, mode, and country. A significant amount is bulk related, grain, nuts, and seed by volume and plastics by value. 38% of exports tons from the region move by water, but 85% of the value moves by rail.

The primary port is New Orleans by volume but higher-value commodities move to Europe through southern Atlantic ports.

- ***Implications for Memphis:*** The region's greater percentage of higher value import traffic needs to continue and be encouraged. These commodities generate additional value added logistics activity in terms of cross docking, repackaging, and distribution. The imbalance of import to export trade means availability of empty container and trailer equipment in the region for repositioning and backhaul

EMERGING TRENDS IN INTERNATIONAL TRADE

Memphis' role in the global supply chain will be influenced by a number of international trade trends that have the potential to change the attractiveness of the region as a major logistics and warehousing hub. These major trends are discussed in this chapter and include:

- **Changing Size of Containership Fleet and Panama Canal Expansion**. Expansion of the Panama Canal will cause shifts in imports from the West Coast to Gulf and East Coast ports. Memphis will be competing with inland hubs in the northeast for containers entering East Coast ports.

- **The Suez Canal**. Changes in Asian manufacturing sourcing will make Asian–East Coast liner services more attractive than going through West Coast ports. The Ports of New York/New Jersey, Norfolk, and Halifax could gain.

- **Shorter Supply Chains.** The global recession and energy price uncertainty is making corporations rethink supply-chain strategies to shorten transit and reduce risk. "Near-sourcing" to Mexico and the Americas is one option that addresses this concern and benefits Texan freight hubs and Kansas City. Memphis also benefits from this trend with expedited Canadian National train service from Prince Rupert which reduces supply chain transit time by 2 - 3 days from Asia.

- **Increased Rail Usage.** The global recession has caused shifts in mode choice from higher-cost air freight and truck to lower-cost rail and water. Distribution centers will be located closer to intermodal terminals and population centers to reduce reliance on higher-cost trucking for long hauls. The increasing use of rail intermodal in international supply chains will make ports and inland hubs with good rail access (such as Memphis) much more attractive.

- **Multi-Modalism**. With increased transportation cost uncertainty, shippers will design more flexible supply chains that use multiple ports, cross-docking, transshipment, and other options that can quickly adapt to changes in costs or demand. The Memphis region's exiting network of warehouses and logistics services, some in response to its air freight-based Aerotropolis plan, will make Memphis a more attractive inland hub.

- **Decreases in Air Freight**. The shift to lower-cost modes has resulted in sustained decreases in domestic air freight and slower growth in international air cargo. FedEx's reaction to this shift could include the use of rail intermodal for domestic transport, affecting freight infrastructure in the region.

CHANGING CONTAINERSHIP FLEET AND PANAMA CANAL EXPANSION

The world's containership fleet can be divided into three broad categories of ships as described below:

1. Feeder Ships: These ships serve smaller ports from a major port and have capacities of 400 TEUs or less.
2. Panamax Ships: These ships are the maximum size to travel through the Panama Canal. They generally carry up to 4,500 TEUs.
3. Post-Panamax Ships: These larger ships are not currently able to travel through the Panama Canal, and have container capacity of between 5,000 and 12,000 TEUs.

PANAMAX AND POST-PANAMAX CONTAINERSHIPS

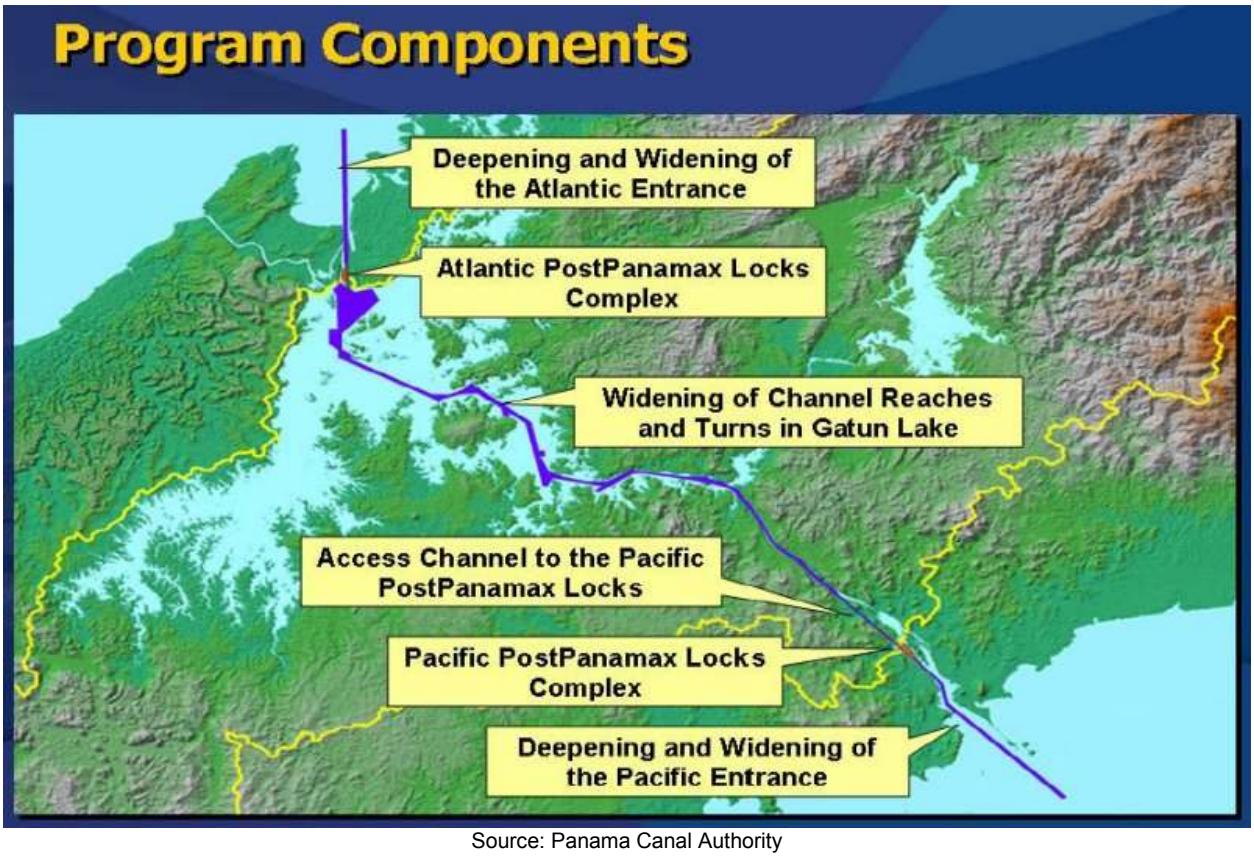
Panamax Ships: Up to 4,500 TEU Capacity

Post-Panamax Ships: 4,500–12,000 TEU Capacity

The world's containership fleet is changing. Based on the current order book, by 2012, ships with the capacity of over 10,000 TEUs will comprise 64% of total containership capacity in TEUs[10]. This change in containership fleet size is the primary reason why the Panama Canal Authority has approved the construction of a third set of locks, large enough to transit a 12,000 TEU ship. The estimated cost of the project is $5.25 billion, with the locks expected to become commercially operational by 2015. Preliminary excavation work on the channels began in September 2007 with all required financing completed. Requests for proposals have been issued for specific dredging and construction projects.

[10] AXS – Alphaliner, April 2008

MAJOR COMPONENTS OF PANAMA CANAL EXPANSION



Source: Panama Canal Authority

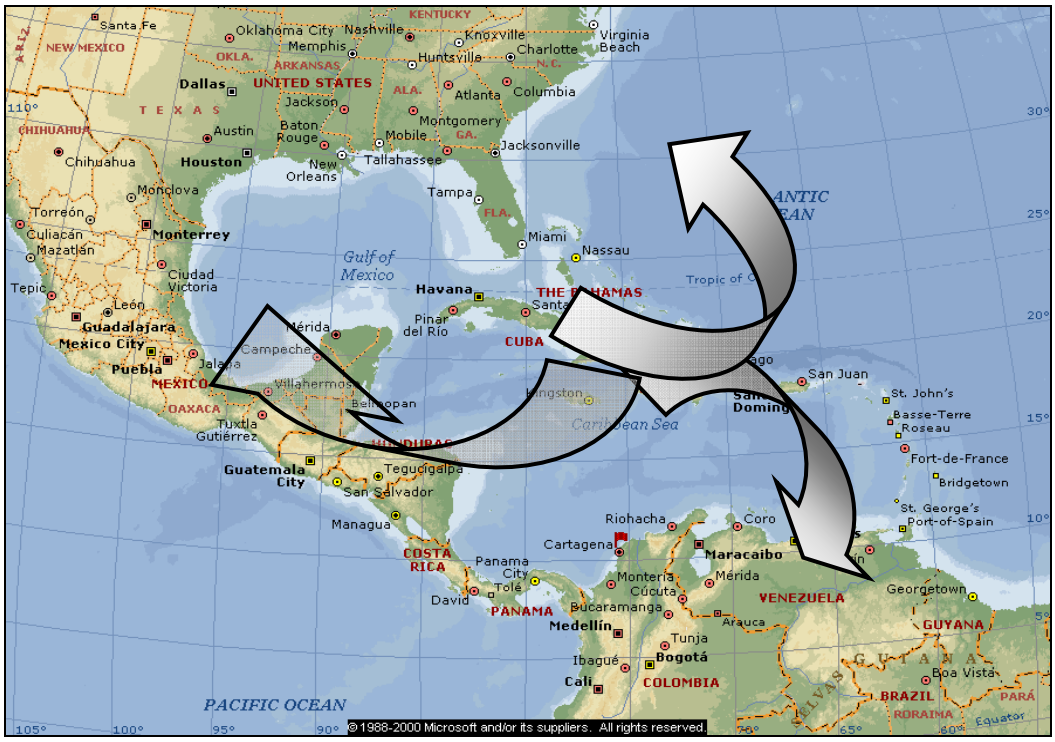
The economics of operating the growing number of post-Panamax ships will fundamentally change international shipping patterns. From the shipping-line perspective, the primary appeal of these vessels is the operating economies of scale. The operating cost of a 5,000 TEU vessel is not that much higher than a smaller 4,000 TEU ship, but has 25% more capacity. Since these larger ships take 2–3 days longer to discharge than smaller vessels, however, these cost efficiencies can only be realized in the line's ability to minimize the number of calls to load or discharge containers. Therefore, these ships will realize their economies of scale on hub-to-hub routes.

With the ability of post-Panamax ships to pass through the Panama Canal, many containers that now discharge on the West Coast and move via land bridge to the Midwest or Eastern United States will travel directly to the Gulf or East Coast ports via the Canal. Nevertheless, shipping lines will not find it economical to make multiple port calls along the East or Gulf coasts with these ships, discharging only part of its container cargo, because of their high operating costs. Instead, the ships will seek single-port hubs for quick container discharge and reloading. This implies transshipment from the target hub to final port locations, and, in the face of the U.S. Jones Act, the hub is likely to be off-shore in the Caribbean.

There are several transshipment hubs, such as Caucedo in the Dominican Republic, Kingston in Jamaica, and Manzanillo International Terminal in Panama already prepared to handle post-Panamax vessels. Investments are also being made to enhance the transshipment capacity of other ports. An advantage of using transshipment in the Caribbean is that the post-Panamax ship can be loaded with multiple-destination containers, including boxes headed for the U.S. Gulf, the U.S. East Coast, the

Caribbean, and Central America, and certain countries in South America. This makes it easier for the liner shipping company to load its ships in Asia to break-even levels.

CARIBBEAN TRANSSHIPMENT TRIANGLE



Source: IHS Global Insight

Feeder ships carrying containers from these transshipment locations to U.S. ports will be smaller and more flexible. The operating cost of transshipment from the Caribbean will still be competitive compared with the alternative of land-bridge transportation from the West Coast for several reasons:

- Transshipment in the Caribbean is fiercely competitive, based on price;
- A large share of the container traffic coming through the Canal will be transshipped, so most will incur the (small) additional charge;
- The economic advantages of loading the ship with containers destined for multiple locations outweighs the cost of transshipping the containers to feeder ships;
- Continued port congestion on the West Coast will make transshipping to alternative ports an attractive option.

***Implications for Memphis*:** It is estimated that up to 25% of the West Coast's current container traffic could shift to East and Gulf Coast ports as a result of Panama Canal Expansion.[11] While estimates of port shifts vary, even half that volume would produce significant changes in U.S. inland container flows and port usage. The attractiveness of Memphis as an inland hub will also change depending on what ports are used as a result of Panama Canal expansion. In terms of transit times by both ocean and inland rail from East and West Coast ports, Memphis is five days away from most West Coast ports, including

[11] John Carver, Executive Vice president, Jones Lang LaSalle. "Ports Brace for East Coast Rivalry with Dominant Western Seaports," National Real Estate Investor, August 26, 2009.

Prince Rupert, due to Canadian National expedited service. By contrast, rail-service intermodal travel time imporvements are needed from the Ports of Seattle and Tacoma to Memphis.

MEMPHIS CONTAINER TRANSIT TIMES

Source: "*Inland Supply Chain Trends and the Implications on North American Distribution Markets,*" Greg Arnold, ProLogis, FHWA Talking Freight Series, July, 2009.

A summary of expected port beneficiaries from the shift of West Coast containers is summarized below.

Atlantic Coast Ports: The Ports of New York and New Jersey, Norfolk, and Savannah are expected to gain greater shares of container traffic from Panama Canal expansion due to their current deep drafts channels, extensive intermodal networks, and proximity to markets. Recent rail investments by Norfolk Southern (Heartland Corridor) and CSX (National Gateway) will improve inland rail access between these ports and specific Midwest inland terminals, particularly Atlanta, Georgia and Columbus, Ohio. In addition, the ports of Baltimore; Philadelphia; Charleston, South Carolina; Jacksonville; and Miami are dredging and building crane and infrastructure capacity in anticipation of increased container handling.

Gulf Coast Ports: Because of its deep draft and proximity to the Dallas intermodal network, Houston is expected to be the biggest Gulf port beneficiary from Canal expansion. Memphis would benefit from increased volume at other Gulf ports, notably Mobile, but these ports lack the intermodal infrastructure needed to gain significant market share.

Mexican Ports: The port of Lazaro Cardenas is expected to benefit most from West Coast cargo shifts due to its deep drafts and on-dock connection with the Kansas City Southern Railroad (KCS), which provides direct inland transport to the Mid-West. Kansas City would benefit most from growth at this port, but lack of a local market precludes any significant market share.

Canadian Ports: The Port of Prince Rupert in British Columbia is an attractive Canadian alternative to the West Coast since it has deep drafts, is a day closer to China, and designed to handle container

traffic. Canadian Northern's (CN's) expedited service to Chicago and Memphis from this port makes both these hubs more attractive. Halifax is not expected to benefit greatly from these shifts due to its distance from major U.S. markets.

Based on this analysis of port impact and inland hubs that could benefit from container trade shifts from West Coast ports, Memphis has natural advantages with the following ports:

1. **Los Angeles and Long Beach:** Will continue to be a major West Coast port with strong highway and rail access to Memphis.
2. **New Orleans**: A major bulk port for Memphis, but limited intermodal growth due to its market size and limited intermodal infrastructure.
3. **Mobile:** Closest Gulf port to Memphis with good rail and highway connections. Lack of intermodal facilities and small market limit international trade growth.
4. **Tampa:** Closest Florida port to Memphis, but rail connection not strong.
5. **Lazaro Cardenas:** Mexican port with most direct inland trade route to Memphis, but Dallas and Kansas City are more attractive as freight hubs from Mexico.
6. **Halifax:** Excellent rail service to Memphis via CN. Deep-water port can handle larger ships, but lack of local market and proximity to more competitive ports (New York, New Jersey, Montréal) limit growth potential.
7. **Prince Rupert:** Excellent train service to Memphis via CN makes it a strong alternative to Los Angeles and Long Beach. Lack of local market limits growth.

Memphis needs to forge relationships with the above ports and the railroads that serve them, to take advantage of its natural competitiveness with trade through these ports Rail train schedule and truck transit times to and from these ports need to be evaluated. Establishing relationships with these ports is a complex process, and must also include the serving rail carriers and trucking companies that link these ports to Memphis.

SUMMARY OF PORT AND INLAND HUB IMPACTS FROM PANAMA CANAL EXPANSION

Port	Level of Impact From West Coast Shift	Inland Hub Opportunities
Prince Rupert, Canada	High	Memphis, Chicago, Toronto
Savannah, GA	High	Atlanta, Raleigh, Memphis
Halifax, Canada	Medium	Memphis, Chicago, Toronto
Vancouver, Canada	Low	Memphis, Chicago, Toronto
Tampa, FL	Low	Atlanta, Memphis
Mobile, LA	Low	Atlanta, Memphis
New Orleans, LA	Low	Memphis, Dallas
Baltimore, MD	Low	Columbus, Chicago
Boston, MA	Low	Harrisburg, Allentown, New Jersey
Charleston, SC	Medium	Atlanta, Raleigh
Houston, TX	High	Dallas, Kansas City
Jacksonville, FL	Medium	Atlanta
Miami, FL	Low	Atlanta
Montreal, Canada	Medium	Toronto, Chicago
New York/New Jersey	High	Columbus, Chicago
Norfolk, VA	High	Columbus
Philadelphia, PA	Low	Columbus, Harrisburg, Allentown

SUEZ CANAL

As international trade rebounds from the global recession, the sourcing of some import traffic to the United States is expected to shift from China to other countries in Southeast Asia. For instance, the signing of a 2001 bilateral trade agreement between the United States and Vietnam significantly increased trade between these two countries. Vietnam's merchandise trade with the United States grew six-fold since 2001, and is expected to reach $13.1 billion in 2008, an increase of 28 % over 2007[12].

The shift of exports to other countries in Southeast Asia is due to factors other than trade agreements. Relatively higher labor costs in China have resulted in the relocation of the manufacture and export of some consumer goods, such as furniture, outside of China to other fast-growing countries in Southeast Asia. This shift in U.S. imports within Asia has implications on container-shipping patterns. Normally, container imports from China arrive at West Coast ports and are trans-loaded to truck or intermodal rail to the Midwest or East Coast. Shipping rates from non-China Southeast Asian regions, however, are less expensive via the Suez Canal to the East Coast of the United States than through West Coast U.S. ports. In the Long term, it is expected that increasing volumes of imported containers from Southeast Asia will travel through the Suez Canal en route to the East Coast of the United States. In fact, container traffic from Asia through the Suez Canal increased by 19% in 2007. Egypt's government plans to provide financial incentives for shippers to divert some Southeast Asia export traffic from U.S. West Coast ports to the Suez Canal. It is also building links with East Coast ports, such as the Port of Virginia, to ensure that adequate port capacity is available to handle the post-Panamax ships capable of passing through the Canal. Certain shipping lines have already begun to respond to these incentives. For example, APL Ltd., of Singapore introduced a new route that will operate eight ships from Asia to the U.S. East Coast.

Implications for Memphis: The impact on Memphis from shifting container traffic via the Suez Canal will be modest. Increases in this traffic will not begin until U.S. West Coast ports reach capacity, forcing investigation of alternative shipping lanes. As discussed in the prior section, this is not expected to occur until 2020. Container shifts to the Suez Canal will increase container activity at the Ports of New York, New Jersey, and Norfolk, benefiting supply chains in New York; northern New Jersey; Allentown, Pennsylvania; and Columbus, Ohio. The Port of Halifax could also benefit from increased traffic from the Suez Canal, but gains will be modest because of its distance from major markets.

SHORTER SUPPLY CHAINS

Fluctuating energy costs, the falling U.S. dollar, limited free-trade agreements, and rising Asian labor and production costs are forcing U.S. manufacturers to reevaluate their extended supply chains, particularly those sourcing in the Pacific Rim. One expected impact of this evaluation will be for manufacturers to assume more control of their supply chains by moving plant operations and sourcing vendors closer to home and away from Asia.

Mexico and the Americas, in particular, have become an increasingly popular source for manufactured goods, as companies compete on time-to-market strategies, seek financial advantages found in Mexico's multiple free-trade agreements, and capitalize on Mexico's investment incentives, streamlined customs processes, and abundant English-speaking workforce. The country is encouraging this trend with the development of a new customs regime (i.e., the set of trade regulations, processes, and practices that regulate the actions of a country's importers and exporters), which is being streamlined to save logistics costs and decrease the number of days in transit. This pilot program, called the Regimen de Recinto Fiscalidado Estrategico (RFE), is expected to begin in 2009 and to save manufacturers in that country $200–600 per container shipment.[13]

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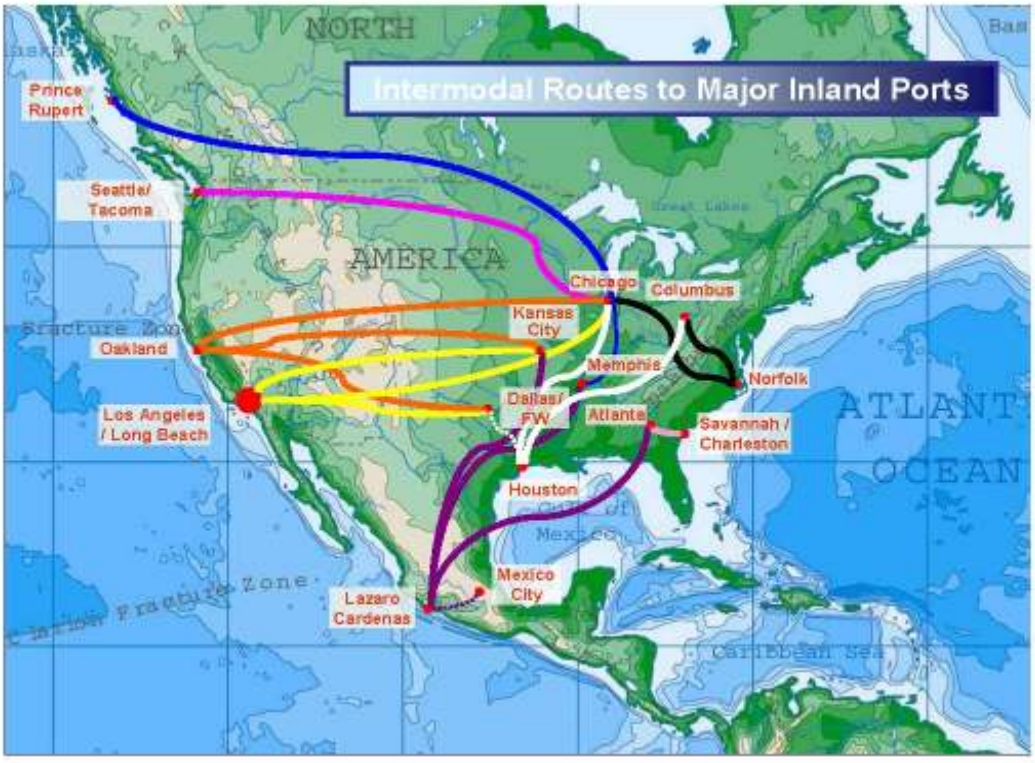
[12] *U.S. – Vietnam Trade Relations: Background Analysis and Issues for Congress*, Congressional Research Service, October 31, 2008 (http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA461404&Location=U2&doc =GetTRDoc.pdf).
[13] J.P. Mogan Global Trade Services Group, *"2008 Global Trade Predictions."*

Implications for Memphis: If successful, sourcing from Mexico and the Americas could negatively affect Memphis, since other inland centers, notably Dallas and Kansas City, are closer to Mexico, and have strong Midwest rail connections from border towns of Juarez and Monterrey, Mexico. Memphis could become a gateway for the South's growing automobile industry if more auto-parts suppliers source from the Americas.

INCREASED USE IN RAIL

Intermodal rail usage has surged in recent years, consistent with increased levels of import traffic. Land bridging (the process of putting shipping containers directly onto rail cars at a port) has also increased, as importers from Asia seek the fastest and least-expensive route from the West Coast to the Midwest and eastern portions of the United States. This higher demand for rail has been accompanied with rail carriers reducing rail costs by rationalizing intermodal networks, and taking advantage of returns to scale, through the routing of container traffic over a few high density rail lanes from ports to a limited number of inland intermodal destinations, including Memphis

INTERMODAL ROUTES TO MAJOR INLAND PORTS



Source: "International Trade Overview: Logistics and the Global Supply Chain," Steve Schellenberg, IMS, Inc., NAIOP Canada, 9/10/08.

Aware of their new advantage, rail companies are investing in new systems, labor, operating procedures, and infrastructure to handle the escalating volume of containers at inland terminals, including in Memphis. Class I rail carriers have invested $424 million upgrading or constructing new rail infrastructure in the

region to support anticipated increases in rail volumes (the Rail Infrastructure Evaluation of this Plan provides more detail on these investments). Two rail initiatives in particular will impact the attractiveness of Memphis as an inland container hub:

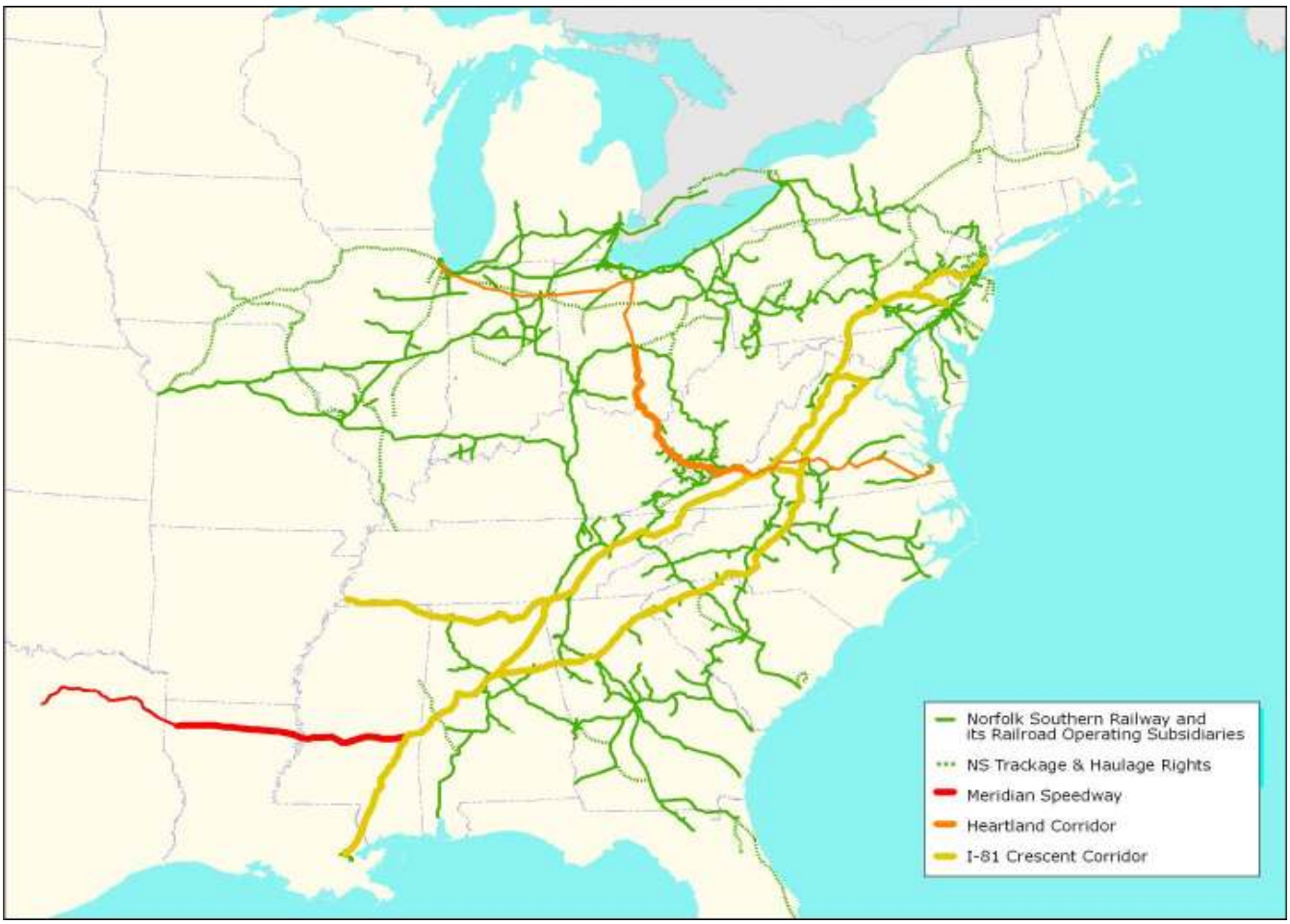
1. **Norfolk Southern "Crescent Corridor."** In the past several years, the rail industry has embarked on a number of "public-private partnerships" designed to secure public funding for capital investments that increase rail capacity in designated high-volume freight corridors[14]. One of these initiatives, the $2-billion Crescent Corridor, has been developed by Norfolk Southern Railroad (NS) in conjunction with federal, state, and local governments. The project is so named because the proposed route runs in a crescent shape along the railroad's southeast rail line paralleling Interstate 81 (I-81), a key congested highway route connecting markets in the Northeast, Mid-Atlantic, and Southeast United States.

   The goal of the Crescent Corridor is to divert motor-carrier traffic from I-81 by adding intermodal capacity, upgrading track infrastructure, and building intermodal terminals. The project is slated to be completed in 2013[15] and will terminate in Memphis.

[14] As part of the $2 million development of the Crescent Corridor, five states - Pennsylvania, Virginia, Alabama, Mississippi, and Tennessee – will contribute $300 million via a request for public Federal stimulus money. This public investment will support the construction of three new intermodal facilities (including Memphis), expansion of two intermodal terminals in Pennsylvania, and track improvements in the five partner states, including 10 passing tracks, 557 individual speed improvements, and 393 miles of upgraded rail. Other examples of these "public-private" partnerships include the Heartland Corridor by Norfolk Southern and the National Gateway project by CSX Corporation.

[15] Remarks by Henry C. Wolf. Merrill Lynch Global Transportation Conference, New York, NY, June 14, 2007, http://www.nscorp.com/nscportal/nscorp/Investors/Executive%20Speeches/2007/hcw061407.html.
Logistics Management. *Norfolk Southern Unveils Plans for $2 Billion Rail Corridor from New Orleans to New Jersey.*

NORFOLK SOUTHERN'S CRESCENT CORRIDOR



Source: Schafer, Bill. I-81 Crescent Corridor and Related Projects. Presented at the I-81 Corridor Conference, Carlisle, PA, September 11, 2007.

2. **Canadian National Railway (CN) Service at Port of Prince Rupert, Canada.** The Port of Prince Rupert in British Columbia, Canada opened in October 2007 and is the first trans-Pacific port built in a century. Constructed at a cost of $170 million, Prince Rupert is expected to be a favored Pacific port for Asian trade since it can handle post-Panamax vessels; is 2–3 days closer by ship to Asian markets than Los Angeles and Long Beach; is designed to minimize container dwell time; and is equipped with up-to-date container security screening technology.

   CN has invested approximately $140 million in port facilities in Prince Rupert and initiated daily train service between the port, Chicago, and Memphis. CN train service to Memphis operates on 117-hour schedules and terminates at the CN intermodal yard in Memphis at the Frank C. Pidgeon Industrial Park. It is designed to provide shippers with a shorter, scheduled route with less congestion for moving imported containers inland to various North America markets.

   Since its inception, container traffic entering Prince Rupert has grown steadily. More than 42,000 TEUs passed through the terminal in the first half of 2008, equally divided between inbound and outbound traffic. Nine ships with a capacity of 5,400 TEUs are calling on the port with another

service with five ships of capacity of up to 8,200 TEUs. The port is planning further expansions of terminals scheduled for 2012 and 2020, which will bring total capacity to 4 million TEUs.[16]

Implications for Memphis: The growing use of rail in the global supply chain has the potential to impact the Memphis region similar to that of FedEx . The region's access to five Class I railroads, its proximity to major markets, excellent interstate access, and rail-carrier intermodal investments will bolster the region's importance as a national distribution hub.

The Norfolk Sothern's Crescent Corridor alone will have a profound impact on Memphis. The railroad plans to construct a 570-acre, $129-million intermodal terminal in Southwest Fayette County, Tennessee that will serve as the western gateway for the corridor, giving the region direct intermodal access to major northeast markets, including Washington, D.C., Philadelphia, and New York. The corridor also improves transit time to the East Coast ports of Norfolk, New York, and New Jersey. The Norfolk Southern estimates 573,000 trucks in Tennessee[17] will divert to rail thanks to the Crescent Corridor. Most of these trucks will travel in and out of Memphis, putting a severe strain on the region's freight infrastructure.

CN's container service from Prince Rupert also benefits Memphis, but its success depends on the port emerging as the port of choice for Asian international trade with the United States. Most successful, high-volume container ports have strong local markets. While this is lacking at Prince Rupert, its water and inland rail transit-time advantages will make the port a major port of entry for Midwestern freight. The ports of Los Angeles and Long Beach, current high-volume ports of entry on the West Coast, likely will be focused on environmental issues for the next several years. When higher rates of growth for international container trade return, as projected in this Plan, Prince Rupert, and Memphis, will have solidified market share and become a desirable port for importers and containership companies.

MULTI-MODALISM

The fragmentation of global supply chains gives shippers and receivers the opportunity to look for greater flexibility and cost savings near ports of entry or inland ports where product is often transferred or mixed. Warehousing, cross-docking, and trans-loading facilities have become critical links in supply chains as more companies look to repack, cross-dock, or consolidate the contents of containers, LTL trucks, or other smaller shipments into 53-foot domestic containers for ultimate delivery to customers.

In the past, trans-loading, cross-docking, and consolidation programs were most beneficial to larger shippers handling high-value goods. The time delays and labor costs associated with the increased benefits of multi-modal shipping were not for every type of product.[18] At inland locations such as Memphis, however, with its variety and diversity of rail, air, truck, and river terminals, these added costs can be minimized to allow medium and smaller shippers to take advantage of multi-modal programs. Moreover, these programs give shippers the ability to adjust their supply chains to changing market conditions.

Implications for Memphis: As global supply chains become increasingly complex and incorporate the efficiencies of various freight modes, there will be greater demand on warehouses and logistics companies to provide value-added types of logistics services, as well as greater demand by manufacturers wishing to be near multi-modal transportation hubs. Trucks, railroads, air freight carriers, and ocean shippers will not only compete with, but also complement each other at these inland port locations as shipping becomes increasingly multi-modal.

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[16] *Port of Prince Rupert and New Express Trade Corridor Surpassing Expectations,* June 15, 2008. http://www.rupertport.com/pdf/media/us%20industries%20today-prince%20rupert%20charting%20growth%20june% 2008.pdf; *Prince Rupert Port Container Traffic Achieves New Milestones,* July 23, 2008. http://www.rupertport.com/pdf/newsreleases/prince%20rupert%20port%20container%20traffic%20achieves%20new%20milestones%20july%2023%2008%20%20nr.pdf.

[17] Crescent Corridor: Horsepower Public-Private Partnerships, Norfolk Southern Corporation, August, 2009.

[18] *The New Age of Trade*, Cushman and Wakefield, June, 2006.

The Memphis region is in a unique position to take advantage of this growing logistics trend because of its large network of consolidators and warehouses near Memphis International Airport (a list of these consolidators is provided in the Air Infrastructure Evaluation section of this Plan). An extension of this activity into other modes is exactly the concept behind Aerotropolis.

AEROTROPOLIS AIRPORT AND DISTRIBUTION CENTERS

Source: "Leveraging Air Logistics for Regional Competitive Advantage", Dr. John D. Karsada, Kenan Institute for Private Enterprise.

To be successful, the region requires modal connectivity between airport warehouse and logistics services and truck terminals, rail intermodal terminals, and the region's large logistics parks.[19] This is one of the major objectives of the Aerotropolis Plan developed by the Chamber.[20]

DECLINING AIR FREIGHT SHIPMENTS

As home to the largest global air-cargo hub in the world through FedEx, Memphis is highly sensitive to shifts in the flow of air freight shipments and changes in the way FedEx manages its air freight operations. Faced with increasing fuel costs, the global recession, and new security regulations for air cargo, many shippers and carriers are switching away from air freight to less-expensive modes. Air freight shippers and forwarders are increasingly beginning to rely on expedited motor-carrier services for portions of their shipments that formerly traveled by air freight. [21]

In addition, some shippers of lower-value international cargo are completely shifting from air to seaborne transportation. While rising fuel costs are the main driver behind this shift, ocean freighters are also beginning to compete with air cargo on service. Ocean carriers are teaming up with motor carriers and rail

[19] An example of emerging multi-modal logistics services that take advantage of Memphis' proximity to air, rail, and truck facilities is the LTL Direct Truckload program offered by Patterson Warehouses in Memphis for Wal-Mart.
[20] "Leveraging Air Logistics for Regional Competitive Advantage", Dr. John D. Karsada, Kenan Institute for Private Enterprise

[21] Clowdis, Charles Jr., *"Air Freight" that Never Leaves the Ground.* October 20, 2008. http://www.globalinsight.com/Perspective/PerspectiveDetail14650.htm.

carriers (see the CN Prince Rupert service above) to offer their customers defined multi-modal delivery schedules, putting additional pressure on air freight services.[22]

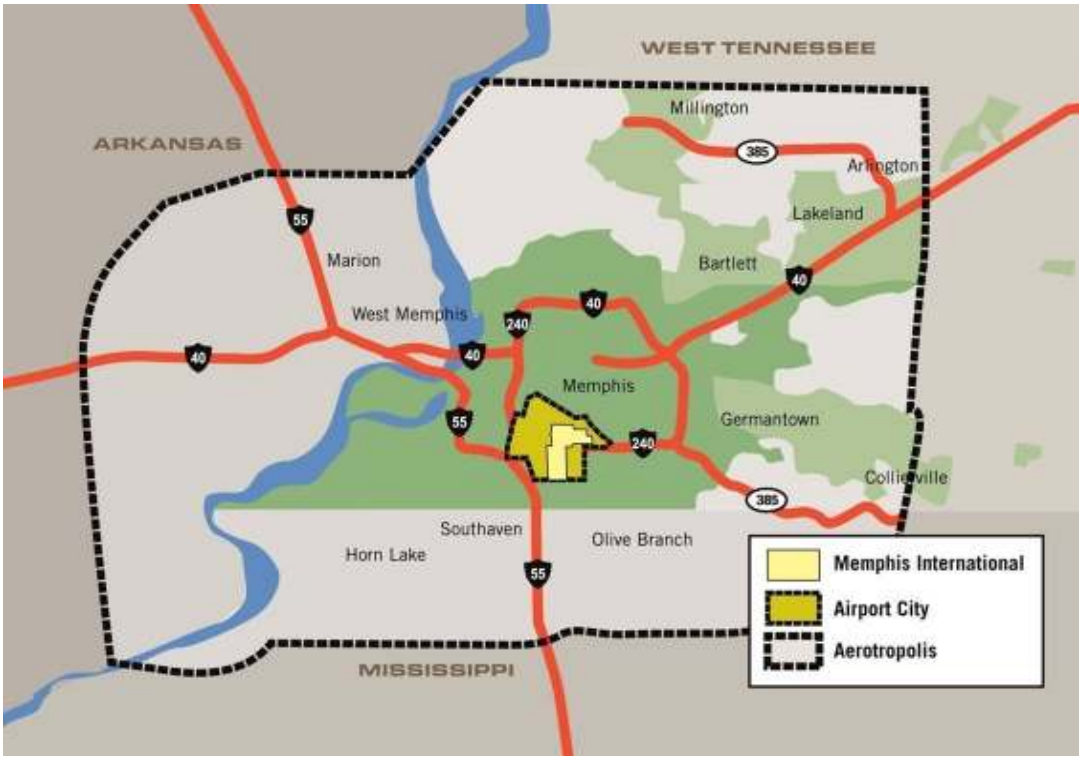
Due to increasing fuel costs and a lack of growth in the domestic express market, FedEx has been shifting more domestic shipments, as well as the domestic leg of its international shipments, away from air onto surface modes, especially trucking.[23] While FedEx primarily relies on trucking as a substitute for some of its domestic air shipments due to more reliable delivery times, it is expected that in the future, FedEx's domestic service will also utilize rail intermodal as part of its ground transportation alternatives[24].

Implications for Memphis: Although some air freight cargo will shift completely to other modes, air transport still remains crucial for shippers of time-sensitive, high-value goods, and will continue to constitute a critical, albeit smaller part of a shipper's supply chain. On the surface, this shift implies a decline in airport activities and operations related to air freight in Memphis. Transfer of this freight from air to other modes offers significant "multi-modal" opportunities for transloading, warehousing, cross-docking, inventory control, and shipment consolidation programs around the Memphis airport area. This type of activity is consistent with the "Aerotropolis" concept, i.e., a large urbanized area growing around an airport and a critical driver of economic development.

Thanks to the presence of FedEx, Memphis International Airport will continue to have a tremendous economic impact on the surrounding region, a trend that will be magnified with increasing transfers of freight from air to other modes. The Memphis region will need to pay closer attention to how the airport is linked to these facilities and modes (air to truck, air to rail, air to warehouse) to insure it can adequately support the changing nature of air freight operations.

[22] DC Velocity. *A Sea Change for Air Freight?* September 2007. http://www.dcvelocity.com/news/?article_id=1237.
[23] Fabey, Michael. *FedEx* Downshifts. Air Cargo World, http://www.aircargoworld.com/regions/northam_0808.htm.
[24] Noted by Mr. Schmitt of FedEx during Infrastructure Plan interviews.

MEMPHIS AIRPORT CITY AND AEROTROPOLIS



Source: "Leveraging Air Logistics for Regional Competitive Advantage", Dr. John D. Kasarda, Kenan Institute for Private Enterprise

SUMMARY: CHANGING INLAND HUB COMPETITION

As global trade rebounds, the role of Memphis in the global supply chain will change. The factors discussed in this chapter, particularly Panama Canal expansion and the rise of rail intermodal, will significantly impact the role of Memphis as an inland terminal. Memphis faces competition from a number of inland logistics hubs and expected shifts in port usage make some inland hubs more attractive than others. Major factors that influence the competitiveness of a region as an inland distribution center are as follows:

- Major railroad access;
- Proximity to major markets (reach 50 million people by truck within eight hours);
- Large population base (strong local market);
- Interstate highway access (at least two);
- Access to a major container ocean port;
- Minimum 1,000 acres total land;
- Access to strong labor pool;
- Public/private freight infrastructure investment;

The map below shows current national inland terminal hubs in the United States. These locations can be divided into first-tier hubs with very large local markets, excellent highway and rail access, and good port connections. They include the Inland Empire, Chicago, Dallas, and Atlanta. Second-tier national hubs such as Memphis are centrally located to major markets and usually excel in one or more of the above characteristics (in the case of Memphis, this includes rail access and proximity to major markets). Some

of these second-tier inland port cities will compete heavily with Memphis as the shifts described in this chapter occur.

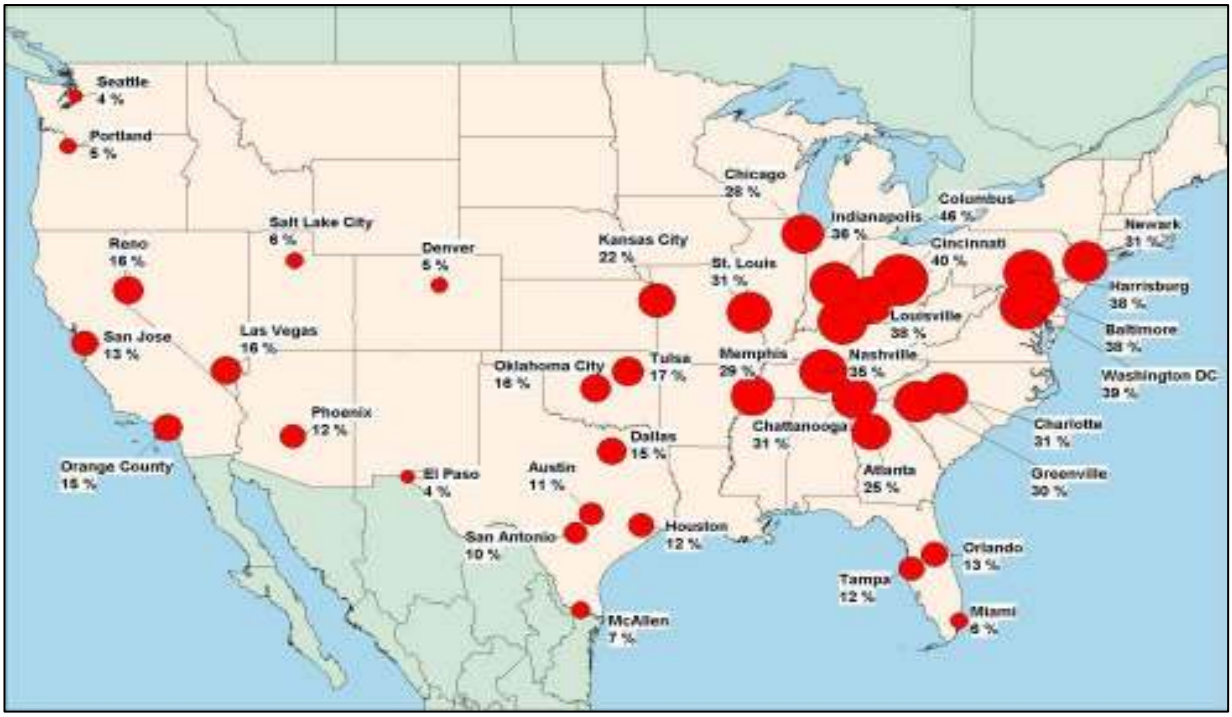
FIRST- AND SECOND-TIER INLAND HUB CENTERS

Source: IHS Global Insight

A major factor influencing the attractiveness of an inland hub is its proximity to major markets. Memphis has similar or better proximity than a number of larger hubs, including Chicago, Atlanta, and Dallas. Proximity gets better with hubs that are north and east of Memphis, including Indianapolis, Indiana and Columbus, Ohio. These are the inland locations that stand to gain against Memphis as more containers arrive on the East Coast.

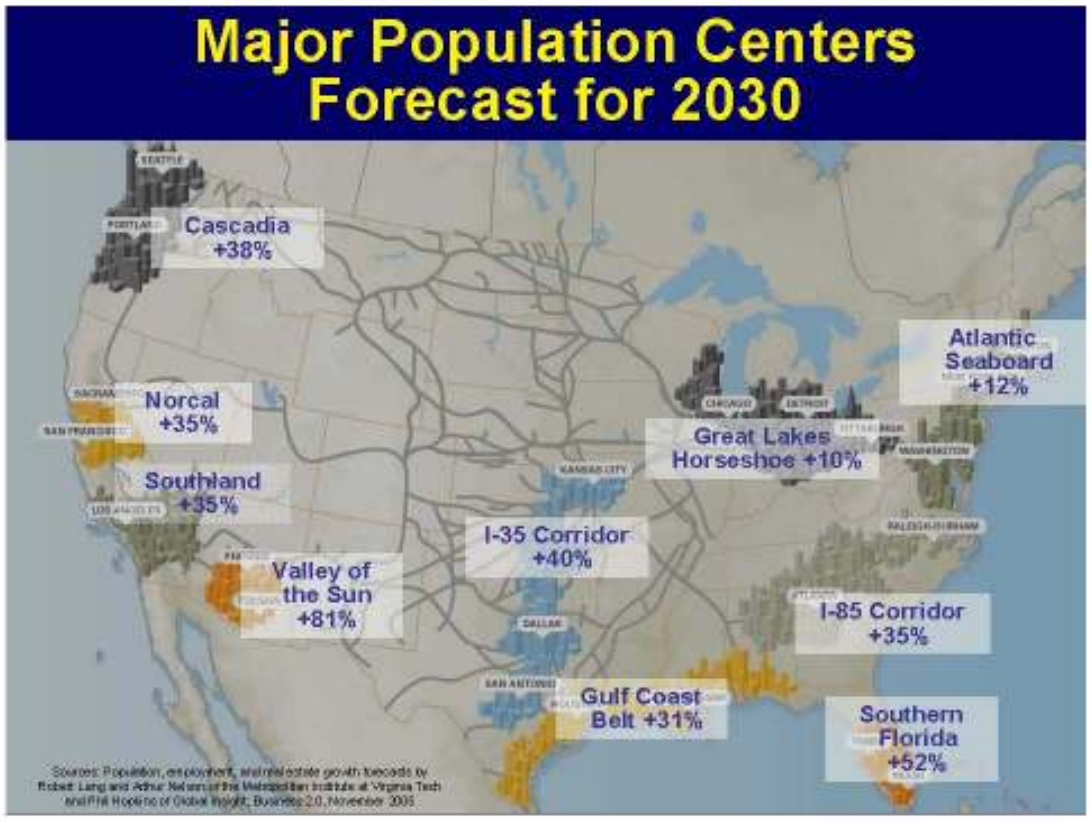
Proximity to growing markets is also a factor in the attractiveness of inland hub. Unlike other hubs, Memphis is not located in a part of the country expected to exhibit significant population growth. Nevertheless, unlike other hubs, its location places it within 600 miles of three growing population corridors.

PERCENTAGE OF U.S. POPULATION WITHIN 500 MILES



Source: "Inland Supply Chain Trends and the Implications on North American Distribution Markets," Greg Arnold, ProLogis, FHWA Talking Freight Series, July, 2009.

INLAND HUBS AND MAJOR POPULATION CENTERS FORECAST FOR 2030



Source: IHS Global Insight

The chart below summarizes the supply-chain trends discussed in this chapter and their impact on Memphis. Memphis will continue to grow as an inland distribution center, particularly through its access to the intermodal rail network, proximity to current and growing markets, and extensive logistics support facilities. Among second-tier hubs discussed previously, Columbus, Ohio and Kansas City, Missouri, in particular, may vie with Memphis as container freight shifts to Mexico, the Gulf, and East Coast ports. Kansas City has strong rail access to Mexico, Mexican ports, and Houston, as well as access by five rail carriers. Columbus is within 500 miles of almost half of the U.S. population, with strong access to East Coast ports thanks to recent intermodal investments by Norfolk Southern (Heartland Corridor) and CSX (Corridor). While both these regions offer some advantages, the Freight Infrastructure Plan presented in this report will lay the foundation for road, rail, runway, and river infrastructure that ensures Memphis continue to be competitive as America's Distribution Center.

Global Supply-Chain Trends	Impact on Memphis
Panama Canal Expansion	Potential shift in container flows to deep-water Gulf and Atlantic ports, especially Houston, Savannah, New York and New Jersey, and Norfolk. Halifax could benefit, but is too far from major markets. Inland hubs such as Dallas, Atlanta, and Columbus could benefit. Gulf ports near Memphis lack sufficient intermodal infrastructure.
Increased Usage of Suez Canal	Impact not expected in the medium term. Will benefit New York and New Jersey, Norfolk, and Halifax. From Halifax, Memphis will compete with Toronto and Chicago.
Increased Rail Usage in International Trade	Increasing intermodal will make Memphis more attractive as distribution hub. Large hubs such as Dallas, Atlanta, and Chicago will continue to benefit. Memphis growth will compete with other second-tier national hubs such as Kansas City, Columbus, and San Antonio.
Shifts in Air Freight Usage	Decrease in domestic air freight in the future will increase use of ground transportation by FedEx. Expect use of rail by FedEx as intermodal reliability improves.
Multi-Modalism in Supply Chains	Increasing use of value-added logistics programs by medium- and smaller-sized shippers will make Memphis more attractive. Region's highway system will need to support modal connectivity and Aerotropolis access.
Prince Rupert and Halifax	Prince Rupert will have positive impact on Memphis, Chicago, and Toronto as inland hubs. Halifax's distance from major markets will be a barrier for growth.
Shorter Supply Chains	Potential near sourcing to Mexico and the Americas make Houston, Dallas, and Kansas City attractive as inland hubs.

Chapter 2: Memphis Regional Freight Infrastructure Inventory

As part of the development of the Memphis Regional Infrastructure Plan, an inventory of current freight facilities in the region was undertaken to serve as a benchmark for subsequent infrastructure capacity evaluation and recommendations. This inventory was conducted by the Center for Intermodal Freight Transportation Studies (CIFTS) at the University of Memphis and analyzed the following freight modes and supporting freight services:

1. Interstate and U.S.-designated highways
2. Airports with runways over 5,000 feet
3. Class I and short-line railroads
4. Mississippi River ports
5. Pipelines
6. Intermodal facilities
7. Trucking company terminals
8. Warehouses
9. Industrial parks.

The above freight infrastructure was inventoried for the Plan's 16-county study area as shown below. Once the information was compiled and verified, an FTP site was created at the University of Memphis as a repository for the data. This site contains maps, reports, databases, and other information for each of the infrastructure components listed above, and can be accessed by the Memphis Regional Chamber and its members. Specific items on the FTP site are listed in each section of this chapter, and instructions for accessing the site are provided in Appendix III.

THE MEMPHIS REGIONAL INFRASTRUCTURE PLAN STUDY AREA

Source: CIFTS

MEMPHIS REGION HIGHWAY INFRASTRUCTURE INVENTORY

The region's major freight highway network totals 840 miles and includes seven interstate and seven U.S.-designated highways.

MEMPHIS REGIONAL HIGHWAYS

Memphis Interstate Highways	Memphis U.S.-Designated Highways	Memphis Local Highway Names
I-40 (125 miles)	U.S. 51 (129 miles)	Elvis Presley Boulevard
I-55 (113 miles)	U.S. 70 (103 miles)	Summer Avenue
I-240 (31 miles)	U.S. 79 (90 miles)	Union Avenue
I-155 (16 miles)	U.S. 61 (79 miles)	Third Street
I-22 (38 miles)	U.S. 64 (59 miles)	Stage Road
I-69/I-269 *	U.S. 78 (56 miles)	Lamar Avenue
	U.S. 72 (39 miles)	Poplar Avenue

Source: CIFTS
*Under design or construction, 230 miles total, 16 open to traffic

Most major highway routes in the study area funnel through Shelby County and the city of Memphis. Some 87% of freight traffic that traveled in the region in 2007 used one of the region's three major freight highways[25]:

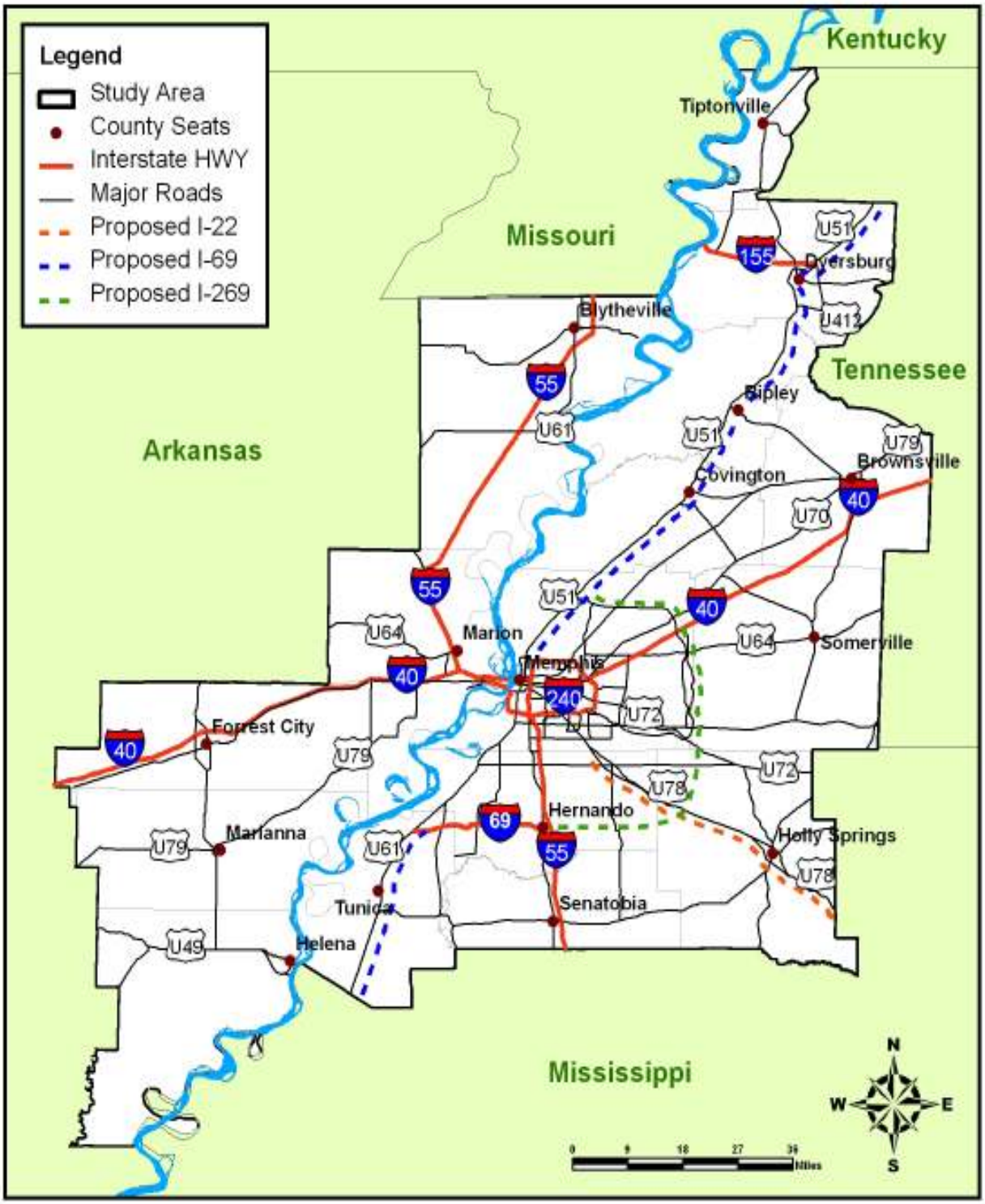
- I-55 is a major north-south interstate that connects Memphis to the cities of New Orleans, Jackson, Saint Louis, and Chicago.
- I-40, a major east-west interstate that connects the Memphis region to the cities of Los Angeles, Albuquerque, Oklahoma City, Little Rock, Nashville, Knoxville, Greensboro, and Raleigh.
- US-78 connects Memphis to Birmingham, Alabama and the Southeast. The new BNSF intermodal facility, as well as numerous warehouse and distribution facilities, are located on US-78, and the future Norfolk Southern intermodal facility will be built nearby in southern Fayette County. This route is being reconstructed to Interstate standards from the Tennessee state line to Birmingham, Alabama and will be designated as I-22 when completed.

Two other freight corridors in Memphis are I-240 and I-155. I-240 is a circumferential route that carries traffic around Memphis and provides access to Memphis International Airport. I-155 is an east-west spur in western Tennessee, crossing the Mississippi River from Missouri to Dyersburg, Tennessee.

Proposed I-69 and I-269 will also be significant freight corridors in Memphis and critical to maintaining the region's role in the global supply chain. When completed, I-69 will extend from Canada to Mexico and across the northern to the southern boundaries of the study area. One segment of I-69 (16 miles) is open to traffic from I-55 to US 61 in northern Mississippi. Other segments of I-69 are in various stages of development. Environmental impact statements are being reviewed for two segments from Fulton, Kentucky to Dyersburg, Tennessee and from Dyersburg, Tennessee to Millington, Tennessee. From Millington, I-69 will follow I-240 to the completed segment in Mississippi on I-55. Design studies are underway to modify the existing roadway to meet the projected traffic demands in this corridor.

[25]The next chapter on Memphis infrastructure evaluation provides more information on freight carried on the region's major interstate and U.S.-designated highways.

HIGHWAYS AND INTERSTATES IN THE STUDY AREA



Source: CIFTS

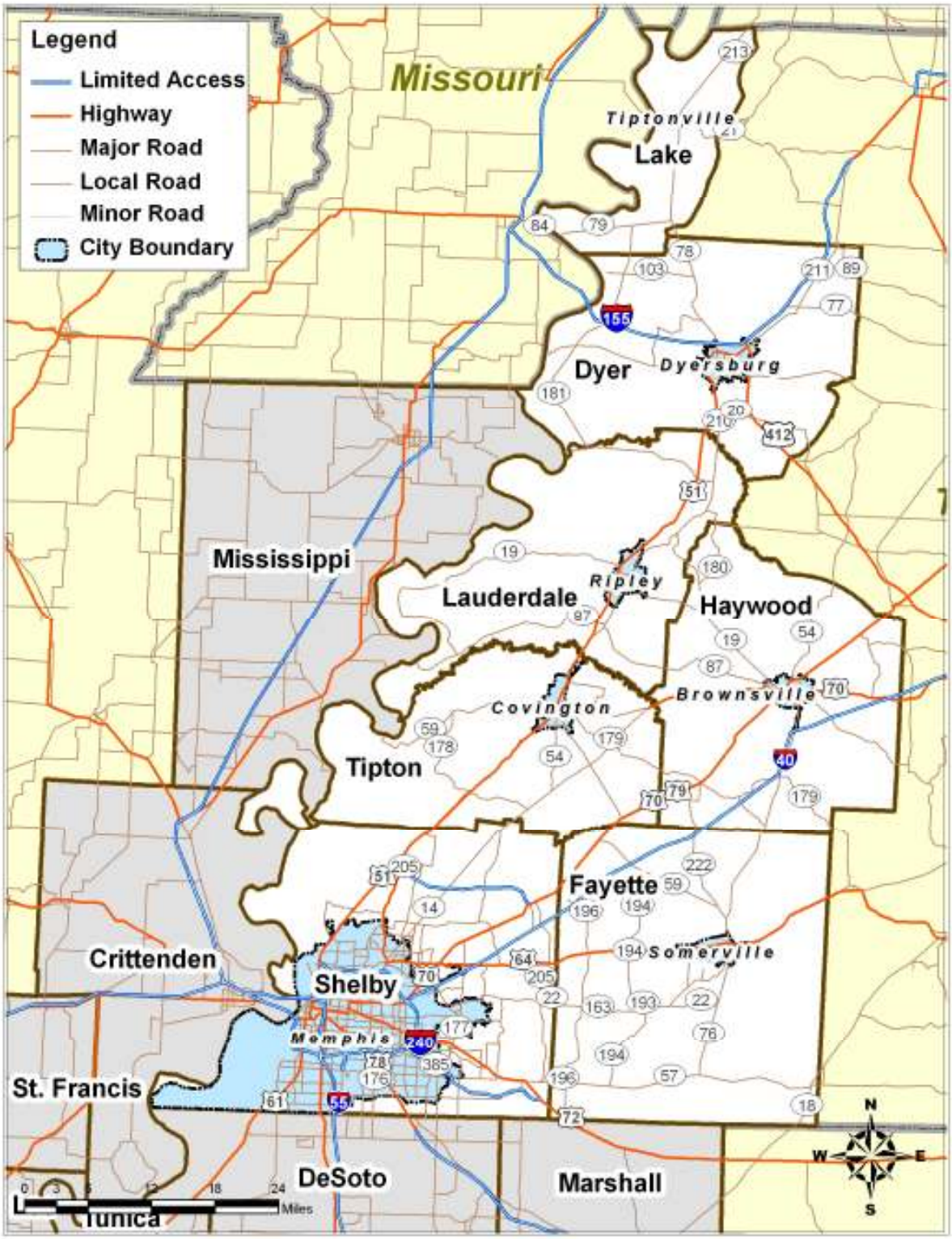
I-269 is part of the larger I-69 project, and begins near the I-55/SR 304 interchange in Hernando, Mississippi and extends north near the intersection of US 51 and SR 385 in Millington, Tennessee. Some segments are currently open to traffic and others are under construction. Preliminary studies are underway for the location of I-269 in northern Mississippi to connect with the segments build or under design. The segment in Mississippi from US 61 to the proposed bridge crossing into Arkansas is also under study.

Other major freight corridors in the Memphis area include Nonconnah Parkway (SR 385), Paul W. Barret Parkway (SR 385), and Austin Peay Highway (SR 14). Major highways in each state of the study area are shown below, followed by individual state maps.

MAJOR HIGHWAY ROUTES IN THE STUDY AREA BY STATE AND COUNTY

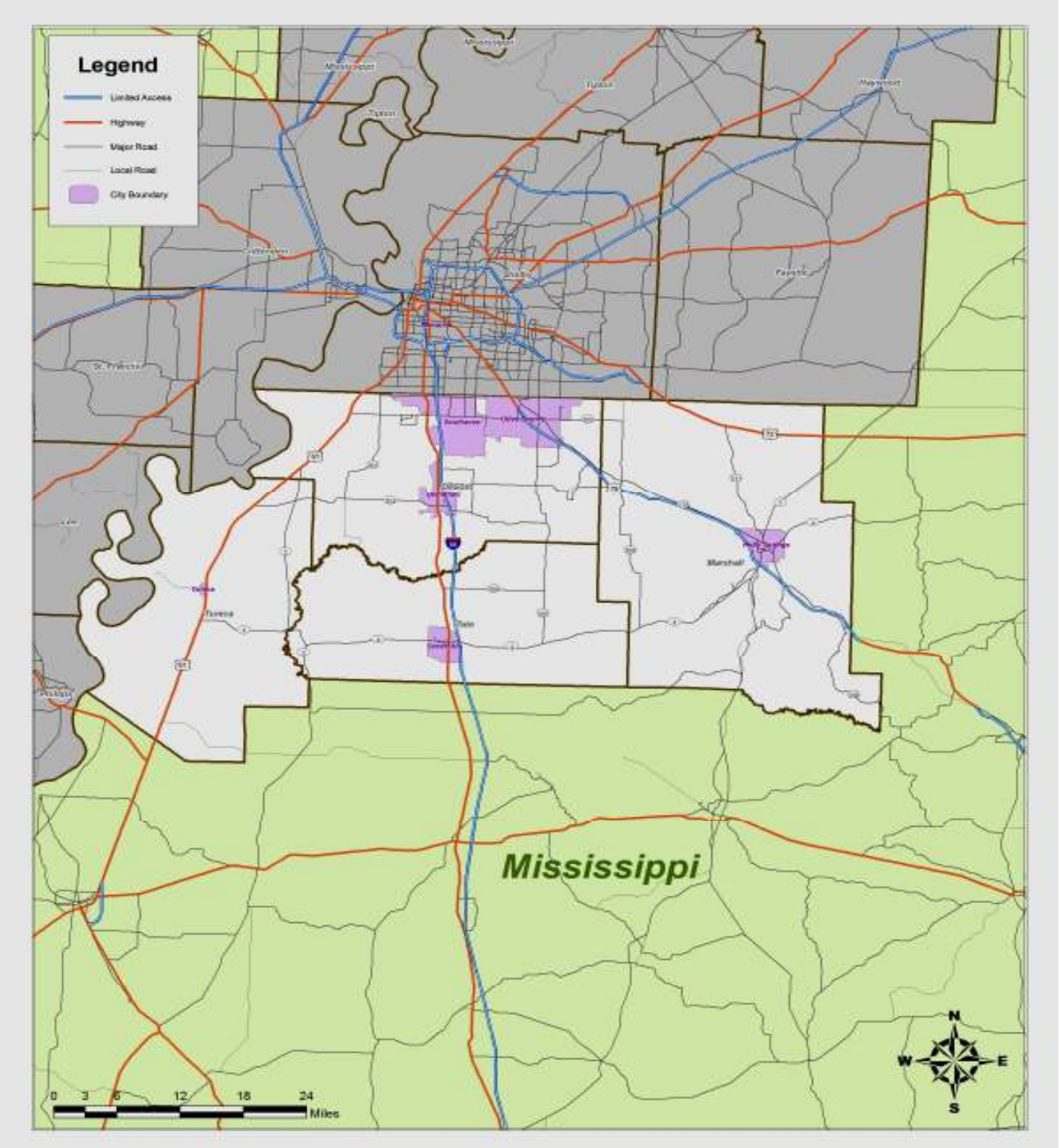
State	County	County Seat	Major Routes
Tennessee	Dyer	Dyersburg	I-155, US 51, SR 78, US 412, SR 104
Tennessee	Fayette	Somerville	I-40, US 64, US 79, SR 76, SR 59, SR 57, SR 18, US 72
Tennessee	Haywood	Brownsville	I-40, US 70, SR 54, SR 76, SR 19
Tennessee	Lake	Tiptonville	SR 78 and SR 21
Tennessee	Lauderdale	Ripley	US 51 and SR 19
Tennessee	Shelby	Memphis	I-40, I-55, I-240, US 61, US 51, Nonconnah Parkway/Bill Morris Parkway (SR 385), US 78, US 64, US 79, US 70, East Shelby Drive (SR 175), Georgetown Road (SR 177), Getwell Road (SR 176)
Tennessee	Tipton	Covington	US 51, SR 54, US 70, US 79, George D. Gracey Highway (SR 59)
Mississippi	DeSoto	Hernando	I-55, US 61, US 78, Goodman Road (MS 302), I-69/MS 304
Mississippi	Marshall	Holly Springs	US 78, US 72, MS 4, MS 7, Mt. Pleasant-Rossville Road (MS 311), Goodman Road (MS 302)
Mississippi	Tate	Senatobia	I-55, MS 51, MS 4, MS 3
Mississippi	Tunica	Tunica	US 61 and MS 4
Arkansas	Crittenden	Marion	I-55, I-40, US 64, US 63, US 79, US 70
Arkansas	Lee	Marianna	Hwy 1, US 79, US 78
Arkansas	Mississippi	Blytheville	I-55, US 61, Hwy 18, Hwy 140
Arkansas	Phillips	Helena-West Helena	Hwy 1 and US 49
Arkansas	St. Francis	Forrest City	I-40, US 79, Hwy 1

MAJOR TENNESSEE HIGHWAY ROUTES IN THE STUDY AREA



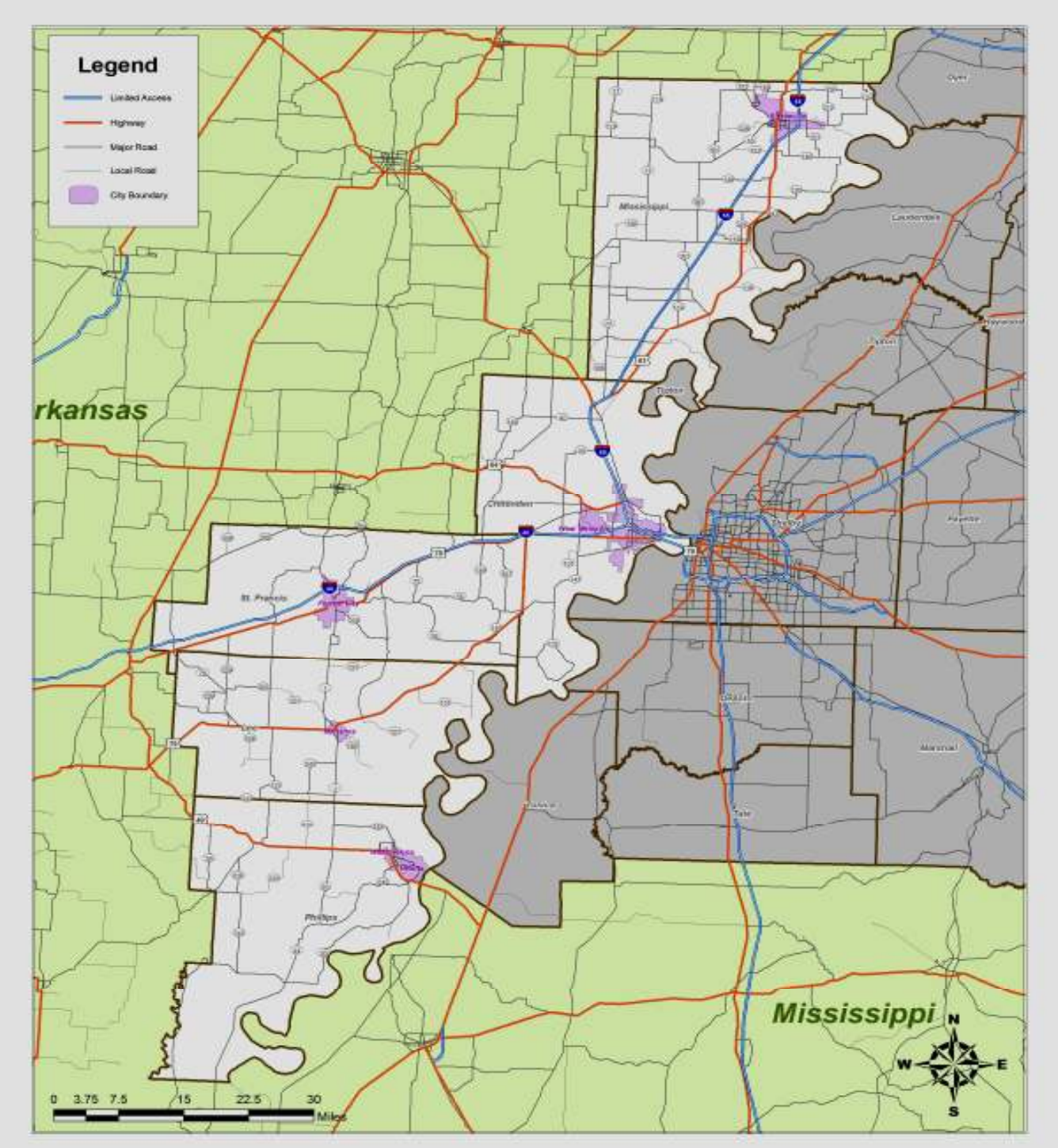
Source: Wilbur Smith Associates

MAJOR MISSISSIPPI HIGHWAY ROUTES IN THE STUDY AREA



Source: Wilbur Smith Associates

MAJOR ARKANSAS HIGHWAY ROUTES IN THE STUDY AREA



Source: Wilbur Smith Associates

Memphis highway inventory information available on the FTP server (See Appendix III):

- Map showing the highway network in the study area;
- Map showing highway congestion links in the study area;
- Spreadsheet with highway network information.

MEMPHIS AIRPORT INFRASTRUCTURE INVENTORY

Ninety-five airports and heliports were identified in the study area, many of which are privately owned, located on farms or hospitals, or not open to the public. Of these air facilities, 20 had the minimal requirements capable of supporting air-cargo activity:[26]

- Arkansas International Airport
- Arnold Field Airport
- Blytheville Municipal Airport
- Charles W. Baker Airport
- Covington Municipal Airport
- Dyersburg Regional Airport
- Fayette County Airport
- Forrest City Municipal Airport
- General Dewitt Spain Airport
- Holly Springs – Marshall County Airport
- Manila Municipal Airport
- Mariana/Lee County – Steve Edward Field Airport
- Memphis International Airport
- Millington Regional Jetport
- Olive Branch Airport
- Osceola Municipal Airport
- Reelfoot Lake Airport
- Thompson – Robbins Airport
- Tunica Municipal Airport
- West Memphis Municipal Airport.

Additional analysis as part of the infrastructure evaluation in the next chapter identified nine of the above airports that have adequate supporting services to viably support air freight operations:

- Memphis International Airport
- Arkansas International Airport
- Millington Regional Jetport
- Blytheville Municipal Airport
- Covington Municipal Airport
- Olive Branch Airport
- Tunica Municipal Airport
- Dyersburg Airport
- West Memphis Airport.

Of these, the dominant air-cargo airport in the region is Memphis International Airport (MEM). MEM has been the world's largest air freight airport since 1992, handled 3.8 million metric tons of cargo in 2007,

[26] Based on discussions with Wilbur Smith Associates, only airports open to the public and have paved runways of 3,000 feet or greater are capable of supporting air cargo activity. Additional analysis of the region's airports regarding air freight infrastructure is provided in the next chapter.

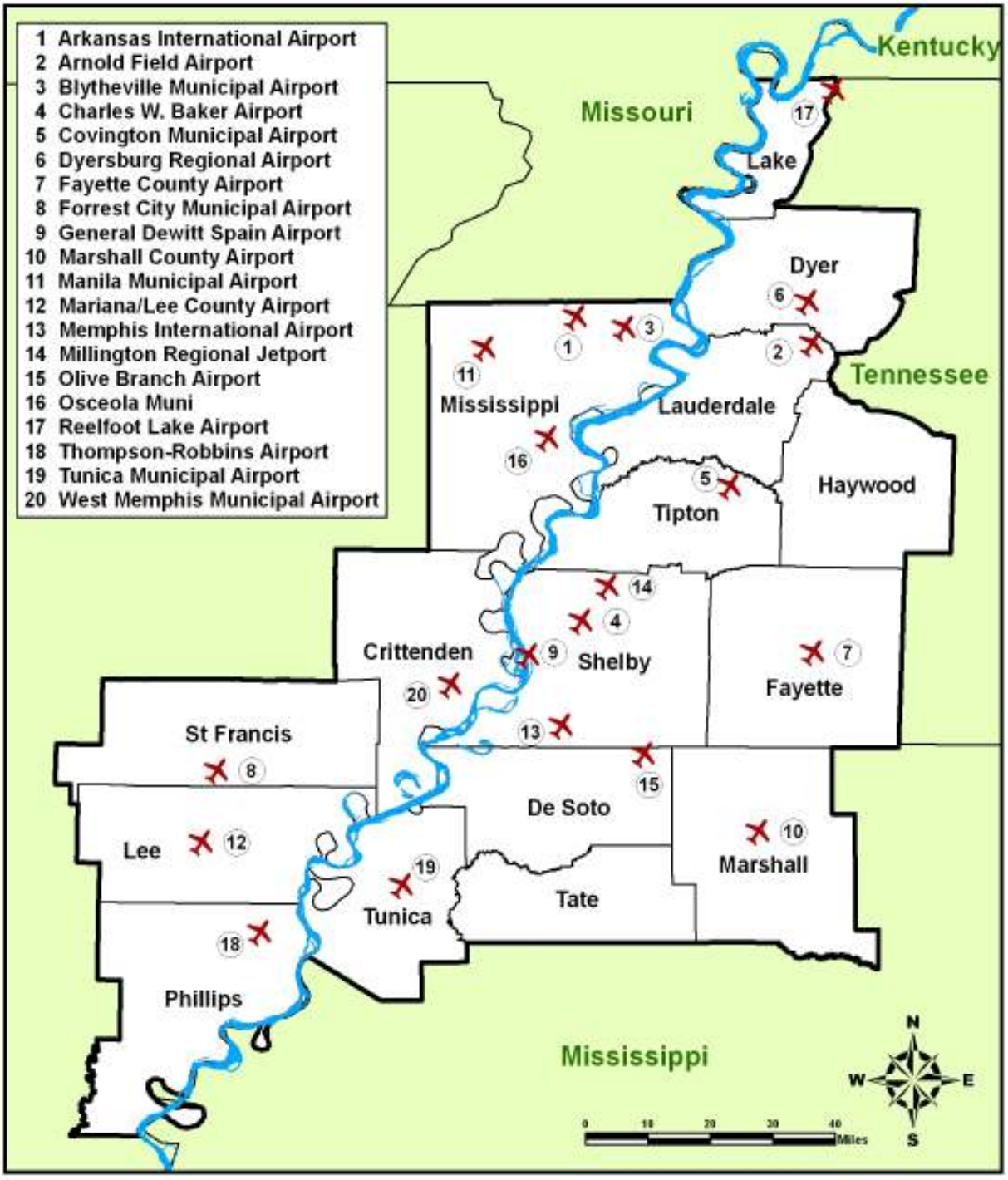
and is home to the FedEx Super Hub (which accounts for over 90% of all cargo at MEM[27]), and handles almost 100% of the air cargo in the region. Additional information on each of these eight airports is provided in the next chapter

Memphis airport inventory information available on the FTP server (See Appendix III):

- Map showing the location of airports covered in the study area.
- Spreadsheet containing facility location, facility infrastructure, facility operations, runway, and based aircraft data for each of the airports.

[27] 2006 Memphis International Airport Annual Report

AIRPORTS IN THE STUDY AREA



Source: CIFTS

MEMPHIS RAILROAD INFRASTRUCTURE INVENTORY

There are 838 route miles of freight rail track in the Memphis study area, owned and operated by five Class I rail carriers[28] and four short line railroads listed below.

Railroads	Miles	Share
Canadian National (CN)	284.5	34%
BNSF Railway Company (BNSF)	180.6	22%
Union Pacific (UP)	174.4	21%
CSX Transportation (CSXT)	69.3	8%
Norfolk Southern (NS)	51.8	6%
Mississippi Central Railroad Company	29.1	3%
Arkansas Midland Railroad Company	28.7	3%
Tennken Railroad Company Incorporated	17.9	2%
Delta Valley and Southern Railway Company (DVS)	1.6	0%
Total	**838.0**	**100%**

Source: Bureau of Transportation Statistics (BTS), National Transportation Atlas Database (NTAD)

Class I Rail Carriers

The five Class I rail carriers that operate in Memphis own over 91% of the region's rail network, and almost 80% of the network is operated by three Class I railroads: CN, BNSF, and UP. Below is a general description of these carriers, followed by maps of their national rail systems. The infrastructure evaluation section of this Plan provides more detail on how each of these carriers operates in the area.

1. **Canadian National** (CN) operates almost 34% of the rail track in the Memphis region, and is the largest rail owner in the study area. The railroad is Canada's largest, and operates approximately 21,000 route miles. Its network stretches from British Columbia to Nova Scotia and south to the Gulf of Mexico, with access to New Orleans and Mobile, Alabama. The carrier's largest rail yard in the area is Johnson Yard and IT operates a joint intermodal facility with CSX at Pidgeon Park.

2. **BNSF Railway Company** (BNSF) owns 22% of the track in the study area. The 24,000-mile railroad (with an additional 8,000 miles of trackage rights) covers the western two-thirds of the United States, serving 27 states and two Canadian provinces. Its largest operation in Memphis is Tennessee Yard on Lamar Ave. (U.S. 78), which is both a railcar and intermodal facility.

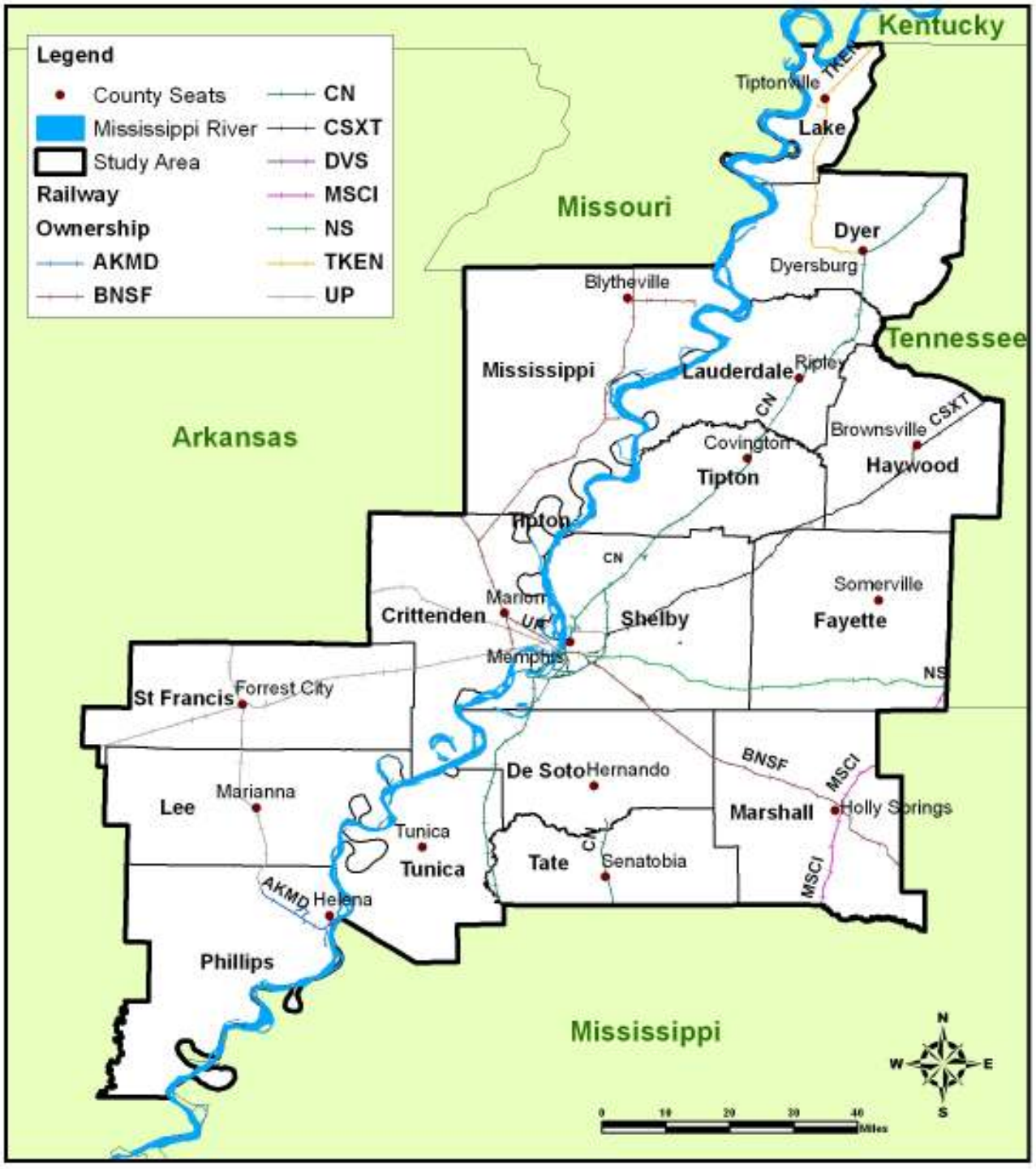
[28] The U.S. Surface Transportation Board (STB) defines a Class I railroad in the United States as having annual carrier operating revenues of $250 million or more.

3. **Union Pacific** (UP) operates approximately 21% of track in the study area. It is the largest railroad in the United States with more than 26,000 owned route miles and links major western and southwestern cities through four eastern gateways: Chicago, St. Louis, Memphis, and New Orleans. Its major intermodal facility is in Marion, Arkansas in the western portion of the region.

4. **CSX Transportation** (CSXT) owns 8% of the track in the study area and operates 22,000 route miles in 22 Eastern and Midwest states, the District of Columbia, and two Canadian provinces. Its network stretches from Chicago, East St. Louis, Memphis, and New Orleans to the eastern Great Lakes to Boston, New York, Philadelphia, and Baltimore on the east and down the Atlantic coast to Tampa and Miami. CSX jointly operates an intermodal facility with CN at Pidgeon Park.

5. **Norfolk Southern** (NS) owns 6% of the track in the study area and operates 21,500 route miles in 22 eastern states, the District of Columbia, and the province of Ontario, Canada. Its largest competitor is CSX. Its mainline runs along Poplar Ave, in Memphis to Forrest Yard and IT recently announced the construction of a new intermodal terminal in southwest Fayette County.

RAILROAD TRACKAGE BY RAILROAD IN THE STUDY AREA



SOURCE::CIFTS

THE CN RAIL NETWORK

Source: http://www.cn.ca/

THE UP RAIL NETWORK

Source: http://www.up.com/

THE CSX RAIL NETWORK

Source: http://www.csx.com/

THE NS RAIL NETWORK

Source: http://www.nscorp.com/

THE BNSF RAIL NETWORK

Source: http://www.bnsf.com/

Short-Line Rail Carriers

Short-line railroads operate 9% of the region's rail network over four carriers:

1. **Arkansas Midland Railroad Company** (AKMD) is a part of the Pinsly Railroad Company. Major commodities transported include forest and grain products, building materials, cotton seeds, and chemicals. AKMD interchanges with Union Pacific at Lexa, Arkansas and operates a seven-mile-long spur to the Port of Helena.[29]
2. **Delta Valley and Southern Railway Company** (DVS) is a private company and serves a cotton processing plant. DVS transports cotton, grain and agricultural products, chemicals, forest products, and clay. It interchanges with BNSF south of Wilson, Arkansas. [30]
3. **Mississippi Central Railroad Company** (MSCI) interchanges with NS at Grand Junction, Tennessee and BNSF at Holly Springs, Mississippi. The short line is owned by Pioneer Railcorp, Inc. and transports wood products, chemicals, pulpwood, scrap steel, cottonseed, fertilizer, and plastics.[31]
4. **Tennken Railroad Company Incorporated** (TKEN) connects with CN at Dyersburg, Tennessee. A formerly-abandoned line, TKEN leases the track from the Hickman River City Development Council. Major commodities include coiled steel, petroleum coke, electro binder, plastics, synthetic resin, carbon black, fertilizer, and grain.[32]

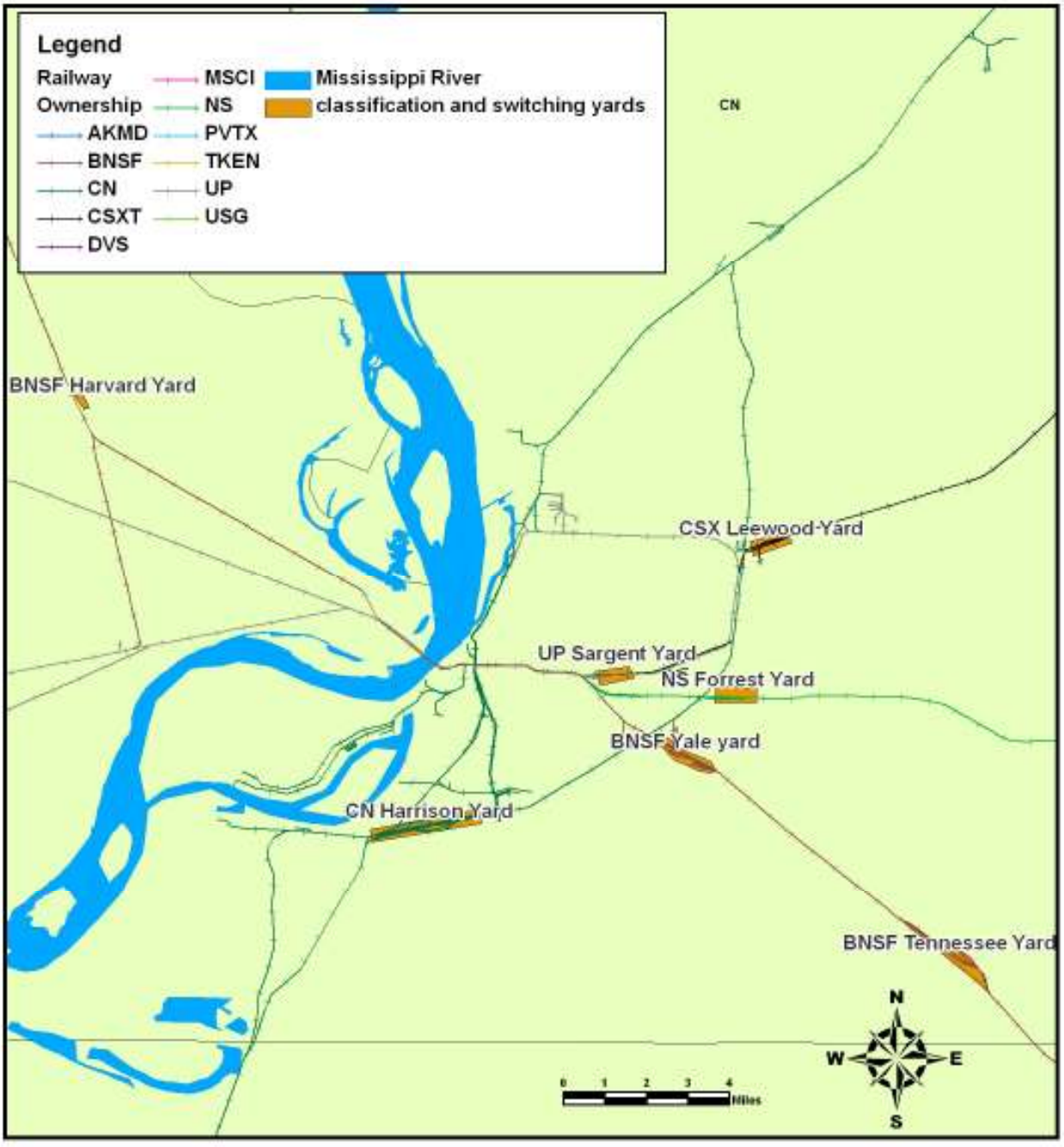
There are seven major rail yards in the study area. Two of these yards, NS Forrest Yard and BNSF Tennessee Yard, are also intermodal yards for rail and truck transfer. They are also included in Intermodal infrastructure inventory later in this section.

Memphis rail inventory information available on the FTP server (See Appendix III):

- Map showing rail network in the study area and the intermodal yards;
- Spreadsheet containing the infrastructure of the railway location, junctions, and intermodal yards.

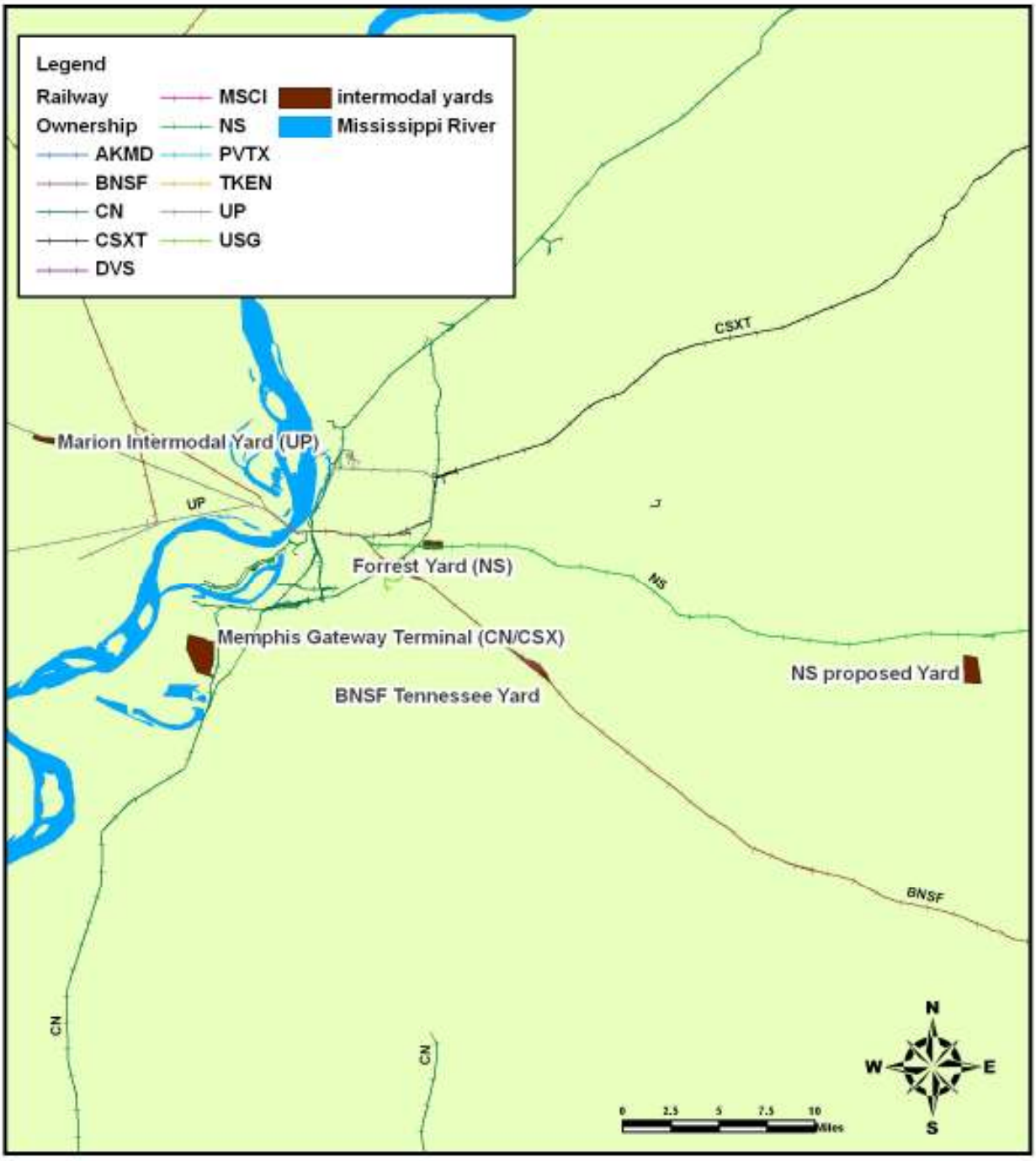
[29] Arkansas Midland Railroad Company website. Accessible at: http://www.pinsly.com/arkansas/
[30] Phone Interview March 2009.
[31] Pioneer Railcorp website. Accessible at: http://www.pioneer-railcorp.com/Subsidiaries/MSCI/msci.html
[32] Tennessee Department of Transportation Short Line Railroad Directory. Accessible at: http://www.tdot.state.tn.us/publictrans/docs/shortline_railroad.pdf

MAJOR YARDS IN THE STUDY AREA



Source: CIFTS

MEMPHIS RAIL INTERMODAL FACILITIES



Source: CIFTS

MEMPHIS PORT INFRASTRUCTURE INVENTORY

There are five major river ports in the Memphis study area and 99 private or public individual water terminals. Major ports in the region are

- International Port of Memphis, Tennessee;
- Port of West Memphis-Crittenden, Arkansas;
- Port of Helena-West Helena, Arkansas;
- Port of Osceola, Arkansas;
- Northwest Tennessee Regional Port Authority (Port of Cates Landing currently under construction).

A list of river terminals in the study area by county is provided in Appendix V. Nineteen of these terminals are not within the confines of a defined port (seven in Arkansas, two in Mississippi, and ten in Tennessee).

In 2006, almost 21 million tons of waterborne freight was handled by the four ports within the study area. The table below shows this tonnage by port (the International Port of Memphis and Port of West Memphis are combined) followed by a brief description of each port in the study area.

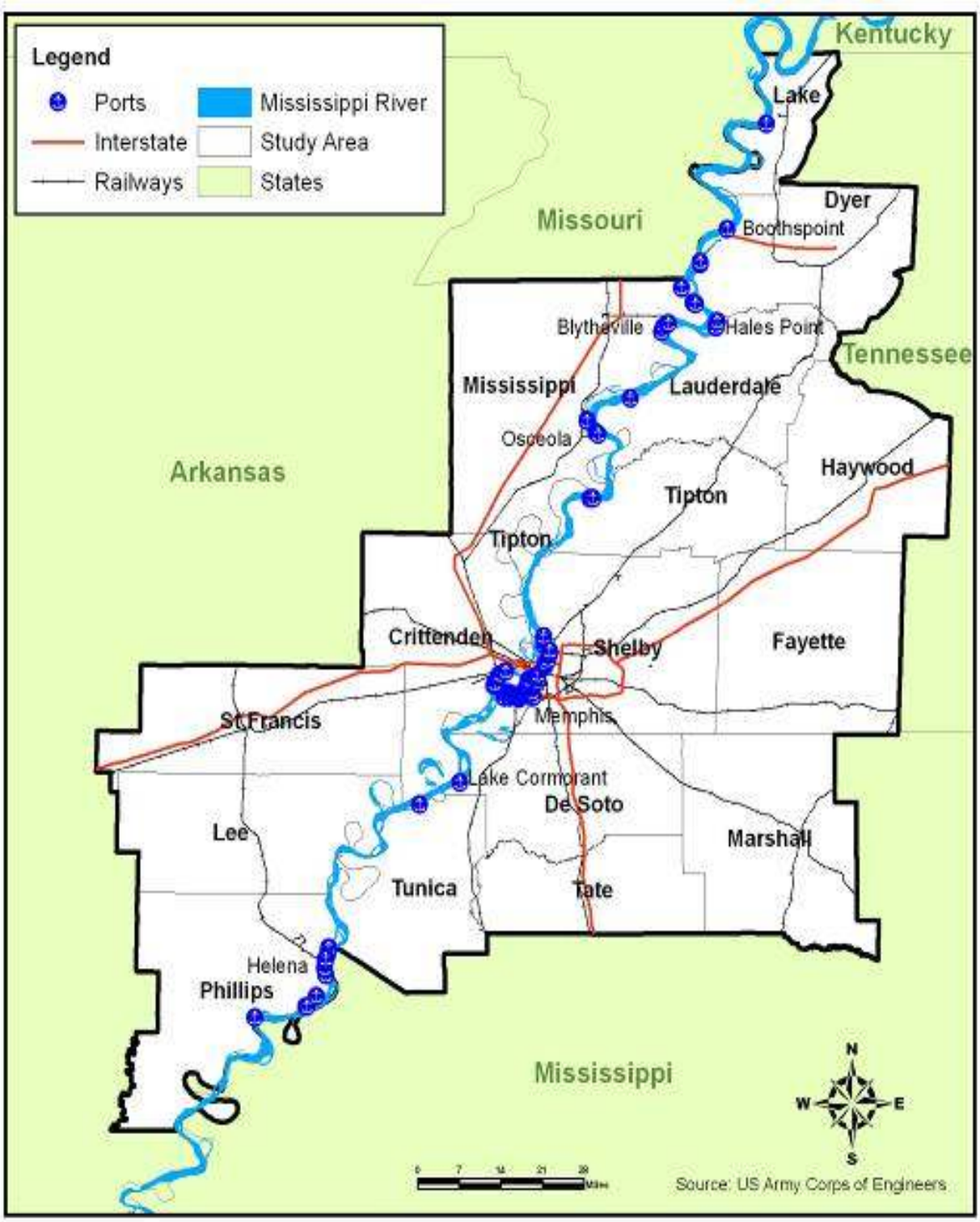
TONS HANDLED BY PORTS (2006)[33]

Port Name	Annual Tonnage (Millions)	Number of Terminals
International Port of Memphis and Port of West Memphis	19.1	62
Port of Helena	1.58	12
Port of Osceola	0.2	4
Total	**20.9**	**78**

Sources: Port of Memphis, US Army Corps of Engineers, Arkansas Waterway Commission, Nucor Steel

[33] 2006 is the latest data available from the International Port of Memphis.

MEMPHIS PORTS AND TERMINALS IN THE STUDY AREA



Source: CIFTS

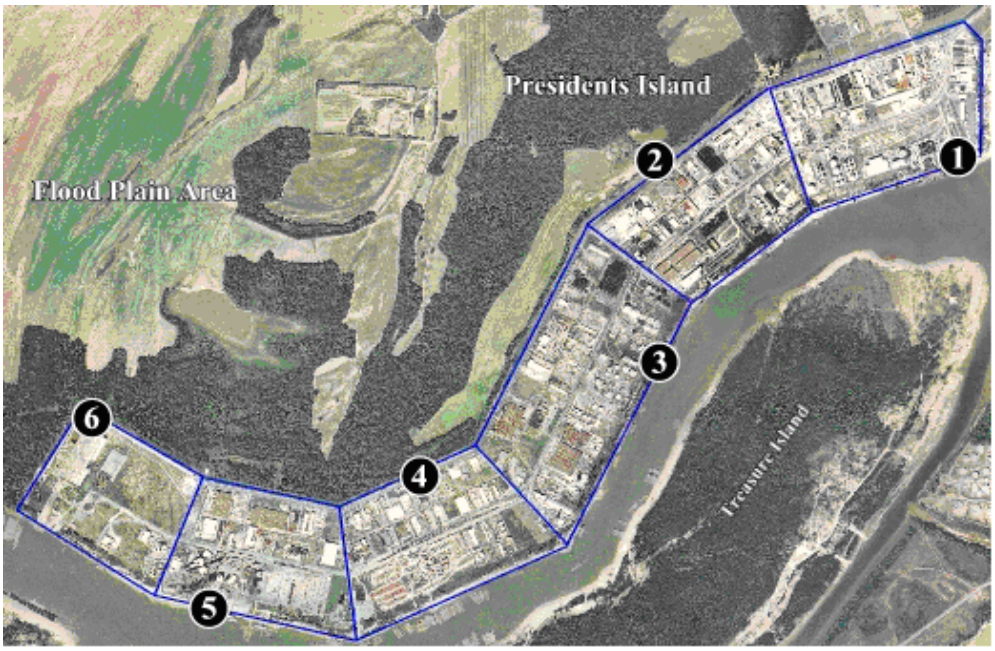
The International Port of Memphis

The area's dominant port is the International Port of Memphis, handling over 90% of water traffic in the study area. The Port is operated by the Memphis and Shelby County Port Authority and the fourth-largest inland port in the United States. It is the second-largest inland port on the lock-free portion of the Mississippi River[34], and 39th in total trade among all U.S. ports.[35] The port supports five public terminals (McKeller Lake/Presidents Island, West Memphis Harbor, Rivergate Harbor, Wolf River Harbor, and Fullen Dock and Warehouse) with a total of 11 berths. In 2006 five commodities constituted 95% of all cargo handled at the Port: petroleum, crude materials, coal, food/farm products, and manufactured goods.

The port is located along 15 miles of Mississippi waterfront and supports between 150 to 200 industries, six grain elevators, 50 concrete silos, and 23 steel tanks with a storage capacity of over 12.3 million bushels. The port also has storage capacity for approximately 89 million gallons of liquid bulk commodities. The two most developed terminals at the port are President's Island and The Frank C. Pidgeon Industrial Park:

- **President's Island** contains 95% of the port's industries and is the most significantly developed terminal at the International Port of Memphis. The island is separated into six blocks and is connected to Interstates 44 and 55 by the Jack Carley Causeway. The Island is home to approximately 105 industries and is served by the Canadian National Railway. Major commodities shipped from the Island in 2006 (latest figures available) include oilseeds, animal feed, soybeans, rice, wheat, iron/steel scrap, petroleum, fuel oil, and gasoline. The Island also has one the largest cranes in the world called Ichabod Crane, a 1,500 ton stiff leg derrick crane operated by Barnhart Crane and Rigging.

PRESIDENT'S ISLAND MAP



Source: http://www.portofmemphis.com/pres_island.asp

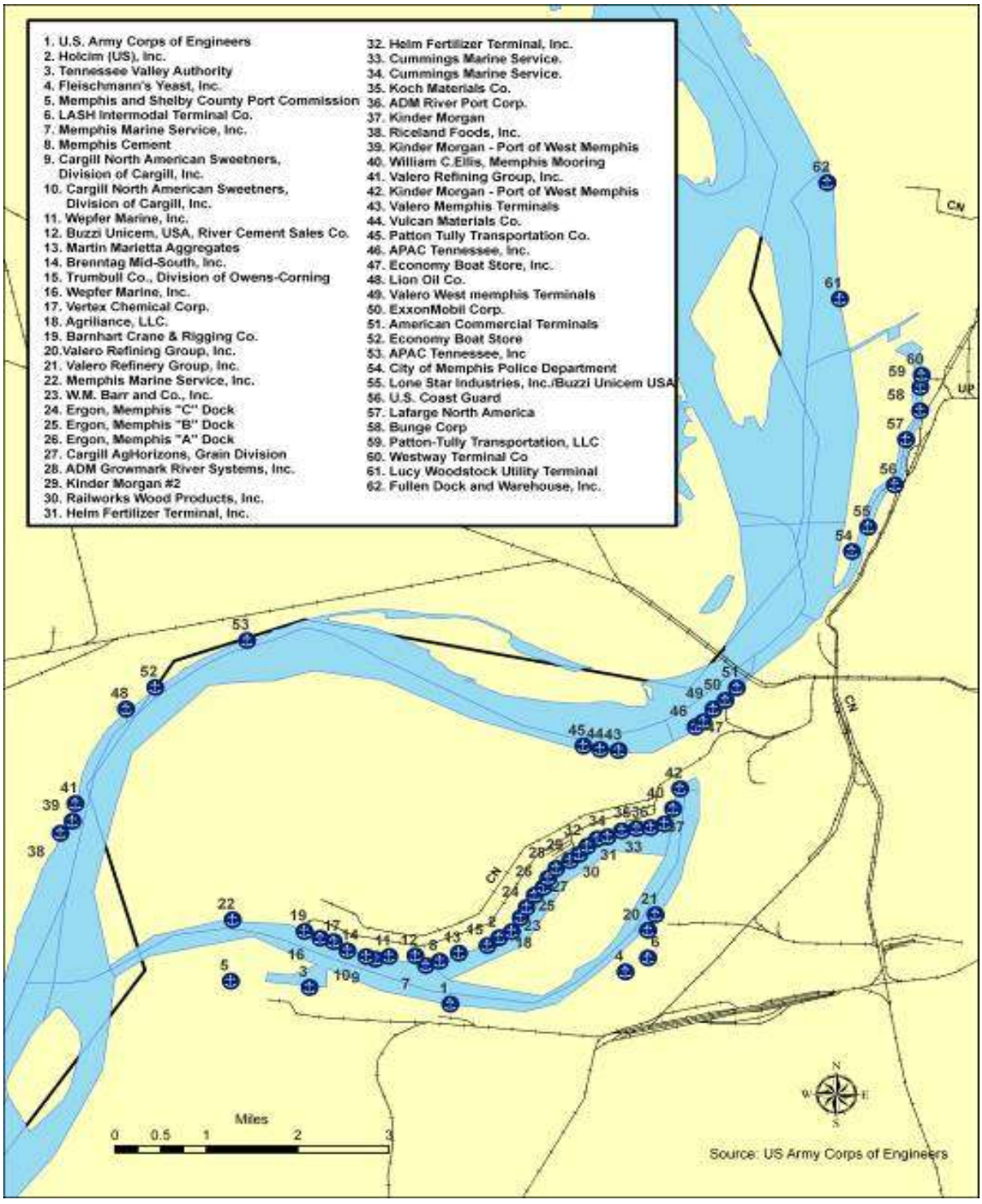
[34] Port information and statistics accessed at: http://www.portofmemphis.com
[35] American Association of Port Authorities (AAPA). *"2006 U.S. Port Cargo Tonnage Rankings"* Found online at: http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=900&navItemNumber=551

- **Frank C. Pidgeon Industrial Park.** Frank C. Pidgeon Industrial Park is the most recently developed terminal at the International Port of Memphis and encompasses approximately 2,500 acres of land. The main tenant in the Park (Area 4) is the Intermodal Gateway, an intermodal terminal operated jointly by Canadian National Railway and CSX Transportation. The terminal has capacity of 200,000 lifts per year.

FRANK C. PIDGEON INDUSTRIAL PARK

Source: Canadian National

TERMINALS AT THE INTERNATIONAL PORT OF MEMPHIS



Source: CIFTS

West Memphis-Crittenden County Port Authority

The Port of West Memphis-Crittenden is a public port terminal operated by Global Materials Services, LLC. It includes a general-purpose river terminal and special-purpose grain terminal (West Memphis Upper and Lower Docks). The port specializes in the receipt and shipment of miscellaneous bulk materials, including crushed stone and sand, steel products, and grain shipping. The Premcor Refining Group also transports refined petroleum products from the West Memphis Terminal Docks.

Helena-West Helena Phillips County Port Authority

The Port of Helena is located 65 miles south of Memphis and has 4,000 acres of industrial sites specializing in the transportation of steel, coal, grain, and break bulk commodities. The port receives and ships dry bulk commodities and other general cargoes for foreign and domestic trade including liquid and dry fertilizer, lumber, soybean oil, cotton seed, and wood pulp. Much of the port's storage infrastructure is aging, and was not in use at the time of the U.S. Army Corps of Engineers study in 2004.

Osceola Riverport Authority

The Port of Osceola is a small public port facility that handles 200,000 tons of agricultural products per year. The main product shipped through this terminal is grain, mostly shipped by truck and rail and transferred onto barges. The port has approximately 600 acres of 500-year flood-protected land available with rail, highways, and utilities either on-site or within one mile. It is served by the Burlington Northern Santa Fe railroad.

Northwest Tennessee Regional Port Authority (Port of Cates Landing)

The Northwest Tennessee Regional Port Authority operates the Port of Cates Landing, which is currently under construction. When complete, the port will include an expandable intermodal port dock and trans-load facility serving barge, rail, and truck traffic. It includes nearly 9,000 feet of slack water harbor, 3,000 acres of developable industrial land, and rail access provided by Canadian National Railroad.

Memphis port inventory information available on the FTP server (See Appendix III):

- Map of the study area showing locations of the ports.
- Map of ports and terminals in Memphis region, including locations and names of all major terminals.
- A spreadsheet that contains the following port information:
    - Port and facility name
    - Owner
    - Operator
    - Contact information
    - Purpose for which the port is used
    - Type of commodities handled
    - Railway connection
    - Remarks regarding description of port: storage facilities, depth, berthing, and distance.

MEMPHIS PIPELINE INFRASTRUCTURE INVENTORY

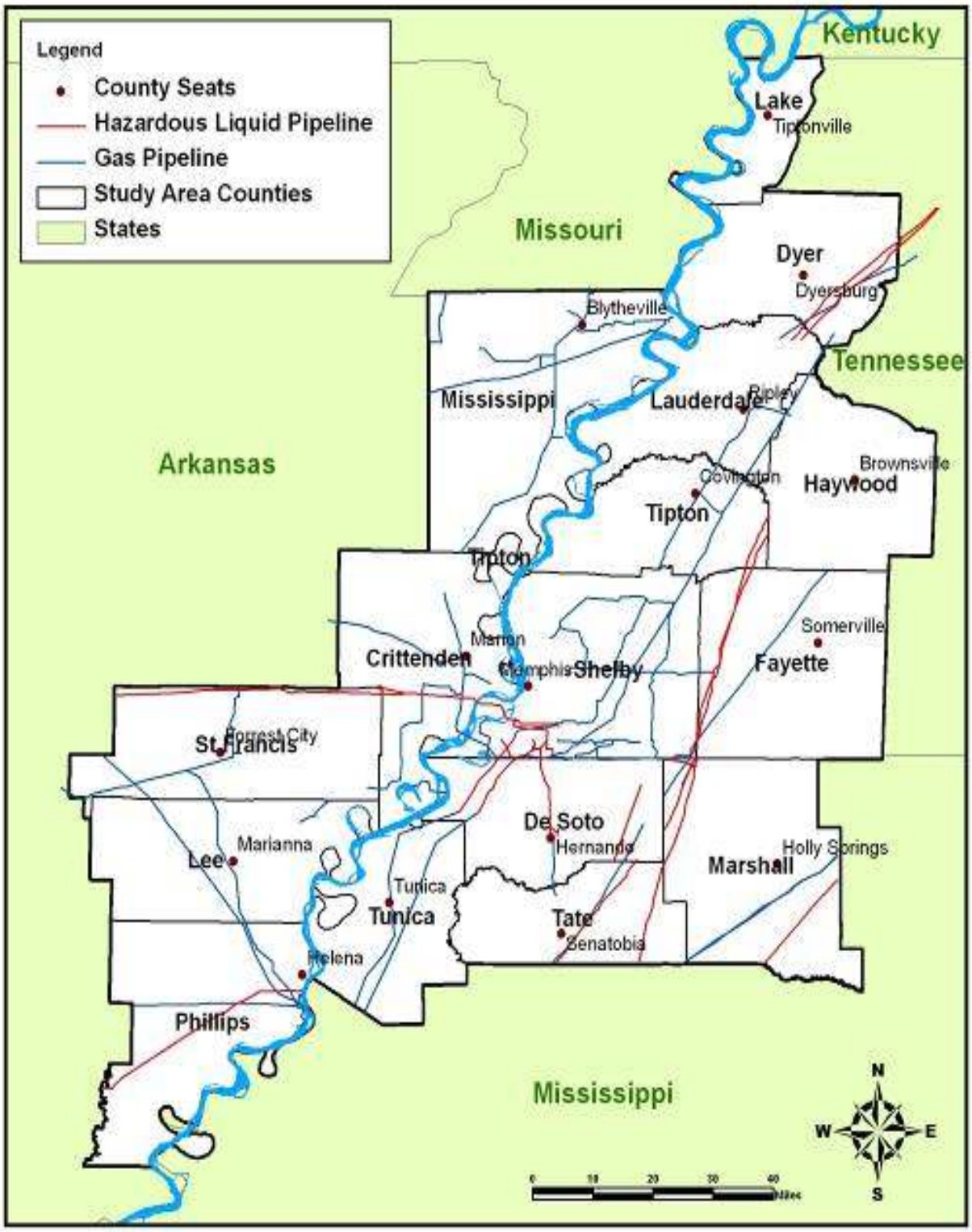
The Memphis study area has over 1,200 miles of pipelines. For security reasons, this pipeline information, obtained from the National Pipeline Mapping System, is only provided based on whether or not the pipeline contains hazardous liquid or gas. The primary commodity for gas in pipelines is natural gas. The primary commodity carried by the hazardous liquid pipeline is crude oil.

An unusual aspect of the region's pipeline network is a 15-mile fuel pipeline that runs from the Port of Memphis to the Memphis International Airport.

Memphis pipeline inventory information available on the FTP server (See Appendix III):

- Map showing locations of the pipelines and major highways.
- File containing the names of the users of the pipelines, by state, county, and the name of the user company.

PIPELINE NETWORK IN THE STUDY AREA



Source: CIFTS

MEMPHIS INTERMODAL INFRASTRUCTURE INVENTORY

For the purposes of this Plan, intermodal terminals included in this inventory are defined as follows:

- The terminal connects at least a pair of transportation modes.
- The terminal is open for use by shippers and carriers, and to the general public.
- The terminal has intermodal freight transfer facilities.

Given this definition, there are 19 intermodal terminals in the study area. The modal breakdown of all these terminals is shown below. Three of these intermodal yards are located in Shelby County and include: the Memphis Gateway Terminal, which is jointly operated by Canadian National and CSX. The fourth intermodal yard is located in Marion and is operated by Union Pacific.

NUMBER AND TYPES OF INTERMODAL TERMINAL IN THE STUDY AREA

Type of Principal Modes (Terminal type)	Number
Air and Truck	3
Port and Truck	2
Port, Rail, and/or Truck	10
Rail and Truck	4
Total	**19**

Source: Bureau of Transportation Statistics and CIFTS

The three air and truck intermodal terminals in the region are all located within Memphis International Airport: Delta Airlines (formerly Northwest), FedEx Corporation (FedEx), and United Parcel Service (UPS). Twelve port-based intermodal terminals are located on the Mississippi River, which enables the transfer of cargo to and from barges to rail or trucks. Ten of these terminals provide both rail and highway connections, and the remaining two have only truck access.

The map on the following page shows the location of the intermodal terminals in the study area. The new NS intermodal terminal in southwest Fayette County, to be completed in 2012, is also shown.

Memphis intermodal terminal information available on the FTP server (See Appendix III):

- Map showing the location of intermodal facilities.
- Spreadsheet showing facility information including mode types, volume information, and address of the facility.
- List of drayage companies.

INTERMODAL TERMINALS WITHIN THE STUDY AREA

Source: CIFTS

MEMPHIS TRUCKING AND DRAYAGE INFRASTRUCTURE INVENTORY

The Memphis region is home to 490 trucking terminals, 70% of which are located within Shelby County. The table below breaks down these terminals based on the annual sales of the trucking company. Almost half of these companies (46%) are relatively small, with annual sales of less than $500,000. Generally, these firms handle "less than truckload" shipments (LTL. Less than Truckload is the transportation of cargo that is less than full truckload but more than courier parcel weighing 150 pounds. This type of transportation occurs locally at the two ends of transport chain whereby a LTL driver usually collects and drops off freight from different customers and shippers and transports it to a freight hub, delivery terminal, or break-bulk facility. The freight is then consolidated, sorted out, and reconfigured for the next line haul. Unlike the full truckload, the freight is handled en route.

Or these firms are drayage companies transporting locally or being consolidated at larger Memphis terminals into full truck loads for further line haul to the final destination.

Truckload trucking involves the transportation of cargo that occupies a full semi-trailer meant for one destination. Unlike with LTL, the freight is never handled en route, but occasionally the driver may transfer the trailer to another driver. In addition, Memphis has a large number of "drayage" companies that pick up or deliver containers or trailers to one of the four intermodal terminals in Memphis. A list of these companies is provided on the following page.

ANNUAL SALES OF TRUCKING TERMINALS IN THE STUDY AREA

Size of Truck Terminal (Annual Sales)	Number of companies	Percent
> $100 Million	3	.3%
$50 - $100 Million	5	.7%
$20 - $50 Million	9	2%
$1 - $20 Million	239	40%
$.5 - $1 Million	65	11%
< $.5 Million	171	46%
Total	**490**	**100%**

Source: InfoUSA

The list of trucking companies that have annual sales in excess of $20 million is shown. These are all national firms with Truckload (TL) or Less Than Truckload (LTL) operations.

Truckload trucking involves the transportation of cargo that occupies a full semi-trailer meant for one destination. Unlike with LTL, the freight is never handled en route but occasionally the driver may transfer the trailer to another driver.

TRUCKING TERMINALS IN THE STUDY AREA WITH ANNUAL SALES OVER $20 MILLION

Seventeen Leading Trucking Companies Based on Annual Sales		
$100–500 Million	**$50–100 Million**	**$20–50 Million**
FedEx	UPS	Ozark Motor Lines
Schneider National Inc	FedEx National LTL	AAA Cooper Transportation
Roadway Express	FedEx Freight	Express Courier Intl
	ComTrack Logistics Inc	VIP Express
	Yellow Transportation	Conway Freight Southern
		Pat Salmon & Sons
		Saia Motor Freight
		Old Dominion Freight Line
		Estes Express Lines

Source: InfoUSA

TRUCKING TERMINALS IN THE STUDY AREA

Source: CIFTS

Memphis truck terminal inventory information available on the FTP server (See Appendix III):

- Map of trucking facilities in the study area.
- Spreadsheet containing information about each trucking facility such as contact information, annual sales, description of services, and a list of drayage companies.

DRAYAGE COMPANIES SERVING THE MEMPHIS AREA (TERMINALS WITHIN THE MEMPHIS REGION)

COMPANY NAME	CITY	STATE	ZIP CODE
ARL Inc	Memphis	TN	38141
Armstrong Transportation & Trailers LLC	Memphis	TN	38113
Atlantic Trucking Company Inc (ATC)	Memphis	TN	37000
B&G Carriers	Memphis	TN	38115
Bridge Terminal Transport (BTT)	Olive Branch	MS	38654
California MultiModal Inc (CMI)	Memphis	TN	38109
Carolina National Transportation	Memphis	TN	38106
Carr Trucking	Hernando	MS	38631
Chickasaw Container Services	Memphis	TN	38114
Clark Freight Lines Inc	Marion	AR	72301
Cline-Maxcy (div of ATF)	Memphis	TN	38109
Commercial Cartage Inc	Memphis	TN	38118
Comtrak Logistics (Corp)	Memphis	TN	38175
ConGlobal Industries (CGI)	Memphis	TN	38109
Cowan Systems	Marion	AR	72364
Delta Express LLC	West Memphis	AR	72303
Eagle Systems	Memphis	TN	38115
Express America Trucking Inc	Memphis	TN	38109
Express America Trucking Inc	Memphis	TN	38118
First Coast Logistics	West Memphis	AR	72301
Graham Trucking LLC	Olive Branch	MS	38654
H&M International Transportation	Memphis	TN	38114
Horizon Freight System Inc	Memphis	TN	38106
Infinity Transport LLC	West Memphis	AR	72301
Intermodal Bridge Transport Inc (IBT)	Memphis	TN	38118
Intermodal Cartage Corp	Memphis	TN	38141
Mainstream Transportation Inc	Memphis	TN	38118
Mason Dixon	Memphis	TN	38118
MLG Trucking Inc	Memphis	TN	38109
Morgan Southern	Memphis	TN	38106
Nationwide Transport Services	Marion	AR	38118
P.B. Industries Inc	Memphis	TN	38118
Pacer Cartage	Memphis	TN	38116
Patriot Logistics Inc	Memphis	TN	38118
RoadLink	Memphis	TN	38106
Star Transportation	Olive Branch	MS	38654
TCW Inc	Memphis	TN	38118
Transcarriers Inc	Memphis	TN	38118
Transportation Made Simple (TMS)	Memphis	TN	38188
Transportation Specialists Inc (TSI)	Memphis	TN	38125
Value Logistics Inc	Memphis	TN	38118
W.W. Rowland	Memphis	TN	38109
Wilmac Enterprises LLC	Memphis	TN	38118

Source: http://www.drayage.com

MEMPHIS WAREHOUSE AND DISTRIBUTION INFRASTRUCTURE INVENTORY

The study area contains 956 warehouses providing over 160 million square feet of usable space. These warehouses have a combined $100 million in sales annually. Below is a map showing the warehouses in the region.

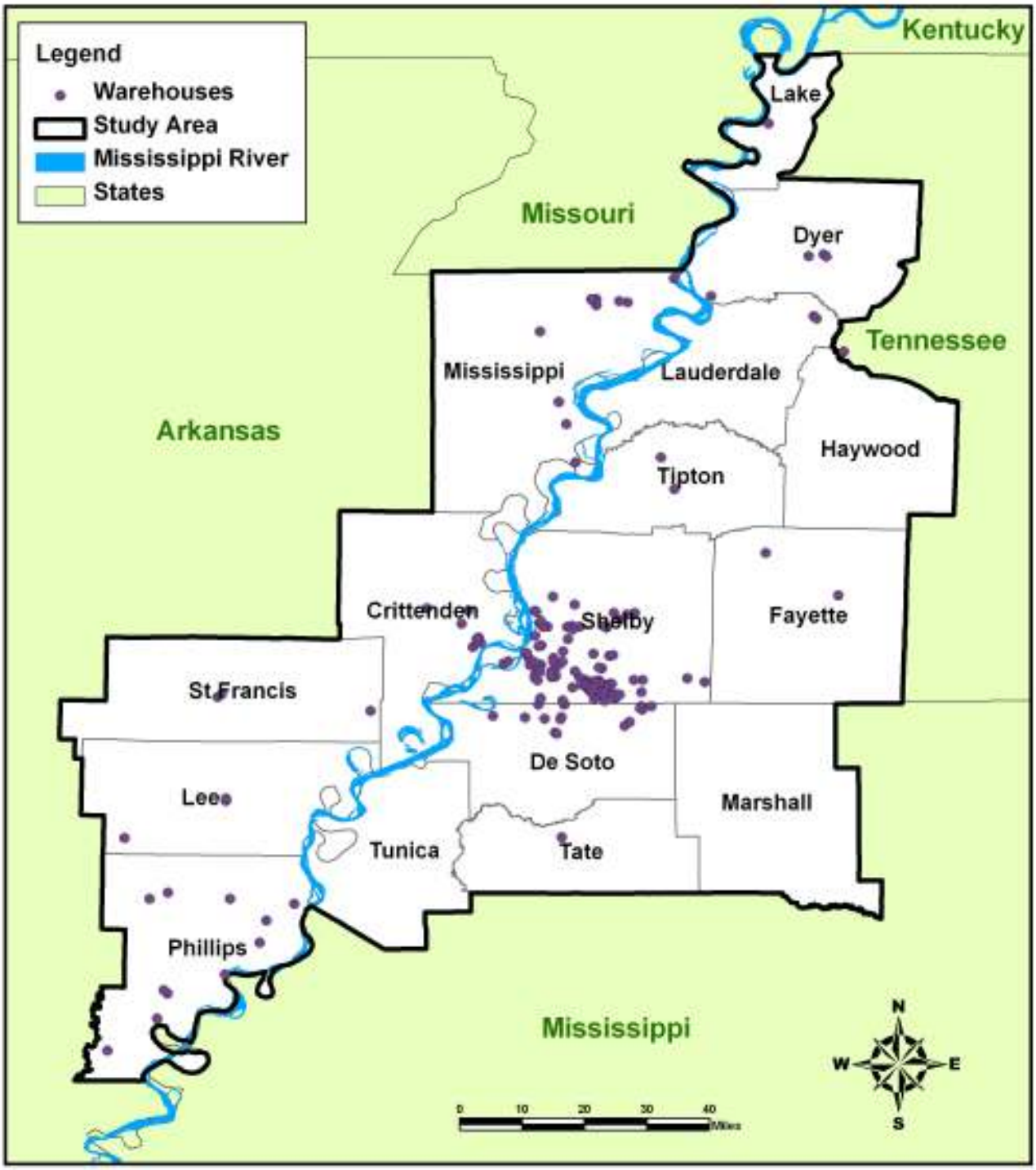
Of the warehouses identified, approximately 157 are within five miles of an interstate, and 63 are located within five miles of the Memphis International Airport.[36] Thirty deal exclusively with agricultural products, providing over 3.5 million square feet of commodity storage. Seven warehouses in the study area provide cold storage with over 2,000,000 square feet of space.

Memphis warehouse inventory information available on the FTP server (See Appendix III):

- Map of the study area showing locations of the warehouses.
- Spreadsheet containing information about all of the warehouses, including square footage, contact information, type of commodities handled, rail access, and availability of cold storage. Each of the warehouses was contacted by telephone to verify this information.

[36] This information was obtained from the INFOUSA™ database supplied by the Greater Regional Chamber, Southeastern Warehouse Association, and the International Warehouse Logistics Association. Information includes all public warehouses in the region. Information on some private warehouses and distribution centers was not available.

WAREHOUSE LOCATIONS IN THE STUDY AREA



Source: CIFTS

MEMPHIS INDUSTRIAL PARKS INFRASTRUCTURE INVENTORY

An industrial park is an area developed solely for the purpose of industrial and commercial activities. The definition in this study includes the lighter industries such as business parks and office parks in addition to heavy industries. The location of the industrial parks closely correlate with the location of transportation facilities in order to provide easy access.

There are 136 industrial parks in the Memphis study area, ranging in size from 2 to 6,600 acres, with a total of over 42,000 acres of industrial park space. The average industrial park size is 227 acres, excluding three of the region's largest industrial parks:

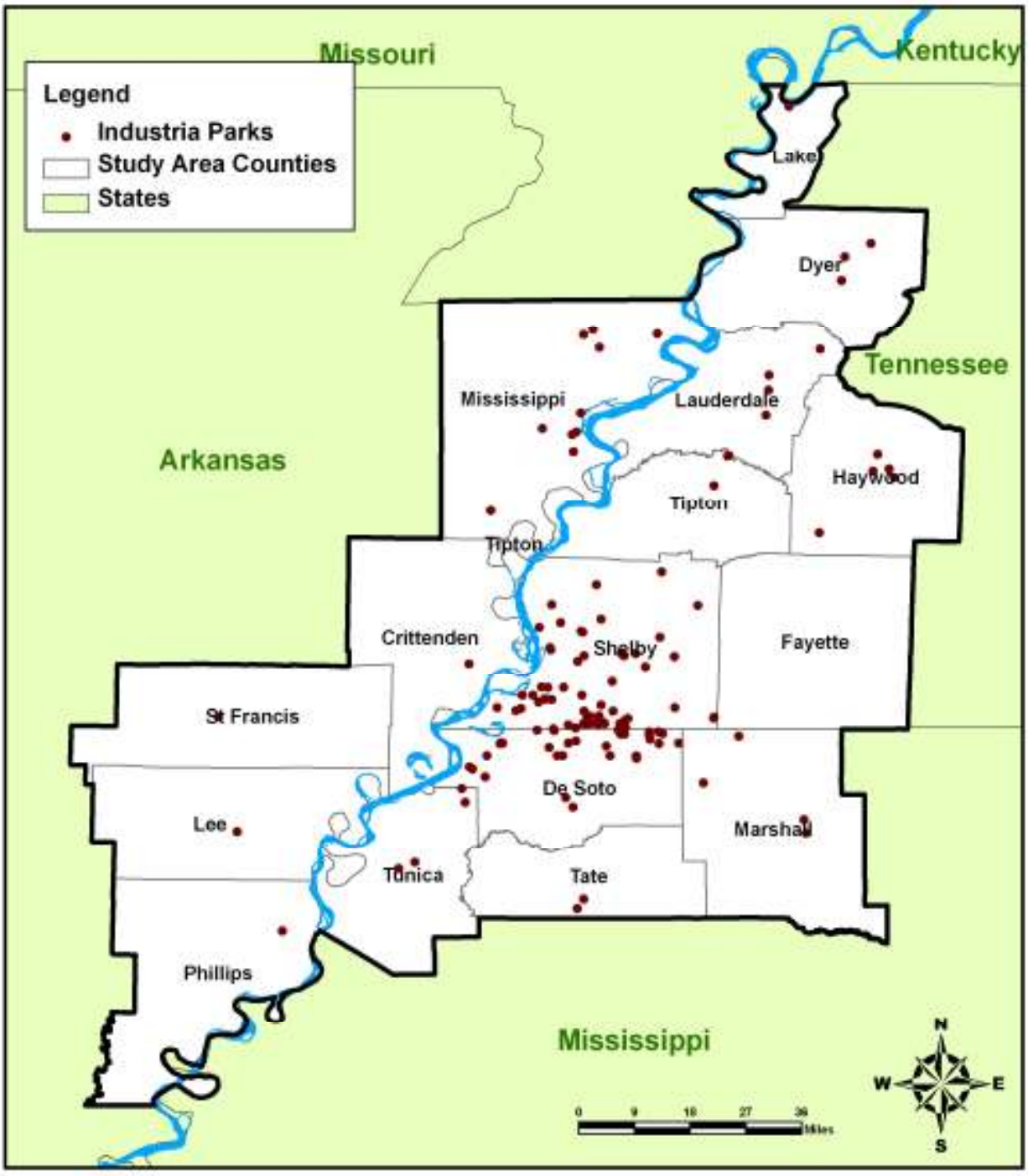
1. Newport Industrial Complex (6,600 acres) is the region's largest industrial park, and is located in Desoto County, Mississippi.
2. Frank Pidgeon Industrial Park (over 3,000 acres) is located in Shelby County, Tennessee, and is served by Canadian National Railway.
3. Chickasaw Industrial Site (2,200 acres) located in Marshall County, Mississippi.

Rail service is available to 37 other industrial parks in the study area, and 68 of these parks have been designated as industrial areas by their respective economic development agencies, but do not currently have industries located in them.

Memphis industrial park inventory information available on the FTP server (See Appendix III):

- Map of the study area showing locations of industrial parks.
- Spreadsheet containing information about all of the industrial parks including acreage, type of industries, and rail access.

INDUSTRIAL PARKS IN THE STUDY AREA



Source: CIFTS

Chapter 3: Evaluation of Memphis Regional Freight Infrastructure

Using the Memphis regional freight infrastructure inventory as a baseline, an evaluation of the region's infrastructure was conducted by Wilbur Smith Associates to assess the region's capacity to support future freight traffic, particularly in relation to the global supply-chain trends discussed earlier in this Plan. This evaluation was conducted for the region's four major freight modes (air, rail, highway, and water) using various regional transportation plans, freight forecasts, and IHS Global Insight proprietary databases.

MEMPHIS HIGHWAY INFRASTRUCTURE EVALUATION

Evaluation of Memphis highway infrastructure was conducted in several stages. First, an overview of the region's current truck freight was conducted using IHS Global Insight's 2007 TRANSEARCH database. A county-by-county profile of this traffic was performed, paying special attention to those counties expecting impacts from projected increases in rail intermodal and Aerotropolis activity.

TRANSEARCH is a comprehensive freight flow database of the United States that includes domestic freight, NAFTA trade, and major elements of inland sea trade activity. This data provides origins and destinations of freight in and around the Memphis region, the quantity and commodity mix of that traffic, and the distribution of modes. Modes include truck, rail carload, intermodal rail, air and water. Volumes are expressed in terms of tons, but can be converted to rail loads or truck units. County-to-county traffic flows are created with routing models along national highway and railroad networks. Commodities are specified by 2 or 4-digit commodity codes, and can be forecasted using IHS Global Insight macroeconomic models.

After profiling the region's freight traffic with TRANSEARCH, congestion ratios were calculated over the region's major highways and compared with projected freight levels. Finally, a "connectivity" analysis was performed to identify highways providing access between major freight hubs in the region (airports, intermodal terminals, warehouses, etc.). This analysis, together with congestion indices, helped prioritize links in the highway network critical to freight transport in the future.

HIGHWAY FREIGHT FLOWS IN THE MEMPHIS REGION OVERVIEW

The Memphis primary highway system carried over 454 million tons of freight in 2007, amounting to nearly 20 million trucks, and $1.3 trillion in value. Some 88% of the freight tonnage in the region travels on three highways that link the region to the nation: I-55, I-40, and US-78.

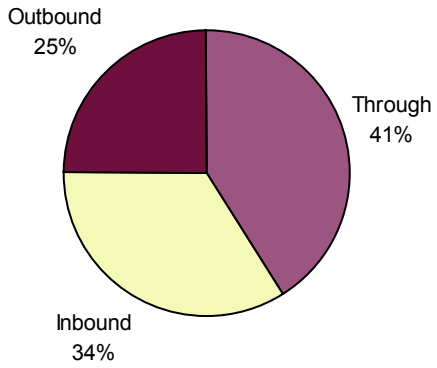
TOTAL TONS IN, OUT, AND THROUGH MEMPHIS BY HIGHWAY AND INTERSTATES (MILLIONS OF TONS - 2007)

Highway/Interstate	Total Tons (Millions)	Share
I-55	184.44	41%
I-40	170.88	38%
US-78	41.31	9%
US-51	36.25	8%
I-155	7.18	2%
US-72	4.97	1%
US-61	4.8	1%
US-64	3.21	1%
US-79	0.45	0%
US-70	0.08	0%
Total	**453.57**	100%

Source: IHS Global Insight *TRANSEARCH* 2007

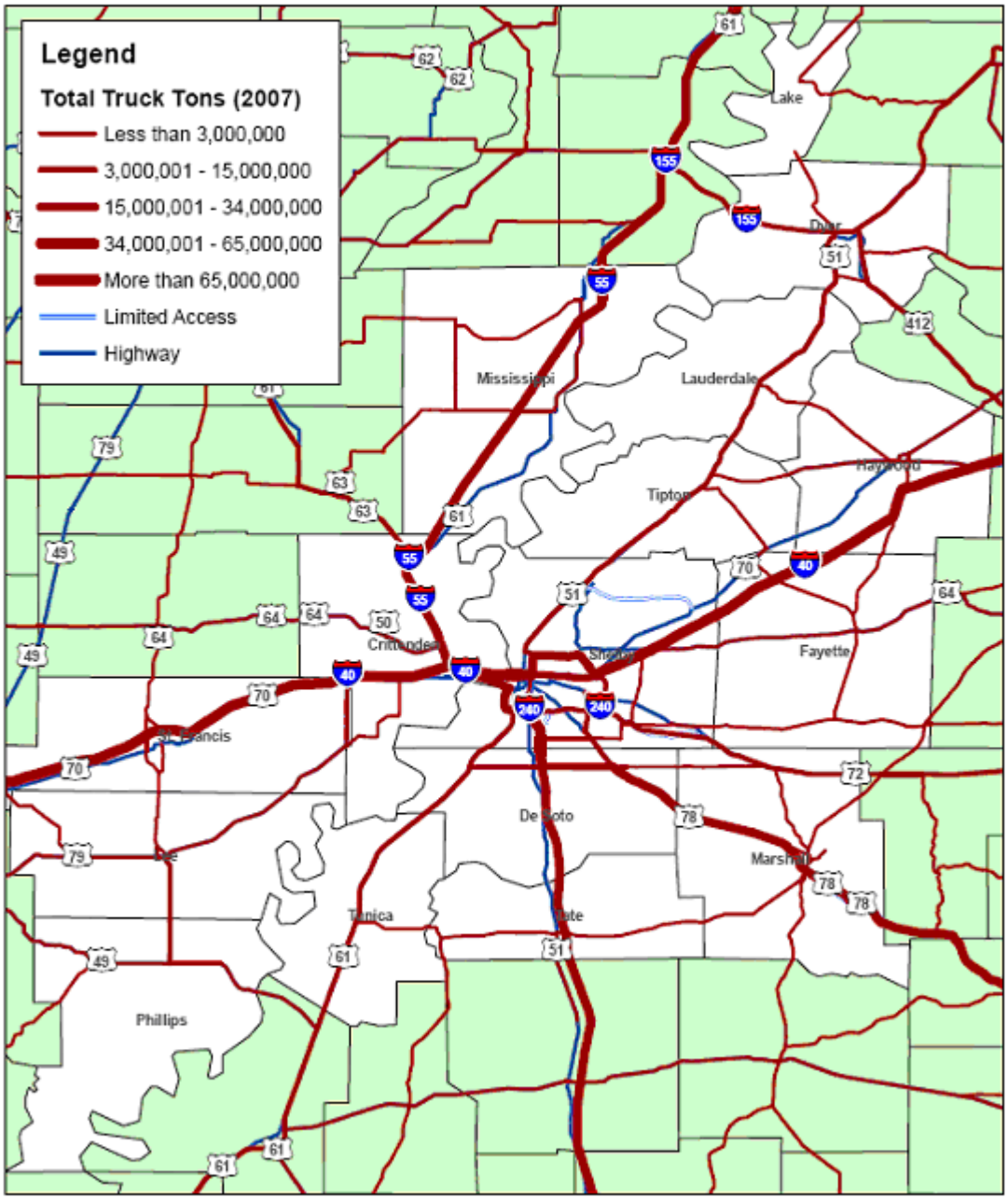
Over 40% of the freight in the region was through traffic, a much smaller proportion than metropolitan areas of similar size (as an example, over 70% of Nashville's truck freight in 2007 was through traffic). Truck flows analyzed by direction indicate that major inbound highways are I-55 south, I-40, US-78 (Lamar Ave.), US-72, US-63, and US-51. Outbound freight moves primarily on I-55 north, I-40, I-240, and US-78.

MEMPHIS TRUCK FREIGHT TRAFFIC BY TYPE (2007)



Source: IHS Global Insight *TRANSEARCH* 2007

Total Truck Tons (Year 2007) for Memphis Study Area



Source: IHS Global Insight TRANSEARCH

The following figures show major highway commodities shipped in the region during 2007 by weight (tonnage), units, and value. Farm products, secondary traffic and manufactured goods, chemicals and allied products, and other manufactured and industrial goods dominate the truck traffic.

TO 10 COMMODITIES SHIPPED BY TRUCK (2007)

Commodity	Millions of Tons	Share
Farm Products	61.8	15.2%
Secondary Traffic	55.2	13.6%
Chemicals or Allied Products	34.1	8.4%
Food or Kindred Products	33.9	8.3%
Nonmetallic Minerals	32.9	8.1%
Petroleum or Coal Products	21.5	5.3%
Primary Metal Products	18.6	4.6%
Coal	17.8	4.4%
Lumber or Wood Products	16.7	4.1%
Rubber or Misc. Plastics	15.9	3.9%
All Other	97.4	24.0%
Total Tons	**405.8**	**100.0%**

Source: IHS Global Insight TRANSEARCH 2007

TOP 10 COMMODITIES SHIPPED BY TRUCK IN MEMPHIS BY UNITS (2007)

Commodity	Millions of Units	Share
Shipping Containers	5.26	28%
Secondary Traffic	3.01	16%
Rubber or Misc. Plastics	1.29	7%
Farm Products	1.21	6%
Food or Kindred Products	1.10	6%
Chemicals or Allied Products	1.08	6%
Nonmetallic Minerals	0.82	4%
Fabricated Metal Products	0.74	4%
Clay, Concrete, Glass, or Stone	0.69	4%
Lumber or Wood Products	0.65	3%
All Other	3.17	17%
Total Units	**19.03**	**100%**

Source: IHS Global Insight TRANSEARCH 2007

TOP 10 COMMODITIES SHIPPED BY TRUCK IN MEMPHIS BY VALUE (2007)

Commodity	Millions of U.S.
Electrical Equipment	112,039
Machinery	89,127
Secondary Traffic	88,822
Chemicals Or Allied Products	85,774
Fabricated Metal Products	66,536
Rubber Or Misc Plastics	64,830
Transportation Equipment	62,969
Apparel Or Related Products	49,228
Primary Metal Products	47,710
Food Or Kindred Products	35,164
Other	197,403
Total Value	**899,602**

Source: IHS Global Insight TRANSEARCH 2007

Highway Freight Flows in Tennessee Counties

Shelby County

Shelby County is home to the region's major freight hubs, including Memphis International Airport, the International Port of Memphis, and intermodal yards for four railroads (NS, CSX, CN, and BNSF). Major freight routes in the county are the Interstate System (I-55, I-40, I-240), and major regional U.S. highways are US-78, US-51, and US-72. Secondary freight routes include Nonconnah Parkway/Bill Morris Parkway (SR 385), US-61, US-64, US-79, US-70, East Shelby Drive (State Route (SR) 175), and Getwell Road (SR 176).

Fayette County

Fayette County will be home to the new Norfolk Southern intermodal facility in southwest Fayette County. More than 100,000 trucks travel through the county annually, the majority of them using I-40 (the major east-west interstate connecting Memphis with Little Rock to the west and Nashville to the east) and US-72, which provides connectivity to Birmingham, Atlanta, and other points in the southeast. Other major freight routes in the county are US-72, US-64, US-70/79, and SR-57. Truck trips in the southern portion of Fayette County will increase substantially when the new NS intermodal facility in southwest Fayette County is completed.

Tipton County

The major freight route in Tipton County is US-51, connecting Memphis to cities to the north. The proposed I-69 will parallel US-51 in the county. Other regional connectors are State Routes 54 and 59 in the eastern and northern sections of the county.

Lauderdale County

Most truck freight in Lauderdale County is through traffic on US-51, similar to Tipton County.

Dyer County

There is a significant amount of industrial development in the Dyersburg region of Dyer County. Major freight routes are I-155 and US-51. The majority of both inbound and outbound freight runs along I-155 west of the city of Dyersburg and US-51 from Dyersburg south. US-51 experiences more inbound than outbound truck units.

Lake County

The major freight route in Lake County is SR 78, which runs the entire length of the county. Compared with other counties, minimal truck traffic travels through Lake County, although volumes will increase after the opening of the Port of Cates Landing.

Haywood County

Haywood County is bisected by I-40. Very little truck traffic originates or terminates in Haywood County. The main local freight routes are SR 59 and 76. The proposed Tennessee megasite in the county will significantly increase truck traffic.

Highway Freight Flows in Mississippi Counties

DeSoto County

There is a substantial amount of warehouse and distribution development in Desoto County. The major freight routes are I-55, US-78, US-61, and Goodman Road (MS 302) with the highest freight volumes traveling along the northern and southern portions of I-55, the length of US-78, and the portion of Goodman Road between I-55 and US-78.

Tunica County

The major generator of traffic within the county is the casino gambling complex. Major freight routes are US-61 and MS 4, with the major truck route being the northern and southern portion of US-61.

Tate County

Tate County's major freight routes are I-55, MS 4, and MS 51. Most inbound and outbound trucks travel the portion of I-55 south of MS 4, and through truck traffic moves the entire length of I-55.

Marshall County

Marshall County contains numerous freight routes: US-78, US-72, Goodman Road (MS 302), MS 7, MS 4, and Mt. Pleasant-Rossville Road (MS 311). US-78 has the largest share of inbound, outbound, and through trucks. The proposed Chickasaw Industrial park, located near the site for the upcoming Norfolk Southern intermodal terminal in southern Fayette County, is expected to significantly increase truck traffic in that area of the county.

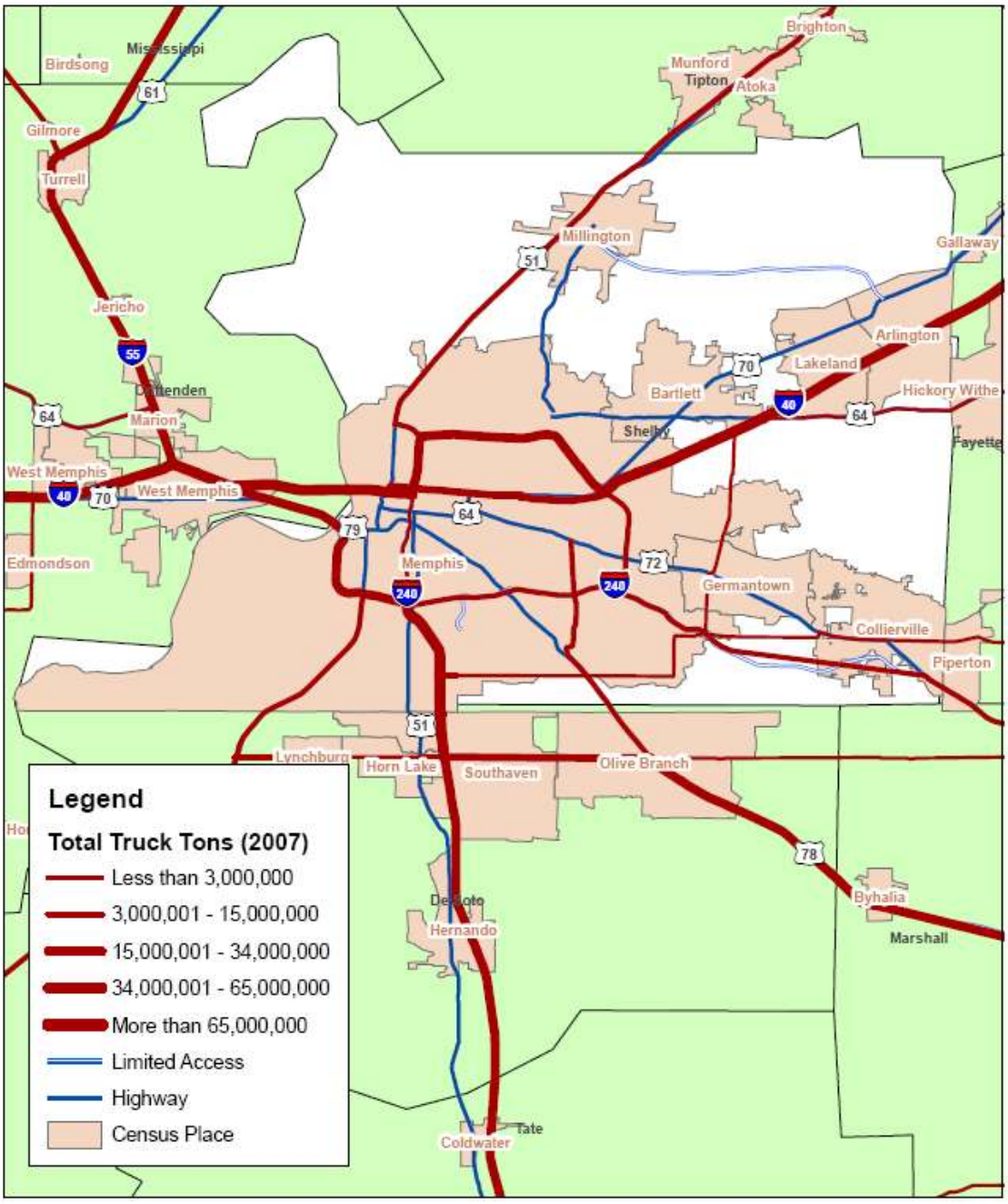
Highway Freight Flows in Arkansas Counties

The majority of truck freight in the Arkansas portion of the study region moves in Crittenden County. Only minimal levels of freight are generated or terminated in the Arkansas counties of Mississippi, St. Francis, Lee, and Phillips, and are not included in this section. The Port of Helena/West Helena is located in Phillips County, and may serve as a generator of truck traffic in the future.

Crittenden County

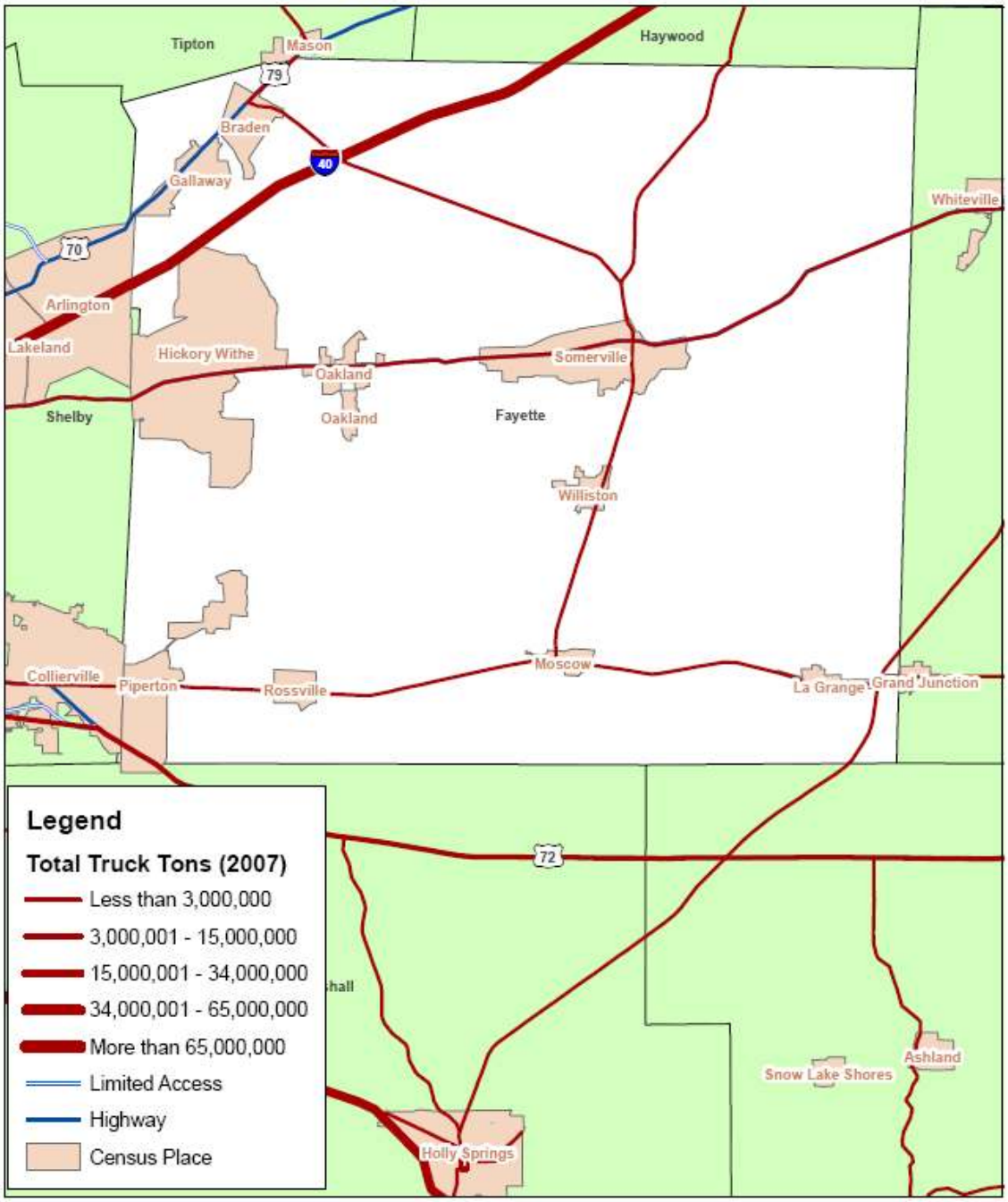
The Union Pacific intermodal terminal, numerous truck terminals, and other industrial land uses are located in Crittenden County. Major freight routes are I-55, I-40, and US-64. I-55 is the dominant interstate in the county, with more than a million truck units moving inbound, outbound, and through the county. The section of I-40 between West Memphis and Shelby County also carries large amounts of inbound, outbound, and through freight. There is a critical weaving area where these two interstates cross at West Memphis.

Total Truck Tons (Year 2007) for Shelby County



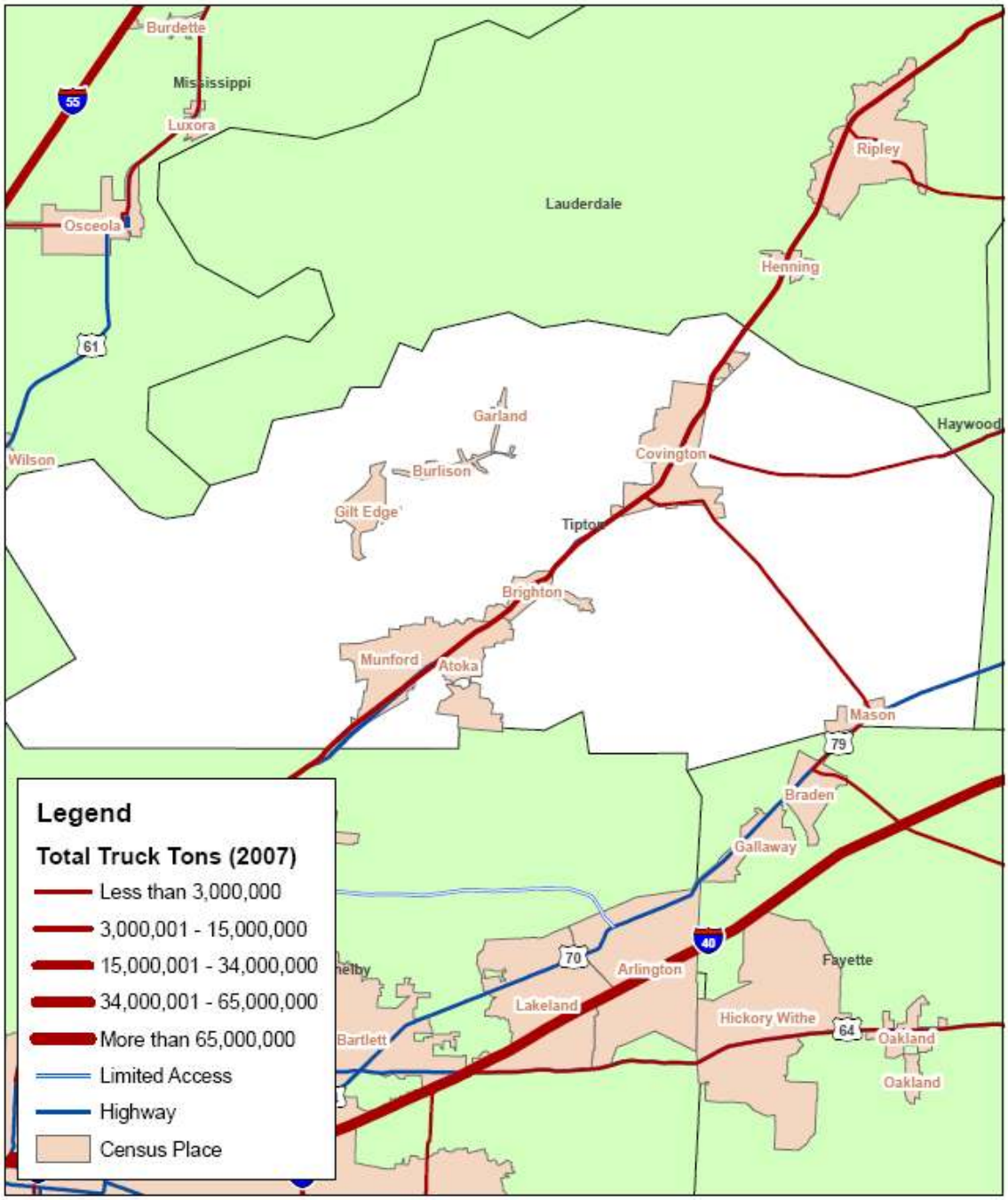
Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Fayette County



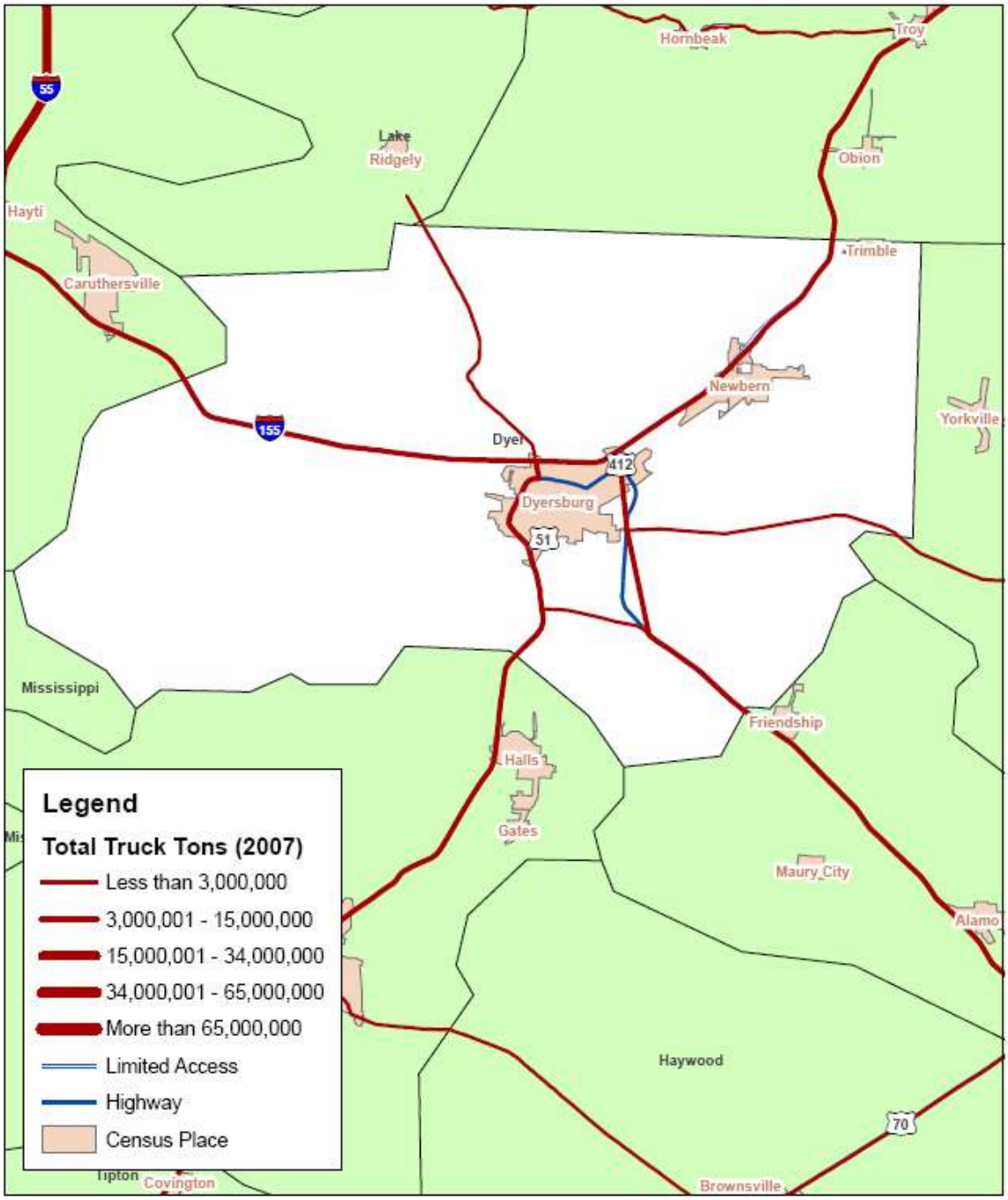
Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Tipton County



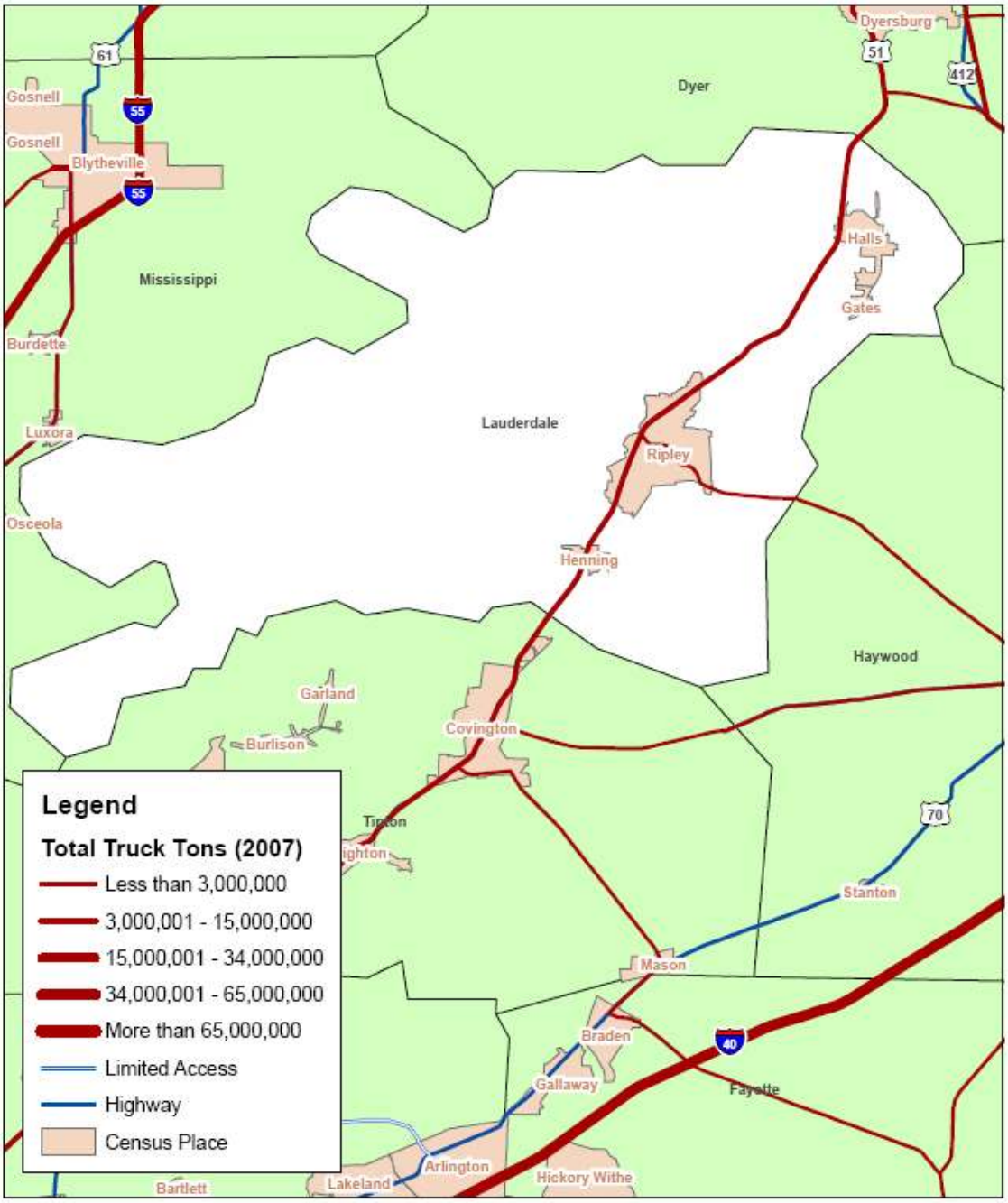
Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Dyer County



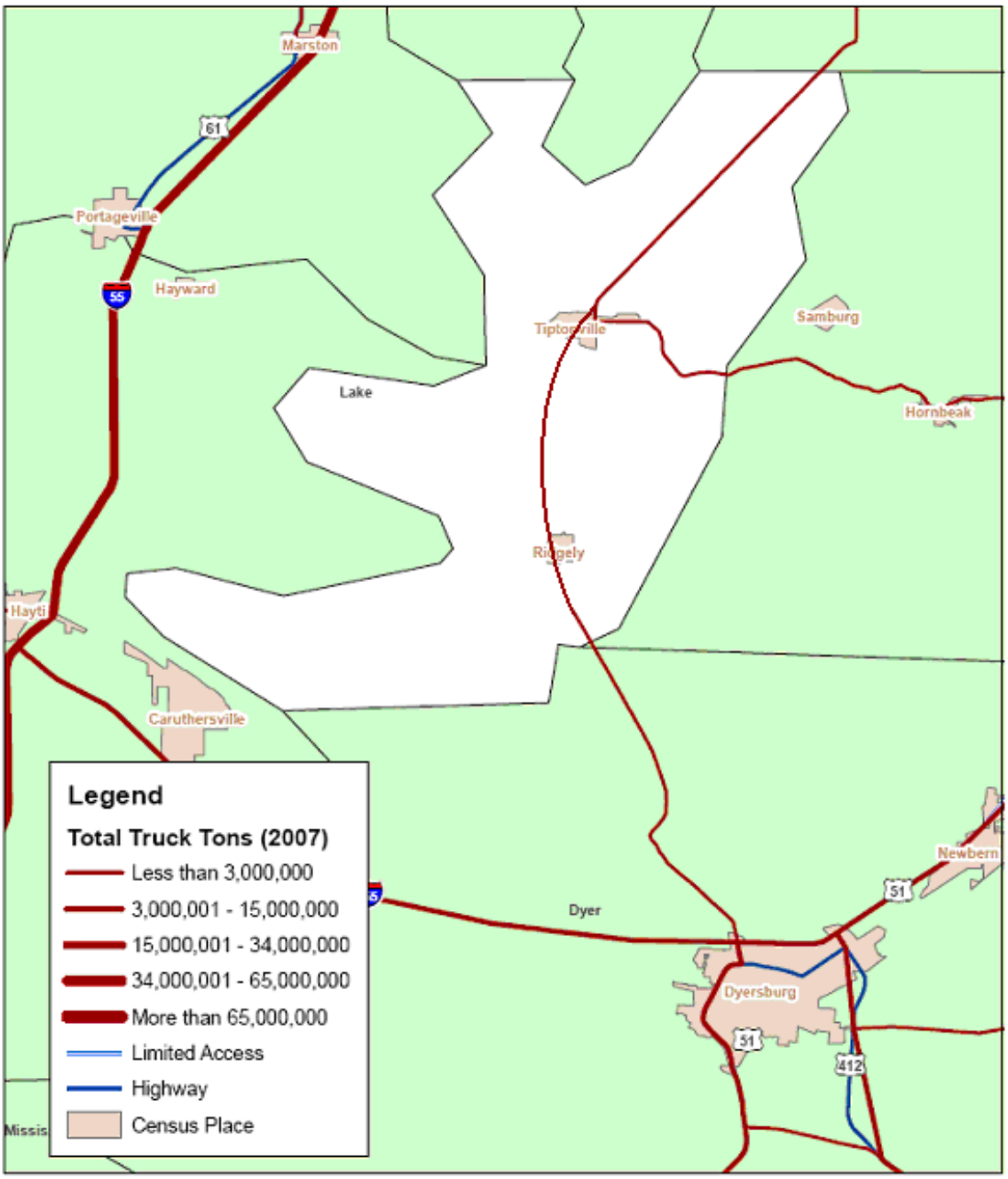
Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Lauderdale County



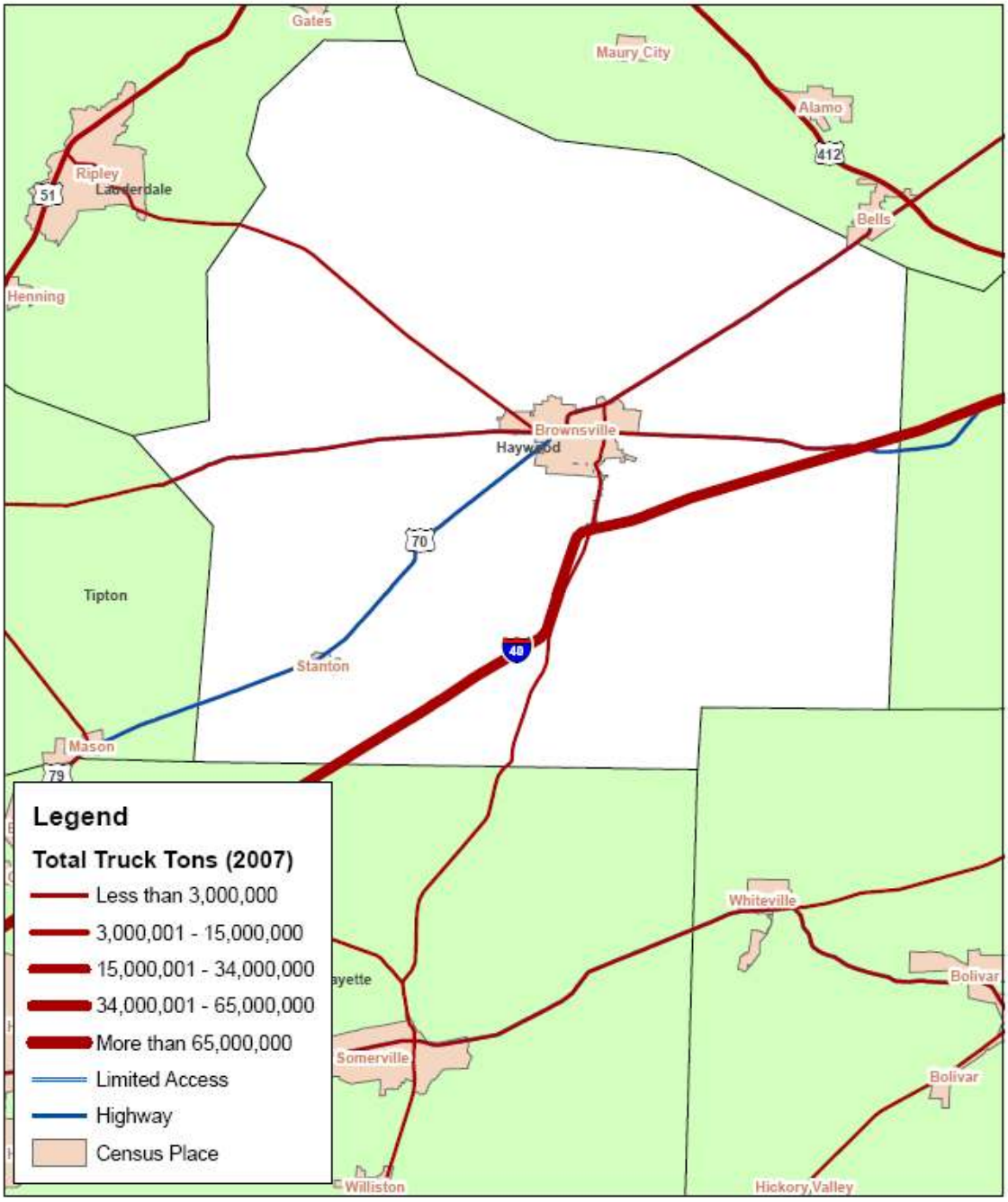
Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Lake County

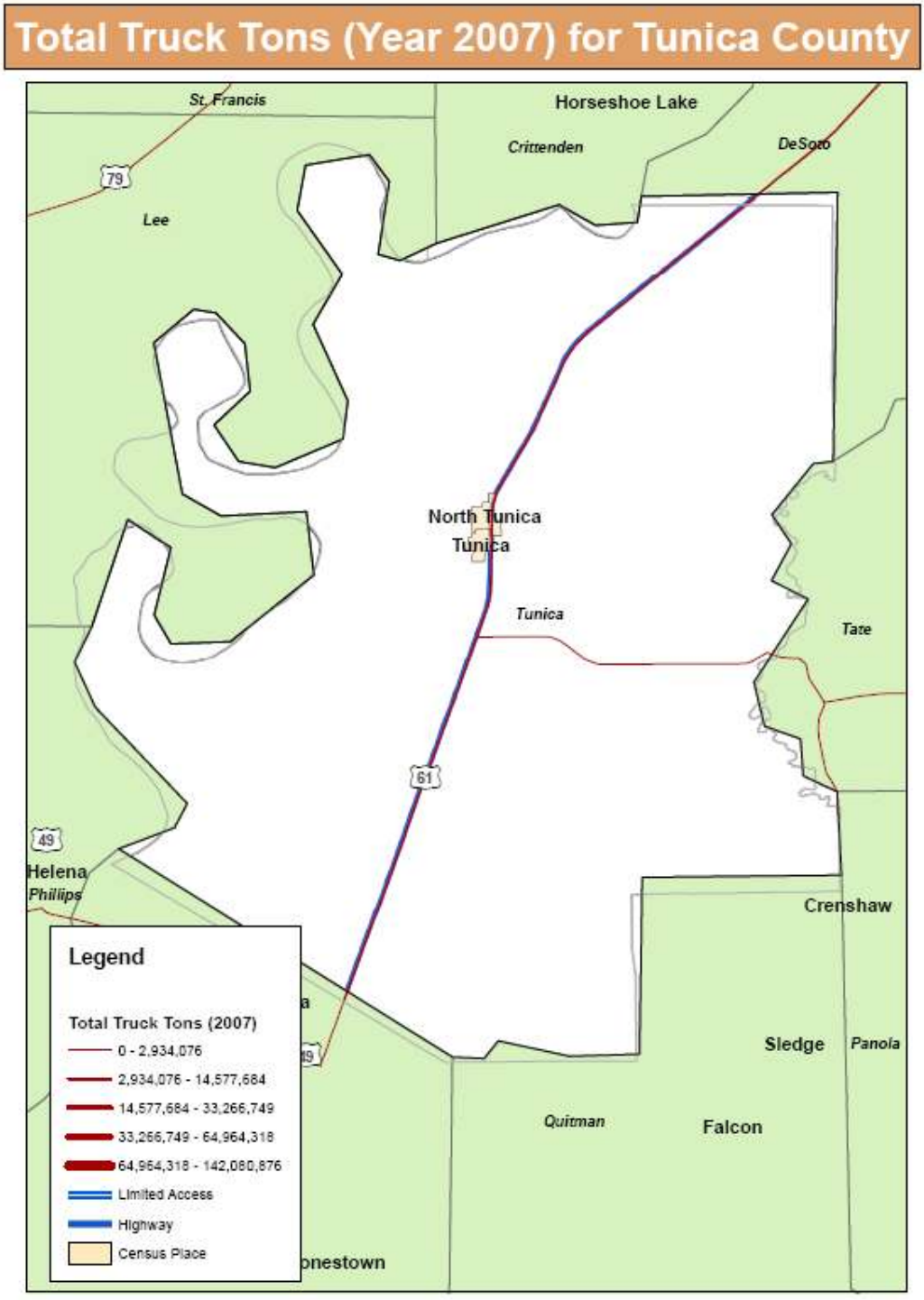


Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Haywood County

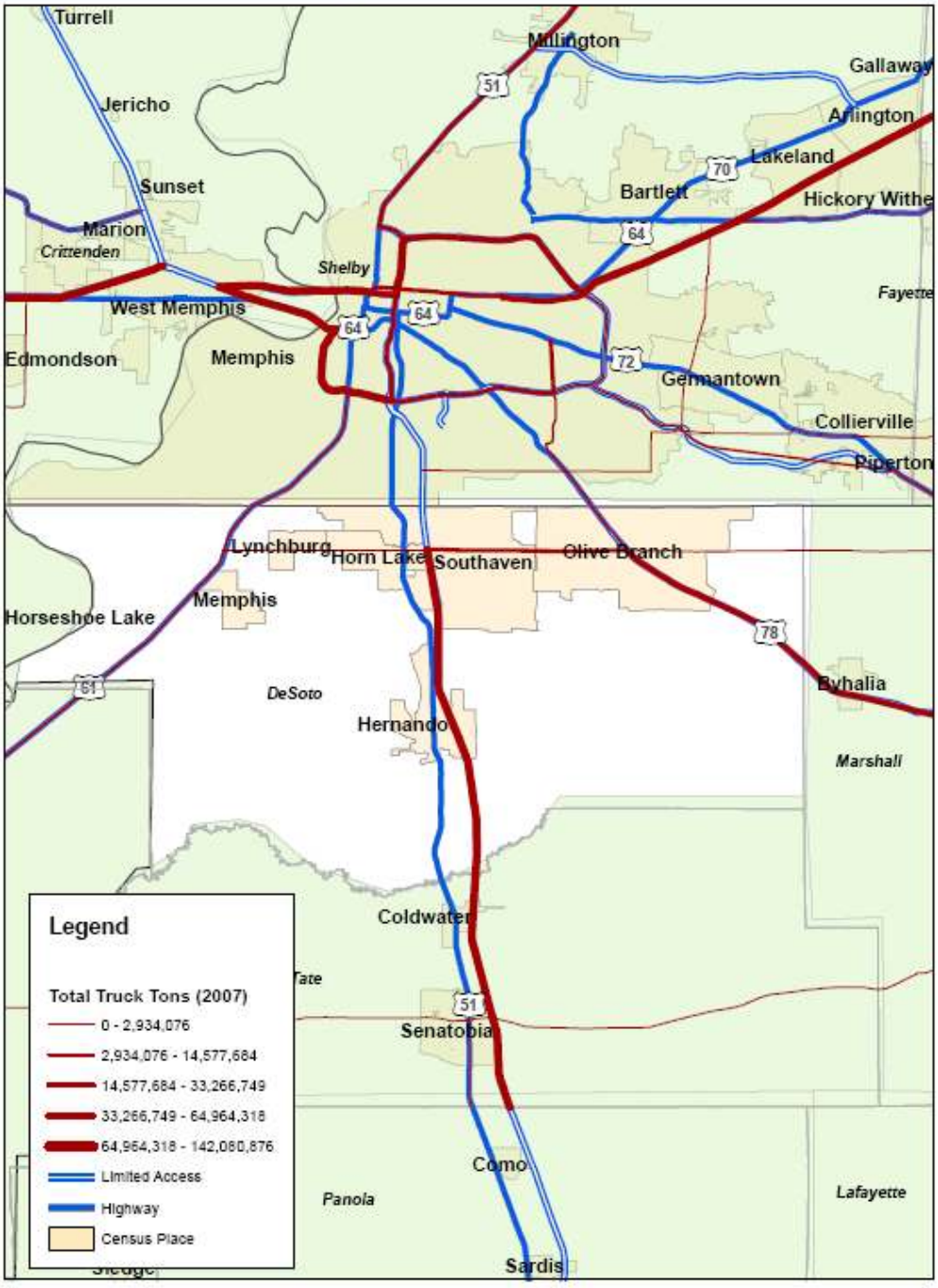


Source: IHS Global Insight TRANSEARCH 2007

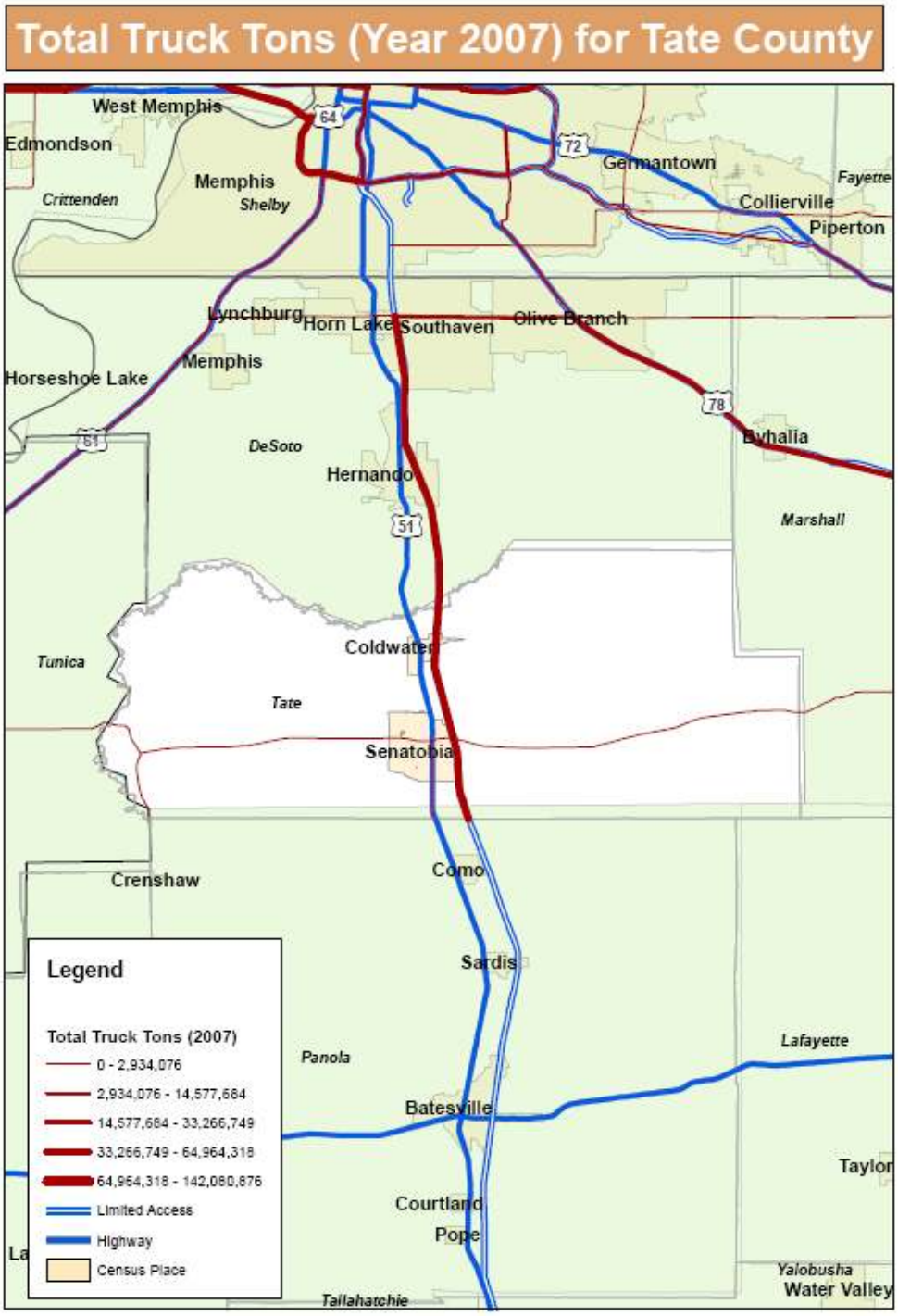


Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for DeSoto County

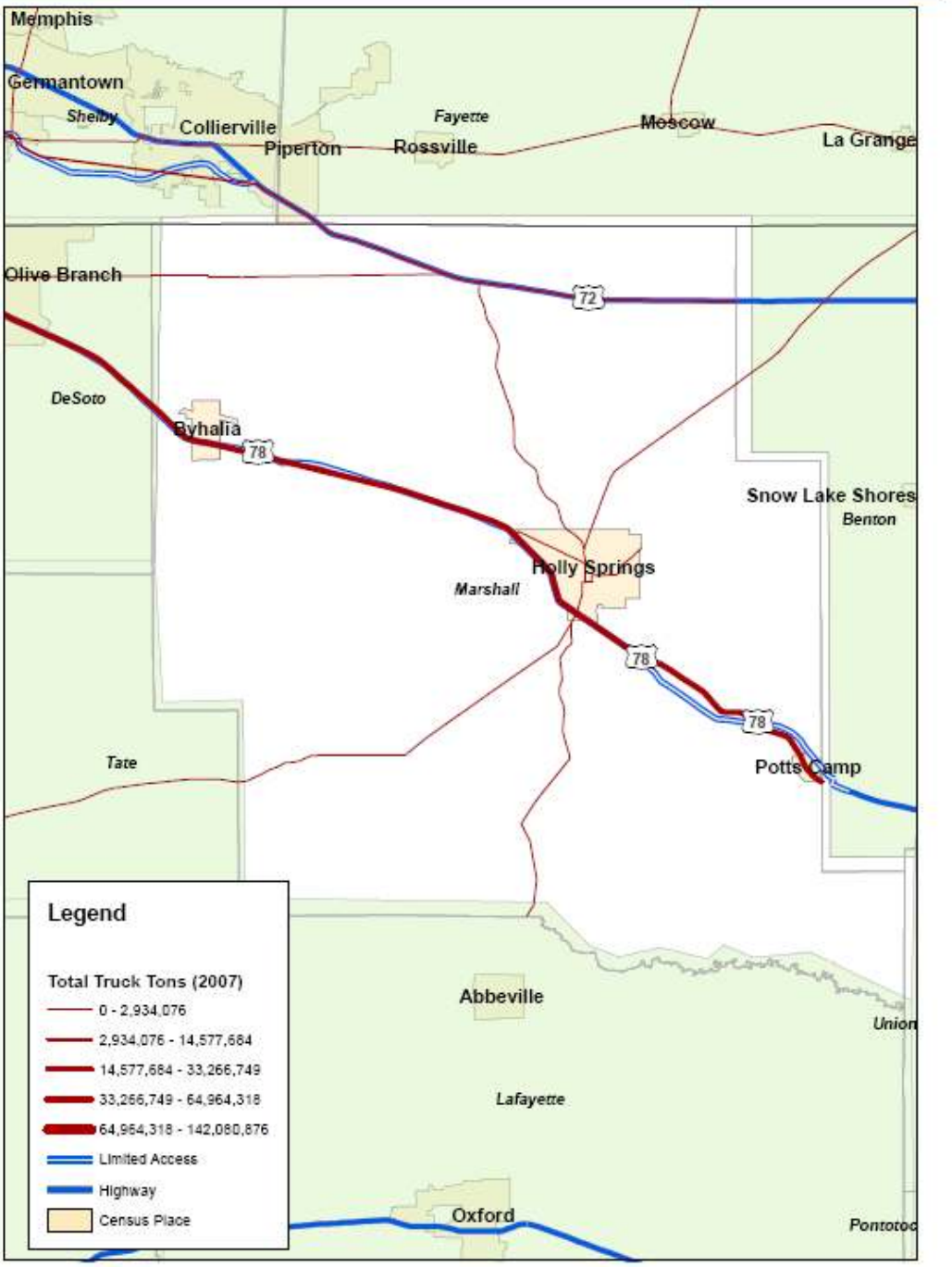


Source: IHS Global Insight TRANSEARCH 2007



Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Marshall County



Source: IHS Global Insight TRANSEARCH 2007

Total Truck Tons (Year 2007) for Crittenden County

Source: IHS Global Insight TRANSEARCH 2007

HIGHWAY CONGESTION BOTTLENECKS IN THE MEMPHIS REGION

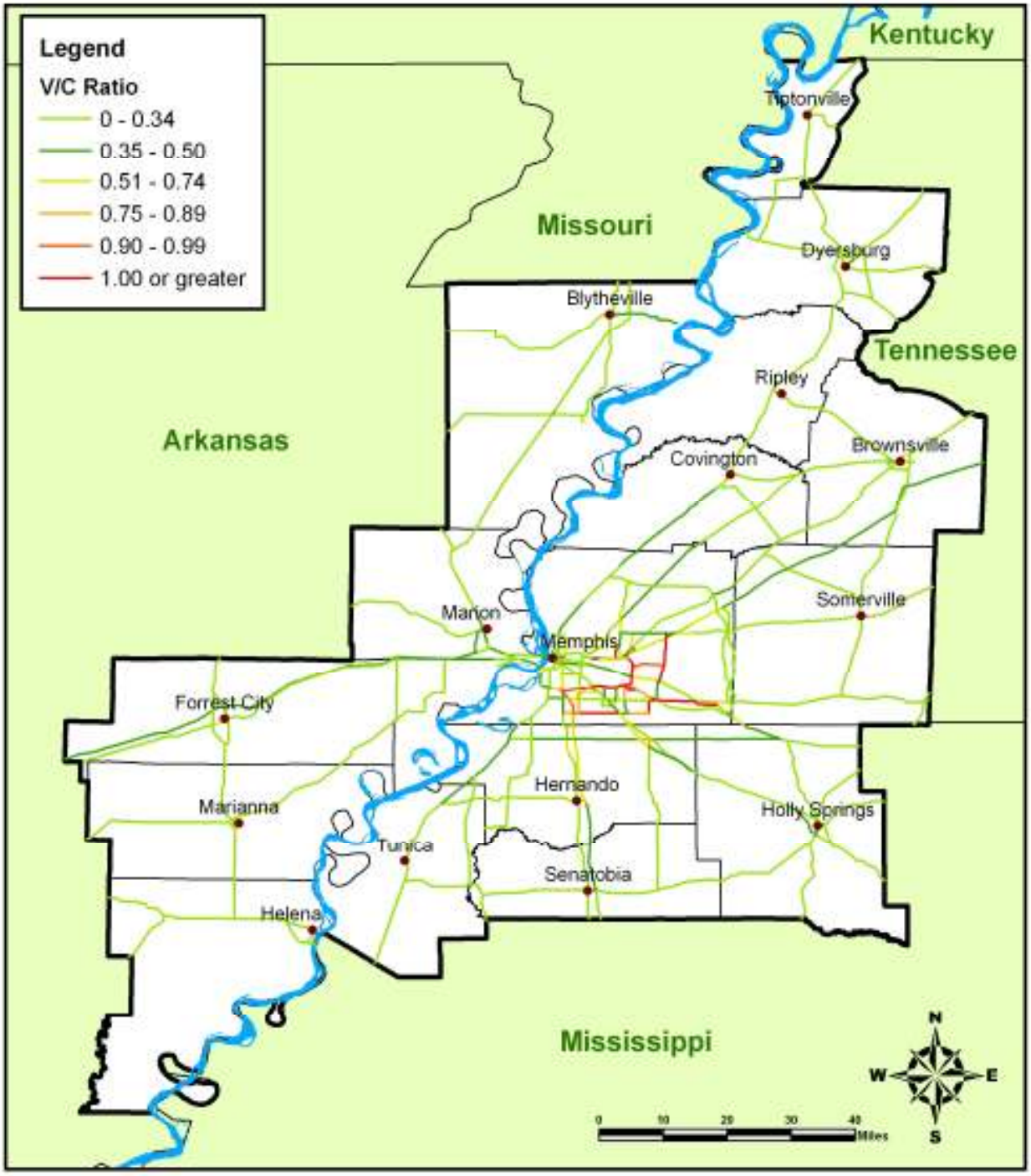
To better assess highway infrastructure improvements in the study area, the level of congestion on the region's major interstate and arterial highways was calculated using volume-to-capacity (v/c) ratios, defined as the ratio of flow rate to capacity for a given transportation artery. The ratio is calculated by dividing the traffic volume of a roadway segment by its theoretical capacity. A v/c ratio of 0.8 to 0.9 means a facility is nearing its capacity and moderately congested. A v/c ratio of 0.9 to 1.0 means that a facility is at capacity and experiences heavy congestion. A v/c ratio greater than 1.0 means the highway is above capacity and experiences severe congestion.

The map below shows v/c ratios for the study area by color. Green represents a low v/c ratio (minimal congestion) and progresses from yellow to red, which represents the highest v/c ratio (high congestion levels). Routes with v/c ratios of .9 or greater are significant bottlenecks and reduce the efficiency in which the freight system operates. Roadway segments in Memphis that meet these criteria include:

- I-55: from South 3rd Street (SR 14) to Stateline Road
- I-240: between Jackson Avenue and Poplar Avenue downtown and from I-55 to I-40
- Nonconnah Parkway/Bill Morris Parkway (SR 385): from I-240 to Germantown Road
- Germantown Road (SR 177): from Stage Road to Nonconnah Parkway (SR 385) and from Winchester Road to East Shelby Drive
- Stratford Road/Covington Pike (SR 204): from Summer Avenue to I-40
- East Shelby Drive (SR 175): from Elvis Presley Boulevard to I-55, Airways Boulevard to Lamar Avenue, and South Mendenhall Road to Germantown Road
- Lamar Avenue (US 78) from the Tennessee/Mississippi state line to I-240
- Walnut Grove Road: I-240 to Germantown Road
- Winchester Road: portions from Airways Boulevard to Plough Boulevard, Lamar Avenue to Perkins Road, and Germantown Road to US 72
- Riverdale Road: from Nonconnah Parkway to East Shelby Drive

All of these congested roadways are located in Shelby County, which is not unusual since congestion levels are typically highest in more urbanized areas. While there are likely spot locations of congestion outside Memphis and its immediate surrounding communities, they are not considered congested since v/c ratios are calculated using average Annual Daily Traffic which includes both peak and off-peak traffic conditions. For example, there are a number of intersections in high employment areas outside the urban area in the study area that experience peak hour congestion due to the large number of employees coming into and going out of the area. However, the average ADT for the intersection or roadway would not be high enough for this segment to be considered congested.

HIGHWAY CONGESTION MAP, MEMPHIS STUDY AREA



Source: CIFTS

MEMPHIS CONNECTIVITY ANALYSIS

Expected increases in local freight traffic near intermodal terminals, growing Aerotropolis activity at Memphis International Airport, and more multi-modalism in the global supply chain, mean the region's highway network needs to be examined in relation to its ability to provide connectivity between major freight nodes in the region. Located in a metropolitan area with major air freight, intermodal, and trucking facilities, the Memphis highway network must effectively link these freight nodes to its warehouses, shippers, receivers, and logistics firms.

To identify which roads contribute to the region's freight connectivity, an analysis was conducted to identify roads used when driving between each of the following freight facilities in Memphis:

- Four rail intermodal terminals: BNSF (Lamar Avenue), UP (Marion, Arkansas), proposed NS (southwest Fayette County, Tennessee), and the Memphis Gateway Terminal (CSX and CN) at Pidgeon Park
- Memphis International Airport and The International Port of Memphis
- The top 10 Memphis freight shippers
- The top 10 public warehouses
- The top 10 truck terminals.

By calculating the most direct route between each of these facilities, a listing of highways that support freight connectivity in the region was compiled. Based on this analysis, the following arterials are critical for freight connectivity in the region (an asterisk indicates that segments of these arterials also had v/c ratios greater than 0.9 as calculated in the prior section of this chapter):

- Plough Boulevard
- Airways Boulevard
- Winchester Road*
- Brooks Road
- Democrat Road
- Jack Carley Causeway
- West Trigg Avenue
- Interstate 55*
- Interstate 40
- Interstate 240*
- McLemore Avenue
- South Parkway
- Riverside Boulevard*
- New Getwell Road
- Lamar Avenue (US-78)
- Shelby Drive*
- Nonconnah Parkway*
- US-72 (Poplar Ave.) east of Nonconnah Parkway
- US-64 (Stage Road)
- Kuhn Road
- Riverport Road
- New Horn Lake Road
- Florida Street.

Truck-volume estimates discussed earlier in this section, together with v/c ratios, stakeholder interviews, and the above connectivity analysis will be the basis for determining roadway infrastructure

recommendations identified in the next chapter. They will include both physical improvements (i.e., lane widening and interchange improvements) as well as "intelligent" systems utilizing technology to mitigate congestion in key freight corridors.

MEMPHIS CONNECTIVITY ANALYSIS MAP

Source: CIFTS

MEMPHIS AIR CARGO INFRASTRUCTURE EVALUATION

As the home to the FedEx Corporation, the economic impact of air cargo infrastructure in the region is substantial. According to a 2009 study conducted by the Sparks Bureau of Business and Economic Research at the University of Memphis[37], air cargo at the Memphis International Airport generated $27.1 billion for the region's economy and provided, directly or indirectly, 208,319 jobs, almost one of every three jobs in the region.

The study demonstrates the concept of the Memphis region being an "Aerotropolis," or an airport-integrated region extending outward from a hub airport in strings and clusters of airport-dependant businesses along with associated residential and commercial complexes. The term was originally coined by John Kasarda, PhD, of the Kenan Institute of Private Enterprise at the University of North Carolina[38] and was first introduced to Memphis in the Memphis International Airport's 2006 Annual Report. It is now a key component of the Memphis Chamber's Fast Forward Initiative.

Given the large scale of FedEx's Superhub, Delta Airlines hub activity at the airport, and the large number of distribution centers utilizing the airport, the region has adopted the name of "America's Aerotropolis". Based on Dr. Kasarda's analysis of Memphis[39] Aerotropolis is comprised of three different levels of development:

1. **The Airport** is the multimodal, multifunctional engine of the Aerotropolis.

2. **Airport City** is the airport enterprise plus nearby aviation-linked commercial developments. In Memphis, the Airport City area would be a region within approximately a five-minute drive from Memphis International Airport.

3. **The Aerotropolis Region** is an "airport-integrated" region extending up to 25 miles outward from the airport, composed of strings and clusters of airport-linked business and their associated residential complexes (largely along or near airport transportation corridors). In Memphis, this initially extends approximately for a 15-20 minute drive from the airport.

Within the context of Aerotropolis, three tasks were undertaken to evaluate the region's air cargo infrastructure:

1. An overview of the air cargo industry was developed, including air cargo service options and a listing of air freight transportation providers in the region.

2. Benchmarking analysis to determine which of the region's airports can support air fright operations.

3. A review of air freight forecasts in relation to the Memphis International Airport's Master Plan.

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[37] "Intermodal Freight Transportation Assets and Needs and Economic Development Opportunities in the Area of the Memphis International Airport", Sparks Bureau of Business and Economic Research/Center for Manpower Studies at Fogelman College of Business and Economics, The University of Memphis, 2009

[38] http://www.aerotropolis.com/aerotropolis.html

[39] "From America's Distribution Center to America's Aerotropolis", Executive Summary, John D. Kasarda, Ph.D., April 2008

AIR CARGO INDUSTRY OVERVIEW

In 2007, the U.S. air freight and express market activity was valued at $103 billion, $34 billion in domestic air freight and $69 billion in international. The International Air Cargo Association estimates the industry transports 40% of world trade by value, but only 2% by weight, reflecting the higher value, relatively light-weight or time-critical commodities that especially benefit from the increased speed of air cargo shipping. Major air cargo commodities handled by FedEx, which accounts for over 90% of air cargo freight at Memphis International Airport, are shown broken down by import and domestic commodities[40].

Air Cargo Services Options

There are four primary distribution channels for air freight: all cargo carriers, integrated express operators, commercial airlines, and freight forwarders.

1. **All Cargo Carriers.** All cargo carriers operate airport-to-airport air cargo and freight services for their customers, but do not offer passenger service. All cargo carriers include Polar Air Cargo, Atlas Air, and Kalitta Air Cargo. These carriers offer scheduled service to major markets throughout the world using wide-body and containerized cargo aircraft. Delta Airlines, a passenger airline with a hub in Memphis, is also one of the world's largest cargo airlines, operating a dedicated fleet of 14 B747F freighters. It is the only U.S. combination carrier (passenger and cargo service) to operate dedicated 747 freighters.

2. **Integrated Express Operators.** Integrated express operators move customers' goods door to door, providing shipment collection, transport via air or truck, and delivery. These companies provide next-day, deferred, and time-definite delivery of documents and small packages (2–70 pounds). Integrated express operators include FedEx Express[41], and UPS, and also transport what is considered heavy freight, i.e., freight more than 70 pounds. Integrated express carriers operate using hub and spoke systems similar to passenger airlines. Integrated air cargo airlines accounted for almost all (99.8%) of freight tonnage at the airport.

3. **Commercial Airlines.** Approximately half of all air cargo shipped worldwide is carried by commercial airlines[42]. Commercial airlines usually provide airport-to-airport service. Freight must be dropped off at the airport by the shipper or the shipper's freight forwarder. Air cargo and freight must be picked up at the destination airport by the customer or the customer's freight forwarder. While there is likely to be a continued market for commercial airline or "belly" cargo, the integrated express carriers have been very successful in expanding their market to capture freight that formerly was the domain of passenger airlines. It is estimated that 5% of U.S. major carrier's revenue comes from cargo[43]. Only a miniscule amount (0.23%) of air freight is transported on passenger airlines at Memphis International Airport, primarily by Delta. Although Memphis is a passenger hub for Delta, it schedules B747F freighter routes at the airport. Delta accommodates air cargo demand in the belly of passenger aircraft and handled an average of 39,400 pounds of freight per day at Memphis International in 2007.

4. **Freight Forwarders.** An air freight forwarder is a company that accepts large and small packages from shippers and consolidates them into container loads. These loads are then transferred to a non-integrated carrier or a passenger airline to deliver to an agent or subsidiary at another airport.

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[40] Figures are for 2008 and supplied by FedEx Corporation.
[41] FedEx has several product types that utilize the FedEx brand name in some form. FedEx Express is the integrated express arm of the company. They provide the "overnight service" synonymous with the brand while FedEx Ground is the trucking division; they operate similar to UPS trucking. FedEx LTL is the Less Than Truckload branch, and FedEx Custom Critical is a truck charter service.
[42] 2006 ACI Airport Economics Survey, Global Cargo Trends, Page 26.
[43] Ibid.

Freight forwarders rely heavily on lifts provided by commercial passenger carriers and have leading gateways near major hub airports, including Memphis International. There are 30 freight forwarders in the Memphis area and over 50 transportation providers, including freight forwarders.

MAJOR AIR FREIGHT COMMODITIES HANDLED BY FEDEX CORPORATION AT MEMPHIS INTERNATIONAL AIRPORT, 2007

Rank	US International -Export	US International-Import	US Domestic
1	Wholesale Trade Durable Goods	Wholesale Trade Durable Goods	Wholesale Trade Durable Goods
2	Instrument-Related Products	Electrical Equipment	Miscellaneous Business Services
3	Electrical Equipment	Machinery Except Electrical	Instrument-Related Products
4	Machinery Except Electrical	Wholesale Trade Nondurable Goods	Engineering & Management Services
5	Miscellaneous Business Services	Furniture & Home Furnishings	Wholesale Trade Nondurable Goods
6	Chemicals, Allied Products	Instrument-Related Products	Miscellaneous Retail Stores
7	Wholesale Trade Nondurable Goods	Miscellaneous Business Services	Trucking & Warehousing
8	Engineering & Management Services	Engineering & Management Services	Machinery Except Electrical
9	Printing & Publishing	Transportation Equipment	Printing & Publishing
10	Transportation Equipment	Trucking & Warehousing	Chemicals, Allied Products
11	Fabricated Metal Products	Apparel & Related Products	Electrical Equipment
12	Trucking & Warehousing	Miscellaneous Manufacturing	Transportation by Air
13	Rubber & Plastics	Rubber & Plastics	Health Services
14	Miscellaneous Retail Stores	Fabricated Metal Products	Apparel Accessories Stores
15	Transportation by Air	Miscellaneous Retail Stores	Furniture & Home Furnishings

Source: FedEx Corporation

U.S. Airport Infrastructure Facilitating Air Cargo Demand

There are relatively few airports in the world that are strictly air cargo airports. Nearly all airports that support the air cargo industry are either passenger airports with extensive cargo activity (such as MEM), or industrial airports where cargo is one of many aviation activities taking place. Commercial, general aviation, and industrial airports can each experience various levels of air cargo activity. An airport's air cargo function or classification can be divided into the following four distinct types. These functional types are not mutually exclusive: local market station, air cargo hub, international gateway, and intercontinental hub.

1. **Local Market Station**. The criteria for a local market station, or direct air cargo service (origin and destination) to an airport's surrounding market area generally coincides with population centers where there is a concentration of industry, commerce, and transportation infrastructure. Often referred to as a node within a cargo carrier's network, the local market station is the simplest and most common type of air cargo facility. These airports represent the "spoke" in a hub-and-spoke air carrier network. For airport-to-airport service providers, the local market station represents the origin or destination point for the cargo they are transporting. Commercial service airports in Nashville, Tennessee, and Little Rock, Arkansas, fall into this category. The sole function of a direct air cargo service facility is to collect from customer's outbound air cargo and distribute customer's inbound air cargo to the airport's surrounding market area.

2. **Air Cargo Hub**. The hub is the backbone of an integrated express carrier since it provides connections to each market in the integrator's system. Each day of operation, flights from around the U.S. arrive at the hub. Once at the hub, packages are unloaded, sorted to the appropriate destination market, and then loaded back onto the appropriate outbound aircraft. The majority of enplaned air cargo traffic at a hub-and-sort facility is generated from the aircraft-to-sort-to-aircraft process. The cargo traffic originating or destined for the local market is often a small percentage of the airport's total enplaned cargo traffic. The market area of this traffic is typically located within a three-hour driving radius of the airport. Memphis International is a national air cargo hub for FedEx. Other hub airports in the United States include Louisville International (where UPS has its national hub), Dallas-Fort Worth International (DFW), Rockford, IL (RFD), Columbia, South Carolina (CAE), as well as Ontario, California (ONT). FedEx operates regional hubs at Indianapolis International (IND), Fort Worth-Alliance, Texas (AFW), and Greensboro, South Carolina (GSO).

3. **International Gateway**. An international air cargo gateway is similar to a hub airport in that the gateway airport is not reliant on the surrounding market area to generate sufficient cargo to justify air cargo operations. The gateway functions as a consolidation, distribution, and processing point for international air cargo. As with the air cargo hub, much of the cargo moving through a gateway airport does not originate and is not destined for the gateway airport's surrounding market area. Memphis International is an international gateway for FedEx. Other airports considered gateway airports include Miami International (MIA), JFK International in New York (JFK), Los Angeles International (LAX), and Chicago International (ORD). Evolving gateway airports include Atlanta-Hartsfield (ATL), Dallas-Fort Worth International (DFW), and Houston Intercontinental (IAH).

4. **Intercontinental Hub**. An intercontinental hub connects two or three continents by air cargo and passenger aircraft and can be located in relatively remote parts of the world, away from dense populations. These airports offer cargo hub capability as well as aircraft service centers for aircraft needing to refuel and change out crews. Only a few airports in the world are considered intercontinental hubs, including Anchorage, Dubai, and Singapore.

FREIGHT TRANSPORTATION PROVIDERS IN MEMPHIS, TENNESSEE, 2008

Transportation Firm	Location	Business Category 1	Business Category 2
AAA Cooper Transportation (ACT)	Memphis, TN	Trucking-Motor Freight	Freight Transportation, General Freight Trucking, Long-Distance, Truckload
Agility Holdings, Inc.	Horn Lake, MS	Freight-Forwarding	Freight Transportation Arrangement, Freight Transportation Arrangement
Allen Lund Co., Inc.	Cordova, TN	Transportation Consultants	Freight Transportation Arrangement, Freight Transportation Arrangement
APL Ltd.	Memphis, TN	Freight Brokers & Agents	Foreign Sea Freight Transportation Trucking Operator-Nonlocal Freight Transportation Arrangement, Deep Sea Freight Transportation
BAX Global	Memphis, TN	Freight-Forwarding	Freight-Forwarding
C. H. Robinson Worldwide, Inc.	Memphis, TN	Trucking-Motor Freight	Freight Transportation, General Freight Trucking, Long-Distance, Truckload
Carmichael International Service	Memphis, TN	Freight Transportation Arrangement	Customhouse Broker & Freight Forwarder
Central Freight Lines, Inc.	Memphis, TN	Trucking, except local	Trucking Operator-Nonlocal
CEVA Logistics	Memphis, TN	Freight-Forwarding	Deep Sea Domestic Transportation Of Freight, Coastal and Great Lakes Freight Transportation
Clark Freight Lines Inc.	West Memphis, AR	Trucking in West Memphis, AR	Trucking Operator-Nonlocal, General Freight Trucking, Long-Distance, Truckload
Comtrak Logistics Inc.	Memphis, TN	Trucking-Motor Freight	Local Trucking Operator Truck Operator-Nonlocal Management Services Local Truck-With Storage, General Freight Trucking, Local
ConGlobal Industries	Memphis, TN	Contractors-Equipment & Supls-	Terminal Maintenance Facilities, Other Support Activities for Road Transportation
Con-Way Freight Inc.	Memphis, TN	Trucking-Motor Freight	Trucking Operator-Nonlocal Local Trucking Operator, General Freight Trucking, Long-Distance, Truckload
Coppersmith Inc.	Memphis, TN	Importers	Freight Transportation Arrangement, Freight Transportation Arrangement
Cornerstone Systems	Memphis, TN	Transportation Consultants	Freight Transportation Agents And Brokers, Freight Transportation Arrangement
D. J. Powers Company, Inc.	Memphis, TN	Freight transportation arrangement	Custom House Broker
Dart Advantage Logistics	Bartlett, TN	Trucking, except local	Trucking Operator-Nonlocal
DHL Global Forwarding	Memphis, TN	Freight-Forwarding	Air Freight Forwarding, Freight Transportation Arrangement
Diversified Global Logistics	Memphis, TN	Freight-Forwarding	International and domestic freight forwarder and customs broker located
DSV Air & Sea Inc.	Memphis, TN	Foreign freight forwarding	Freight Forwarding Services
Estes Express Lines	Memphis, TN	Trucking, except local	Trucking Operator-Nonlocal
Exel Transportation	Memphis, TN	Brokers, shipping	Freight Brokers
Expeditors International of Washington, Inc.	Memphis, TN	Freight-Forwarding	Freight Forwarding, Freight Transportation Arrangement
FedEx Freight	Memphis, TN	Warehouses	Trucking Operator-Nonlocal Truck Rental/Leasing, General Freight Trucking, Long-Distance, Less Than Truckload
FedEx Trade Networks, Inc.	Memphis, TN	Customs Brokers	Freight Transportation Arrangement, Freight Transportation Arrangement

FREIGHT TRANSPORTATION PROVIDERS IN MEMPHIS, TENNESSEE, 2008 (CONTINUED)

Transportation Firm	Location	Business Category 1	Business Category 2
Forward Air, Inc.	Memphis, TN	Freight transportation arrangement	Freight Transportation Arrangement Air Courier Services
H & M International Transportation, Inc.	Marion, AR	Freight transportation	Railroad Freight Contractor
HYC Logistics	Memphis, TN	Customs Brokers	Freight Transportation Arrangement, Freight Transportation Arrangement
JAS Forwarding (USA) Inc.	Memphis, TN	Freight-Forwarding	Freight Forwarding, Freight Transportation Arrangement
Lane Balance Systems	Collierville, TN	Brokers, shipping	Freight Transportation Arrangement
M.G. Maher & Co., Inc.	Memphis, TN	Customs Brokers	Freight Transportation Arrangement, Freight Transportation Arrangement
Maersk Line	Cordova, TN	Freight Transportation Arrangement	Freight Transportation Arrangement
Mallory Alexander International Logistics	Memphis, TN	Freight-Forwarding	Freight Transportation Arrangement General Warehouse/Storage, Freight Transportation Arrangement
Northwest Airlines/KLM	Memphis, TN	Air cargo carrier, scheduled	Scheduled Air Transportation
NYK Logistics	Memphis, TN	Freight Brokers & Agents	Freight Transportation Arrangement, Freight Transportation Arrangement
Old Dominion Freight Line / ODFL	Memphis, TN	Trucking-Motor Freight	Transportation Services, All Other Support Activities for Transportation
Panalpina, Inc.	Memphis, TN	Foreign freight forwarding	Freight Transportation Arrangement
PBB Global Logistics (Corporate)	Memphis, TN	Customs Brokers	Freight Transportation Arrangement, Freight Transportation Arrangement
Pilot Air Freight Services	Memphis, TN	Air Freight Transportation	Air Freight Transportation
QW Express	Memphis, TN	Truck transportation brokers	Freight Transportation Arrangement
Saia Motor Freight	Memphis, TN	Trucking	Trucking Operator-Nonlocal, General Freight Trucking, Long-Distance, Truckload
Schneider National, Inc.	West Memphis, AR	Trucking	Local Trucking-With Storage, General Freight Trucking, Local
Seko Worldwide	Memphis, TN	Transportation Services	Air Courier Services, Couriers
Service By Air, Inc.	Memphis, TN	Air Cargo Service	Scheduled Air Transportation, Scheduled Freight Air Transportation
Southern States Forwarding, Inc.	Memphis, TN	Customs Brokers	Freight Transportation Arrangement, Freight Transportation Arrangement
Team Worldwide (Air, Land, & Sea Solutions)	Memphis, TN	Air Cargo Service	Scheduled Air Transportation, Scheduled Freight Air Transportation
Towne Air Freight	Memphis, TN	Air Cargo Service	Truck Operator-Nonlocal Air Courier Service Airport/Airport Services Nonscheduled Air Trans Scheduled Air Transport, General Freight Trucking, Long-Distance, Truckload

FREIGHT TRANSPORTATION PROVIDERS IN MEMPHIS, TENNESSEE, 2008 (CONTINUED)

UPS Supply Chain Solutions	Memphis, TN	Freight Transportation Arrangement	Freight Transportation Arrangement
UTi Integrated Logistics	Memphis, TN	Trucking	Trucking Operator-Nonlocal, General Freight Trucking, Long-Distance, Truckload
V. Alexander & Co., Inc.	Memphis, TN	Freight forwarding	Freight Transportation Arrangement
Vitran Express, Inc.	Memphis, TN	Trucking-Motor Freight	Ltl Trucking, General Freight Trucking, Long-Distance, Truckload
W.W. Rowland Trucking Co., Inc.	Memphis, TN	Trucking, except local	Trucking Operator, Nonlocal Freight Transportation Arrangement Local Trucking Operator

Source: Wilbur Smith Associates

MEMPHIS REGION AIRPORT BENCHMARKING ANALYSIS

Benchmark analysis provides insights on which of the airports in the region contain adequate facilities capable of supporting air cargo aircraft and activity. This analysis is limited to those 20 airports listed in the airport inventory in the previous Memphis Infrastructure Inventory chapter.

Benchmark Analysis – Jet Freighters

The first air cargo benchmark analysis was to ascertain the minimum facility requirements for air cargo operations using jet freighters. These freighters comprise wide-body or narrow-body aircraft and typically are passenger aircraft converted for air cargo use (see examples below). Wide-body aircraft were formerly configured with two passenger aisles, typically operate at major metropolitan airports, and are used on both short domestic and long transoceanic international routes. Narrow-body aircraft contained a single passenger aisle, serve smaller metropolitan areas, and used primarily on domestic routes.

EXAMPLES OF WIDE-BODY CARGO AIRCRAFT

BOEING B747[44]

BOEING 777F

AIRBUS A380

EXAMPLES OF NARROW-BODY CARGO AIRCRAFT

DOUGLASS DC9-15

MCDONNELL DOUGLAS MD-80

BOEING B727-100

Source: Wilbur Smith Associates

Each of the 20 airports in the region was compared with the following minimum facility standards for cargo jet aircraft:

[44] Please note that the Boeing 787 is excluded. The Boeing 787 is currently a passenger aircraft, with a freighter version not expected to be available for 10-15 years.

Runway Length – A minimum runway length of 7,500 feet is required for takeoff and landing distances for both wide-body and narrow-body jet aircraft.

Full-Length Parallel Taxiway – Full-length parallel taxiways allow for quick access to each runway end without taxiing on the runway. Parallel taxiways also improve airport traffic efficiency and safety. Full-length parallel taxiway system is a required criterion for wide-body and narrow-body cargo jet service.

Precision Approach – Precision approaches assist pilots to land in poor weather and visibility. These approaches involve instrument approach and landing using precision lateral and vertical guidance with minimal standards as determined by the category of landing approach (lateral and vertical guidance refers to the guidance provided either by a ground-based navigation aid or computer-generated navigation data displayed to the pilot of an aircraft). Most air cargo carriers will not operate at airports without a precision approach.

Airport Access – Truck access to airports is critical in jet-cargo operations. For this analysis, a distance of 15 miles or less to an interstate highway was considered acceptable for access to an air cargo airport. In addition, access roads to the airport must be four lanes or greater to ensure efficient traffic flow in the airport's environs.

Acreage – Air cargo operations require airports of considerable size for future growth, control of land use surrounding the airfield, and the ability to provide a buffer from non-aviation uses. An airport of 400 acres or greater in size is considered sufficient to meet this criteria.

Using the above criteria, three of the 20 airports in the study area support cargo jet aircraft:

- Memphis International Airport in Memphis, Tennessee
- Arkansas International Airport in Blytheville, Arkansas
- Millington Regional Jetport in Millington, Tennessee.

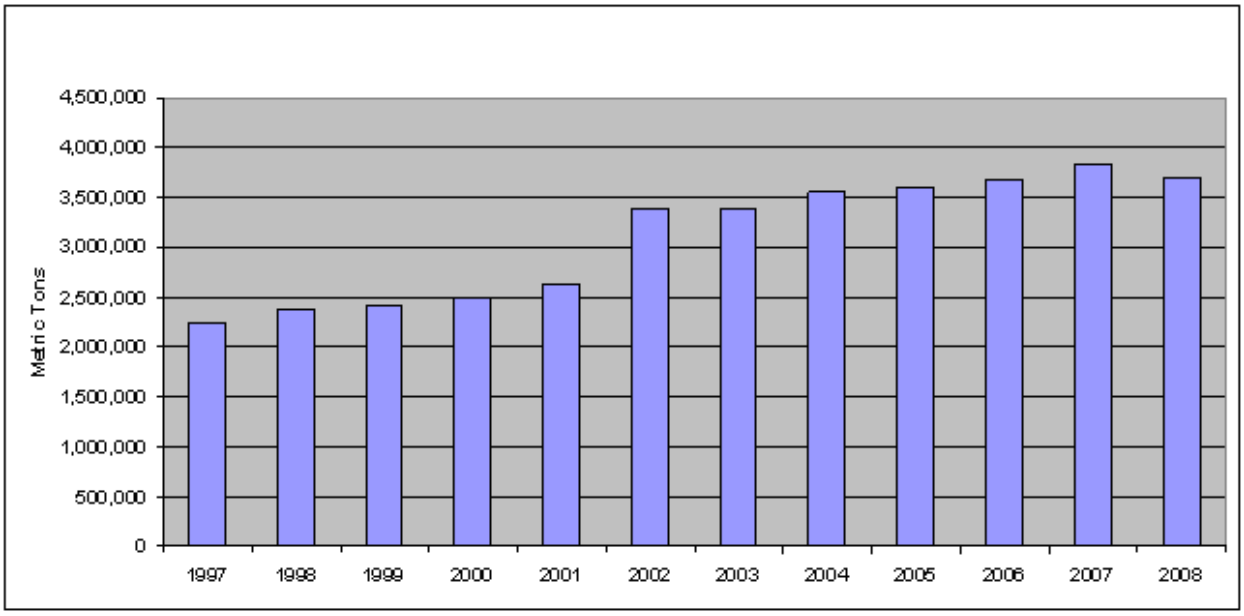
Runway length was the key criteria that eliminated nearly all the airports from consideration. The exception is Tunica Municipal Airport in Tunica, Mississippi, with a runway length of 8,500 feet. It did not meet the criteria for interstate highway access, four-lane access roads, or airport size, however. The three airports that met the benchmark analysis are discussed briefly below.

1. **Memphis International Airport -** Memphis International Airport is the region's major commercial service, public airport located three miles south of the central business district of Memphis. It is owned and operated by the Memphis-Shelby County Airport Authority. The airport is home to FedEx's global "SuperHub" and processes a significant portion of the freight carrier's packages. Since 1993, Memphis has been the world's largest cargo airport by volume due to the FedEx's hub, as well as the presence of United Parcel Service's third-largest regional sort facility.

   FedEx Corporation established its freight hub in Memphis in 1973. Its volume at Memphis International would be even higher if it did not divert considerable freight to its regional hubs as a way to manage volume at the SuperHub. UPS increased its presence at Memphis International Airport in 1999, opening a 330,000-square-foot package storage facility on an 84-acre site adjacent to the new third parallel runway. In addition, Delta Airlines operates its third-largest passenger hub in Memphis.

   Memphis International covers an area of 3,900 acres, which contains four paved runways. Air cargo tonnage at Memphis International Airport had an average annual growth rate of 4.3% between 1997 and 2008. Air freight volumes at the airport increased from 2.2 million tons in 1997 to a record-high 3.8 million in 2007. Tonnage declined 3.8% between 2007 and 2008 due to economic conditions and a decline in air cargo freight activity.

TOTAL ANNUAL AIR CARGO TONNAGE AT MEMPHIS INTERNATIONAL AIRPORT, 1998–2008



Source: Airports Council International-North America

In 2008, Memphis International Airport ranked as the number one-cargo airport in the world in terms of volume, as it has for 18 consecutive years. How the airport's facilities compare with other top cargo airports in the United States is shown in the following tables.

WORLD AIRPORT RANKING BY TOTAL CARGO (IN METRIC TONS), 2008

Rank	City	Airport Code	Tons	Change
1	Memphis	MEM	3,695,438	-3.8
2	Hong Kong	HKG	3,660,901	-3.0
3	Shanghai	PVG	2,602,916	1.7
4	Inchon	ICN	2,423,717	-5.2
5	Anchorage	ANC	2,339,831	-17.2
6	Paris	CDG	2,280,050	-0.8
7	Frankfurt	FRA	2,111,031	-2.7
8	Tokyo	NRT	2,100,448	-6.8
9	Louisville	SDF	1,974,276	-5.0
10	Singapore	SIN	1,883,894	-1.8
11	Dubai	DXB	1,824,992	9.4
12	Miami	MIA	1,806,770	-6.0
13	Los Angeles	LAX	1,629,525	-11.9
14	Amsterdam	AMS	1,602,585	-3.0
15	Taipei	TPE	1,493,120	-7.0
16	London	LHR	1,486,260	6.5
17	New York	JFK	1,450,605	-9.8
18	Beijing	PEK	1,365,768	14.5
19	Chicago	ORD	1,332,123	-13.1
20	Bangkok	BKK	1,173,084	-3.9

Source: Wilbur Smith Associates

2. **Arkansas International Airport -** Arkansas International Airport (formerly Eaker Air Force Base) covers 1,100 acres, and has one runway measuring 11,602 feet, the longest runway in Arkansas and the study area. The airport contains 1.5 million square feet of available building space, consisting of commercial, communal, recreational, educational, garage, industrial, office, residential, hangar, and warehousing facilities.

   The airport has certain facilities not available at other airports in the region, such as 5 million square feet of ramp space and six full-size hangars totaling approximately 300,000 square feet. These hangars are large enough to accommodate wide-body aircraft such as a DC-10 or a Boeing 747.

   Between 1993 and 2001, Arkansas International Airport functioned as the Christmas Mail Air Network sort facility for two weeks prior to the Christmas holiday. During this time, 33 cargo aircraft landed each day, and more than 600 workers unloaded mail from the planes, sorted it, and loaded it onto planes for various destinations. After the United States Postal Service (USPS) identified trucking as an alternative to the Christmas Air Network, the Christmas Air Network was suspended in 2002.

3. **Millington Regional Jetport -** Millington Regional Jetport is a public airport in Millington, Tennessee, 16 miles north of Memphis, and designated by FedEx as an alternate airport to Memphis International. As a result, FedEx partially funds the airport's air-traffic control tower operating budget[45].

[45] FedEx Corp. agreed to an extension of its contract with the Millington Airport Authority into at least 2011. http://suburbancommunitynews.com/articles/2008/01/02/millington_star/news/doc477c58da0511c949626110.txt; conversations with airport staff.

The jetport was formerly the Naval Air Station Memphis until 1995, when the 1993 Base Realignment and Closure Commission directed its realignment and re-designation to Naval Support Activity Mid-South. In 1998, the name of the remaining naval base (i.e., non-airfield) was changed to the Naval Support Activity Mid-South (NAVSUPPACT) to better reflect its current mission. NAVSUPPACT is one of the largest single employers in the State of Tennessee, with approximately 6,000 military, civilian, and contractor employees on 1,950 acres. It still provides support to military aircraft visiting the adjacent Naval Support Activity Mid-South.

Millington Regional Jetport covers 400 acres and has one runway. The airport has four corporate hangars, four 10-unit T-hangars, a full Instrument Landing System, Air Traffic Control Tower, and Aircraft Rescue and Fire Fighting Station.

TOP 15 U.S. CARGO AIRPORTS AND THEIR FACILITIES 2007

Airport Name	Airport ID	2007 ACI Cargo USA Rank	Pax Hub	Cargo Hub	Cargo Gateway	Total Air Carriers	Total Air Cargo Carriers	Airport Land Area: in acres	Air Cargo Ramp Available in Acres^	Number of cargo Terminal Buildings	Warehouse Space In Square Feet	Percent Occupied
Memphis International	MEM	1	Yes	Yes		32	17	3,900	176	2	4,200,000	100%
Ted Stevens Anchorage Int'l	ANC	2	Yes	Yes	Yes	56	28	4,500	204	4	200,000	100%
Louisville International	SDF	3		Yes		20	3	1,823	300	2	4,000,000	95%
Miami International	MIA	4	Yes		Yes	92	36	3,320	85	14	2,400,000	95%
Los Angeles International	LAX	5	Yes	Yes**	Yes	106	34	3,706	170	24	2,100,000	98%
JF Kennedy International NYC	JFK	6	Yes		Yes	115	38	4,930	94	37	4,100,000	90%
Chicago O'Hare International	ORD	7	Yes	Yes**	Yes	95	27	7,000	67	15	2,615,433	100%
Indianapolis International	IND	8		Yes**		26	5	12,000	23	5	1,700,000	25%
Newark Liberty International	EWR	9	Yes	Yes**		42	12	2,027	41	11	1,450,000	90%
Dallas/Ft Worth International	DFW	10	Yes	Yes**	Yes	57	20	18,076	52	30	2,600,000	98%
Hartsfield Atlanta International	ATL	11	Yes		Yes	45	17	4,700	58	12	1,800,000	95%
Metro Oakland International	OAK	12		Yes**	Yes	18	4	2,500	38	5	400,000	100%
San Francisco International	SFO	13	Yes		Yes	63	15	6,171	54	11	845,000	100%
Philadelphia International	PHL	14	Yes	Yes**	Yes	21	6	2,302	111	8	67,500	99%
Ontario International	ONT	15		Yes**	Yes	42	16	1,700	52	5	676,000	100%
Average						**55**	**19**	**5,244**	**102**	**12**	**1,943,596**	**90%**

Source: Air Cargo World Airports Directory, Airports Council International (ACI), AirNav.com, Wilbur Smith Associates

^Mullituse ramp area reported by some airports *Foreign Trade Zone **Regional hub Pax = Passenger

Note: The Memphis International Airport owns 3,900 acres (publicly owned) of which the TANG (Tennessee Air National Guard) leases 108 and FedEx leases 648. FedEx owns 3,850 acres adjacent to the airport (on private property) supporting cargo sort operations, trucking and aircraft parking. Combining the facilities creates a 7,750 acre airport/air cargo complex.

Source: Wilbur Smith Associates, CIFTS

TOP 15 U.S. CARGO AIRPORTS AND RELATED INFORMATION 2007

							Distance to in Miles:				
Airport Name	Airport ID	Number of Freight Forwarders	Perishables Facilities	FTZ*	U.S. Customs	USDA	Rail	Ocean Port	Inter-state	Truck Terminal	Inland Waterway Port
Memphis International	MEM	12		Yes	Yes	Yes	3	300	1	3	9
Ted Stevens Anchorage Int'l	ANC	24	Yes	No	Yes	Yes	4	4	None	1	2
Louisville International	SDF	24	Yes	Yes	Yes	Yes	5	1,200	1	5	5
Miami International	MIA	450	Yes	Yes	Yes	Yes	1	8	1	1	2
Los Angeles International	LAX	150	Yes	No	Yes	Yes	17	20	2	4	None
JF Kennedy International NYC	JFK	500+	Yes	Yes	Yes	Yes	7	12	On Site	1	None
Chicago O'Hare International	ORD	500	Yes	Yes	Yes	Yes	1	25	3	3	25
Indianapolis International	IND	17		Yes	Yes	Yes	7	1,200	On Site	On Site	120
Newark Liberty International	EWR	500+		Yes	Yes	Yes	2	1	2	0	1
Dallas/Ft Worth International	DFW	130	Yes	Yes	Yes	Yes	On Site	0	1	On Site	None
Hartsfield Atlanta International	ATL	120	Yes	Yes	Yes	Yes	4	300	0	1	300
Metro Oakland International	OAK	5		No	Yes	No	9	9	2	2	None
San Francisco International	SFO	244	Yes		Yes	Yes	30	15	1	2	30
Philadelphia International	PHL	34			Yes	Yes	5	75	0	5	5
Ontario International	ONT	12		Yes	Yes		On Site	60	3	On Site	None
		132.5					**7.3**	**215.3**	**1.3**	**2.3**	**49.9**

Source: Air Cargo World Airports Directory, Airports Council International (ACI), AirNav.com, Wilbur Smith Associates

TOP 15 U.S. CARGO AIRPORTS AND THEIR AIRSIDE FACILITIES 2007

Airport Name	Airport ID	Number of Runways: Total Number of Runways	Number of Runways: Greater Than 7,500 ft	Longest Runway Length	Longest Runway Width	Parallel Primary Runways	Most Stingent ILS Approach
Memphis International	MEM	4	4	11,120	150	Yes	ILS/DME (CAT. IIIB) RWY 36C
Ted Stevens Anchorage Int'l	ANC	3	3	11,584	150	Yes	ILS (CAT. IIIB) RWY 06R
Louisville International	SDF	2	2	11,890	150	Yes	ILS/DME (CAT. IIIB) RWY 35L
Miami International	MIA	4	3	13,000	150	Yes	ILS (CAT. I) RWY 09
Los Angeles International	LAX	4	4	12,091	150	Yes	ILS/DME (CAT. IIIB) RWY 25L
JF Kennedy International NYC	JFK	4	4	14,572	150	Yes	ILS/DME (CAT. IIIB) RWY 04R
Chicago O'Hare International	ORD	7	6	13,000	200	Yes	ILS/DME (CAT. IIIB) RWY 14R
Indianapolis International	IND	3	3	11,200	150	Yes	ILS/DME (CAT. IIIB) RWY 05L
Newark Liberty International	EWR	3	2	11,000	150	Yes	ILS/DME (CAT. IIIB) RWY 04R
Dallas/Ft Worth International	DFW	7	7	13,401	200	Yes	ILS/DME (CAT. IIIB) RWY 17C
Hartsfield Atlanta International	ATL	4	4	11,890	150	Yes	ILS/DME (CAT. IIIB) RWY 09R
Metro Oakland International	OAK	4	1	10,000	150	No	ILS (CAT. IIIB) RWY 29
San Francisco International	SFO	4	4	11,870	200	Yes	ILS/DME (CAT. IIIB) RWY 28R
Philadelphia International	PHL	4	2	10,506	200	Yes	ILS/DME (CAT. IIIB) RWY 09R
Ontario International	ONT	2	2	12,198	150	Yes	ILS/DME (CAT. III) RWY 26L

Source: Wilbur Smith Associates

BENCHMARK CRITERIA FOR AIRPORTS SUPPORTING CARGO JET ACTIVITY, 2007

Airport Name	Code	Airport Type*	Full Length Runway Greater Than 7,500'	Parallel Taxiway System	Precision Approach	Less Than 15 Miles to Interstate	4 Lane or > Access Road	Airport Greater Than 400 Acres	Meet All Criteria
MEMPHIS INTL	MEM	Commercial Service	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
TUNICA MUNI	UTA	Commercial Service	Yes	Yes	Yes	Yes	No	No	No
CHARLES W. BAKER	2M8	Reliever	No	Yes	Yes	Yes	No	No	No
GENERAL DEWITT SPAIN	M01	Reliever	No	Yes	Yes	Yes	No	No	No
OLIVE BRANCH AIRPORT	OLV	Reliever	No	Yes	Yes	Yes	Yes	No	No
WEST MEMPHIS MUNI	AWM	Reliever	No	Yes	Yes	Yes	No	Yes	No
ARKANSAS INTL	BYH	General Aviation	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
BLYTHEVILLE MUNI	HKA	General Aviation	No	Yes	Yes	Yes	No	No	No
COVINGTON MUNI	M04	General Aviation	No	Yes	Yes	No	No	Yes	No
DYERSBURG RGNL	DYR	General Aviation	No	Yes	Yes	Yes	No	No	No
FAYETTE COUNTY	FYE	General Aviation	No	No	Yes	No	No	No	No
FORREST CITY MUNI	FCY	General Aviation	No	Yes	Yes	Yes	No	No	No
HOLLY SPRINGS-MARSHALL COUNTY	M41	General Aviation	No	No	Yes	No	No	No	No
MANILA MUNI	MXA	General Aviation	No	Yes	Yes	Yes	No	Yes	No
MARIANNA/LEE COUNTY	6M7	General Aviation	No	No	No	No	No	No	No
MILLINGTON RGNL JETPORT	NQA	General Aviation	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
OSCEOLA MUNI	7M4	General Aviation	No	No	Yes	Yes	No	No	No
THOMPSON-ROBBINS	HEE	General Aviation	No	No	Yes	No	No	Yes	No
ARNOLD FIELD	M31	General Aviation	No	Yes	No	Yes	No	No	No
REELFOOT LAKE	0M2	General Aviation	No	No	No	No	No	No	No

* Airports are presented by type. Commercial service airports have scheduled passenger service, reliever airports are general aviation airports which support the general aviation community near busy commercial airports. General aviation airports role is to accommodate the aviation needs of general aviation activity.

Source: Wilbur Smith Associates, CIFTS

Benchmark Analysis – Feeder Air Cargo Facilities

The second benchmark analysis compared each of the region's 20 airports for their ability to support cargo feeder aircraft. Integrated express carriers, such as FedEx and UPS, rely heavily on these aircraft to transport cargo to and from small- to medium-sized markets to cargo jets at other airports bound for cargo hubs. These aircraft comprise of piston and turboprop aircraft often owned and operated by small airlines and contracted with the integrated carriers.

COMMON AIR CARGO FEEDER AIRCRAFT

CESSNA 208 CARAVAN

FAIRCHILD METRO III

SHORTS SH360

Source: Wilbur Smith Associates

The second benchmark analysis compared each of the region's 20 airports to the following criteria for supporting cargo feeder aircraft:

Runway Length – A minimum runway length of 5,000 feet provides required takeoff and landing distances for fully loaded piston and turboprop cargo aircraft.

Precision or Non-Precision Approach – Precision approaches assist pilots to land in poor weather and visibility. A non-precision approach is an instrument approach and landing, which utilizes lateral, but not vertical, guidance. Examples of non-precision approaches that are pilot-interpreted make use of ground beacons and aircraft equipment such as VOR, NDB, and DME, often in combination. Most air cargo feeder operators will not operate scheduled flights to airports lacking a precision or non-precision approach.

Runway Approach Visibility – Visibility is related to the minimum distance a pilot needs to land safely during a precision or non-precision approach, generally a minimum of two miles.

Jet A Fuel – Jet A fuel is used on all jet and turboprop aircraft.

Weather Reporting Equipment – Automated airport weather stations are designed to serve aviation and meteorological observing needs for safe and efficient aviation operations and weather forecasting.

Besides the three airports identified in the previous benchmark analysis, 6 of the 20 airports in the study area meet the above cargo feeder aircraft criteria for air cargo feeder operations:

- Blytheville Municipal Airport in Blytheville, Arkansas
- Covington Municipal Airport in Covington, Tennessee
- Dyersburg Regional Airport in Dyersburg, Tennessee
- Olive Branch Airport in Olive Branch, Mississippi
- Tunica Municipal Airport in Tunica, Mississippi
- West Memphis Municipal Airport in West Memphis, Arkansas.

Runway length was the key criteria that eliminated nearly all the remaining airports. The exception is Fayette County Airport in Somerville, Tennessee, which has a runway length of 5,000 feet, but does not have Jet A fuel available. The above six airports are briefly discussed below.

1. **Blytheville Municipal Airport -** Blytheville Municipal Airport is located two miles east of Blytheville, Arkansas. The airport has a runway length of 5,001 feet and 26 based aircraft. The airport's FBO (fixed base operator) is a full-service facility with aviation fuel, flight training, aircraft rental, aerial tours and aerial sightseeing, aircraft maintenance, pilot supplies, and courtesy transportation.

2. **Covington Municipal Airport -** Covington Municipal Airport is located three miles northeast of Covington, Tennessee. The airport has a runway length of 5,004 feet and 44 based aircraft. The airport provides FBO services such as fuel sales and courtesy transportation.

3. **Dyersburg Regional Airport -** Dyersburg Regional Airport is two miles south of the city of Dyersburg, Tennessee. The airport has a runway length of 5,698 feet and 29 based aircraft. The airport provides FBO services such aviation fuel, aircraft maintenance, catering, pilot supplies, rental cars, and courtesy transportation.

4. **Olive Branch Airport -** Olive Branch Airport is just south of Memphis in Desoto County, Mississippi. The airport has one asphalt paved runway, Runway 18/36, which is 6,000 feet in length and 146 based aircraft. According to the FAA's National Plan of Integrated Airport Systems, Olive Branch Airport is categorized as a general aviation reliever airport.

5. **Tunica Municipal Airport -** Tunica Municipal Airport is a public-use airport located one mile east of the central business district of Tunica, Mississippi. The airport covers an area of 71 acres and has one runway, Runway 17/35, with an asphalt surface measuring 8,500 feet in length.

6. **West Memphis Municipal Airport -** West Memphis Municipal Airport is a city-owned public-use airport located three miles west of the central business district of West Memphis, Arkansas. According to the FAA's National Plan of Integrated Airport Systems for 2007–11, West Memphis Municipal Airport is categorized as a reliever airport. It covers an area of 457 acres that contain one concrete paved runway, Runway 17/35, measuring 6,003 feet in length with 124 based aircraft. FAA data indicates a Cessna 208 operates each weeknight with a flight to and from West Memphis to Columbia, Missouri operated by McNeely Charters.

   The West Memphis Municipal Airport has a full-service FBO offering concierge services, rental cars on the field, courtesy vans, aviation fuels, executive conference room, and meeting facilities. Aircraft maintenance, flight training, and freight and cargo operations are also on the field.

BENCHMARK CRITERIA FOR AIRPORTS SUPPORTING FEEDER AIRCRAFT ACTIVITY

			Cargo Feeder Aircraft & Truck Operations Support Criteria					
						Approach		
			Runway		Precision	Visibility	Airport	Meet
			Greater Than	Jet A	or Non Precision	Less Than	AWOS or	All
Airport Name	**Code**	**Airport Type***	**5,000'**	**Fuel**	**Approach**	**2 miles**	**ASOS**	**Criteria**
MEMPHIS INTL	MEM	Commercial Service	Yes	Yes	Yes	Yes	Yes	**Yes**
TUNICA MUNI	UTA	Commercial Service	Yes	Yes	Yes	Yes	Yes	**Yes**
CHARLES W. BAKER	2M8	Reliever	No	No	Yes	Yes	Yes	No
GENERAL DEWITT SPAIN	M01	Reliever	No	No	Yes	No	Yes	No
OLIVE BRANCH AIRPORT	OLV	Reliever	Yes	Yes	Yes	Yes	Yes	**Yes**
WEST MEMPHIS MUNI	AWM	Reliever	Yes	Yes	Yes	Yes	Yes	**Yes**
ARKANSAS INTL	BYH	General Aviation	Yes	Yes	Yes	Yes	Yes	**Yes**
BLYTHEVILLE MUNI	HKA	General Aviation	Yes	Yes	Yes	Yes	Yes	**Yes**
COVINGTON MUNI	M04	General Aviation	Yes	Yes	Yes	Yes	Yes	**Yes**
DYERSBURG RGNL	DYR	General Aviation	Yes	Yes	Yes	Yes	Yes	**Yes**
FAYETTE COUNTY	FYE	General Aviation	Yes	No	Yes	Yes	Yes	No
FORREST CITY MUNI	FCY	General Aviation	No	Yes	Yes	Yes	Yes	No
HOLLY SPRINGS-MARSHALL COUNTY	M41	General Aviation	No	No	Yes	Yes	Yes	No
MANILA MUNI	MXA	General Aviation	No	Yes	Yes	Yes	Yes	No
MARIANNA/LEE COUNTY	6M7	General Aviation	No	No	No	No	Yes	No
MILLINGTON RGNL JETPORT	NQA	General Aviation	Yes	Yes	Yes	Yes	Yes	**Yes**
OSCEOLA MUNI	7M4	General Aviation	No	No	Yes	No	Yes	No
THOMPSON-ROBBINS	HEE	General Aviation	No	Yes	Yes	Yes	Yes	No
ARNOLD FIELD	M31	General Aviation	No	No	No	No	Yes	No
REELFOOT LAKE	0M2	General Aviation	No	No	No	No	Yes	No

* Airports are presented by type. Commercial service airports have scheduled passenger service, reliever airports are general aviation airports which support the general aviation community near busy commercial airports. General aviation airports role is to accomdate the aviation needs of general aviation activity.

Source: Wilbur Smith Associates

AIR CARGO INDUSTRY FORECAST AND TRENDS

Air cargo traffic fell precipitously in the United States in 2008 as a result of the global recession, a decline that was nearly twice as much as that experienced in 2001 from the 9/11 attacks. The severity of the air freight slump is partially driven by manufacturers seeking to correct large inventory overhangs that emerged in late 2008. For example, the semiconductor assembly industry was severely affected by inventory overhang in 2008, as well as a slowdown in demand for personal computers and cell phones. Many semiconductor manufacturers had built up excess inventory over the last several quarters to protect themselves against possible supply shortages. The economic downturn in the last half of 2008 only compounded this inventory surplus and, as a result, air freight capacity was reduced on routes serving the semiconductor industry.

The lingering decline in air freight is also the result of international shippers switching to maritime containerized shipping. While this mode is a much slower transport alternative, the cost savings are considerable. More importantly, it is unclear if this shift to container shipping will reverse as the economy rebounds. As mentioned earlier in this plan, many air freight shippers are reevaluating their supply chain management in light of uncertain energy prices and higher freight transportation costs in general.

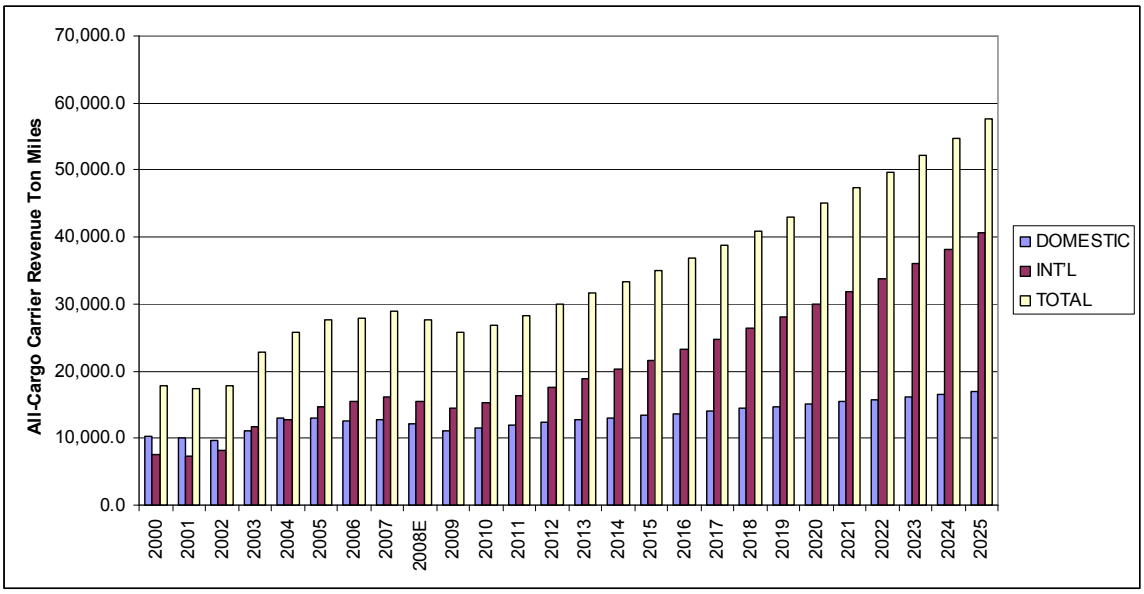
This section provides global and domestic air cargo forecasts and trends as a context for the evaluation of air cargo infrastructure in Memphis. These forecasts are summarized from the Federal Aviation Administration's (FAA) Aerospace Forecast,[46] which ties air cargo activity primarily with gross domestic product (GDP).[47] The FAA forecasts use Revenue Ton Miles (RTMs) as a metric. The distribution of RTMs between passenger carriers and all-cargo carriers (similar to FedEx) was based on an analysis of historic trends in shares, changes in industry structure, and market assumptions. Air cargo forecasts for each of these carriers are summarized below.

- *All-Cargo Carrier Domestic and International RTMs Forecast* -FAA air cargo forecast for all-cargo carriers most directly affects Memphis, since it includes FedEx. Total domestic RTMS for all-cargo carriers are expected to decline 2.8% in 2009, and grow an average 2.8% between 2010 and 2020. International RTMS for all-cargo carriers are forecasted to go down 0.8% in 2009 and grow 6.9% between 2010 and 2020. Domestic cargo growth for all-cargo carriers will remain relatively flat in the future due to a maturing domestic air freight market discussed in more detail below. Nevertheless, International air cargo will experience more robust growth during the forecast period.

- *Passenger Carrier Domestic and International RTMs Forecast* – Domestic RTMS for these domestic carriers are expected to decline 4.4% in 2009 and grow 1.0% between 2010 and 2020. International RTMS for passenger carriers are forecasted to go down 2.1% in 2009 and grow 5.5% between 2010 and 2020. Similar to all-cargo carriers, much of air freight growth for passenger carriers will be in international air freight.

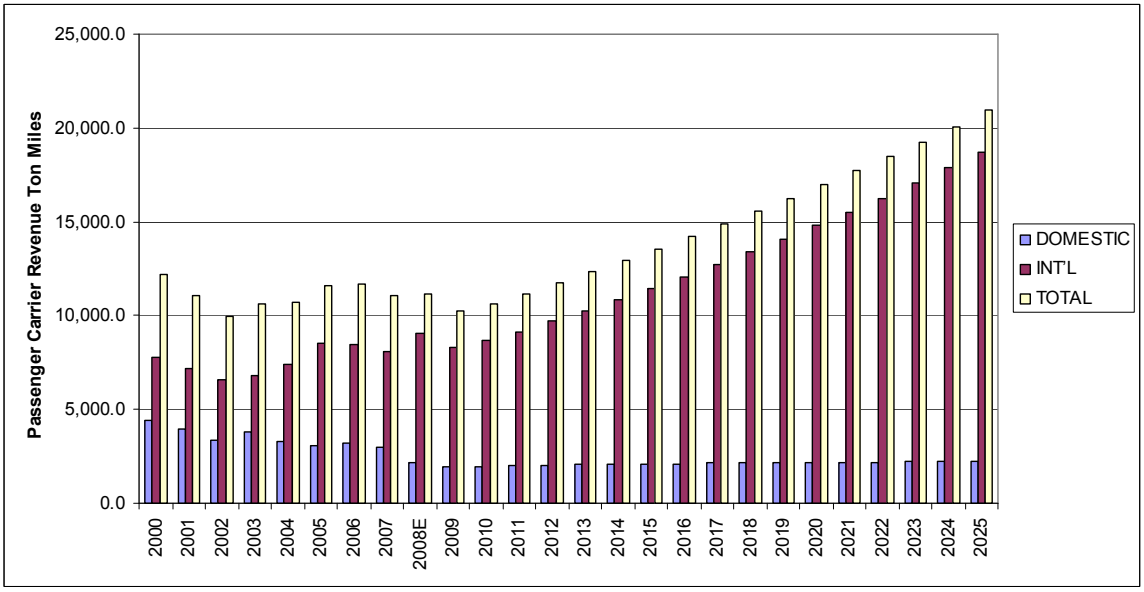
[46] FAA Aerospace Forecast Fiscal Years 2008–2025, page 37.
[47] Other factors the FAA considers include declining real yields, improved productivity, and globalization. Additionally, the FAA takes into consideration changes in air cargo security regulations by the FAA and TSA; market maturation of the domestic express market; modal shift from air to other modes (especially truck); increases in air fuel surcharges; growth in international trade from open skies agreements; use of all-cargo carriers (e.g., FedEx) by the U.S. Postal Service to transport mail; and increased use of mail substitutes (e.g., e-mail and internet bill payments).

AIR CARGO FORECAST FOR ALL-CARGO CARRIERS, 2009–25, IN REVENUE TON MILES (RTMS)



Source: FAA Aerospace Forecast 2009-2025

FAA AIR CARGO FORECAST FOR PASSENGER CARRIERS, 2009-2025, IN REVENUE TON MILES (RTMS)



Source: FAA Aerospace Forecast 2009-2025

The FAA air cargo forecasts indicate a long-term trend of relatively flat growth in the domestic cargo market over the next 15 years. This is due to a maturing market for domestic air freight being caused by several factors:

Vertical Integration – As the air cargo industry itself has matured, the double-digit growth of the 1980s and 1990s has ended leaving many companies looking for vertical integration[48] opportunities. For instance, UPS started as a trucking company and expanded into air cargo, while FedEx began as an integrated express company that is now expanding into trucking through the acquisition of several companies, including RPS and American Freightways. In response to the needs of supply-chain managers, many suppliers of overnight package delivery now offer time-definite cargo services in the form of two- or three-day delivery.

Modal Shift – The shift in focus from integrated express to time-definite service, coupled with financial and cost-saving measures, has led to the increasing use of trucks on longer routes traditionally served by aircraft. This modal shift is particularly pronounced within the integrated express carrier community. Less-than-truckload (LTL) companies have become major competitors to air freight and enjoy significant cost advantages over air cargo carriers because of lower capital costs for equipment and lower wage scales. To compete effectively in this segment, FedEx Express recently formed its own LTL subsidiary, FedEx LTL.

Declining Availability of Belly Space on Domestic Carriers – While half of international air cargo is transported on passenger aircraft in the United States, a small portion of air cargo is carried on domestic passenger aircraft because fewer wide-body aircraft are used on domestic routes. The increased use of regional jets offers limited cargo capacity. Higher load factors, which mean more passenger baggage, further reduce belly cargo capacity. New security rules are anticipated to negatively affect air cargo carried on domestic air carriers when 100% screening takes effect in 2010.

Declining USPS Mail Volume – A number of factors have resulted in changes to the way mail is transported. Historically, mail traveling more than 500 miles was carried in aircraft, but with the proliferation of regional jets reducing air cargo capacity, the threshold for the use of trucking for mail has shifted to 800 miles. In the past, USPS formed several business alliances and capacity agreements with multiple all-cargo carriers, blurring the distinction between postal and private delivery. In addition, the increased use of email and overnight delivery services like FedEx has decreased the amount of mail carried on passenger aircraft by the USPS.

The Memphis Regional Air Cargo Market

As stated previously, Memphis International Airport (MEM) is the predominant air cargo airport in the study area thanks to the level of air cargo activity taking place at FedEx's SuperHub (which handles about 3.3 million packages per day). The benchmark analysis in this chapter identified eight other airports in the region that could compete with Memphis International Airport for air cargo. As part of the Infrastructure Plan's airport evaluation, a survey was conducted to determine the level of air freight activity at these eight other airports:

- *Arkansas International Airport* at one time was utilized by the USPS for the Christmas Mail Air Network.
- *Millington Regional Jetport* is designated by FedEx as an alternate airport to Memphis International, using it when weather conditions at Memphis International are poor.
- FAA data indicates *West Memphis Municipal Airport* once had scheduled cargo feeder activity with a nightly flight to and from Columbia, Missouri.

Based on this analysis, besides Memphis International Airport, no other airport in the study area is known to have scheduled air cargo activity.

[48] Vertical integration is defined as the process in which several steps in the production or distribution of a product or service are controlled by a single company or entity, in order to increase that company's or entity's power in the marketplace.

Memphis Freight Air Infrastructure Assessment

The 16-county Memphis study area contains Memphis International Airport, the world's busiest air cargo airport, two additional airports capable of accommodating scheduled air cargo jet aircraft, and six airports capable of accommodating cargo feeder aircraft activity. Nearly all of the (West Tennessee) region's air cargo is shipped to and from Memphis International Airport, a trend that is expected to continue through the next 12 years.[49]

Based on the above analysis of the region's airports and forecasts of future air freight activity, the region's airport infrastructure is not expected to reach air cargo capacity over the 20-year planning period. This is due to a number of factors:

- Adequate Capacity at Memphis International Airport. Since 1988, the Memphis-Shelby County Airport Authority has invested more than $1 billion in infrastructure, including parallel runways for simultaneous aircraft landing and take-offs. Soon, it will begin work on a 4,000-space parking garage and a new ground transportation center. These investments, in addition to adjustments in operations within FedEx, have created sufficient air cargo capacity at the airport for the foreseeable future. Although the airport's master plan is still in development, there are several positive signs for the airport's long-term commitment to air cargo. In 2007, a new 30-year lease with the Memphis-Shelby County Airport Authority and FedEx increased its total space leased from MEM to 30.5 million square feet. In addition, FedEx continues to focus on improving sort capacity and on utilizing bigger, more fuel-efficient aircraft. The airport supports this with investments in larger ramps (such as the "World Runway") and the necessary taxiway improvements.

- Available capacity at Arkansas International and Millington Regional airports. These two airports are capable of air cargo activity, but not currently expected to be utilized by integrated express carriers for air cargo.

- Other airport capacity for cargo feeder service at six general aviation airports in the study area. While minimal improvements are required in the region's physical air infrastructure, continued emphasis needs to be placed on airport connectivity as delineated in the Memphis Aerotropolis Study. Interviews with various freight stakeholders as part of this Plan found that air-ground cargo transfers at MEM are often impeded by congested roadways in the airport environs. Airport area cargo access, including access to nearby warehouses and distribution centers, is mainly along local arterial roads with frequent intersections. These roads include:

    - Lamar Avenue
    - Interstate 240
    - Airways Boulevard
    - Shelby Drive
    - Winchester Road
    - Holmes Road.

Specific improvements to the above arterials that streamline the flow of air freight and eliminate unnecessary stops will be a major consideration in developing infrastructure recommendations. Moreover, while the Aerotropolis study focuses only on Memphis International Airport, it is important that the role of other airports in the region capable of handing air freight also be examined, and their infrastructure needs addressed, as part of a regional airport systems plan.

[49] Tennessee Airport System Plan 2001, Page 8-24.

MEMPHIS RAIL INFRASTRUCTURE EVALUATION

Among the freight infrastructure factors that make Memphis unique is accessibility to the five Class I railroads listed below. An overview of these carriers and their national system maps were provided in the previous rail inventory chapter:

1. BNSF Railway Company (BNSF)
2. Union Pacific (UP)
3. Norfolk Southern (NS)
4. CSX Transportation (CSXT)
5. Canadian National Railways (CN).

As discussed in the prior infrastructure inventory chapter, 90% of the region's rail network is owned by the above five Class I railroads. As an indicator of the region's growing importance in the national rail freight network, these carriers have invested over $500 million upgrading or constructing new infrastructure in Memphis in anticipation of increased rail volumes, most of it intermodal activity. These rail investments include:

- A total of $100 million by CN to rebuild and upgrade its Johnston Yard freight train switching facility in Memphis.
- A $200 million expansion of the Burlington Northern Railroad's Tennessee Yard, its intermodal terminal facility at Shelby Drive and Lamar Avenue. The expansion doubled the capacity of the terminal to 400,000 lifts.
- Some $129 million by NS for construction of a new 570-acre intermodal facility in the region west of Knox and south of Neville Roads near US-72 in Fayette County.
- A $70-million intermodal terminal by Union Pacific in Marion, Arkansas, 10 miles west of Memphis, with a 370,000-container lift capacity annually.
- $25 million in upgrades to Frank C. Pidgeon Industrial Park by Canadian National Railways and CSX to support joint intermodal terminal operations at Pidgeon.
- Daily through train service by CN between the Port of Prince Rupert, Chicago, and the CN intermodal yard at Frank C. Pidgeon Industrial Park. This service operates on 117-hour schedules and is designed to provide shippers with a shorter, scheduled route with less congestion for moving imported containers inland from Asia to various North America markets.

Note that most rail infrastructure in the region is privately owned and operated. The assessments of the region's rail infrastructure that follow were conducted with the understanding that improvements in capacity are generally part of a rail carrier's capital program with little input from the public sector. A number of public and private partnerships regarding rail infrastructure in Memphis have been proposed, however, particularly involving joint rail facilities where more than one railroad shares infrastructure to achieve operating efficiencies and numerous public benefits. Some of these facilities, and their consideration in the Memphis Regional Infrastructure Plan, are discussed below.

Joint Rail Facilities

While each of the five Class I railroads serving Memphis has invested significant capital in expanding rail infrastructure in the region, these investments have been undertaken with little coordination among the carriers themselves, often resulting in sub-optimal regional planning. As a result, a number of joint rail facilities have been proposed by various public agencies to improve rail operations in the area and minimize congestion. These proposals include:

1. **Frank C. Pidgeon Industrial Park "Super Terminal".** Over $28 million in infrastructure improvements were made at Frank C. Pidgeon Industrial Park. Leaders within Memphis hoped that the park, currently operated by CN and used by CSXT, would serve as a joint rail "super

terminal," serving most, if not all of the five Class I railroads within the Memphis area. One major example of this effort was the recent proposal by the city that NS jointly use the park with CN and CSXT as its proposed intermodal facility. NS officially declined, concerned about distance of the yard from NS mainline and trackage rights over CN. Given recent investments by UP and BNSF, it is also unlikely these carriers would participate in a super terminal at the park.

2. **Memphis Rail Bypass.** Another proposed joint rail facility is the construction of a new rail bypass around the city. Under this proposal, NS and other rail lines would circumvent downtown Memphis through the construction of new trackage. Current lines in the city would be used to support local freight and rail transit. The Mississippi Highway 304 corridor has been proposed as a potential location for this rail bypass. The Memphis bypass proposal was analyzed in the 2003 Tennessee State Rail Plan and found to have a cost-benefit ratio of 0.64, with costs outweighing the benefits.

3. **Third Rail Bridge**. Current rail freight crossing over the Mississippi River uses one of two bridges: the Frisco Bridge operated by BNSF, and the Harahan Bridge, operated by UP. Both bridges are at or close to capacity, carrying up to 80 trains a day. While there are numerous rail operating procedures that can increase bridge capacity, a more serious problem is that both bridges are dated and unable to withstand even a mild earthquake. Various proposals have been put forward to build a third bridge that would combine both rail and motor vehicle traffic. More discussion is required with BNSF and UP to discuss seismic issues regarding current rail bridge river crossings.

Joint rail facilities offer rail carriers significant efficiencies when operating in highly dense trackage areas (such as Chicago) or serving large rail intensive facilities such as ports or industrial parks (i.e. Pidgeon Park). However, aside from these specialized situations, they often pose problems for Class I railroads since they require compromises with a carrier's operating priorities and schedules. As traffic on these railroads continues to grow, and capacity becomes tighter, rail carriers are even more reluctant to invest in joint facilities and possibly lose flexibility in their operations. As a result, the above proposed joint rail facilities, although attractive from a regional perspective, are unlikely to be seriously considered by the carriers themselves and will not be included in the evaluation of the region's rail infrastructure.

In light of the capital investment by rail carriers, this section assesses railroad infrastructure in the study area by reviewing three components that affect rail capacity:

1. Railroad track capacity
2. Railroad terminal capacity
3. Projected rail freight volumes.

In addition, detailed information on each Class I carrier's operating infrastructure in the region is provided.

MEMPHIS RAIL INFRASTRUCTURE – TRACK CAPACITY

The biggest factor in the capacity of a rail network is the extent of single or double tracking. Most of the 838 miles of rail within the Memphis region are single track, with the exception of the BNSF mainline as it passes through Shelby County, and portions of the CN mainline in Shelby County. The impact of single versus double track on the capacity of a rail line varies depending upon a number of other factors, including number of passing sidings, mix of trains that use a segment, topography (track grade, curvature, speed limits), and the dispatch control method used on that segment.

The type of dispatch control on a rail line is the most important factor affecting track capacity and can consist of one of three operating methods:

1. **Centralized Traffic Control (CTC).** A little under half of the route miles within the area are dispatched using Centralized Traffic Control (CTC). With CTC, a central office controls a series of signals and switches that provide trains with the authority to occupy specific areas of track. The

dispatcher can reduce the spacing of trains from what is possible under an ABS system. The computer software of the CTC system is designed to ensure that conflicting authorities cannot be granted. CTC systems are used for high-density rail lines.

2. **Automatic Block Signals (ABS).** A little over a quarter of the route mileage within the region is dispatched by Automatic Block Signals (ABS) system. ABS uses electronic sensors that detect the presence of trains. Combined with control signals, ABS grants or denies a train authority to occupy sections of track, called "blocks." Block length is dictated by train size and distance to stop in a safe manner. ABS systems are controlled by block occupancy and cannot be controlled by a remote dispatcher. ABS systems are used for medium-density rail lines.

3. **Manual Block Dispatching**. A little over a quarter of the route miles in the area are dispatched using manual block dispatching system. Under manual block TWC, a dispatcher must give each train verbal authority to occupy a block. The train crew must repeat that authority to the dispatcher and can then proceed to occupy that block for a given period of time. This system is generally used for rail lines that are less dense, since it requires more time and planning for train crews to verbally communicate with dispatchers.

Within or near rail yards, trains are typically allowed to move at speeds that avoid conflicts. Yardmasters direct trains within yards, but do not provide movement authority as dispatchers do on mainlines. Trains and engines must visually identify each other, in a system analogous to "visual flight rules" in aviation.

MEMPHIS RAIL INFRASTRUCTURE – TERMINAL CAPACITY

As described in the freight inventory section of this Plan, there are nine major rail yards within the Memphis region. Rail terminals and yards perform a range of railroad operating functions and are usually segregated between intermodal and "carload" (i.e., non-intermodal) activities. Carload terminal activities include:

- *Classification* – In a classification yard, cars are sorted into and out of trains. Trains can either be switched on flat ground or in "hump yards," where an artificial "hump" lets gravity push cars onto classification tracks. In a "local" yard, the cars of local shippers are switched into and out of trains. Generally, local yards are smaller than yards that support customers from multiple regions.

- *Transload* – Transload activity at a rail yard involves the transfer of bulk or break-bulk commodities between rail and truck or water. Bulk commodities are those that are shipped in loose condition and of homogeneous nature. Break-bulk cargoes are neither bulk nor containerized.

- *Interchange* – Cars from one rail carrier are delivered to or received by another rail carrier.

- *Car inspection, car and locomotive repair*

- *Train-crew change*

There are seven major carload terminals in the Memphis region. In addition to these terminals, there are four intermodal terminals where intermodal containers and trailers are transferred between railcars and trucks. One of these terminals at Pidgeon Park is jointly operated by two railroads and two other intermodal terminals (BNSF Tennessee yard and NS Forrest Yard) share their property with the carload activities described above. However, even within these two yards carload and intermodal operations are completely segregated[50].

RAIL TRANSLOAD FACILITIES IN THE MEMPHIS STUDY AREA

Transload Facility Name	City	State	Associated Railroad
Barfield Elevator	Blytheville	AR	BNSF
Global materials services-Memphis, TN	Memphis	TN	CN
GST (greater south transportation) Memphis, TN	Memphis	TN	CN
CN Memphis distribution center	Memphis	TN	CN
Transwood, Inc. - Memphis, TN	Memphis	TN	BNSF
Transtore, Inc. - Memphis, TN	Memphis	TN	BNSF
Transload of Tennessee - Memphis, TN	Memphis	TN	BNSF
Supreme Distribution Services, Inc. - Memphis, TN-423	Memphis	TN	BNSF
Supreme Distribution Services, Inc. - Memphis, TN-379	Memphis	TN	BNSF
Supreme Distribution Services, Inc. - Memphis, TN	Memphis	TN	BNSF
Meritex Logistics - Memphis, Inc. - Memphis, TN	Memphis	TN	BNSF
Mallory Distribution Centers, LLC - Memphis, TN	Memphis	TN	BNSF
AAA Warehouse Logistics - Memphis, TN	Memphis	TN	BNSF
Supreme Distribution Services, Inc.	Memphis	TN	BNSF/CN/UP
Southern Warehouses, Inc.	Memphis	TN	BNSF
Mallory Distribution Center	Memphis	TN	BNSF
Natchez Adam County Port Commission	Natchez	MS	CN
Mid-South Bulk Services, Inc. - West Memphis, AR	West Memphis	AR	BNSF
Global Material Services (GMS) - West Memphis, AR	West Memphis	AR	BNSF

Source: Wilbur Smith Associates

As shown on the following table, intermodal terminals in Memphis have a total annual lift capacity of over 2 million trailers/containers.

RAIL INTERMODAL TERMINAL CAPACITY IN THE MEMPHIS STUDY AREA

Railroad	Intermodal Terminal	Acres	Annual Lift Capacity (# of Units)	Investment (million $)
NS	Current: Forrest Yard (Memphis, TN)	50	123,000	N/A
	Proposed: Southwest Fayette County, TN	570	327,000	$129
BNSF	Tennessee Yard (Lamar Ave.)	185	1,000,000	$200
UP	Marion, AR	600	375,000	$70
CN/CSX	Frank C. Pidgeon Industrial Park	155	200,000	$25
	Total	**1,560**	**2,025,000**	**$424**

Source: Railroad Press Releases

[50] NS will end intermodal activity at Forrest Yard with construction of its new intermodal yard in Fayette County. This will eliminate approximately three trains a day along Poplar Avenue in Memphis.

Memphis Region Rail Freight Flows

Current and forecasted rail freight flows within the Memphis study area were analyzed to assess future rail infrastructure requirements in the region. The source of the data is the U.S. Surface Transportation Board's (STB) waybill sample, a stratified sample of carload waybills for terminated shipments by railroad carriers. Because the waybill sample includes proprietary information that could identify confidential relationships between carriers and shippers, this data has been aggregated to show total rail traffic in, out, within, and through the Memphis region.

Forecasts have been prepared based on IHS Global Insight's economic models, purchased by the Tennessee Department of Transportation (TDOT). Because the data come from the Tennessee DOT, they only include rail freight that traveled within Tennessee. UP and BNSF traffic between Arkansas and points west was not included in this data, although it enters and exits the study region. The data, however, is illustrative of the current and expected flows of traffic in the region.

Rail traffic is particularly dense on the BNSF Thayer South Subdivision, which enters the region at Crittenden County. Traffic on this line exceeds 1 million gross ton-miles per mile (MGTM), the U.S. Federal Railroad Administration's (FRA) highest-density rating. The CN Yazoo Division, which enters the region in Tunica and Tate Counties, carries between 40.0 and 59.8 MGTM per year, as does the NS Memphis West End District, which enters the area in Fayette County.

Carload, non-intermodal rail traffic constitutes 90% of the volume and 55% of the units. Almost half of the carload traffic is overhead, i.e. it passes through the region. Over 860,000 intermodal units originated or terminated in the region in 2007 and are expected to more than double by 2035 to two million units. This increase in intermodal trailers and containers will put increased pressure on the region's highway system that serves rail intermodal facilities, particularly Lamar Ave (BNSF) and the major arterial highways in southern Fayette County, site of the new Norfolk Southern intermodal terminal. Total carload traffic is only expected to increase by 27%.

FORECASTED RAIL FLOWS FOR MEMPHIS REGION (TENNESSEE TRAFFIC)

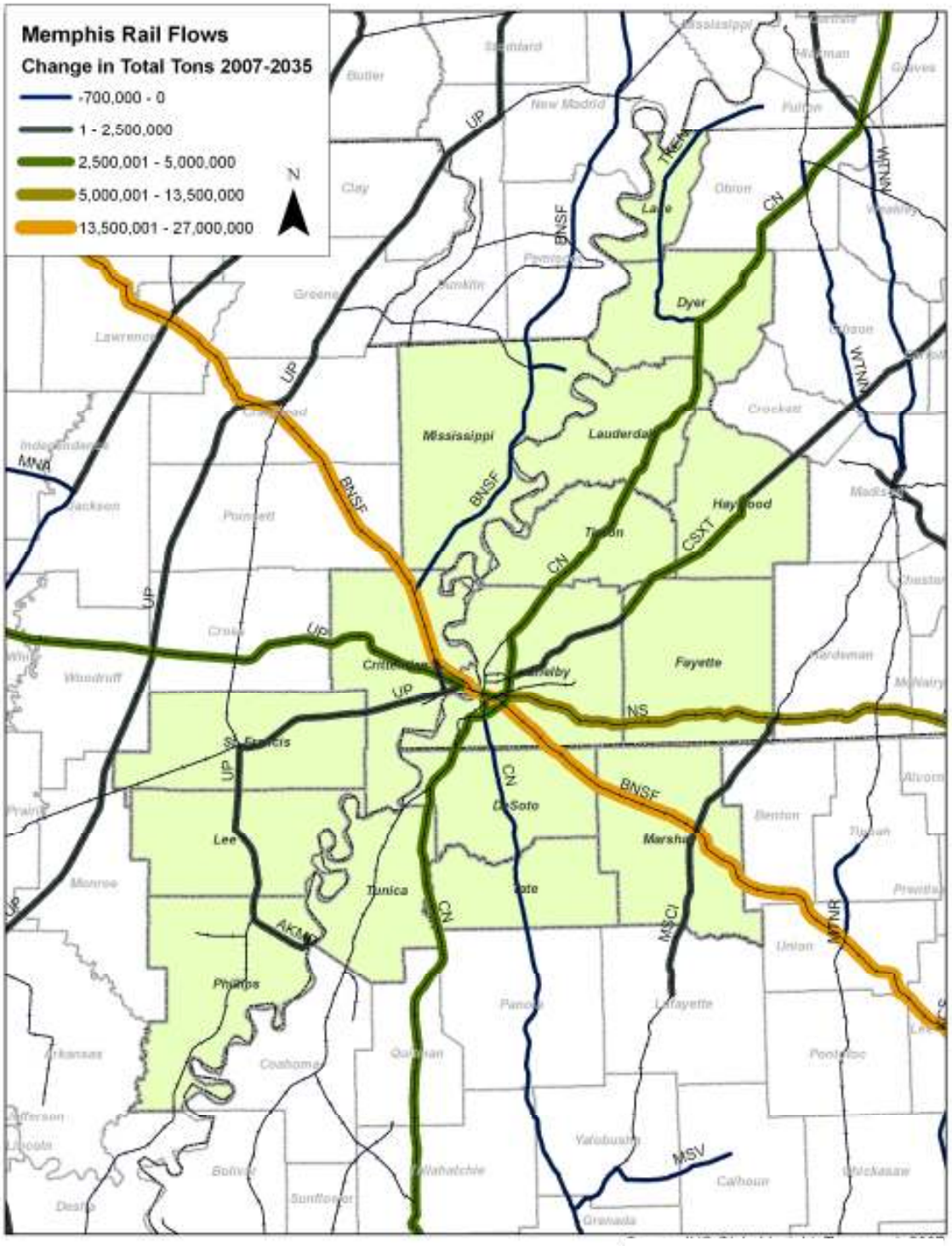
	2007		2035		% Chg Units
Direction	**Tons**	**Units**	**Tons**	**Units**	**2006–35**
Intermodal					
Overhead	1,333,161	104,768	2,497,368	201,973	93%
Inbound	4,691,008	389,534	9,781,431	840,664	116%
Outbound	6,206,382	466,141	15,362,556	1,195,132	156%
Local	68,280	4,920	168,001	12,071	145%
Total	**12,298,831**	**965,364**	**27,809,355**	**2,249,840**	**133%**
Carload					
Overhead	51,592,509	551,592	71,251,489	756,986	37%
Inbound	30,646,746	331,499	32,615,406	362,281	9%
Outbound	25,692,585	272,520	33,853,318	352,962	30%
Local	401,076	8,808	380,217	9,836	12%
Total	**108,332,915**	**1,164,419**	**138,100,431**	**1,482,065**	**27%**
Overall	**120,631,746**	**2,129,783**	**165,909,786**	**3,731,905**	**75%**

Source: IHS Global Insight TRANSEARCH

RAIL TRAFFIC FLOWS IN THE MEMPHIS STUDY AREA, GROSS TON-MILES PER MILE

Source: Wilbur Smith Associates

PROJECTED TONNAGE INCREASES IN RAIL TRAFFIC, MEMPHIS STUDY REGION (TENNESSEE PORTION ONLY)



Source: IHS Global Insight TRANSEARCH

The figure above shows forecasted rail tonnage routed over the region's rail network[51]. The figure projects that the highest rail traffic growth will be on the BNSF mainline followed trackage in the NS Memphis District. Forecasted volume increases on these lines are primarily intermodal traffic traveling to and from new intermodal facilities being constructed by both Class I carriers.

MEMPHIS CLASS I RAIL INFRASTRUCTURE

Because the five Class I carriers constitute a significant portion of the region's rail infrastructure, a more detailed description of each carrier's facilities and operating characteristics within the study area is presented as part of the freight capacity evaluation.

BNSF Railway Company (BNSF)

Memphis is in the BNSF's Springfield Operating Division[52] and composed of three subdivisions: the River Subdivision, which has a northern terminus in St. Louis, Missouri; the Thayer South Subdivision, which has a western terminus in Springfield, Missouri; and the Birmingham Subdivision, which terminates in Birmingham, Alabama. The River and Thayer South Subdivisions join at River Junction and proceed approximately 84 route miles across the Mississippi River over the Frisco Bridge (single track) into Memphis and to BNSF's Tennessee Yard, near the Tennessee-Mississippi state line. From Tennessee Yard, the BNSF runs southeast on its way to its terminus in Birmingham, Alabama (Springfield Division, Birmingham Subdivision) and exits the study area 44 miles later near Potts Camp, Mississippi.

BNSF SUBDIVISIONS IN THE MEMPHIS STUDY AREA

Subdivision	Thayer South	River	Birmingham	Other
Route miles in region	40	53	44	14
Counties where subdivision is located	Crittenden, AR; Shelby, TN	Mississippi, AR; Crittenden, AR	Shelby, TN; Desoto, TN; Marshall, TN	
No. tracks	Single except for 10 miles double track between Mississippi River and Tennessee Yard	Single	Single	Single
Trackage rights to other carriers	NS 2 miles			
Dispatching	CTC	CTC	CTC	Manual/Yard
Trains per day	40 River Jct to Tennessee Yard, 25 – 40 North of River Jct.	8 - 15	20	NA
Maximum speed	55 - 60	55 - 60	55 - 60	NA
Major Access Roads to Intermodal Terminal	US-78 (Lamar Avenue), Shelby Drive, Holmes Rd, Winchester Rd, I-240			

BNSF rail yards in the study region include its new intermodal terminal in its Tennessee Yard on Lamar Avenue. This terminal is undergoing a $200 million improvement that will enlarge the facility from 35 to 185 acres with 8,000-foot-long tracks. BNSF will be using a new gantry crane system, much larger than traditional intermodal gantries, and capable of greater container throughput. Once completed, Tennessee

[51] The forecasted increases in rail tonnage are expressed as "net" tons, i.e. they characterize increases only in rail cargo as opposed to "gross" tons which include the weight of empty and loaded railcars and locomotives.
[52] Railroads are organized into "divisions" which contain a series of rail lines within a geographic area. Each division is comprised of "subdivisions," which represent specific rail lines. NS refers to its subdivisions as "districts."

Yard will have capacity of over 1,000,000 containers per year. Tennessee Yard also serves as the railroad's hump yard classification facility in Memphis.

NEW BNSF MEMPHIS INTERMODAL TERMINAL

Source: Conden Rails; http://condrenrails.com/Recent-Trains/TY/TY%20060-900.jpg

Canadian National Railway (CN)

CN is the largest rail carrier in terms of track miles within the study area. The railroad's principal line is the north-south Chicago-New Orleans mainline. The line enters the study area in Trimble, Tennessee, as the Fulton Subdivision and continues south 83 miles to Woodstock, near Millington, Tennessee. It then passes to the east of downtown Memphis and continues south crossing the CSXT, NS, and BNSF main tracks. Approximately two miles of this route, from the CSXT crossing at Leewood south to Aulon, are owned and controlled by CSXT. The Fulton Subdivision then turns west and ends 19 miles to the southwest at Johnston Yard.

Harrison Yard is the CN's classification yard and part of a major capital improvement project. The railroad is spending $100 million to reconfigure the yard and add a hump. CN acquired 88 additional acres for the upgrade, installing new tracks, switches, support buildings, yard tower, car shop, locomotive servicing area. Between 16 and 20 trains per day operate over the Fulton Subdivision north of Memphis. This includes two daily *City of New Orleans* Amtrak trains.

The Memphis Subdivision extends from the Fulton Subdivision north of downtown Memphis at Woodstock and continues due south through downtown. It passes the Amtrak station (Central Station) and crosses the Fulton Subdivision 16 miles to the south at East Junction near the east end of Johnston Yard. From East Junction, the Grenada Subdivision runs south of Memphis to Jackson, Mississippi. The Grenada Subdivision exits the study area in southern Tate County approximately 39 miles from East Junction. The Yazoo Subdivision begins at the west end of Johnston Yard (West Junction) also destined for Jackson and exits the study area 48 miles from West Junction at the southern end of Tunica County, Mississippi. The Yazoo Subdivision runs parallels to the Grenada Subdivision approximately 20 miles to the west. About 16 trains per day, including Amtrak, operate over the Yazoo Subdivision.

Local CN industrial trackage serves President's Island and Intermodal Gateway Memphis, a new 155-acre intermodal facility located in Frank C. Pidgeon Industrial Park. Gateway Memphis serves as CN's Memphis intermodal terminal which it shares with CSX Intermodal. A small local yard is located at Hollywood just north of Leewood. CN handles about 150,000 containers per year at the Gateway Memphis facility, expected to rise to 180,000 due to the opening of CN's terminal in Prince Rupert.

CN SUBDIVISIONS IN THE MEMPHIS STUDY AREA

Subdivision	Fulton	Grenada	Memphis	Yazoo	President's Island	Other
Route miles in region	102	39	16	48	6	5
Counties where subdivision is located	Dyer, TN; Lauderdale, TN; Tipton, TN; Shelby, TN	Shelby, TN; DeSoto: MS; Tate, MS	Shelby, TN	Shelby, TN; DeSoto, MS; Tunica, MS	Shelby, TN	Shelby, TN
No. tracks	Mostly single, 18 miles double near Memphis	Single	Single	Single	Single	Single
Trackage rights to other carriers	CSXT 19 miles		UP, BNSF 1 mile	CSXT 2 miles	UP, BNSF	
Dispatching	Mostly CTC, 13 miles ABS, 5 miles Manual	ABS	ABS	34 miles CTS, 14 ABS	Manual	ABS
Trains per day	16–20	2	4–10	16	0–2	NA
Maximum speed	60	40	25–40	60	25–40	25–40
Major Access Roads to Intermodal Terminal	River Port Rd, I-240					

CSX Transportation (CSX)

CSX has a single east-west main line that serves the study area, the Memphis Subdivision of the Nashville Division. It enters the region through Haywood County near Bells, Tennessee and runs 67 miles to its terminus in Memphis, Tennessee. The line connects with the remainder of the CSX system in Nashville, Tennessee.

The CSX Memphis Subdivision is single-track and is dispatched by manual, direct traffic control block system (DTC).[53] Sidings, located typically 5 to 15 miles apart, permit trains (up to 20 trains per day), to pass each other. Maximum authorized speeds are 49 miles per hour unless otherwise restricted. Maximum allowable carload weights and clearances are not restrictive.

CSX facilities in the study area include its Leewood classification yard and an intermodal terminal shared with the Canadian National Railroad, the Intermodal Gateway Memphis facility, located in Frank C. Pidgeon Industrial Park. CSX reaches the Park via trackage rights over the CN railway.

[53] The rail line is divided into sections (blocks), and authority to enter and move through a block is given verbally by the train dispatcher.

CSX SUBDIVISIONS IN THE MEMPHIS STUDY AREA

Subdivision	Memphis
Route miles in region	67
Counties where subdivision is located	Haywood, TN; Tipton, TN; Fayette, TN; Shelby, TN
No. tracks	Single
Trackage rights to other carriers	BNSF three miles in Memphis, CN two miles in Memphis
Dispatching	Manual
Trains per day	10–20
Maximum speed	49
Major Access Roads to Intermodal Terminal	Riverport Rd, I-240

Norfolk Southern Railway (NS)

Memphis is the western terminus of NS's Memphis District, part of its Tennessee Division. Connections with the remainder of the NS system are in Chattanooga, Tennessee and Sheffield, Alabama. The line is a component of the carrier's Crescent Corridor initiative as described in Chapter One of the Plan.

The NS mainline enters the study area in Fayette County, Tennessee, near Grand Junction, and runs west approximately 47 miles to downtown Memphis. It is a single-track line that accommodates approximately 30 trains per day. Within the Memphis terminal area, the NS line is a double-track route that is not signalized. The maximum speed limit for intermodal trains is 60 miles per hour while other freight is limited to 50 miles per hour outside of the terminal area. The NS classification yard and intermodal terminal are both located at Forrest Yard and interchange activities are initiated through KC Junction. The railroad recently successfully negotiated the purchase of 465 acres in Fayette County for construction of a new intermodal terminal.

NS SUBDIVISIONS IN THE MEMPHIS STUDY AREA

District	Memphis
Route miles in region	47
Counties where subdivision is located	Fayette, TN; Shelby, TN
No. tracks	Single except for two miles in Memphis terminal area that are double
Trackage rights to other carriers	None
Dispatching	ABS
Trains per day	25–35
Maximum speed	50 (60 intermodal trains)
Major Access Roads to Intermodal Terminal	Spotswood Ave, Airways Blvd

Union Pacific Railroad (UP)

UP serves the study area over the former Southern Pacific Railroad and the former Missouri Pacific Railroad. Three different Union Pacific lines are located in Arkansas, two of which, the Brinkley and the Memphis Subdivisions, join and extend into Memphis over the double-tracked Harahan Bridge and continue to Sargent Yard. In Memphis, UP operates 14 miles of track that circles the city.

The Memphis Subdivision line enters the study area near Earle, Arkansas, in Crittenden County. The Brinkley Subdivision line enters near Wheatley, Arkansas, in St. Francis County. The two lines combined total approximately 85 miles in Arkansas. Both operate at a maximum speed of 60 miles per hour and handling approximately 30 trains per day. The lines serve as a gateway to UP's north-south mainline connecting Texas and Chicago via St. Louis, Missouri.

The third UP line is the Helena Subdivision, part of the Louisiana Division, which enters at St. Francis County near Colt, Arkansas after crossing the Memphis Subdivision. It then crosses the Brinkley Subdivision at Forest City and terminates at Lexa, AR in Phillips County, AR, where it connects with short line Arkansas Midland. The Helena Subdivision is limited to a maximum speed of 49 miles per hour. The Helena Subdivision averages two trains per day.

All three lines are single track with the exception of about five miles of double track where the two east-west lines come together at Briark, Arkansas, before crossing the Mississippi River. The Helena and Memphis Subdivisions are signalized with Centralized Traffic Control. The Brinkley Subdivision is dispatched using ABS signaling system.

UP also operates a branch line, the Tenark Industrial Lead, which splits from the Brinkley Subdivision near Hulbert, Arkansas. The line is four miles long and is dispatched by manual signaling system. The traffic along the line is two or fewer trains per day.

Union Pacific facilities in the study area include the 600-acre Ebony Intermodal Terminal located near Marion, Arkansas, and Sargent Yard, a classification and interchange facility located at KC Junction in Memphis. UP's intermodal facility has been expanded three times since it opened in 1998.

UP SUBDIVISIONS IN THE MEMPHIS STUDY AREA

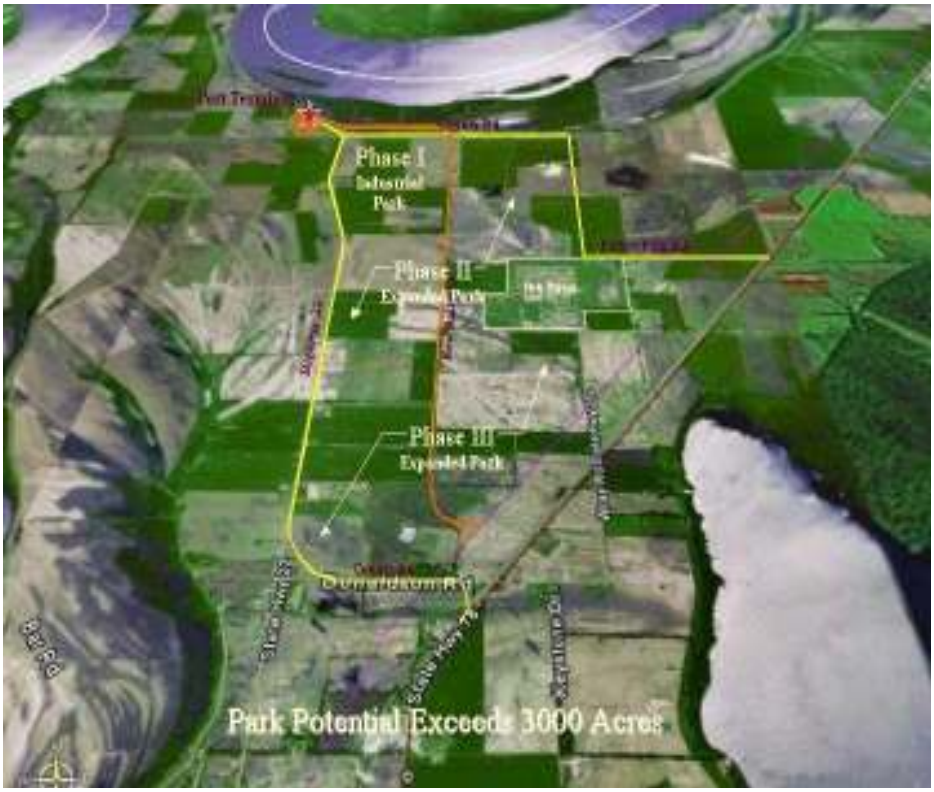
Subdivision	Memphis	Brinkley	Helena	Tenark Industrial Lead
Route miles in region	41	58	42	4
Counties where subdivision is located	Crittenden, AR:; Shelby, TN	St. Francis, AR; Crittenden, AR	St. Francis, AR; Lee, AR; Phillips, AR	Crittenden, AR
No. tracks	Single except for five miles between Briark, AR and MS River	Single	Single	Single
Trackage rights to other carriers	BNSF 25 miles; CSXT 4 miles	BNSF		
Dispatching	CTC	ABS	CTC	Manual
Trains per day	10–20	5–10	2	0–2
Maximum speed	60	60	49	Unknown
Major Access Roads to Intermodal Terminal	Kuhn Rd, SR 147, I-240			

MEMPHIS WATER INFRASTRUCTURE EVALUATION

As discussed in the prior Memphis infrastructure inventory chapter, most of the region's 99 river terminals in the study area are located within five port areas. Stakeholder interviews with representatives of these ports as well as a review of individual port plans indicated a variety of projects to increase water infrastructure capacity in the region. A summary of these projects for each port are provided below:

- **International Port of Memphis, Tennessee**. The Port's five public terminals have adequate capacity to handle expected volumes of water freight for the foreseeable future. A significant transportation infrastructure improvement at the Port involves modifications to the Mallory Avenue/Interstate 55 interchange to improve highway access to and from the Port. The interchange is a main entry point for trucks to several port terminals and a major bottleneck for freight movements. In addition, the Fullen Dock and Warehouse facility is notable in that it is the only terminal within the study area that loads containers directly to and from barge and trucks, an emerging transportation product with significant potential.
- **Port of West Memphis-Crittenden, Arkansas**. The port has planned more than $12 million in infrastructure improvements over the next 10 years, including extending rail service by traversing the St. Francis levee, and expansion to handle container shipping. They are currently in the middle of a three-phase project to improve port access. Once this project is complete, the port will have more than adequate mooring depths and on-site storage space and an excellent location for the transportation of intermodal containers on the inland waterway system.
- **Port of Helena-West Helena, Arkansas**. Future needs at this port include a dock extension and cover, conveyor and grain-hopper construction, development of a climate-controlled warehouse, and construction of a rail marshalling yard. If these needs are addressed, the port will have the necessary facilities to greatly increase annual shipping capacity. A rail marshalling yard is critical to the port's future development potential.
- **Port of Osceola, Arkansas**. Osceola has over $3 million of infrastructure investments planned in the next five years. These investments include: pavement overlay on the port road, shop maintenance, storage bins, dock expansion, and a mobile crane. These investments will insure the Port remains a major waterborne shipping terminal in the study area for the foreseeable future.
- **Northwest Tennessee Regional Port Authority (Port of Cates Landing).** After completion of basic port infrastructure at Cates Landing, the Port Authority has plans for over $37 million in development over the next 20 years. Some $9 million is earmarked for transportation investments including road construction to connect Highway 22 to the port and a rail connection to Canadian National's nearby short line railroad.

PORT OF CATES LANDING



Source: Port of Cates Landing, www.portofcateslanding.com

Many of the current and future projects described above involve access to port facilities by highway and rail with minimal additions to the region's water infrastructure capacity. Indeed, from stakeholder interviews, it appears that water infrastructure capacity in the Memphis region is more than adequate to handle expected volumes of water freight. Forecasts of Mississippi River freight using IHS Global Insight's TRANSEARCH database shows water tonnage to and from Memphis growing an average 3.3% annually (compounded) to 2015, levels easily handled by the region's current water infrastructure capacity. In addition, an ongoing water infrastructure requirement is the need to maintain adequate channel depths along the River and particularly at the Port of Memphis.

SUMMARY OF MODE INFRASTRUCTURE CAPACITY AND OBJECTIVES

Based on the capacity analysis conducted in this chapter, and global supply chain trends discussed earlier in this Plan, four modal objectives have been formulated as they relate to infrastructure development in the region. The capacity evaluation of each of these systems and their infrastructure development objectives are described below:

Memphis Highway Infrastructure Objective: *Intraregional Connectivity*

There are over 840 miles of primary (Interstate and U.S.-designated) highways in the greater Memphis region. An analysis of the region's freight traffic found that Memphis has significantly more "local" freight that originates and terminates in the area than metropolitan areas of similar size. Expected increases in this local freight traffic from intermodal growth, and a trend toward multi-modalism in domestic and international supply chains, mean the region's highway system needs to support connectivity between major freight nodes in the region. These nodes include:

- Rail intermodal terminals
- Memphis International Airport
- The International Port of Memphis
- Memphis freight shippers and receivers
- Public and private warehouses and industrial parks
- Major truck terminals

A connectivity analysis conducted as part of this Plan identified major highway arteries that facilitate freight access between the above nodes and reduce bottlenecks. This analysis will guide the Plan's highway infrastructure recommendations and include both physical improvements (i.e. lane widening and interchange improvement) as well as the use of "intelligent" transportation system technology.

Memphis Air Freight Infrastructure Objective: *Aerotropolis Expansion*

The air freight infrastructure capacity analysis for the region found that minimal improvements are required. However, air-ground cargo transfers are often impeded by congested roadways in the airport environs. Immediate airport area cargo access, including access to nearby warehouses and distribution centers, is mainly along local arterial roads with frequent intersections. Local roads that support Airport access include:

- Lamar Avenue
- Interstate 240
- Airways Boulevard
- Shelby Drive
- Winchester Road
- Holmes Road

Continued emphasis on airport connectivity, as delineated in the Memphis Aerotropolis study, is recommended based on air infrastructure analysis in the Plan and are consistent with the highway connectivity goals discussed above. This Plan includes specific recommendations for many of the airport's connector highways, and the interchanges that connect them, to improve airport freight access and minimize unnecessary stops that increase time, fuel use, and pollution.

In addition, the Aerotropolis study focused on Memphis International Airport. It is important that the role of other airports in the region capable of handing air freight also be considered and their infrastructure needs also be addressed as part of a regional airport systems plan.

Memphis Rail Freight Infrastructure Objective: *Intermodal Growth*

A major global supply chain development is the increasing use of intermodal rail for inland freight movement. The region's rail service by five Class I railroads and four intermodal terminals make Memphis well positioned to serve as a major logistics/distribution hub in the future for this intermodal trend. Class I rail carriers have invested over $400 million in intermodal terminal improvements in the area, further supporting the region's importance in the global supply chain.

From the evaluation of rail capacity conducted in this Plan, rail intermodal traffic in the region is expected to grow 133% by 2035 to a total of 2.3 million containers and trailers. This level of rail intermodal activity will put tremendous stress on the region's highway network. As such, rail infrastructure improvements need to focus on highway projects that accommodate the region's expected growth in intermodal truck traffic, facilitate truck movement between the region's freight hubs, and minimize potential congestion in the areas surrounding intermodal terminals.

Memphis Water Infrastructure Objective: *Rail/Truck Accessibility*

The region's water infrastructure has sufficient capacity to support projected water freight in the foreseeable future, expected to grow an average 3.3% annually (compounded) to 2015. While increases in water terminal capacity is not necessary, the Plan's capacity analysis found that road and rail access to certain river terminals, particularly Frank C. Pidgeon Industrial Park, the Port of Helena, and the Port of Cates Landing, need improving. This will assist Port Authorities, and other entities, offer numerous multimodal transportation options for the region's water shippers. In addition, an ongoing water infrastructure requirement is the need to maintain adequate channel depths at a minimum of nine feet along the River and particularly at the Port of Memphis.

Chapter 4: Infrastructure Recommendations

Based on this Plan's capacity analysis, global supply-chain trends, and stakeholder interviews, a series of freight infrastructure recommendations for the Memphis region have been formulated. While the Plan's analysis and interviews produced a large number of deserving projects, specific recommendations were selected using the modal objective discussed earlier and the following guidelines:

- Potential for implementation within the medium term (3–10 years). These projects were considered ones that could produce the greatest impact on facilitating the region's freight transport.
- Projects with known or defined funding sources. These projects were considered as having a better chance of being implemented.
- Projects with notable impacts on supporting freight. Many infrastructure projects discussed during the interview process focused on passenger or commuter traffic. These projects were considered outside the scope of this Plan.

This chapter lists 25 infrastructure recommendations using the above guidelines as well as five key recommendations considered the most critical in improving the region's freight infrastructure. These key recommendations are:

1. Lamar Avenue/U.S. 78 Corridor Improvements
2. Holmes Road Corridor Improvements
3. Interstate 40/Interstate 55 Interchange Modifications
4. Construction/Completion of I-69/I-269
5. Third Mississippi River Bridge Crossing

The Plan's infrastructure recommendations are listed below by state. (*) Asterisk indicates the Plan's five key recommendations. Recommendations involving more than one state are shown for each state. The remaining infrastructure recommendations are listed below by State. Recommendations involving more than one state are shown for each state. Since each recommendation addresses a number of modal infrastructure objectives in the region as shown earlier in this section, they are not listed in priority order.

Infrastructure Recommendations - Tennessee

- Lamar Avenue/U.S. 78 Corridor Improvements*
- Holmes Road Corridor Improvements*
- Construction of I-69/I-269*
- Third Mississippi River Bridge Crossing*
- Improve Rail Access to Frank C. Pidgeon Industrial Park
- I-55 and Crump Boulevard Interchange Modification.
- Upgrade At I-55 And Mclemore Interchange And Access Road To President's Island
- SR 78 Inland Port Highway Accessibility, Port of Cates Landing
- Reconstruct I-240 and Airways Boulevard interchange
- Complete East Shelby Drive intersection improvements: I-55 to Lamar Avenue
- Plough Boulevard and Winchester Road Interchange design completion
- Expansion of Millington Regional Jetport terminal building and construction of new t-hangers and storage hangers.
- Widen US 72 (Poplar Avenue) between SR 57 to Shelby Drive from 2 to 5 lanes
- Widen US 72 (Poplar Avenue) between Shelby Drive to SR 196from 2 to 4 lanes
- Widen SR 57 (Poplar Avenue) between SR 385 to Tchulahoma Road from 2 to 4 lanes
- Port of Cates Landing Access to CN

- Upgrade Tennken Railroad excepted tracks and rehabilitation of tracks and bridges to support 286k load limits
- Brownsville, TN Mega Site Rail Access
- Widen Hacks Cross Road to 4 lanes
- I-40/I-240 East Interchange Phase 2
- I-240 Midtown Widening and Interchange Improvement
- I-240 and Poplar Interchange Improvements

Infrastructure Recommendations - Mississippi

- Lamar Avenue/U.S. 78 Corridor Improvements*
- Completion of I-69/I-269*
- Construction of I-22
- Upgrade Mississippi Central Railroad to support 286,000-pound load limits Tunica Mega Site Rail Access

Infrastructure Recommendations - Arkansas

- Interstate 40/Interstate 55 Interchange Modifications*
- Third Mississippi River Bridge Crossing*
- Construction Of Rail Marshalling Yard And Rail Access To Port Of Helena
- West Memphis Port Access to UP
- West Memphis Airport 10 Year Capital Plan

The above recommendations were matched against the modal objectives discussed as part of the infrastructure analysis to ensure they addressed the region's critical capacity issues. Most of the Plan's recommended projects relate to at least two modal objectives, and many address all four. Each recommendation is described briefly below, followed by a more detailed review of the Plan's five key recommendations.

MEMPHIS INFRASTRUCTURE RECOMMENDATIONS BY MODAL OBJECTIVES

Mode:	Highway	Air	Rail	Water
Objective:	*Intraregional Connectivity*	*Aerotropolis Expansion*	*Intermodal Growth*	*Rail/Truck Accessibility*
Infrastructure Recommendations - Tennessee				
Lamar Avenue/ U.S. 78 Corridor Improvements	*x*	*x*	*x*	
Holmes Road Corridor Improvements	*x*	x	*x*	
Completion of I-69/I-269	*x*	*x*	*x*	
Third Mississippi River Bridge Crossing*	*x*	*x*	*x*	*x*
Improve rail access to Frank C. Pidgeon Industrial Park	x		x	x
I-55 and Crump Boulevard interchange modification	x	x	x	x
Upgrade at I-55 and McLemore interchange and access road to President's Island	x		x	x
SR 78 and Inland Port Highway Accessibility, Port of Cates Landing	x			x
Reconstruct I-240 and Airways Boulevard interchange	x	x		
Complete East Shelby Drive intersection improvements: I-55 to Lamar Avenue	x	x	x	
Plough Boulevard and Winchester Road interchange design completion	x	x		
Expansion of Millington Regional Jetport terminal building and construction of new t-hangers and storage hangers.		x		
Widen US-72 (Poplar Avenue) between SR 57 to Shelby Drive from 2 to 5 lanes	x		x	
Widen US-72 (Poplar Avenue) between Shelby Drive to SR 196 from 2 to 4 lanes	x		x	
Widen SR 57 (Poplar Avenue) between SR 385 to Tchulahoma Road from 2 to 4 lanes	x		x	
Port of Cates Landing Access to CN	x			x
Upgrade Tennken Railroad to support 286,000-pound load limits			x	x
Brownsville, Tennessee, megasite rail access	x		x	
Widen Hacks Cross Road to four lanes	x		x	
I-40/I-240 East Interchange Phase 2	x	x	x	
I-240 midtown widening and interchange improvement	x		x	
I-240 and Poplar Interchange improvements	x		x	
Infrastructure Recommendations - Mississippi				
Lamar Avenue/U.S. 78 Corridor Improvements	*x*	*x*	*x*	
Completion of I-69/I-269	*x*	*x*	*x*	
Construction of I-22	*x*	*x*	*x*	
Upgrade Mississippi Central Railroad to support 286,000-pound load limits			x	
Tunica Mega Site Rail Access	x		x	
Infrastructure Recommendations - Arkansas				
Interstate 40/Interstate 55 Interchange Modifications	*x*	*x*	*x*	*x*
Construction of third Mississippi River Bridge	*x*	*x*	*x*	*x*
Construction of rail marshalling yard and rail access to Port of Helena			x	x
West Memphis Port Access to UP	x			x
West Memphis Airport 10-Year Capital Plan		*x*		

INFRASTRUCTURE RECOMMENDATIONS – TENNESSEE

RECOMMENDATION: Improve rail access to Frank C. Pidgeon Industrial Park

MODE: Water, rail, highway

COUNTY: Shelby

LOCATION: International Port of Memphis

DESCRIPTION: Highway and rail access to the region's water infrastructure is a key modal objective. Prior analysis of a joint rail "super terminal" in the city of Memphis indicated that road and rail access to certain river terminals, particularly Frank C. Pidgeon Industrial Park, needed improvement[54]. Currently, the CN rail line stops before terminal dock facilities at Pidgeon Park. Extension of this line would increase transportation options at the International Port of Memphis by supporting multiple modes of freight transport between rail, highway, and water. It also has the potential to handle the expected increase in containers at the Gateway Memphis facility, and help alleviate highway congestion to and from the port by providing another means to transport freight.

RECOMMENDATION: I-55 and Crump Boulevard interchange modification

MODE: Water, rail, highway, air

COUNTY: Shelby

LOCATION: I-55 and Crump Boulevard

DESCRIPTION: The I-55 and Crump Boulevard (U.S. Highway 64) intersection is located south of downtown Memphis and approximately 0.5 mile from one of two Mississippi River crossings. I-55 is a major north-south interstate that carries outbound freight north from Shelby County and through many counties in the study area. Existing and estimated high truck volumes at this interchange, together with v/c ratios of 0.9 and greater on both highways, form the basis for this infrastructure recommendation. In addition, both highways were identified as key arterials to support freight connectivity in the region, particularly to West Memphis and Shelby County. The Crump Boulevard/I-55 intersection will also connect to the future I-22, another future major freight route in the study area. The reconstruction of this interchange is currently in the design review stage.

RECOMMENDATION: Upgrade at I-55 and McLemore interchange and access road to President's Island

MODE: Water, rail, highway

COUNTY: Shelby

LOCATION: I-55 and McLemore

DESCRIPTION: This interchange provides access to Jack Carley Causeway, via Riverside Boulevard, the only access to President's Island. As noted in previous chapters of this Plan, the Island is the most significantly developed terminal at the International Port of Memphis and handles a majority of the waterborne freight in the region. Improvements to this interchange will not only improve access to the Port, but also relieve congestion on I-55. It is a key component of the region's infrastructure that supports

[54] Task 8: Evaluation of Rail Infrastructure Proposals, Basic Freight Rail Connection, Project 1, Scenario A, East-West Rail Connection, Tennessee Rail System Plan, Tennessee Department of Transportation, September 2002

freight connectivity in the region. This project was mentioned frequently by port users in the Plan's stakeholder interviews as making the port more productive.

RECOMMENDATION: SR 78 Inland Port Highway Accessibility, Port of Cates Landing.

MODE: Water, Highway

COUNTY: Lake

LOCATION: SR 78 between Cates Landing Road between Interstate 155 (30.78 miles); Cates Landing Road between SR 78 and Pea Ridge Road (8.28 miles)

DESCRIPTION: Cates Landing is located between Memphis and Cairo, IL and within close proximity to I-55, I-155, I-40, I-24, and I-69. Improvements to SR 78 proposed in the previous project will improve accessibility between Cates Landing and other regional freight facilities in the Memphis region. This project will enhance the region's freight movement capacity and economic development by facilitating connections in the region between multiple modes of freight transport. It supports the Plan's modal objective of improved rail/highway access to water infrastructure.

Much of the inbound and outbound truck activity in Lake and Dyer Counties occurs along State Route 78 north of Tiptonville, TN. This project will improve access to the Port by widening this major freight arterial highway from two to four lanes as traffic warrants. Improvements to SR 78 will also include more substantial design elements to accommodate planned bulk truck freight which typically move in larger, heavier trucks. Cates Landing Road will be widened from two to four lanes as traffic warrants.

RECOMMENDATION: Reconstruct I-240 and Airways Boulevard interchange

MODE: Air, highway

COUNTY: Shelby

LOCATION: I-240 and Airways Boulevard

DESCRIPTION: The I-240 and Airways Boulevard intersection is a major freight link in the Memphis region and a key ingress and egress point to the Memphis International Airport. There are a number of trucking terminals and warehouse facilities in the vicinity of this intersection, including Huddleston Enterprises, the Memphis Depot warehouse, and FedEx. Both highways are considered key airport connectors in the Aerotropolis plan, and are major arterials that link key freight hubs in the region. I-240 suffers a congestion ratio of 0.9 or higher, while Airways Boulevard provides north-to-south access from downtown Memphis to the airport and through the study area. Navigation of the interchange was mentioned several times during stakeholder interviews as being difficult. Field reviews of the interchange confirmed a high level of weaving at the interchange.

RECOMMENDATION: Complete East Shelby Drive intersection improvements

MODE: Air, highway, rail

COUNTY: Shelby

LOCATION: East Shelby Drive (SR 175) from I-55 to Lamar Avenue (US-78), 7.19 miles

DESCRIPTION: East Shelby Drive is a major arterial route in the region that runs east and west through the southern portion of the Memphis International airport. This seven-mile stretch of road connects two major freight corridors in the region, Lamar Avenue and I-55, and has a v/c ratio of 0.9 or greater. Lamar Avenue and I-55 are also heavily traveled truck routes that serve the airport, numerous warehouses, trucking terminals (east of Getwell Road in particular), and the BNSF intermodal terminal. As a result,

improvements to Shelby Drive support numerous modal objectives of the Infrastructure Plan, including Aerotropolis, highway freight connectivity, and intermodal growth.

This project will complete a number of intersection improvements on Shelby Drive, including traffic-signal synchronizations and intelligent transportation systems (ITS). Specific intersections to be completed include Airways Boulevard, Swinnea Road, and Getwell Road.

RECOMMENDATION: Plough Boulevard and Winchester Road Interchange design completion

MODE: Air, highway

COUNTY: Shelby

LOCATION: Plough Boulevard and Winchester Road

DESCRIPTION: The Plough Boulevard and Winchester Road interchange is the main access point to Memphis International Airport. Winchester Road runs parallel to I-240 and Democrat Road to the north and to East Shelby Drive to the south. It is the main route along the northern portion of the Memphis International Airport campus and provides freight access to I-240 via Plough Boulevard and Airways Boulevard (Plough Boulevard becomes Airways Boulevard near the I-240 intersection).

Interstate 240 is another of the region's major truck routes that carries traffic around Memphis, providing access to numerous freight facilities.

Similar to Shelby Drive, improvements to the Plough Boulevard and Winchester Road interchange support a number of the Infrastructure Plan's modal objectives: Aerotropolis access, highway freight connectivity, and intermodal growth. This project has been identified as a priority by the Memphis Metropolitan Planning Organization, and programmed in the Transportation Improvement Program (TIP) with dedicated Federal Surface Transportation Program (STP) and local funds. This funding is meant to improve 3,000 feet along Plough-Airways Boulevard south from Brooks Road and improve 3,000 feet along Winchester east of original at-grade section. The improvements will provide a grade-separated interchange to replace the existing at-grade condition at the Plough-Airways and Winchester Road intersection. The final design will maintain the present direct connectors between Plough Boulevard and the airport. The preliminary planning will include coordination with Memphis Area Transit Authority (MATA) to address future light-rail service to the airport.

RECOMMENDATION: Expansion of Millington Regional Jetport terminal building and construction of new T-hangers and storage hangers.

MODE: Air

COUNTY: Shelby

LOCATION: Millington Regional Jetport

DESCRIPTION: Millington Regional Jetport is a public airport in Millington, Tennessee, 16 miles north of Memphis, and designated by FedEx as an alternate airport to Memphis International. Currently, Millington Regional Jetport covers 400 acres and has one runway. Expansion of the terminal building and construction of new T-hangers and storage hangers would increase the facility’s ability to handle more freight and increase the possibility of attracting more air freight in the region. In addition, new T-hangers and storage hangers are needed for emergency preparedness as part of the Jetport's use as a back-up facility to FedEx.

RECOMMENDATION: Widen US-72 (Poplar Avenue) from two to five lanes

MODE: Rail, highway

COUNTY: Fayette

LOCATION: US-72 (Poplar Avenue) from SR 57 to Shelby Drive (2.6 miles)

DESCRIPTION: Poplar Avenue is a major truck route in Shelby, Fayette, and Marshall Counties. This project involves a portion of US-72 located in Shelby County, running southeast from downtown Memphis between Interstate 40 to its north and Nonconnah Parkway to the south.

This section of Poplar Avenue provides access to numerous warehouses, distribution facilities, and truck terminals with truck volumes expected to grow due to construction of the Norfolk Southern intermodal terminal in Southwest Fayette County, Tennessee.

This project will increase capacity along a southern portion of the road from State Route 57 to Shelby Drive by widening it from two to five lanes, and is critical to improving access to the new NS intermodal facility. As a result, it will help accommodate intermodal growth in the region as well as contribute to freight connectivity with other major freight routes, namely I-240 and Nonconnah Parkway.

RECOMMENDATION: Widen US-72 (Poplar Avenue) from two to four lanes

MODE: Rail, Highway

COUNTY: Fayette

LOCATION: US-72 (Poplar Avenue) from Shelby Drive to SR 196

DESCRIPTION: As discussed previously, Poplar Avenue is a major truck route in the study area running through Shelby, Fayette, and Marshall Counties. This project involves a portion of US-72 located in Shelby and Fayette Counties. This section of Poplar is currently less freight intensive than northern portions, but will handle much larger volumes of truck traffic due to the new NS intermodal terminal in Southwest Fayette County, Tennessee.

This project will increase a southern portion of the road from Shelby Drive to SR 196 by widening it from two to four lanes, and is critical to improving access to the new NS intermodal facility. As a result, it will help accommodate intermodal growth in the region, as well as contribute to freight connectivity with other major freight routes, namely I-240 and Nonconnah Parkway.

RECOMMENDATION: Widen SR 57 (Poplar Avenue) from two to four lanes (divided)

MODE: Rail, Highway

COUNTY: Fayette

LOCATION: SR 57 (Poplar Avenue) from SR 385 to Tchulahoma Road (1.03 miles)

DESCRIPTION: This project proposes widening a small portion of Poplar Avenue (SR 57) located in Collierville, Tennessee, from two to four lanes. This portion provides access to the national headquarters and plant for AOC, LLC, and will improve accessibility between the new NS intermodal facility, I-40, and proposed I-269, construction of which is one of the five key freight infrastructure recommendations in this Plan. Similar to other Poplar Avenue projects, it will help accommodate intermodal growth in the region from the new NS facility (which will be located just east of this project) as well as contribute to freight connectivity with other major freight routes, namely I-40 and the future I-269.

RECOMMENDATION: Port of Cates Landing Access to CN

MODE: Water, rail

COUNTY: Lake

LOCATION: Northwest Tennessee, Regional Port Authority, Port of Cates Landing

DESCRIPTION: The Port of Cates Landing is located about three miles from the Tennken Railroad (with connection to CN at Dyersburg, Tennessee) on the Mississippi River between Memphis, Tennessee, and Cairo, Illinois. This project would build a three-mile rail spur from the Port to Tennken Railroad to support inland transport of bulk water tonnage, including calcium carbonate; petroleum products, paper, steel coils, natural rubber, and soybean meal, that typically move by rail. Combined with other Plan recommendations to widen both SR 78 and Cates Landing Road, this project is part of a $9-million plan to improve rail and water access to the port, consistent with the Infrastructure Plan's modal objectives of improved rail and highway access to water infrastructure. An economic impact study of the port estimates that the port and adjacent industrial park will create more than 5,600 new jobs in the area.

RECOMMENDATION: Upgrade Tennken Railroad excepted tracks and rehabilitate tracks and bridges to support 286,000-pound load limits

MODE: Rail,water

COUNTY: Dyer and Lake

LOCATION: Tennken Railroad, Dyersbrug, Tennessee

DESCRIPTION: The Tennken Railroad carries approximately 4,300 carloads annually of coiled steel, steel pipe, petroleum coke, electro binder, plastics, synthetic resin, carbon black, fertilizer, and grain. This project recommends $23.27 million in improvements to Tennken Railroad track to handle heavier railcars that are interchanged from CN to "286k" standards. The 286k standard refers to the standard of 286,000 pounds gross weight of a railcar traveling on the railroad's trackage. Current tracks on the Tennken Railroad cannot support this weight, and preclude the heavier loading of railcars to and from its customers that is common on most of Class I railroad networks.

In addition, some track on Tennken Railroad is FRA “excepted track," i.e., it does not meet the minimum U.S. Federal Railroad Administration (FRA) standards. Freight may be carried over excepted tracks, but train speeds are not permitted to exceed 10 miles per hour, no passengers can be carried on the line, and excepted track cannot include segments near bridges.

Upgrading Tennken Railroad to 286k compatibility and rehabilitating excepted track promotes economic development by improving transportation options and business opportunities for the railroad's customers and the upcoming Port at Cates Landing. Of the $23.27 million, $7.50 million would be applied to rehabilitating 15 miles of excepted track, $10.80 million would be used to upgrade track and bridges to handle 286k cars, $3.0 million would rehabilitate track for intermodal freight. Other proposed work includes the installation of crossing gates at the Highway 51 bypass, rehabilitating a yard, expanding the yard at Dyersburg.

RECOMMENDATION: Brownsville, Tennessee, mega-site rail access

MODE: Rail, highway

COUNTY: Haywood

LOCATION: Brownsville, Tennessee

DESCRIPTION: The Brownsville, Tennessee, mega-site near Stanton and I-40 is one of two located within the Infrastructure Plan study area. These sites are high acreage parcels of available land ready for use by large industrial tenants. Local economic development agencies ensure the sites meet local zoning and regulatory requirements and can be quickly approved by regulatory agencies for industrial development.

The Haywood, TN site is 1,700 acres (with the possibility of an additional 3,000) and being targeted for development by the auto industry. This project involves providing rail access to the site from both CSXT and CN which gives a potential tenant competitive rail access. The CSX mainline passes to the north of the site and requires a short rail spur. Access to the CN requires an additional spur line of 18 miles west of the site that would connect to the CN Fulton Subdivision at a cost of approximately $2 million per mile. Since it is uncertain a potential tenant would necessarily want rail access to both railroads, construction of these rail spurs would not occur until a purchase agreement was reached.

RECOMMENDATION: Widen Hacks Cross Road to four lanes

MODE: Highway, rail

COUNTY: Fayette

LOCATION: Hacks Cross Road between State Line Road and East Shelby Drive

DESCRIPTION: Hacks Cross Road is a freight arterial that runs north and south from Mississippi to East Shelby Drive in the southern part of Shelby County. There are several major distribution centers, truck terminals, and warehouses, as well as Olive Branch Airport, near the intersection of Hacks Cross Road and State Line Road. To the north, Hacks Cross Road connects to East Shelby Drive, a major arterial route that runs east and west through the southern portion of the Memphis International airport and is used as a connector to East Shelby Drive and the BNSF intermodal terminals. This project will increase the road's capacity by widening it to four lanes and provide better access to Memphis International Airport, as well as improve the flow of freight shipments moving north and south from nearby freight terminals.

RECOMMENDATION: I-40/I-240 East Interchange Phase 2
MODE: Highway, air, rail
COUNTY: Shelby
LOCATION: I-40/I-240 East Interchange
DESCRIPTION: This project proposes the separation of traffic through the use of ramps at the intersection of I-40 and I-240 east of downtown Memphis, including an I-40 flyover ramp. Both I-40 and I-240 are key freight connectivity arterials in the region. I-40 connects Memphis to Los Angeles, Albuquerque, Oklahoma City, Little Rock, Nashville, Knoxville, Greensboro, and Raleigh. I-240 is a circumferential route that carries freight traffic around Memphis and provides connectivity to numerous freight facilities in the region. Segments of both highways have congestion ratios of .9 or higher with plans widen I-240 to eight lanes

The intersection of these major highways provide direct access to other local freight routes including Sam Cooper Boulevard and Summer Avenue (US Highway 64) where several warehouse and truck terminals are located. This project has been identified as a priority by the Memphis Metropolitan Planning Organization. It is currently in the design phase with dedicated Federal IM and state funds.

RECOMMENDATION: I-240 Midtown Widening and interchange improvement

MODE: Highway, rail

COUNTY: Shelby

LOCATION: I-240 between I-55 to I-40 (4.97 miles)

DESCRIPTION: This five-mile stretch of I-240 travels through midtown Memphis and provides access to numerous freight facilities including truck terminals, CSX Sargent Yard, business parks, industrial parks, and warehouse and distribution facilities. This project proposes widening this facility from six to eight lanes and has been identified as a priority by the Memphis Metropolitan Planning Organization. It is programmed in the TIP with dedicated Federal HPP funding. As mentioned in other recommendations, I-240 is a major freight connector in the region to freight hubs such as President's Island and Memphis International Airport. This recommendation was suggested by a large number of stakeholders during the interview phases of the Infrastructure Plan.

RECOMMENDATION: I-240 and Poplar Interchange improvements

MODE: Highway, rail

COUNTY: Shelby

LOCATION: I-240 and Poplar Avenue Interchange

DESCRIPTION: This interchange is one of the most congested in the Memphis region. Proposed improvements will streamline access to and from Poplar Avenue to East Memphis, Germantown, and Collierville, and become a key ingress and egress point for the new Norfolk Southern intermodal facility in Southwest Fayette County, Tennessee.

INFRASTRUCTURE RECOMMENDATIONS – MISSISSIPPI

INFRASTRUCTURE RECOMMENDATION: Construction of I-22

MODE: Highway

COUNTY: Desoto, Marshall

LOCATION: I-22 from Memphis to Birmingham (270.80 miles)

DESCRIPTION: Proposed Interstate 22 follows US-78 from Memphis to Birmingham, Alabama. Future I-22 will be a part of the interstate highway system, connecting I-55 and I-40 in Memphis to I-65 and I-20 in the southeast. This road is completed as a four-lane freeway (but not up to interstate standards) from the Tennessee and Mississippi state line in the study area to Exit 30 in Mississippi, and along part of the Jasper bypass in Alabama. Within Shelby County in Tennessee, I-22 would link to the proposed I-269 Memphis bypass paralleling Lamar Avenue (US-78). Lamar Avenue is currently under study by Cambridge Systematics to provide recommendations for alleviating congestion on this corridor, including synchronized signals, extending I-22 from the Mississippi state line to I-240, rerouting traffic around the corridor by way of Interstates 69 and 269 or other roads, and creating grade-separated interchanges at key intersections to provide limited access.

RECOMMENDATION: Upgrade Mississippi Central Railroad excepted tracks, and rehabilitate tracks and bridges to support 286,000 load limits

MODE: Rail

COUNTY: Marshall

OCATION: Holly Springs, Mississippi

DESCRIPTION: This project recommends $19 million for rail work on the Mississippi Central Railroad to handle railcars carrying 286,000 pounds gross weight. These heavier railcars can travel throughout the Class I railroad network, but are restricted on the Mississippi Central, severely limiting the rail loading options of the rail carrier's customers. The railroad interchanges with BNSF at Holly Springs, Mississippi,

and NS at Grand Junction, Tennessee. Some track on the Mississippi Central is also FRA "excepted track," i.e., segments that do not meet the minimum U.S. Federal Railroad Administration (FRA) standards. Freight may still be carried over excepted tracks, but train speeds are not permitted to exceed 10 miles per hour, no passengers can be carried on the line, and excepted track cannot include segments near bridges. Upgrading the Mississippi Central Railroad to 286k compatibility and rehabilitating excepted track promotes economic development by improving transportation options and business opportunities for the railroad's customers.

RECOMMENDATION: Tunica Metro Mega site rail access

MODE: Rail

COUNTY: Tunica

LOCATION: Intersection of Highway 304 and Highway 61

DESCRIPTION: The Tunica Metro Mega Site is the second of the two mega-sites located within the Freight Infrastructure Plan study area[55]. The site encompasses 2,221 acres and is located at the intersection of Highway 304 and U.S. Highway 61. Local officials are targeting the auto industry for the site.

This project involves construction of a rail spur to connect the site with the CN Yazoo subdivision line that passes several miles to the east. Rail access is generally a requirement of large tenants, which are the prime candidates of mega-sites. Since it is uncertain if a potential tenant would necessarily want rail access, however, construction of rail spur would not occur until a purchase agreement is reached.

INFRASTRUCTURE RECOMMENDATIONS – ARKANSAS

RECOMMENDATION: Construction of rail marshalling yard and rail access to the Port of Helena

MODE: Water, rail

COUNTY: Phillips

LOCATION: Helena-West Helena Phillips County Port Authority

DESCRIPTION: The Port of Helena is located 65 miles south of Memphis and has 4,000 acres of industrial sites specializing in the transportation of steel, coal, grain, and break bulk commodities. In 2006, the port handled 1.58 million tons at its 14 terminals.[56]

A Union Pacific (UP) rail connection is needed to more efficiently handle and distribute the bulk commodities that currently use the port. Access to UP and a rail marshalling yard have been identified by the port as key components of their development plan to retain and encourage freight traffic. This is consistent with the modal recommendation in the Infrastructure Plan of better rail and highway access to the region's water infrastructure. In addition, improved rail access at the Port of Helena was mentioned in the analysis of the joint Memphis rail "super terminal" concept as an example of improved road and rail access to certain river terminals in the region.[57]

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[55] Mega sites are large parcels of land for high acreage industrial development. Local economic development agencies ensure that the sites meet local zoning and regulatory requirements and are eligible for quick regulatory approval. Often, private consultants pre-certify sites, so that companies can be sure that they are ready-to-go and relatively risk-free. Besides Tunica, the other mega-site in the study area is located in Brownsville, Tennessee.

[56] Port of Memphis, US Army Corps of Engineers, Arkansas Waterway Commission, Nucor Steel

[57] Task 8: Evaluation of Rail Infrastructure Proposals, Basic Freight Rail Connection, Project 1, Scenario A, East-West Rail Connection, Tennessee Rail System Plan, Tennessee Department of Transportation, September 2002

RECOMMENDATION: West Memphis Port Access to UP

MODE: Water, rail

COUNTY: Crittenden

LOCATION: West Memphis-Crittenden County Port Authority

DESCRIPTION: Consistent with this Plan's modal objective of improving rail and track access to the region's water infrastructure, this recommendation will provide rail access to the Port of West Memphis. The Port owns the "Friday-Graham" Rail Spur off of its interchange with the UP. This spur was rehabilitated in 1991 as part of an agreement to locate a new TETRA chemical plant in the area. The rail line stops at the TETRA chemical plant, less than a mile from the port facilities.

Direct rail access would make the facility more desirable for the handling of bulk and specialized materials that travel by water. It was a key recommendation of West Memphis stakeholders during the Plan's interview process. One issue with direct access into the Port of West Memphis is a levee near the port, which blocks access to the port terminal. A proposed solution would be to extend the rail line to the levee and use conveyors to load or unload railcars across the levee.

RECOMMENDATION: West Memphis Airport 10-Year Capital Plan

MODE: Air

COUNTY: Crittenden

LOCATION: West Memphis Airport

DESCRIPTION: As part of its evaluation of the region's air infrastructure, Wilbur Smith noted the need to support other regional airports that have air cargo handling capacity besides Memphis International. West Memphis Airport is one of three airports in the region capable of handing air cargo capital jet. It is a city-owned public-use airport located three miles west of the central business district of West Memphis, Arkansas. The airport's 10-year, $11-million capital plan is intended to capture a larger share of the air cargo market and includes: rehab of taxiway alpha, taxi lane south of ramp, extend the runway 600 feet, and strengthening runway plus increase lighting level.

KEY INFRASTRUCTURE RECOMMENDATIONS

Key Infrastructure Recommendation: 1: Lamar Avenue Corridor Improvements

Lamar Avenue (US-78) is one of the region's most significant freight corridors, serving as an arterial for both interstate and local freight traffic. In the Plan's evaluation of highway infrastructure, it was estimated that Lamar carried over 41 million tons of freight in 2007, approximately 10% of the total freight moved on the region's Interstate and U.S.-designated highway network.

Lamar is also one of the most congested corridors in the region, with a volume to capacity ratio of 0.9 or greater. Nationally, the corridor links Memphis to the southeast United States and Birmingham, Alabama. Locally, it supports a highly dense network of truck terminals, warehouses, industrial development, and the BNSF intermodal terminal off East Shelby Drive and SR 175, as well as air freight transport to and from Memphis International Airport via Democrat Road. In fact, the concentration of freight facilities along Lamar is a prime example of the Aerotropolis concept as described in the Memphis Aerotropolis Plan referenced earlier.

The Lamar corridor supports all the region's modal objectives outlined in this Infrastructure Plan, particularly for air, highway, and rail. Currently, the corridor is under study by Cambridge Systematics to

recommend options to alleviate congestion on the corridor, including synchronized signals, extension of I-22 from the Mississippi state line to I-240, rerouting traffic around the corridor by way of Interstates 69 and 269 or other roads, and creating grade-separated interchanges at key intersections to provide limited access. Also under review will be the application of Intelligent Transportation System (ITS) technology to the corridor that is part of this Plan's recommendations. An overview of ITS technology proposed for this corridor is discussed later in this section.

Key Infrastructure Recommendation 2: Holmes Road Corridor Improvements

Holmes Road runs east and west just south of the Memphis International Airport, beginning at US-61 and intersecting other major freight arterials including Lamar Avenue and I-55 (although there is no interchange access with I-55). The western portion of Holmes Road is primarily residential, with more industrial and commercial use located closer to the Lamar Avenue intersection.

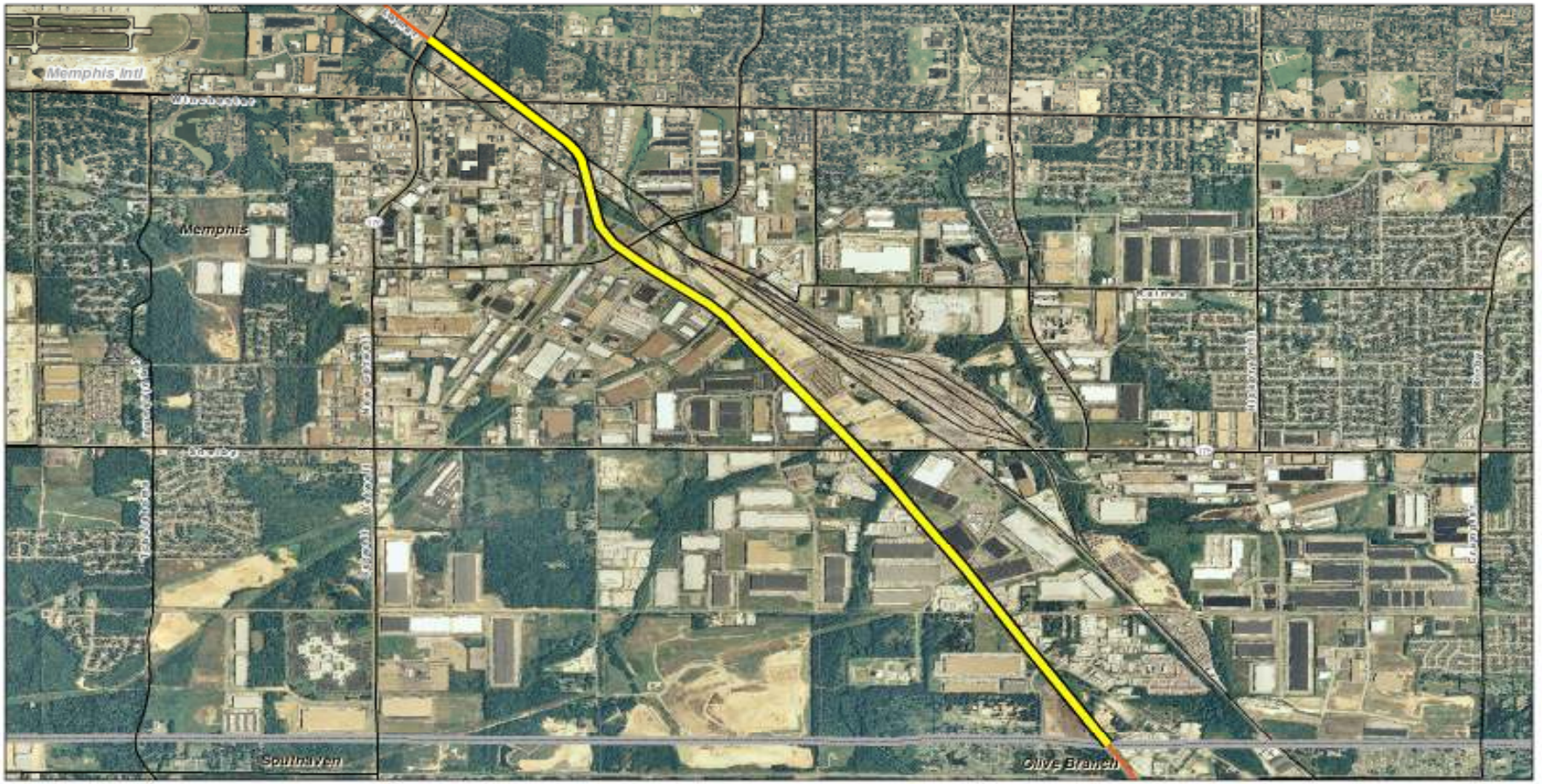
Based on the evaluation of the region's freight highway infrastructure, the Holmes Road corridor is considered significant to the region's future as a logistics center for a number of reasons:

- The corridor already is an important east-west connection for freight near Lamar Avenue with increasing levels of congestion.
- The area of Holmes Road near I-55 is currently sparsely developed. Infrastructure improvements offer opportunities for additional industrial and commercial development in this area.
- The corridor runs parallel to East Shelby Drive, a major freight arterial that has been identified as severely congested. Improvements on Holmes Road offer an alternative to alleviate access and congestion issues along East Shelby Drive and its supporting facilities.
- Holmes Road is part of arterial highway network that connects Memphis International Airport with surrounding logistics and distribution centers.

The Holmes Road widening project has been on the MPO Transportation Plan since 1969, and is included in the MPO TIP[58]. Similar to Lamar Avenue, this recommendation proposes including the use of ITS technology where appropriate. An overview of ITS technology proposed for this Corridor is discussed below.

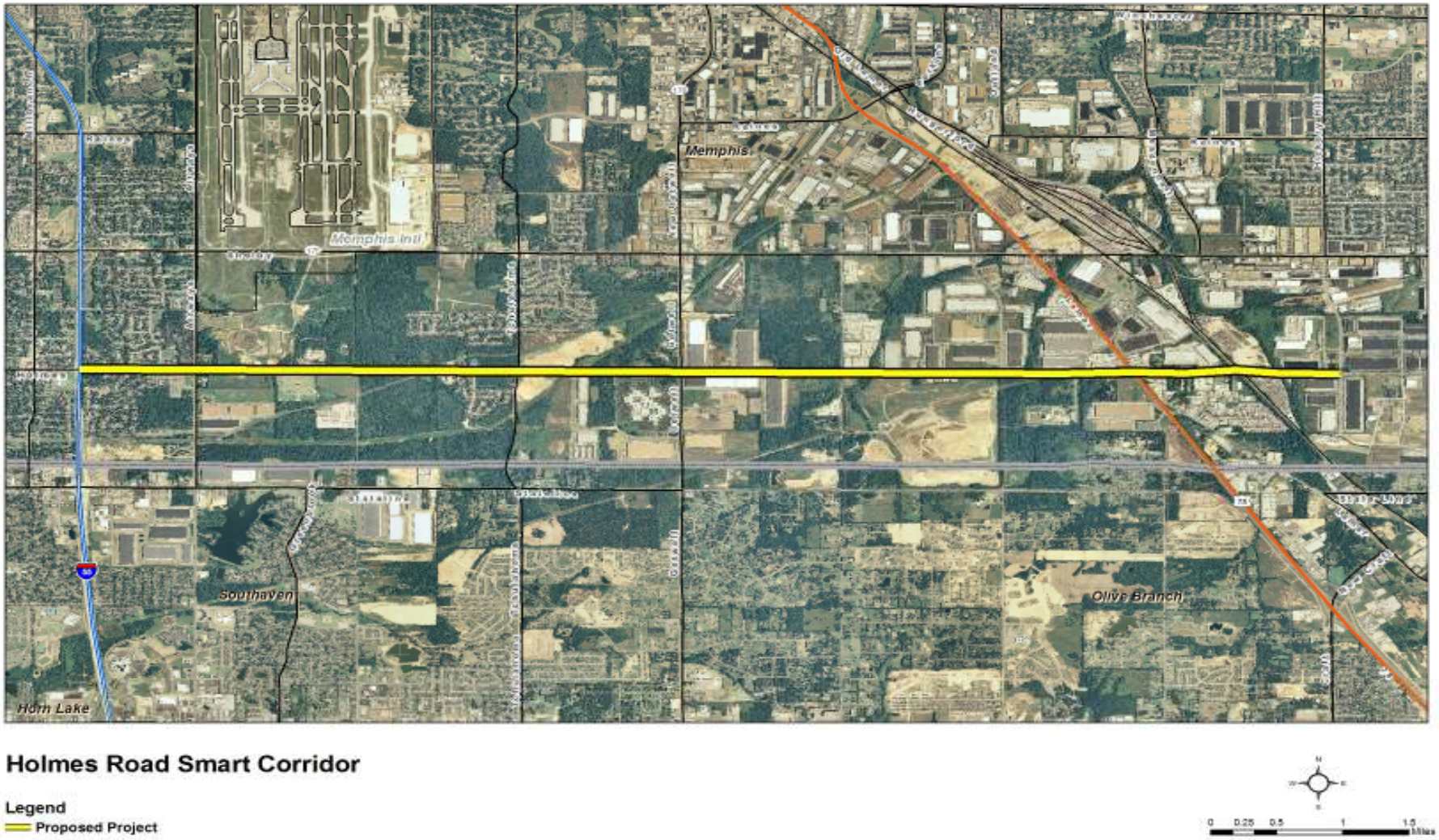
[58] http://holmesroadexpansion.com/

KEY MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE RECOMMENDATION 1: LAMAR AVENUE CORRIDOR IMPROVEMENTS



Source: Wilbur Smith Associates

KEY MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE RECOMMENDATION 2: HOLMES ROAD CORRIDOR IMPROVEMENTS



Source: Wilbur Smith Associates

Intelligent Transportation Systems

In addition to targeting lane-widening and interchange improvements to Lamar Avenue (Key Infrastructure Recommendation #1), and Holmes Road (Key Infrastructure Recommendation #2), this Plan also proposes making each of these arterials "Smart Corridors," i.e., employing Intelligent Transportation Systems (ITS) technology to more effectively manage freight congestion. An overview of ITS and its applicability to the Lamar Avenue and Holmes Road corridors is provided in the following sections.

The implementation of a Smart Corridor along Lamar Avenue and Holmes Road would involve the use of advanced technologies and real-time system management techniques to help keep all transportation facilities within the corridors operating at maximum efficiency, even following a major disruptive incident. The project is envisioned as a program to implement real-time transportation management measures through the use of advanced technologies to:

- Collect real-time data
- Process data
- Deliver information to travelers; and
- Adjust traffic management devices and activities to reflect changing traffic conditions.

ITS is the use of technology to move traffic more efficiently without the addition of new traffic lanes by addressing incidents that affect the capacity of the transportation system. ITS applies smart processes and technologies to improve the safety and efficiency of the transportation system and provide timely information to truckers on detours, approaching accidents, and similar road hazards. ITS components such as cameras and speed-detection devices allow quick detection, confirmation, and appropriate response to highway incidents. Changeable message boards and Internet links to roadway cameras allow the public to adjust their travel plans to minimize the impact of incidents and reduce travel delays. Ultimately, ITS is expected to increase people- and vehicle-carrying capacity of a multimodal transportation system.

An ITS architecture is a framework of systems that work together to deliver transportation services. An ITS architecture defines how systems functionally operate and the interconnection of information exchanges that must take place between these systems to accomplish transportation services.[59] Examples of ITS technologies and applications include dynamic message signs, traffic-signal synchronization, and traffic management centers. A regional ITS architecture was developed for the Memphis region in 2002.

[59] http://www.iteris.com/itsarch/html/glossary/glossary.htm

DYNAMIC MESSAGING SIGN AS PART OF AN INTELLIGENT TRANSPORTATION SYSTEM

Source: Georgia DOT

TDOT *SmartWay*

In Tennessee, the TDOT SmartWay system is the ITS system applied to improve the safety and operation of the State's highways and other transportation modes. There are several components of SmartWay, including the Memphis TDOT SmartWay system that started operations on 13 November 2008. The state system currently includes the following components:

1. Dynamic Message Signs (78) to provide traffic information;
2. Roadway Traffic Sensors (700) to report traffic counts, speed, and travel time;
3. Traffic cameras (250);
4. Three (3) transportation management centers: Nashville, Knoxville, and Memphis;
5. Freeway Service Patrols to reduce congestion by removing minor incidents in a timely fashion. TDOT's HELP trucks have been in operational in Memphis since 2000.

In addition, SmartWay employs a city-wide highway advisory radio station broadcasting on AM 1660 and makes SmartWay information available to truckers in Tennessee by calling 511, or via the web at: http://www.tdot.state.tn.us/tdotsmartway/default.htm.

Potential ITS Applications for Lamar Avenue and Holmes Road

Potential ITS applications for Lamar Avenue and Holmes Road are shown on the following table. Certain components of ITS would be especially effective in freight-intensive corridors such as Lamar Avenue and Holmes Road: arterial management, crash prevention and safety, traffic incident management, traveler information, information management, and intermodal GPS system integration.

COMPONENTS OF INTELLIGENT TRANSPORTATION SYSTEMS (ITS) APPLICABLE TO LAMAR AVENUE AND HOLMES ROAD

Application Area	Definition	Application to Lamar Avenue and Holmes Road
 **Arterial Management**	Arterial management systems manage traffic along arterial roadways, employing traffic detectors, traffic signals, and various means of communicating information to travelers. The systems make use of information collected by traffic- surveillance devices to smooth the flow of traffic along travel corridors. They also disseminate important information about travel conditions to travelers via technologies such as dynamic message signs (DMS) or highway advisory radio (HAR).	Arterial management solutions are already used in Memphis on Interstates 40, 55, and 240 under TDOT's SmartWay ITS program. Use of this ITS application on Lamar Avenue and Holmes Road would be the first non-interstate application of this technology in the region. One benefit of this application in these corridors would be the ability to disseminate information regarding corridor congestion to drivers on the region's interstates prior to arrival at Lamar Avenue or Holmes Road, particularly during peak periods of intermodal activity at the BNSF intermodal terminal.
 **Crash Prevention & Safety**	Crash-prevention and safety systems detect unsafe conditions and provide warnings to travelers to take action to avoid crashes. Crash-prevention and safety systems typically employ sensors to monitor the speed and characteristics of approaching vehicles and frequently include environmental sensors to monitor roadway conditions and visibility. Some systems provide a general warning of the recommended speed for prevailing roadway conditions. Other systems provide a specific warning by taking into account the particular vehicle characteristics (truck or car) and a calculation of the recommended speed for the particular vehicle based on conditions.	Crash-prevention and safety systems are particularly useful on Holmes Road for at-grade rail crossings to provide warnings and information regarding approaching trains. For Lamar Avenue, the system would be used at its high-volume intersections at New Getwell, Winchester, and South Perkins Roads. At both arterials, crash-prevention and safety systems can provide alerts of oncoming dangerous intersections and truck traffic, especially near the BNSF terminal or areas of warehouse activity at the southern end of the Corridor. One Tennessee example of a crash-prevention and safety system is on I-75 in Chattanooga, Tennessee, where dense fog is often an issue. The system notifies travelers in advance of the dense fog area to make appropriate changes in speed,
 **Transportation Management Centers**	Transportation management centers (TMCs), sometimes called traffic management centers and traffic operations centers (TOCs), coordinate ITS operations. TMCs can be owned or operated by a single agency or multiple transportation agencies and perform an array of functions including data acquisition, command and control, computing, and communications for many types of ITS applications.	A Transportation management center is already in operation in the Memphis region. Its role would be expanded to include ITS applications at Lamar Avenue and Holmes Road.
 **Traffic Incident Management**	Traffic-incident management systems can reduce the effects of incident-related congestion by decreasing the time to detect incidents, the time for responding vehicles to arrive, and the time required for traffic to return to normal conditions. Incident management	Currently, TDOT utilizes traffic-incident management on all interstate highways in Memphis as part of TDOT's SmartWay system. A combination of traffic-incident management strategies are employed in the region, including traffic cameras, traffic detectors, and HELP Truck deployment. These systems are not

	systems make use of a variety of surveillance technologies, often shared with freeway and arterial management systems, as well as enhanced communications and other technologies that facilitate coordinated response to incidents.	currently used on the Lamar Avenue or Holmes Road corridors, however. Experience with these systems at other freight corridors has shown they are especially useful in deployment of appropriate heavy towing equipment in incidents involving trucks. The lack of proper equipment at these crashes often prolongs delays and congestion.
Traveler Information	Traveler information applications use a variety of technologies, including Internet websites, telephone hotlines, as well as television and radio, to allow users to make more informed decisions regarding trip departures, routes, and mode of travel. Ongoing implementation of the designated 511 telephone number will improve access to traveler information across the country benefits.	Truck shipments that are routed for Lamar Avenue or Holmes Road could consult traveler information in advance to determine the condition of traffic in the corridor. In addition, traveler information system can be linked to trucks entering and exiting the BNSF intermodal terminal to advise on congested segments of Lamar Avenue or Holmes Road, as well as suggest alternative routes or times to bypass congested intersections during peak commuter travel.
Information Management	ITS information management supports the archiving and retrieval of data generated by other ITS applications and enables ITS applications that use archived information. Decision support systems, predictive information, and performance monitoring are some ITS applications enabled by ITS information management. In addition, ITS information management systems can assist in transportation planning, research, and safety management activities.	Information management is not currently available at Lamar Avenue or Holmes Road. The archiving of truck-route data and truck travel patterns along both corridors would be invaluable for freight planning and congestion mitigation. The lack of this type of data hinders effective management of freight flows in both corridors.
Intermodal Freight	ITS can facilitate the safe, efficient, secure, and seamless movement of freight. Applications being deployed provide for tracking of freight and carrier assets such as containers and chassis, and improve the efficiency of freight-terminal processes, drayage operations, and international border crossings.	ITS systems regarding intermodal freight would link GPS systems in use by private trucking and drayage companies using the BNSF terminal. These linkages would provide real-time location data on all truck traffic to and from the terminal. "Geo-fencing" or route- adherence monitoring systems used by trucking companies could be linked to ITS traveler information systems to adjust routes in reaction to congested conditions near warehouses and terminals on the corridor.

The first step in implementing ITS on Lamar Avenue or Holmes Road would be the completion of a feasibility plan that examines each ITS application to the specific traffic conditions and physical infrastructure of both corridors. One significant barrier to ITS implementation is overcoming jurisdictional issues that exist between multiple agencies and municipalities with a corridor. When a project involves multiple entities, the review and approval process can be difficult and time consuming. For an ITS project the size of Lamar Avenue to be successful, strong leadership will be needed to maintain progress and help refine the project concept. Many of these issues in Memphis have been resolved through the implementation of the Regional ITS Architecture.

Key Infrastructure Recommendation 3: Interstate 40 Interstate 55 Interchange Modifications

Interstates 40 and 55 are not only important connectors to local freight generators in the region, but critical components of the national interstate system for the movement of freight. I-55 links New Orleans, Memphis, St. Louis, and Chicago, while I-40 crosses from California to North Carolina. More importantly, these interstates locally serve the UP intermodal facility in Marion, Arkansas, several West Memphis national trucking terminals, as well as warehouse and distribution facilities for a number of national retail chains. They are major arterials to and from the International Port if Memphis, Memphis International Airport, and local West Memphis water and air facilities. Segments on both these interstates in West Memphis exceed a congestion ratio of 0.9.

The interchange complex in West Memphis merges these two major arterials as well as connects them with local arterials Highway 77 and Highway 191 that serve the freight hubs described above. Interchange access for I-55 and I-40 is located closely to the split of these highways, causing significant weaving and the need to change lanes multiple times to properly enter and exit. The I-40, I-55, Highway 77, and Highway 191 intersection, west of the I-40 and I-55 split, is even more complicated, involving the convergence of four major roadways. These intersections experience large amounts of truck traffic and create a series of unsafe conditions that lead to accidents and congestion in this area.

Given the importance of these national and local highways for the efficient flow of freight, this recommendation proposes a detailed engineering study to determine the most appropriate solution for the I-40 and I-55 and I-40, I-55, Highway 77, and Highway 191 intersections in West Memphis, Arkansas. This study could potentially result in the complete redesign of the I-40 and I-55 and the I-40, I-55, Highway 77, and Highway 191 intersections.

Key Freight Infrastructure Recommendation 4: Construction/Completion of I-69 and I-269

Currently, there is only indirect access, non-interstate access between the Mexican and Canadian borders, impeding the smooth flow of freight that has resulted from the North American Free Trade Agreement (NAFTA). Dubbed the "NAFTA superhighway," Interstate 69 (I-69) is planned to be a new north-south interstate route that provides a continuous controlled access highway link between Mexico and Canada, a route length of approximately 1,650 miles. It is one of several high-priority corridors being evaluated by the U.S. Department of Transportation to address increased freight traffic associated with NAFTA.

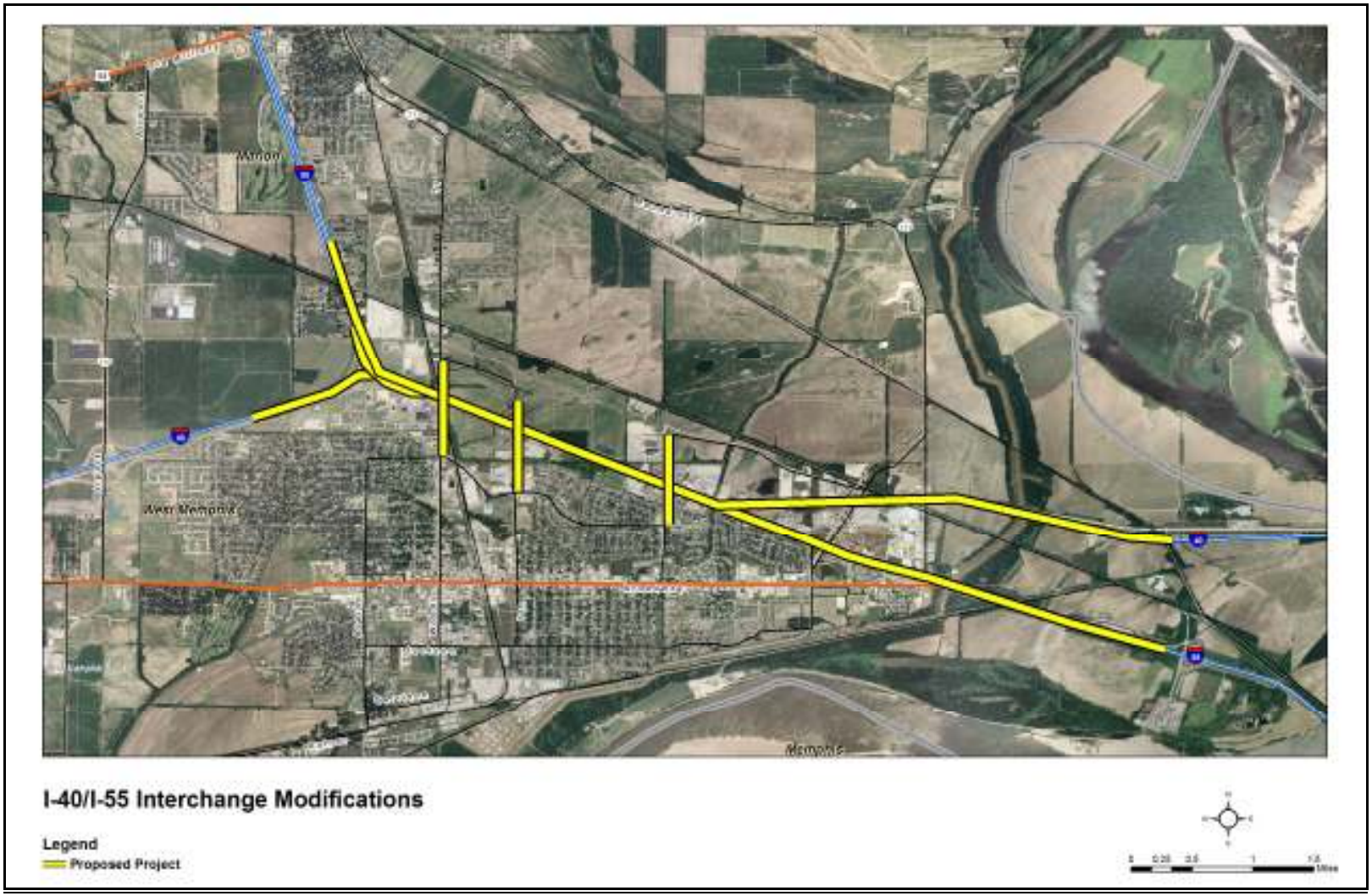
In the Memphis area, I-69 from the north would enter the state of Tennessee from Fulton, Kentucky, and continue southwest to Memphis, replacing and bypassing existing US-51, serving Union City, Dyersburg (where it will intersect Interstate 155), Ripley, Covington, and Millington. Currently, a 21-mile section of I-69 exists in the Memphis area, sharing its alignment with I-40, I-240, and I-55.

I-269 is part of the larger I-69 system. The new four-lane interstate would begin near the interchange of Interstate 55 and State Route 304 in Hernando, Mississippi, and extend north to the intersection of US-51 and State Route 385 in Millington, Tennessee, connecting to I-69 north of Memphis. It is intended to divert through traffic around the city and reduce congestion.

Besides the national freight goal of facilitating North American highway freight between the United States, Canada, and Mexico, I-69 and I-269 offer significant local benefits to the region. I-69 increases highway freight accessibility to the largely rural Western Tennessee portion of the study region, and will stimulate economic development. I-269 provides greater highway and freight access to eastern Shelby County and north Mississippi, and minimizes freight congestion in Memphis by diverting through freight traffic away from downtown Memphis. Both interstates support the Plan's objectives of freight connectivity and intermodal growth, especially for the outlying UP and proposed NS intermodal terminals.

Given the importance of these national and local highways for the efficient flow of freight, this recommendation proposes a detailed engineering study to determine the most appropriate solution for the I-40/I-55 and I-40/I-55/Highway 77/Highway 191 intersections in West Memphis, Arkansas. This study could potentially result in the complete redesign of the I-40 and I-55 and the I-40/I-55/Highway 77/Highway 191 intersections. Alternatively, an arterial highway could be constructed along the Union Pacific rail right of way that parallels I-40 and I-55 where the two interstates merge in West Memphis.

KEY MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE RECOMMENDATION 3: I-40/I55 INTERCHANGE MODIFICATIONS



Source: Wilbur Smith Associates

KEY MEMPHIS REGIONAL FREIGHT INFRASTRUCTURE RECOMMENDATION 4: CONSTRUCTION OF I-269/I-69

Source: Wilbur Smith Associates

Key Freight Infrastructure Enhancement 5: Third Mississippi River Bridge Crossing

A third Mississippi River bridge crossing would not only reduce congestion in the region, but become a critical link for local and national freight connectivity. The need for the third river bridge has been documented by multiple agencies, and has been studied by the Tennessee Department of Transportation (TDOT)[60]. The project is also identified by the Memphis and West Memphis MPO in their Long Range Transportation Plans. This recommendation supports the need for a third bridge from these previous studies and reiterates the basic arguments for constructing this critical infrastructure, including:

- *Provide adequate cross-river system linkage and rerouting opportunities for the region.* As this Plan has demonstrated, the Memphis area is a major multi-modal distribution center with limited Mississippi River rail and highway crossings. Currently, there are two highway bridge crossings located two miles apart in the vicinity of downtown Memphis. These crossings are susceptible to closures and congestion in the case of vehicular incidents, an earthquake, or other catastrophes. It is critical that an additional, seismically sound river crossing be provided to enable cross-river mobility in the event of bridge damage due to natural disasters or transportation-system incidents. Moreover, with both bridges being near central Memphis, all interstate and intercity truck traffic must compete with passenger traffic to and from downtown Memphis. An additional river crossing diverts freight away from these downtown Memphis traffic circulation patterns on the current bridges, improving the overall efficiency and effectiveness of the metropolitan Memphis transportation system.

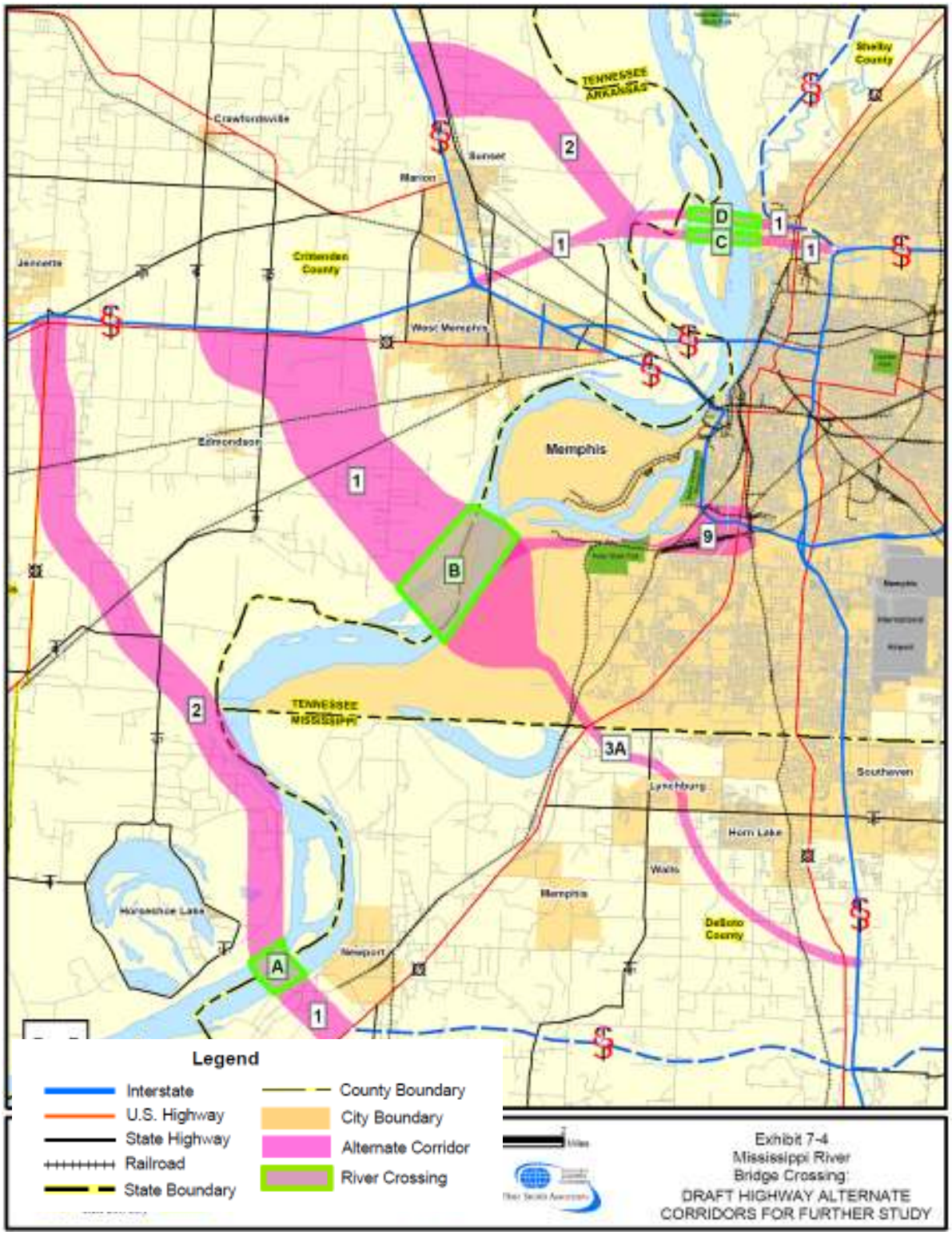
- *Provide capacity relief for existing I-40 and I-55 bridge crossings.* The importance of I-55 and I-40 as major local and national freight routes has been discussed earlier. With growth of freight in and through the region expected to increase, freight transportation system capacity will continue to be a critical concern (this is the motivation behind the funding of this Plan). For bridge traffic, it will be necessary to either add capacity or provide an alternate route to meet current and future traffic demand. Adding capacity to existing bridge facilities does not appear to be practical so a new highway and rail bridge provides additional capacity to relieve existing traffic congestion and improve level of service.

- *Enhance connectivity between major regional freight hubs in the region.* Current Mississippi River bridges are key freight connectors in the region. A third bridge improves highway access between these connectors, particularly in light of the expected increases in rail intermodal traffic to various freight hubs in the region.

- *Ensure efficient mobility for expected population and employment growth, including protecting the economic vitality of the region.* Economic benefits of a third bridge include lower freight transportation costs, enhanced productivity, competitiveness for Memphis area businesses, and potentially new employment opportunities in the region. The bridge also helps the area maintain its position as a major transportation and distribution center and allows other area business sectors in the region to experience economic vitality and growth.

[60] In 2006, the Tennessee Department of Transportation (TDOT) conducted the *Mississippi River Crossing Feasibility and Location Study*. The purpose of the study was to (1) determine the feasibility of providing a new Mississippi River Bridge Crossing in the Memphis metropolitan area and (2) identify and evaluate possible transportation solutions to help TDOT reach a decision on a preferred corridor alternative for proposed improvements for cross river mobility over the Mississippi River in the vicinity of Memphis. The study area encompassed Shelby County, Tennessee; Crittenden County, Arkansas; and DeSoto County, Mississippi. Likely Mississippi River bridge crossing locations generally fell within Shelby County, Tennessee.

KEY FREIGHT INFRASTRUCTURE ENHANCEMENT 5: SITES FOR A THIRD MISSISSIPPI RIVER BRIDGE



Source: Wilbur Smith Associates

FUTURE DEVELOPMENTS

This chapter has identified highway, rail, water, and air freight infrastructure recommendations to ensure Memphis maintains its position as "America's Aerotropolis" in the midst of changing global supply chain trends. As these recommendations are evaluated and implemented, they need to reviewed within the context of the next "game changing" freight development in Memphis, namely the increasing impact of rail, particularly rail intermodal, on the region's freight infrastructure.

As noted in this Plan, the Memphis region's unique rail infrastructure makes it very attractive as a national rail intermodal hub. It is only one of only five United States cities served by five Class I rail carriers and boasts four intermodal terminals (one used jointly by two railroads). More importantly, it is situated at the western or eastern terminus of three rail carrier networks, creating opportunities for the interchanging of intermodal trailers and containers with other rail carriers.

Recognizing the region's intermodal advantages, and its proximity to major consuming markets, Class I railroads have invested almost $424 million in intermodal terminal development in Memphis. Moreover, two carriers, Canadian National and Norfolk Southern, plan significant train service improvements that will further increase the level of intermodal activity in the area[61]. IHS Global Insight projects rail intermodal traffic in Memphis to grow to over 2 million trailers and containers by 2035, more than twice the current levels.

This growing activity of intermodal rail traffic, and associated logistics and warehouse related development, has the potential to significantly transform the freight landscape in Memphis similar to the arrival of Federal Express in 1973. While the logistics impact of FedEx was concentrated around one freight facility (i.e., Memphis International Airport) and involved one carrier, rail intermodal activity will occur at multiple locations and from numerous rail companies, complicating the management of its potential impact.

Logistics and warehouse related land use development, congestion, increased local/cross-town truck traffic, job creation, and grade crossing delays are some of the regional impacts of growing intermodal freight rail activity. Unlike other modes, freight rail infrastructure investment is primarily private, limiting the ability of public agencies such as the Memphis Urban Area Metropolitan Planning Organization (MPO) to adequately plan for these impacts. However, public agencies can be very influential in coordinating and managing private rail freight infrastructure investment to maximize the significant public benefits that can accrue from intermodal traffic. The experiences of public rail planning efforts in Chicago and Seattle in particular can be instructive as to how Memphis can address expected increases in rail intermodal freight activity. The following recommendations are offered as potential mechanisms to better plan for this increased activity:

Staff Freight Rail Knowledge/Expertise. To better understand and coordinate growing rail activity in the region, knowledge of rail freight operations and management will be increasingly important as part of the staff competencies at public agencies in Memphis that guide and manage the region's infrastructure investments. Freight rail experience needs to be included in future staffing decisions by the MPO, the Chamber, and other public agencies. The University of Memphis Center for Intermodal Studies, local retired freight railroad employees, and local transportation engineering firms are good sources to identify individuals with this type of special freight knowledge who can advise and work with freight railroads on behalf of the region. It is recommended that the MPO and other public agencies work more closely with the University of Memphis regarding additional staff training in rail freight.

Rail Freight Coordinating Committee. One key to successful rail infrastructure planning in the region is closer coordination among the five rail carriers that serve Memphis. Experience in Chicago,

[61] The Norfolk Southern and the States of Alabama and Tennessee were recently awarded $105 million as part of the Transportation Investment Generating Economic Recovery (TIGER) grant program to support construction of two intermodal facilities on the Crescent Corridor in Memphis, TN and Birmingham, AL.

a metropolitan area with significant rail freight infrastructure and six Class I railroads, has shown that this type coordination is difficult. Individual rail carriers often operate with their own specific characteristics, schedules, and priorities, with little interaction between them.

To guide and coordinate rail infrastructure development and planning in Chicago, the Chicago Transportation Coordination Office (CTCO) was created. The CTCO has representatives from each serving railroad in Chicago and develops managerial solutions to day-to-day rail operations that impact the region, works with public agencies on mitigating the public effects of rail service, and assists in coordinating and advising on each carrier's capital planning process as it affects the city or other railroads. Memphis should consider the establishment of a similar public/private operating organization within the region to facilitate communication and coordination between railroads and with the public sector.

Corridor Planning. Intermodal development around the BNSF terminal on Lamar Avenue has shown the need for certain infrastructure planning to be conducted within a "corridor" framework encompassing major freight thoroughfares and multiple modes. This corridor concept is particularly relevant in Memphis. Besides Lamar Ave, this Plan identified Holmes Road and I-69/I-269 as major freight corridors in the region.

Formal corridor planning is difficult since it spans various jurisdictions, municipalities, and modes. However, recent experience by the Seattle, WA MPO, the Puget Sound Regional Council, with its Freight Action Strategy for the Everett-Seattle-Tacoma Corridor (FAST Corridor) is an example of how of a corridor planning framework can effectively guide and influence rail infrastructure investment. FAST is an innovative partnership composed of transportation agencies, ports, cities, economic development organizations, trucking, rail and business interests that collectively analyze freight movement within a defined corridor and developed projects that moved freight more efficiently and increased safety for cars, trucks and trains. Since 1998, FAST identified and assembled $568 million in public and private funding to build nine strategic infrastructure improvements in the corridor and start four more. This type of planning approach should be considered as part of the current Cambridge Systematics Lamar Ave. Study as well as for Holmes Road and the I-69/I-269 corridor which connects the region to Shelby, DeSoto, Fayette, and Tipton counties.

Freight Transportation Advisory Board. The importance of the region's infrastructure for efficient freight movement as well as economic development requires effective partnerships between the public and private sectors to properly plan infrastructure development. While Memphis has formed a number of these partnerships, especially through its Aerotropolis initiatives, it is recommended that private sector involvement, particularly involving rail freight, be formally institutionalized in the region's freight planning process through the creation of a Freight Advisory Board. This Board, composed of public agencies, shippers, and carriers, would be responsible for prioritizing and coordinating freight infrastructure development and would include representatives from all five Class I railroads serving the Memphis region. The formation of such a Board could be in conjunction with the Memphis Chamber's Regional Logistics Council and especially useful in the collection of data and private freight expertise critical to effective regional transportation planning. Additional research is needed to determine how this Board would interact with the proposed Rail Freight Coordinating Committee and Corridor Planning groups recommended above.

AN EXAMPLE OF FREIGHT CORRIDOR PLANNING: FREIGHT ACTION STRATEGY FOR THE EVERETT-SEATTLE-TACOMA CORRIDOR (FAST)

Besides the growing impact of intermodal rail, below are a number of other future developments that have the potential to influence the region's freight infrastructure development in the future.

Integrated Logistics Centers.

A natural extension of the region's expanding freight infrastructure is the development of "integrated logistics centers." These centers are large, unified complexes where every component of the supply chain are operated and managed on one campus. They generally are Foreign Trade Zones located near an intermodal terminal and include public cross-dock and warehouse activities, container storage yards, private distribution centers, container storage facilities, and logistics support services such as hotels, truck stops, office space, and retail.

Integrated logistics centers are usually developed by private commercial developers (often in conjunction with a Class I rail carrier) and offer many private and public advantages: less congestion, minimization of costly truck drayage and demurrage, speedier pro product handling, value-added activities, and significant job creation. At the proper scale, these centers can even serve as platforms for corporate carbon footprint reductions and generate a variety of effective "green" logistics initiatives.

Integrated logistics centers are being developed at a number of major inland distribution locations including Joliet, Illinois (Centerpoint Intermodal Center); Alliance, Texas (The Alliance Gateway); Winter Haven, FL; and Raritan, NJ With the region's growing intermodal activity, extensive air-based Aerotropolis development, and interstate access, the Memphis region has the key ingredients to develop a similar complex near one or more of its intermodal terminals. Possible large acreage locations that could support such a center include Fayette County near the proposed Norfolk Center terminal or West Memphis with its cluster of truck terminals and the UP intermodal terminal. In particular, additional research is necessary to assess the impact of Foreign Trade Zones in these areas.

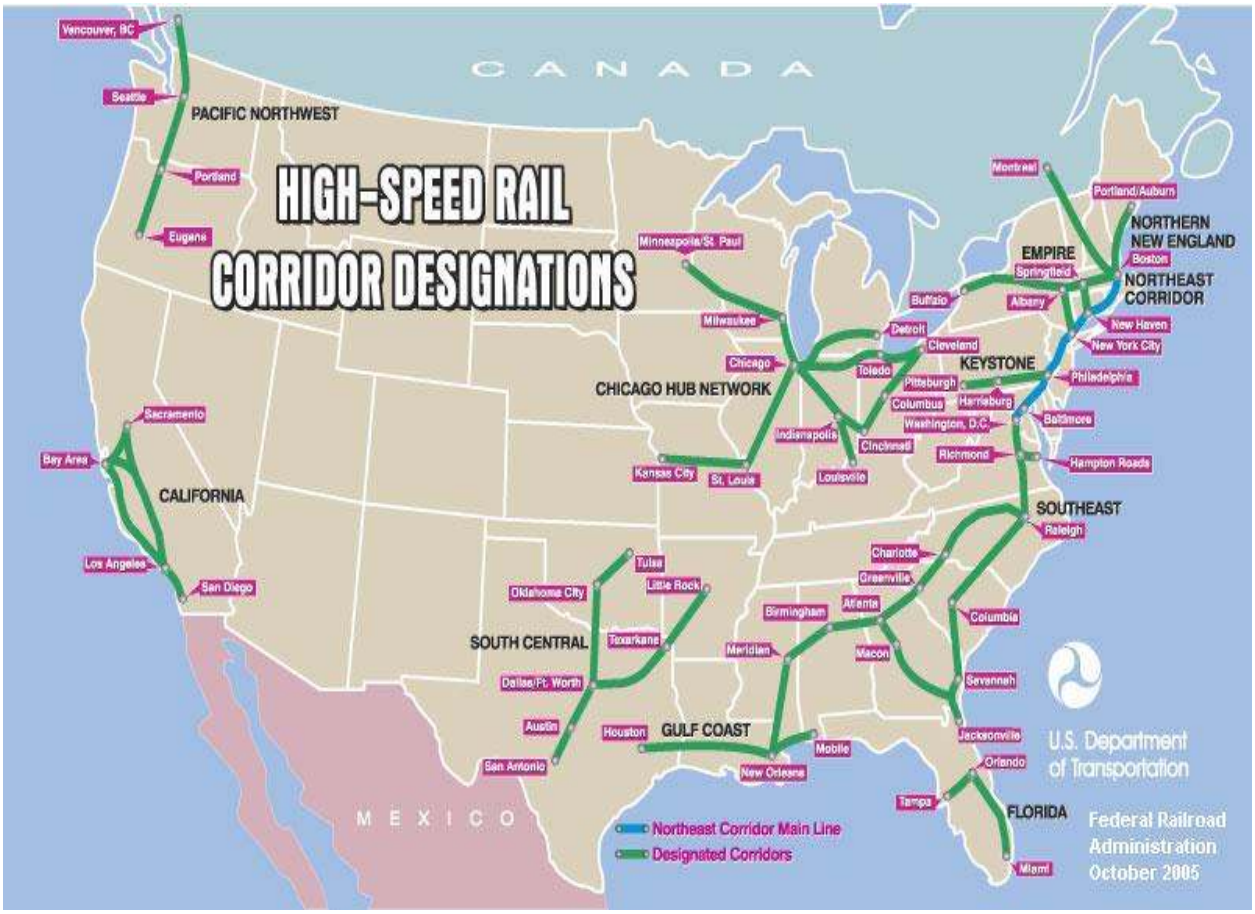
PROPOSED CENTERPOINT INTERMODAL INTEGRATED TERMINAL, JOLIET, IL

Passenger Rail.

While this Plan focused on freight infrastructure, the growing importance of high-speed passenger rail linking major urban areas such as Memphis, and its development in conjunction with freight infrastructure, cannot be ignored. The Federal Railroad Administration's Vision For High Speed Rail in America[62] has made the development of high-speed rail network a national priority. For Memphis, this involves the possibility of extending the "South Central" high-speed corridor that currently ends in Little Rock to Memphis, along one of two existing freight railroad rights of way.

Shared passenger and rail infrastructure is most applicable to rail, since most passenger rail operates on freight railroad track. Consideration of high-speed rail in Memphis, however, raises the larger issue of shared infrastructure between passenger and freight for other freight modes besides rail. Although passenger and freight traffic often have different priorities and operating characteristics, shared facilities provide significant economies of scale and the opportunity to leverage scarce funding for maximum benefit. Within the Memphis region, there are many opportunities for shared passenger and freight infrastructure, particularly this Plan's key recommendation regarding a third Mississippi River Bridge with both rail and highway right-of-way. Other future infrastructure improvements in the region also need to be considered with this shared use in mind.

HIGH-SPEED RAIL CORRIDOR DESIGNATIONS



Source: US DOT

[62] Vision for High-Speed Rail in America, U.S. Department of Transportation, Federal Railroad Administration, April 2009

Container-on-Barge .

There have been numerous studies in the region on expanding the Memphis river port system to provide the region with greater water access to world markets. One such promising freight concept is "container-on-barge," i.e., the transfer of international containers on and off barges traveling the Mississippi River to rail or truck. While container-on-barge operations have been discussed in theory at a number of inland water locations, Memphis already has a successful container-on-barge operation at Fullen Dock and Warehouse within the International Port of Memphis.

Prior studies of container-on-barge activity in the region estimated that the annual economic impact of a container-on-barge operation in Memphis could be as high as $5.5 billion, with over 16,000 associated jobs[63]. Discussion with Fullen Dock staff as part of stakeholder interviews for this Plan revealed that this niche freight service has a very well defined, and untapped, market. In light of the growing trend of using multiple modes in the global supply chain and greater reliance on low-cost transportation, the region should leverage its experience in container-on-barge operations to develop additional freight opportunities that take advantage of this unique component of the region's water infrastructure.

CONTAINER-ON-BARGE OPERATION AT FULLEN DOCK

Source: http://www.fullendock.com/.

[63] Transportation Research Forum, Marine Baord 2005 Annual Meeting, April 13, 2005.

Appendix I: World Trade Service Forecasting Methodology

Introduction

The primary purpose of IHS Global Insight's world trade forecasting system is to provide information to assist decision makers involved with international transportation. International transportation businesses, such as ocean shipping companies, terminal operators and port authorities, need detailed global trade volume forecasts for their operations and development planning. Policy makers and managers in companies that are not in the transportation business also can use these comprehensive forecasts to analyze world trade issues.

To meet the needs of the users, our global trade forecasts include all commodities that have physical volume, but not trade in services or commodities without physical volume, such as electricity. These commodities are grouped into our own categories derived from the International Standard Industrial Classification (ISIC). We cover 77 ISIC categories, as listed in here.

For all trade partners in the world, we track 54 major countries individually and group the rest of the countries in the world into 16 regions according to their geographic location.[64] Therefore, we forecast 77 commodities traded among 70 country/regions. This is a framework of 77×70×(70-1), or 371,910 potential trade flows. Because not every country trades every commodity with every other country, we presently have about 270,000 trade flows in our forecasts.

We forecast world trade in nominal and real commodity value and then convert to physical volume by transportation mode. Primary modes of transportation include air, overland and maritime transport, all measured in metric tons as well as in value. Maritime transport is further detailed for liquid bulk, dry bulk, general cargo/neobulk, and container trades. Container trade is measured in twenty foot equivalent units (TEUs) as well as metric tons. Below, the 18 concepts of the world trade in the forecast are shown.

Trade Data Sources

The primary international trade history data come from the United Nations as processed and published by Statistics Canada. These commodity trade statistics are collected from each member country's customs agencies. Customs departments have records of both the export and import sides of trade flows. Statistics Canada produces export data in f.o.b. (free on board) terms, which are better to use in estimating the real value of the commodity trade. This data covers all UN member countries and non-member economies, such as Taiwan. IHS Global Insight also purchases OECD International Trade by Commodity Statistics for more current data from the developed countries.

Because international trade statistics collected by different countries usually have discrepancies when compared to each other, and because no one source has entirely complete data, we also use U.S. Customs data and IMF Direction of Trade data to calibrate and supplement the historical commodity trade data. Data from different sources are recorded in different classification systems and units of measurement. We convert the data into thousands of current U.S. dollars and then into 1997 real commodity value.

The world trade forecasting models also rely on IHS Global Insight's comprehensive macroeconomic history and forecast databases. Among the data used are population, GDP, GDP deflators, industrial output, foreign exchange rates, and export prices by country. We use these data as exogenous variables in the trade forecast models. For international commodity prices, we also obtain data from the U.S. Bureau of Labor Statistics' on international import and export prices. We also use other data, such as foreign direct investment and import tariffs, as available, as determinants of a country's export capacity and import costs.

[64] Table I in the appendix lists the 54 countries and 16 regions used in the trade forecasting models.

Modeling International Trade

The basic structure of the model for the trade flow of a commodity is that a country's import from another country are driven by the importing country's demand forces, enabled by the exporting country's capacity of exporting (supplying) the commodity, and affected by the exporting country's export price and importing country's import cost for the commodity. A country will import more of a commodity if its demand for this commodity increases. At the same time, the country will import more of this commodity from a particular exporting country if that exporter's capacity to export this commodity is larger and its export price for this commodity is lower than in other exporting countries. Importers will ultimately purchase based on the delivered cost, importing more when the import cost decreases. The distance between two countries is also an important factor in determining the scale of trade between two countries. Our models are constructed to capture the dynamics of international trade so that geographic distance as a constant is embedded in determining the scale of the base.

Demand forces are commodity specific. Presently, we group 77 commodities into two types. For the first type of commodities, major demand forces are the importing country's population and income growth. For the second type of commodities, the major demand forces are the importing country's production and technology development.

A country's export capacity for a commodity is estimated based on the country's capacity to produce this commodity and its ability to export it. The infrastructure, the establishments and resources that are needed for production determine production capacity. For export capabilities, we pay attention to the capacity that exceeds that needed to meet a country's domestic demand. Export capability is also determined by the quality and cost of the products that face competition in world markets.

Import costs are determined by export prices, import tariffs, and each importing country's foreign exchange rates. We categorize our 77 commodities into three groups to control the estimation of the impact of import costs on countries' imports of each commodity. These three groups generally can be described as price inelastic, low price elastic, and price elastic.

The models are constructed in real value terms. That is, value type variables are in terms of value minus the effect of price inflation. For example, the trade flow of a commodity is measured in the 1997 value of this commodity, and GDP of a country is measured in its 1990 value of GDP. We use the data in real value terms, because only in real terms do the levels of imports and exports show clear respective responses to changes in demand, supply, and prices.

As our main purpose is not simply forecasting a country's aggregate imports and exports, the models must be able to forecast each country's imports and exports with each of its trade partners. Trade between each pair of trading partners is generally quite volatile with importing behavior exhibiting switching of suppliers on an ongoing basis. A very simple example of switching behavior is when the pattern of an exporter's supply dynamic is smaller than the importer's demand dynamic, the exporter's supply dynamic will dominate the trade. In the opposite case, when an importer's demand dynamic is smaller than the exporter's supply dynamic, the importer's demand dynamic will dominate the trade. To capture such a pattern switch, we use multi-stage switch models.

Model Estimation

To minimize the impact of measurement errors and achieve stationarity for valid estimation of times series models, our models are constructed to represent the relationship between year-over-year growth indexes of commodity trade and the year-over-year growth indexes of other exogenous variables. Because the calculated year-over-year index is asymmetric around unity, it can exaggerate growth dynamics if the present year is an upturn and the previous year is a downturn. This problem can be serious for the detailed international trade data that have very volatile dynamics. To reduce such asymmetric distortion in model estimation, we rectify the asymmetry in the data before estimating the trade models.

Our trade models are nonlinear multi-stage switch models. Switch models are not continuous functions, so conventional derivative methods cannot be applied to estimating these models. So to estimate the trade models, we use a direct search method. Though thus use of the direct search method is infrequent in economic forecasting, it is popular in other scientific fields. This is because economists often abstract from reality to fit simplified theoretical models, while scientists must construct their models to capture reality as evidenced in empirical data. Our experience has shown that international trade of goods among world markets are so complicated with regard to each commodity, each pair of partners, and over time that they cannot be sufficiently abstracted to fit into simple continuous functions for accurate forecasting. Instead we have developed our system using complex switch functions, for which we employ a direct search method for estimation.

For estimating simple continuous functions, derivative methods have the advantage of quick convergence. However, with faster computers and decreasing computation costs convergence time is no longer a problem. This means our ability to estimate practical models can depend upon the criterion used for choosing our estimation method. The direct search method we use has three major advantages over conventional derivative methods. The first advantage, which is the most important one, is that it can be used to estimate switch functions. The second advantage is that it allows us to freely define our error minimization function. For forecasting it is minimizing the relative absolute error not the sum of squared error that is important for producing the most accurate models. However, an absolute error function is not continuous so we use a direct search method for its estimation. For nonlinear models, the continuous error function defined for derivative methods sometimes cannot avoid multi local minimums, so use of a derivative method frequently cannot attain global minima. Through the use of the direct search method, we can freely define the error function to only contain one minimum. The third advantage is that the direct search method allows us to conveniently set the boundary of model parameters. That means it allows us to apply prior information to our model estimation.

Forecast Approach

There are two key factors that influenced our choice of forecasting approach. One is the scale of our trade forecasts, and the other is the real character of international trade. The real character of international trade includes economic resource constraints, heterogeneous import behavior, and overall supply and demand equilibrium.

Previous international trade forecasting approaches can be categorized as bottom-up, top-down, and a (manual) hybrid approach. Our forecasting experience leads us to believe that none of these approaches are suitable to best meet our requirements. The bottom-up approach requires that the individual items to be forecast are not subject to total resource constraints or an overall equilibrium. This denies the existence of real resource constraints in international trade. For just one example, a country's imports are limited by its income constraint. We also find that there is an overall equilibrium in international trade, where no country can export more than what other countries are willing to import from it. In contrast, the top-down approach requires that individual items to be forecast have identical dynamic patterns. Examining commodity trade statistics quickly reveals that it is difficult to find one country's imports of a commodity from two different countries that have the same dynamic patterns. So this approach is not appropriate either. To overcome the shortcomings of using the bottom-up or top-down approaches alone, some economists have forecast individual commodities and their aggregates simultaneously and then manually reconciled the difference between the sum of individual forecasts and the aggregate forecasts. This is called a hybrid approach, which is generally a manual method. Unfortunately, the manual reconciliation is very time consuming, so it cannot be efficiently applied to comprehensive forecasts such as ours, which include more than a quarter million forecast series.

To overcome the weaknesses in these approaches, we have built a system that can be described as a top-down controlled approach. To implement this approach, we aggregate detailed trade flows to three top levels. We call the most detailed trade flows Level 4 (the lowest level) and aggregate them up level-by-level in the following structure:

Level 1

L1: World trade of total commodities,

1×1×1 = 1 series.

Level 2

L2C: World trade by commodity,

77×1×1 = 77 series.

L2M: Total commodities that each country/region imports from the world,

1×1×70 = 70 series.

L2X: Total commodities that each country/region exports to the world,

1×70×1 = 70 series.

Level 3

L3M: Commodities that each country/region imports from the world,

77×1×70 = 5,390 series maximum.

L3X: Commodities that each country/region exports to the world,

77×70×1 = 5,390 series maximum.

Level 4

L4: Commodities traded between each pair of countries/regions,

77×70× (70-1) = 371,910 series maximum.

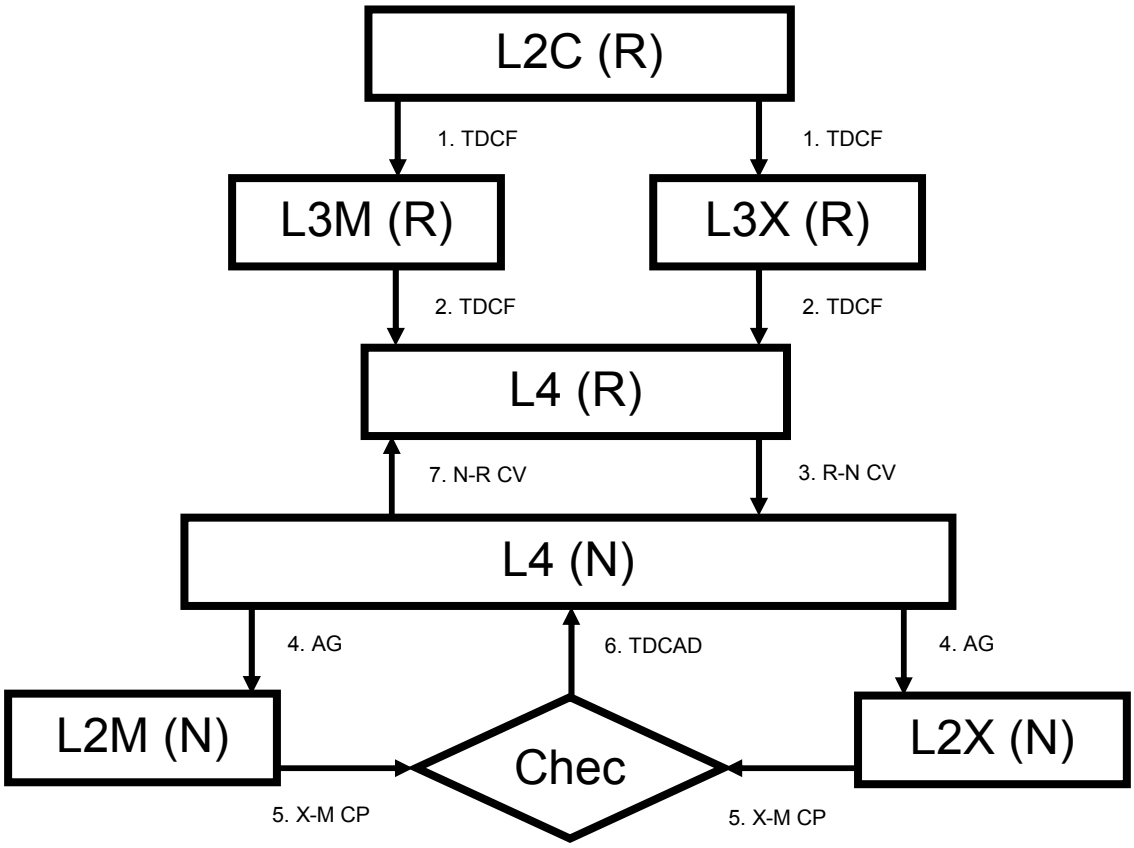
In this hierarchical structure, each series in levels L2C, L3M, L3X, and L4 has its own behavioral equation in the model structure (as described above in section 3). In this top-down controlled forecasting approach, each series is forecast by its own behavioral equation, but individual items at the lower level are forecast under the control of the forecast of their aggregate at the higher level. The forecasting program detects the discrepancy between the sum of individual forecasts and the aggregate forecast, identifies individual items that can be adjusted, and adjusts them step by step to diminish the discrepancies. The identification and adjustment are based on the estimated allowable variation of the behavior models. With such a design, the top-down controlled forecast adheres to the reality that international trade is subject to economic resource constraints, has heterogeneous behavior, and will attain overall supply and demand equilibrium.

Forecasting Process

Our forecast approach determines our forecasting process, as shown by the flowchart that follows. The numbers in the flowchart indicate the sequence of the forecasting. The forecast starts from L2C. These are the top-level forecasts. We then use them to do top-down controlled forecasting of L3M and L3X, and in turn use L3M and L3X to do top-down controlled forecasting of L4. They are all forecast in real commodity value. After we obtain the detailed forecasts of the international trade in real commodity value, we check whether the overall forecast implies a reasonable trade balance that we should expect for every country/region according to their macro economic development. Trade balance is a financial concept that we need to examine in nominal, not real, value terms. Therefore, we convert real value L4 into nominal value L4 and then aggregate them to import and export by country/region, i.e., L2M and L2X in nominal value. Although our forecast does not include service sectors, we take into account the development of services trade for each country/region when examining the trade balance between L2M and L2X. If the

forecasted trade balance for a country/region is not reasonable, we adjust L2M or L2X, or both, and then use the adjusted L2M and L2X to do a top-down controlled adjustment of the nominal L4 detailed trade. Because the trade of these countries/regions link to each other, adjusting the trade balance of one country/region affects the trade balance of other country/regions, depending on the magnitudes of their trade links. Therefore, usually we need several rounds of adjustments to attain reasonable trade balances for all country/regions. After completing the trade balance check and adjustment step, we convert nominal value L4 to real value L4 and aggregate these final detailed forecasts to their upper three levels.

IHS Global Insight World Trade Forecasting Process



Where: R – real commodity value

N – nominal value

TDCF – top-down-controlled forecast

R-N CV – real-nominal value conversion

AG – aggregation

X-M CP – export-import balance comparison

TDCAD – top-down-controlled adjustment

N-R CV – nominal-real value conversion

Because the release of trade data always lags behind current trade activity, and because behavioral forecasting models cannot include unexpected events, such as disease outbreaks in livestock, oil price shocks, earthquakes, strikes, wars, etc., we create dummy variable multipliers for each series, and modify some of them at certain levels in accordance with development of events in the world.

Converting Real Value Trade to Transportation Volume

There are predictable relationships between the physical volume and the real value of each trade flow. After we obtain the forecasts of world trade in real commodity value, we use these relationships to convert the real commodity value to the physical volume of 77 commodities transported among 70 countries/regions, by transportation mode. We first convert the commodity flows to the value and physical volumes shipped by different transportation modes. Transportation mode represents the primary mode of transport used in the international shipment, usually for the greatest distance (or line haul) part of the complete origin-to-destination shipment. These major modes are air, overland/other (comprised mainly of truck, rail and pipeline) and maritime. For maritime trade, we further distinguish between liquid bulk, dry bulk, general cargo/neobulk and container trade. The volume of commodities carried by each mode reflects the historic shares carried by each mode, at a commodity-specific and trade route-specific basis with adjustments made to maritime shares based on observed shifts in share between the types of maritime shipping. For container trades, the forecast tonnage volume is further translated into twenty-foot equivalent units (TEUs) through application of commodity-specific and trade route-specific stowage factors for twenty-foot and forty-foot containers and the mix of twenty-foot and forty-foot containers used on each trade route. (The full list of forecast trade concepts produced is shown below.)

Forecast Range and Frequency

The history of our trade statistics starts from 1980 and extends to about a one-year lag from the current time. We forecast 20 or more years into the future, depending on clients' needs. Our forecasts are annual series, because the main historical trade data are reported as annual series. However, our supplementary trade data and exogenous macro economic data can be annual series, quarterly series, or monthly series. They are updated quarterly or monthly so we update our trade forecasts every quarter.

IHS GLOBAL INSIGHT WORLD TRADE SERVICE FORECAST COMMODITY CATEGORIES

Count	ISIC	Description
1	1A	Grain
2	1B	Oil Seeds
3	1C	Vegetables, Fruits and Eggs – Requiring Refrigeration
4	1D	Vegetables and Fruits - non-Refrigerated
5	1E	Cork and Wood
6	1F	Natural Rubber
7	1G	Cotton
8	1H	Other Raw Textile Materials
9	1I	Other Agriculture
10	2A	Stone, Clay and Other Crude Minerals
11	2B	Crude Fertilizers
12	2C	Ores and Scrap
13	2D	Coal
14	2E	Crude Petroleum
15	2F	Natural Gas
16	2G	Scrap
17	311A	Meat/Dairy/Fish Requiring Refrigeration
18	311B	Other Meat/Dairy/Fish
19	311C	Sugar
20	311D	Animal Feed
21	311E	Animal and Vegetable Oils
22	311F	Other Food
23	313	Beverages
24	314	Tobacco
25	321	Textiles
26	322	Wearing Apparel
27	323	Leather and Products
28	324	Footwear
29	331	Wood Products
30	332	Furniture and Fixtures
31	341A	Waste Paper
32	341B	Pulp
33	341C	Paper and Paperboard and Products
34	342	Printing and Publishing
35	3511A	Organic Chemicals
36	3511B	Inorganic Chemicals
37	3512	Fertilizers and Pesticides
38	3513	Synthetic Resins
39	3521	Paints, Varnishes and Lacquers
40	3522	Drugs and Medicines
41	3523	Soap and Cleaning Preparations
42	3529	Chemical Products, nec.
43	353	Petroleum Refineries
44	354A	Briquettes and Coke
45	354B	Residual Petroleum Products

46	355	Rubber Products
47	356	Plastic Products, nec.
48	361	Pottery, China etc.
49	362	Glass and Products
50	369	Non-Metallic Products, nec.
51	371	Iron and Steel
52	372	Non-Ferrous Metals
53	381	Metal Products
54	3821	Engines and Turbines
55	3822	Agricultural Machinery
56	3823	Metal and Wood Working Machinery
57	3824	Special Industrial Machinery
58	3825	Office and Computing Machinery
59	3829	Machinery and Equipment, nec.
60	3831	Electrical Industrial Machinery
61	3832A	Radio and TV
62	3832B	Semi-conductors, Electronic Tubes, etc.
63	3832C	Other Communications Equipment
64	3833	Electrical Appliances and Housewares
65	3839	Electrical Apparatus, nec.
66	3841	Shipbuilding and Repairing
67	3842	Railroad Equipment
68	3843A	Motor Vehicles
69	3843B	Parts of Motor Vehicles
70	3844	Motorcycles and Bicycles
71	3845	Aircraft
72	3849	Transport Equipment, nec.
73	3851	Professional Equipment
74	3852	Photographic and Optical Goods
75	3853	Watches and Clocks
76	390	Other Manufacturing, nes.
77	399	Goods not classified by kind

Note: nec – not elsewhere classified; nes – not elsewhere specified

IHS Global Insight World Trade Service Forecasting Countries/Regions

Count	Country Name	Count	Country Name
1	United States	41	Pakistan
2	Canada	42	Venezuela
3	Japan	43	Brazil
4	Germany	44	Argentina
5	France	45	Colombia
6	United Kingdom	46	Peru
7	Italy	47	Chile
8	Austria	48	Mexico
9	Belgium	49	Israel
10	Denmark	50	Saudi Arabia
11	Finland	51	United Arab Emirates
12	Greece	52	Egypt
13	Ireland	53	Kenya
14	Netherlands	54	South Africa
15	Norway		
16	Portugal	**Aggregate Regions**	
17	Spain	**Count**	**Region Name**
18	Sweden	55	Other Europe
19	Switzerland	56	Baltic States
20	Turkey	57	CIS West
21	Russia	58	CIS Southeast
22	Poland	59	Other Indian Subcontinent
23	Czech Republic	60	Other East Coast of South America
24	Slovak Republic	61	Other West Coast of South America
25	Hungary	62	Caribbean Basin
26	Romania	63	Other Central America
27	Bulgaria	64	Other Persian Gulf
28	Australia	65	Other Mediterranean Region
29	New Zealand	66	Other North Africa
30	China	67	Other East Africa
31	Taiwan	68	Western Africa
32	Hong Kong	69	Other South Africa
33	South Korea	70	Other Region
34	Indonesia		
35	Philippines		
36	Singapore		
37	Malaysia		
38	Thailand		
39	Vietnam		
40	India		

IHS GLOBAL INSIGHT WORLD TRADE SERVICE FORECAST CONCEPTS

Count	Concept
1	Nominal Value
2	Real Value
3	Airborne Nominal Value
4	Seaborne Nominal Value
5	Airborne Real Value
6	Seaborne Real Value
7	Airborne Metric Tons
8	Seaborne Metric Tons
9	Tanker Metric Tons
10	Dry Bulk Metric Tons
11	General Cargo/Neobulk Metric Tons
12	Container Metric Tons
13	Number of 20 foot Containers
14	Number of 40 foot Containers
15	Container Twenty-foot Equivalent Units (TEUs)
16	Over Land / Other Transportation Nominal Value
17	Over Land / Other Transportation Metric Tons
18	All Transportation Mode Metric Tons

Appendix II: U.S. International Trade Monitor

The **U.S. Inland Trade Monitor** (USITM) is a forecasted database of seaborne import and export trade that illuminates how this freight moves within the United States. With the explosion in international offshore trade, the need to know where and how international trade flows within the United States has become critical. The USITM is the only source for tracking containerized and most bulk trade into and out of U.S. ports. Covering all major points of entry and embarkation, the service provides a detailed regional break-down for road, rail and inland waterway, enabling clients to plan for infrastructure enhancements, perform policy analysis, drive capital investment decisions, and support market and economic development efforts. Built upon the solid base of IHS Global Insight's exclusive TRANSEARCH INSIGHT™ U.S. goods movement database, the World Trade Service, plus other proprietary and public data, the USITM is a must-have resource for understanding the impacts of international trade on your organization.

As one of the few internationally recognized trade data experts, and the expert on U.S. domestic freight flow data, IHS Global Insight has worked with carriers, shippers, ports, and governments around the world, helping them to make sense of complex freight flow data. The new USITM draws from this vast experience and offers annually updated forecast data, including:

Commodity Measurements

- Trade volumes (TEUs and weight in tons) by origin, marine gateway, and destination for containerized and non-containerized trade
- Volume totals incorporate trans-shipped and inland traffic

Commodity Detail*

- **Coverage**: 2 -digit STCC or ISIC: Same 77 commodity groupings used by: World Trade Service
- **Customization**: A range of greater commodity detail can be provided on request.

Modes

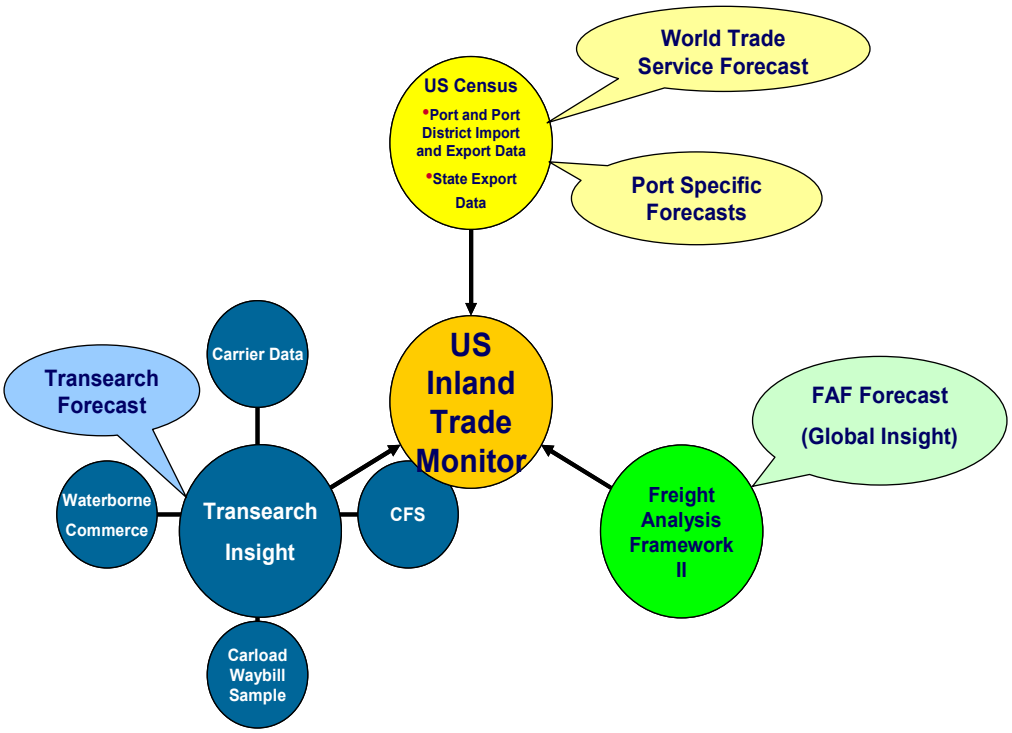
- Highway, conventional and intermodal rail, and inland waterway

Geography

- **U.S. Coverage:** Within the U.S., between marine gateways (defined as all Port Districts plus the 25 largest U.S. Seaports) and State-level Business Economic Area's (BEA's) and States
- **Global Coverage**: Between marine gateways and 53 countries representing 86% of US seatrade imports and 73% of US seatrade exports, with the full remainder grouped into 16 regions: Same countries/regions of export/import as in the World Trade Service
- **Customization**: A range of greater geographic detail can be provided on request (other gateway ports, county or MSA inland points, other countries).

Forecast Horizon and Update Frequency

- Two-year annual forecast with standard product (base year plus two subsequent years)
- Optionally up to 25-year outlook available
- Forecast updated yearly



The USITM is flexibly packaged and can be delivered as a stand-alone database, as an enhanced version of the TRANSEARCH INSIGHT™ database, as well as an extension to the IHS Global Insight *World Trade Service*. Each delivery mechanism is designed to meet the varying requirements of a broad spectrum of users, ranging from ports and government planning agencies of all sizes, to carriers and various supply chain participants.

There are numerous data sources used to create IHS Global Insight's USITM. The diagram below gives an overview of how these sources are combined to create this product.

Appendix III: Accessing the University of Memphis Intermodal Freight Transportation Institute FTP Site

Step 1 – Obtain and load WINSCP Software

To view the FTP site, the WINSCP software is needed.

The software is free and can be downloaded from the following site:

https://umdrive.memphis.edu/haklim/public/software/WINSCP.exe

Complete download instructions for placing WINSCP on the desktop are given.

Step 2 – Access the FTP Site

How to use Transportation Research Center FTP:
Double click on WINSCP.

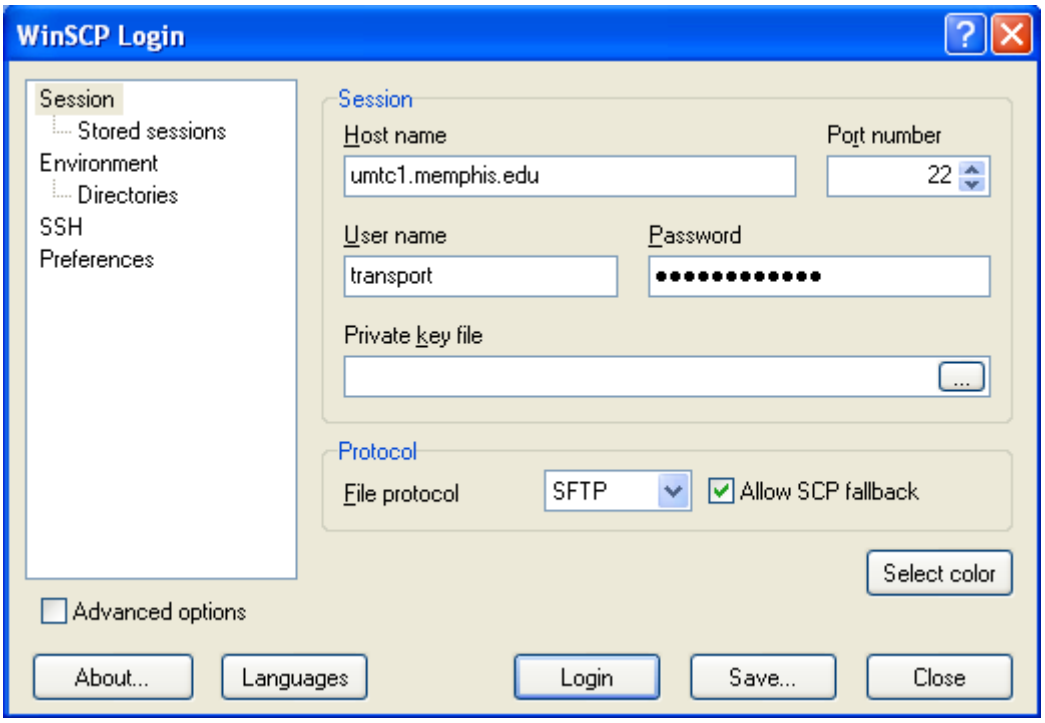
You will see a screen like the one below.

Enter the 'Host name" as: **umtc1.memphis.edu**

The 'Port number' stays as default: **22**

The 'User name' is: **transport**

The 'Password' is: **t-center2008**

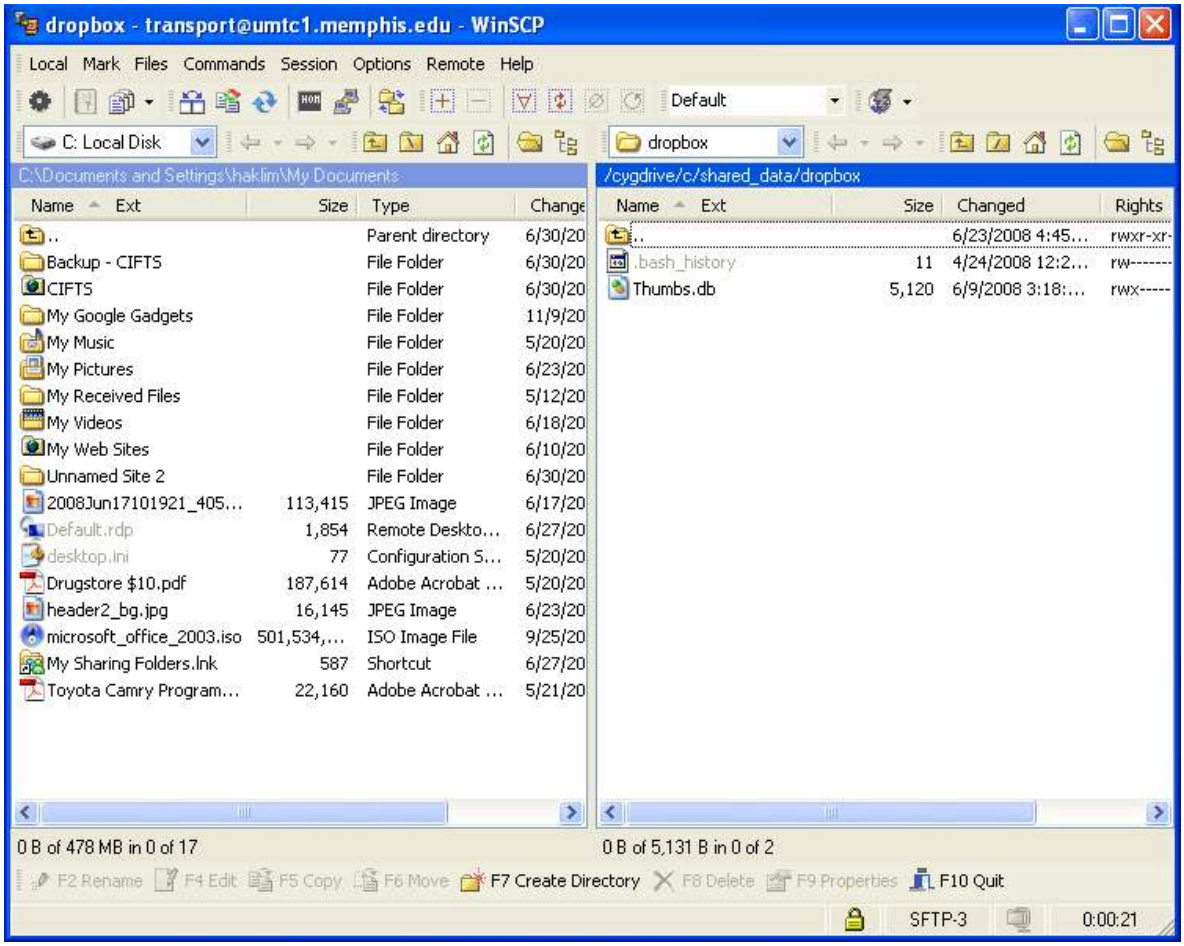


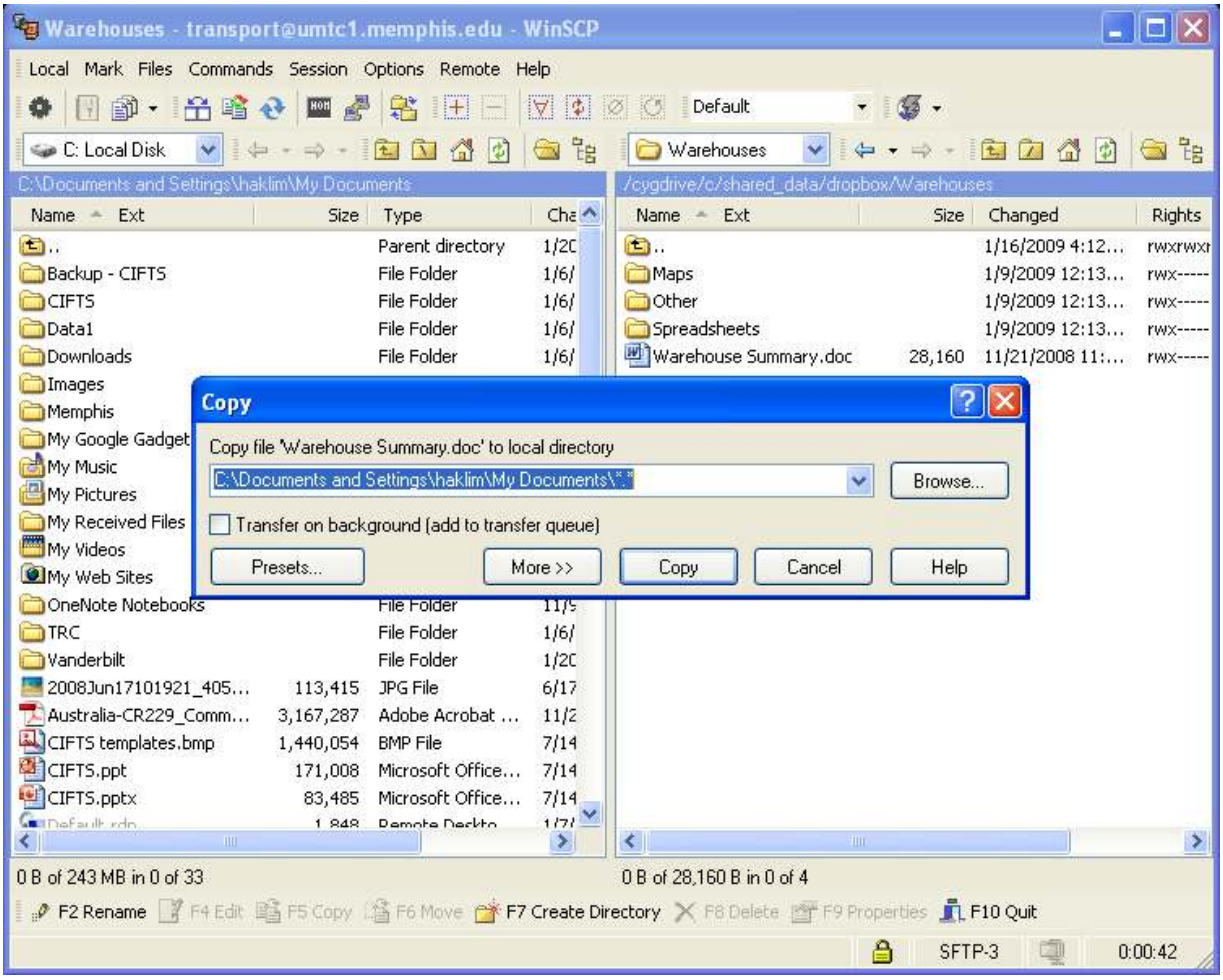
1. If all the information is entered correctly, you will be able to connect to our FTP host.
   You should see a screen similar to the one below:

2. Two windows can be seen. The window on your left is your own local drive. The window on your right is our FTP folders.

STEP 3 – DOWNLOAD FILES TO YOUR COMPUTER

1. You can ONLY upload and download the files in the FTP host using copy and paste or drag and drop. Make sure the files you wanted are copied to your PC before attempting to open it. DO NOT ATTEMPT TO DOUBLE CLICK ON THE FILES inside the FTP window. WINSCP is a freeware and is not able to read commercial files extension such as Microsoft Office Word, etc.





2. To copy a file, right-click on the selected file, select copy and choose a location for the file to be transferred to as shown below.

3. Click Copy. And once the “Copy” window is gone, your selected file has been transferred to your PC.

4. Close the application when you are done uploading/downloading the files.
You have terminated the connection with the FTP host.

Appendix IV: Stakeholder Interviews as Part of the Memphis Regional Infrastructure Plan

Prefix	First Name	Last Name	Company/Organization
Ms.	Julie	Ellis	Aerotropolis Transportation Work Group Chair
Mr.	Bill	Ramia	Averitt Express
Mr.	Scott	Jenkins	BNSF
Mr.	Tony	Brightman	Buckeye Technologies
Mr.	Dan	Bresolin	Canadian National Railway
Mr.	John	Thompson	Cargill
Ms.	Kay	Brockwell	City of Marion, Arkansas
Mr.	Ward	Wimbish	City of West Memphis
Mr.	Lee	Johnston	Covington-Tipton County Chamber
Mr.	Lynn	Caller	CSX
Mr.	Cliff	Lynch	CTSI
Mr.	Fred	Williams	Cummins, Inc.
Mr.	Jim	McDougal	Desoto County
Mr.	Jim	Flanagan	DeSoto County Economic Development Council
Mr.	David	Taylor	Dyersburg Chamber
Mr.	Allen	Hester	Dyersburg Chamber
Mr.	John	Ford	Dyersburg Chamber
Mr.	Mike	Maulden	Entergy Arkansas
Mr.	Scott	Nicholson	Exel, Inc.
Mr.	Tom	Schmitt	FedEx
Mr.	David	Taylor	Forcum Lannom Contractors (Dyersburg)
Mr	Randall	Rhodes	Forcum Lannom Contractors (Dyersburg)
Mr.	Lanny	Chalk	Fullen Dock & Warehouse, Inc.
Mr.	Dave	Barnett	Future Electronics (Desoto County)
Mr	Wes	Horner	Helena Chamber of Commerce
Mr.	Martin	Chaffin	Helena-West Helena Port Authority
Mr.	Kurt	Nelson	Industrial Developments International, Inc.
Mr.	Dave	Riggs	Kinder Morgan/Port of Memphis
Mr.	Neely	Mallory	Mallory Alexander International Logistics
Ms.	Martha	Lott	Memphis MPO
Mr.	Larry	Cox	MemphisShelby County International Airport
Mr.	Greg	Johnson	Meritex Logistics-Memphis, Inc.
Mr.	John	Dudas	MPO Sub-Committee Chair
Mr.	James	Carter	Norfolk Southern
Mr.	Thad	Solomon	NUCOR
Mr.	Buzz	Fly	Patterson Warehouses, Inc.
Mr.	Scott	Talley	PFSweb, Inc.
Mr.	Don	McCrory	Port of Memphis
Mr.	Ken	Vaughn	Schneider National
Mr.	Ben	Steinberg	Southern Financial Partners
Mr	Sloan	Sparrenberger	Swift Transportation
Mr.	Robert	Linne	Technicolor Distribution of Memphis
Mr.	David	Dean	Thomas & Betts Corp.
Mr.	David	Spann	U.S. Department of Commerce
Mr.	Drew	Tessier	Union Pacific
Ms.	Lynda	Avery	West Memphis Airport
Mr.	Eddie	Brawley	West Memphis MPO

Mr.	Ed	Sands	Williams-Sonoma, Inc.
Mr.	Glenn	Lacy	Yellow Transportation
Mr.	Charles	Gulotta	Memphis/Shelby County Division of Planning and Development
Mr.	Pete	Johnson	Delta Regional Authority
Mr.	John	Sicola	Memphis Area Association of Governments
Mr.	Joe	Barker	Southwest Tennessee Development District

Appendix V: Port Terminals by County in the Memphis Study Area[65]

Terminal Facility	County	Ownership
APAC Tennessee, West Memphis Dock.	Crittenden	Private
Kinder Morgan, West Memphis Lower Dock.	Crittenden	Public
Kinder Morgan, West Memphis Upper Dock.	Crittenden	Public
Premcor Refining Group, West Memphis Terminal Dock.	Crittenden	Private
Riceland Foods, West Memphis Export Terminal Dock.	Crittenden	Private
Warren Unilube, West Memphis Dock.	Crittenden	Private
Martin Marietta Aggregates, Lake Cormorant Dock.	De Soto	Private
Bunge Corp., Boothspoint Elevator Dock.	Dyer	Private
Bunge Corp., Heloise Elevator Dock.	Dyer	Private
Choctaw Transportation Co., Heloise Dock.	Dyer	Private
Cargill AgHorizons, Tiptonville Elevator Dock.	Lake	Private
Cargill AgHorizons, Hales Point Elevator Dock.	Lauderdale	Private
Continental Grain Co., Golddust Elevator Dock.	Lauderdale	Private
Hutcherson Metals, Hales Point Dock.	Lauderdale	Private
Lauderdale River Terminals, Hales Point Dock.	Lauderdale	Private
Bunge Corp., Barfield Terminal Dock.	Mississippi	Private
Bunge Corp., Huffman Elevator Dock.	Mississippi	Private
Bunge Corp., Osceola Landside Dock.	Mississippi	Private
Bunge Corp., Osceola Riverside Dock.	Mississippi	Private
Marine Terminals of Arkansas, Barfield Dock and Fleet Mooring.	Mississippi	Private
Marine Terminals of Arkansas, Hickman Docks.	Mississippi	Private
Nucor Steel, Blytheville Dock.	Mississippi	Private
Nucor-Yamato Steel Corp., Blytheville Dock.	Mississippi	Private
Osceola Riverport	Mississippi	Public
Poinsett Rice & Grain, North Dock.	Mississippi	Private
Poinsett Rice & Grain, South Dock.	Mississippi	Private
Terra Industries, Blytheville Plant Dock.	Mississippi	Private
Archer Daniels Midland Co., Helena Dock.	Phillips	Private
Bunge Corp., Helena Elevator Dock.	Phillips	Private
Entergy Arkansas, Robert E. Ritchie Steam Electric Station Dock.	Phillips	Private
Helena Bridge Terminal Docks.	Phillips	Private
Helena Marine Service Dock.	Phillips	Private

[65] The U.S. Army Corps of Engineers, database

Helena-West Helena Phillips County Port Authority, Helena Public	Phillips	Public
Helm Fertilizer, Helena Terminal Dock.	Phillips	Private
McAllister Grain, Old Town Terminal Dock.	Phillips	Private
Mississippi Limestone Corp., Repair Dock.	Phillips	Private
Planters Service, Helena Terminal Dock.	Phillips	Private
Scoular Company, Helena Port Terminal Dock	Phillips	Private
Texas Eastern Products Pipeline Co., Helena Dock.	Phillips	Private
ADM Growmark River Systems, Memphis Elevator Dock.	Shelby	Private
ADM River Port Corp., Memphis Dock.	Shelby	Private
Agriliance, Memphis Terminal Dock.	Shelby	Private
American Commercial Terminals, Memphis Dock.	Shelby	Private
APAC Tennessee, Memphis Terminal Dock.	Shelby	Private
Barnhart Crane & Rigging Co., Memphis Wharf.	Shelby	Public
Brenntag Mid-South, Memphis Dock.	Shelby	Private
Bunge Corp., Memphis Elevator Dock.	Shelby	Private
Buzzi Unicem USA, River Cement Sales Co. Memphis Terminal Dock.	Shelby	Private
Cargill AgHorizons, Memphis Terminal Elevator Dock.	Shelby	Private
Cargill North American Sweeteners, Memphis Grain Dock.	Shelby	Private
Cargill North American Sweeteners, Memphis Liquid Dock.	Shelby	Private
City of Memphis Police Department, Mud Island Harbor-Patrol Boat	Shelby	Public
Cummings Marine Service, Memphis Fleet "B".	Shelby	Private
Cummings Marine Service, Memphis Fleet Mooring.	Shelby	Private
Economy Boat Store, Memphis Dock.	Shelby	Private
Economy Boat Store, Memphis South Dock.	Shelby	Private
Ergon, Memphis "A" Dock.	Shelby	Private
Ergon, Memphis "B" Dock.	Shelby	Private
Ergon, Memphis "C" Dock.	Shelby	Private
ExxonMobil Corp., Memphis Terminal Dock.	Shelby	Private
Fleischmann's Yeast, Memphis Molasses Dock.	Shelby	Private
Fullen Dock and Warehouse, Memphis Wharves.	Shelby	Private
Helm Fertilizer Terminal, Memphis Dry-Bulk Dock.	Shelby	Private
Helm Fertilizer Terminal, Memphis Liquid-Bulk Dock.	Shelby	Private
Holcim (US), Memphis Terminal Wharf.	Shelby	Private
Kinder Morgan terminals	Shelby	Private
Kinder Morgan terminals	Shelby	Private
Koch Materials Co., Memphis Dock.	Shelby	Private
LASH Intermodal Terminal Co. (LITCO), Memphis Dock.	Shelby	Private
Lion Oil Co., Memphis Terminal Dock.	Shelby	Private
Lone Star Industries, Memphis Terminal Dock.	Shelby	Private
Lucy Woodstock Utility Terminal, Memphis Dock.	Shelby	Private

Martin Marietta Aggregates, Memphis Dock.	Shelby	Private
Memphis and Shelby County Port Commission, McKellar Lake Mooring.	Shelby	Public
Memphis Cement, Memphis Terminal Dock.	Shelby	Private
Memphis Marine Service, Memphis Dock and Fleet Mooring.	Shelby	Private
Memphis Marine Service, Tennessee Chute Fleet Mooring.	Shelby	Private
Memphis Queen Co., River Boats Dock.	Shelby	Private
Patton-Tully Transportation Mooring.	Shelby	Public
Patton-Tully Transportation, Memphis Dock.	Shelby	Private
Port of Memphis Public Terminal, Pidgeon Industrial Harbor Dock.	Shelby	Private
Port of Memphis Public Terminal, Pidgeon Industrial Harbor Dock.	Shelby	Public
Premcor Refining Group, Memphis Refinery Lower Dock.	Shelby	Private
Premcor Refining Group, Memphis Refinery Middle Dock.	Shelby	Private
Railworks Wood Products, Memphis Dock.	Shelby	Private
Tennessee Valley Authority, Thomas H. Allen Plant Memphis Wharf.	Shelby	Public
Trumbull Co., Memphis Dock.	Shelby	Private
U.S. Army Corps of Engineers, Ensley Yard Memphis Wharf.	Shelby	Public
U.S. Coast Guard, Group Lower Mississippi River Memphis Mooring.	Shelby	Public
Valero Terminal-Memphis	Shelby	Private
Vertex Chemical Corp., Memphis Terminal Dock.	Shelby	Private
Vulcan Materials Co., Memphis Dock.	Shelby	Private
W. M. Barr and Co., Memphis Dock.	Shelby	Private
Wepfer Marine, McKellar Lake Fleet Mooring.	Shelby	Public
Wepfer Marine, Memphis Repair Yard Mooring.	Shelby	Private
Westway Terminal Co., Memphis Dock.	Shelby	Private
William C. Ellis, Memphis Mooring.	Shelby	Public
Cargill AgHorizons, Richardsons Landing Dock.	Tipton	Private
U.S. Army Corps of Engineers, Richardson Casting Field Landing.	Tipton	Public
Tunica County, Riverpark Landing.	Tunica	Public

Appendix VI: Transit Times between Memphis and Major U.S. and Canadian Ports

Proximity to major consuming markets and major coastal ports are significant competitive factors that make an inland port attractive in global shipping. Memphis reaches 192 major metropolitan markets (including 40 of the top 100 markets) overnight by truck.[66] With the exception of Pacific Northwest ports, every major port is three days or less to Memphis by truck. Six of the top eleven ports are four days or less by rail intermodal. Despite its greater rail distance, Prince Rupert is competitive by rail with other, closer West Coast ports due to the Canadian National expedited service. By contrast, rail service improvements are needed from the Ports of Seattle/Tacoma to Memphis. Transit from these ports to Memphis is one day longer than ports at comparable distances.

For the Port of New Orleans, in addition to truck and rail transportation, barge is commonly used to transport goods from Memphis to the port. It takes approximately 80 hours, or 3 days to transport goods from the Memphis region to the Port of New Orleans.

Travel Times to Memphis from Major U.S. and Canadian Ports

Port	Rail Distance (miles)	Rail Time (days)	Truck Distance (miles)	Single Truck Time (days)
Charleston	912	3	702	1.1
Halifax	2,121	4	2,007	3
Houston	560	2.7	645	1
LA/Long Beach	1,942	4.6	1,807	2.8
New Orleans	395	2	394	0.3
NY/NJ (Newark)	1,171	3.5	1,096	1.8
Oakland	2,208	4.8	2,078	3.1
Prince Rupert	3,136	4.9	3,003	4.7
Savannah	727	3	630	1
Seattle/Tacoma	2,543	5.5	2,425	3.8
Vancouver	2,575	6	2,549	3.9

Source: Major Railroad service schedules and Con-way Trucking website single driver truckload hour basis

[66] "Proposal: Memphis Regional Assets", Memphis Regional Chamber Departments of Economic and Community Development

Appendix VII: Commodities Shipped Through Memphis

Commodity	Millions $	Thousands Tons
MOTOR VEHICLE PARTS OR ACCESSORIES	1,189	245
ACCOUNTING OR CALCULATING EQUIPMENT	1,185	59
MOTOR VEHICLES	1,176	106
GAMES OR TOYS	1,125	145
MISC INDUSTRIAL ORGANIC CHEMICALS	978	610
PLASTIC MATER OR SYNTH FIBRES	972	465
MISC PLASTIC PRODUCTS	889	331
RADIO OR TV RECEIVING SETS	880	61
FURNITURE OR FIXTURES, NEC	809	327
TIRES OR INNER TUBES	640	225
SPORTING OR ATHLETIC GOODS	572	168
PRIMARY IRON OR STEEL PRODUCTS	401	460
MISC INTERNAL COMBUSTION ENGINES	371	39
FABRICATED METAL PRODUCTS, NEC	367	143
COTTON,RAW	360	303
REFRIGERATION MACHINERY	319	66
MISC INDUS INORGANIC CHEMICALS	293	203
HOUSEHOLD COOKING EQUIPMENT	263	88
DRUGS	255	6
PAPER	245	274
MISC AIRCRAFT PARTS	225	1
MOTORS OR GENERATORS	221	38
GRAIN	213	1,302

METAL SCRAP OR TAILINGS	207	252
MISC FREIGHT SHIPMENTS	201	33
Commodity	**Millions $**	**Thousands Tons**
OIL KERNELS, NUTS OR SEEDS	200	634
CURRENT CARRYING WIRING EQUIPMENT	187	21
SURGICAL OR MEDICAL INSTRUMENTS	182	17
MISC GLASSWARE,BLOWN OR PRESSED	174	108
CONSTR MACHINERY OR EQUIPMENT	174	29
ELECTRICAL TRANSFORMERS	168	15
WOMENS OR CHILDRENS CLOTHING	168	16
PHOTOGRAPHIC EQUIP OR SUPPLIES	168	9
ELECTRONIC DATA PROC EQUIPMENT	161	9
INORGANIC PIGMENTS	156	82
CHEMICAL PREPARATIONS, NEC	154	66
LEATHER FOOTWEAR	148	17
DISTILLED OR BLENDED LIQUORS	148	33
FRESH FISH OR WHALE PRODUCTS	140	38
MENS OR BOYS CLOTHING	133	14
ALUMINUM OR ALLOY BASIC SHAPES	132	36
MISC FOOD PREPARATIONS, NEC	124	50
STEAM ENGINES, TURBINES, ETC.	115	2
BOOKS	108	31
CUTLERY,NOT ELECTRICAL	108	21
BEDS,DRESSERS,CHESTS, ETC.	105	54
BUILDERS OR CABINET HARDWARE	105	30
METALLIC ORES	103	411
CANNED OR CURED SEA FOODS	102	26
METALWORKING MACHINERY	102	8
STORAGE BATTERIES OR PLATES	101	26

Commodity	Millions $	Thousands Tons
MISC FABRICATED WIRE PRODUCTS	100	71
VENTILATING EQUIPMENT	97	24
HOUSEHOLD VACUUM CLEANERS	96	22
PLYWOOD OR VENEER	92	93
MECH POWER TRANSMISSION EQUIPMENT	90	17
ANIMAL SPECIALTIES	89	41
CYCLIC INTERMEDIATES OR DYES	88	42
HOUSEHOLD REFRIGERATORS	86	19
CARBON PROD FOR ELECTRIC USES	82	15
MISC NONFERROUS BASIC SHAPES	79	7
HOUSEHOLD OR OFFICE FURN, NEC	77	36
DRESSED POULTRY, FROZEN	74	96
NUT OR VEG OILS OR BY-PRODUCTS	73	85
INDUSTRIAL PUMPS	70	9
MISC GENERAL INDUSTRIAL	69	8
CANNED FRUITS,VEGETABLES, ETC.	67	81
COMMERCIAL LAUNDRY EQUIPMENT	67	13
MEAT, FRESH FROZEN	65	26
VALVES OR PIPE FITTINGS	65	9
ELECTRIC HOUSEWARES OR FANS	64	11
PENS OR PARTS	60	6
DIE-CUT PAPER OR PPBD PRODUCTS	59	51
MAN-MADE OR GLASS WOVEN FIBRE	58	12
OIL FIELD MACHINERY OR EQUIPMENT	54	5
CANDY OR OTHER CONFECTIONERY	52	19
SHIPS OR BOATS	51	3
TROPICAL FRUITS	51	112
LAWN OR GARDEN EQUIPMENT	51	10
TEXTILE GOODS, NEC	50	16

Commodity	Millions $	Thousands Tons
LUMBER OR DIMENSION STOCK	48	71
RUBBER OR PLASTIC SCRAP	47	105
MISC PRIM NONFERR SMELTER PRODUCTS	46	14
WET CORN MILLING OR MILO	46	88
MOTORCYCLES, BICYCLES OR PARTS	44	6
SURFACE ACTIVE AGENTS	44	15
TEXTILE HOUSEFURNISHINGS	43	9
CONVEYORS OR PARTS	41	4
MISC COAL OR PETROLEUM PRODUCTS	41	65
FIBER, PAPER OR PULPBOARD	40	67
MISC AGRICULTURAL CHEMICALS	38	14
GREETING CARDS, SEALS, ETC.	38	7
DEHYDR OR DRIED FRUIT OR VEG	38	48
TELEPHONE OR TELEGRAPH EQUIPMENT	36	2
MISC ELECTRONIC COMPONENTS	36	2
MANUFACTURED PROD, NEC	36	6
SOFT DRINKS OR MINERAL WATER	36	49
MISC WOOD PRODUCTS	35	16
EDGE OR HAND TOOLS	35	9
MISC FABRICATED TEXTILE PRODUCTS	35	7
BALL OR ROLLER BEARINGS	33	4
METAL DOORS, SASH, ETC.	32	15
RUB OR PLAS HOSE OR BELTING	32	6
ADHESIVES	31	7
MISC HARDWARE	31	7
BLANKBOOK, LOOSE LEAF BINDER	31	15
TUFTED CARPETS,RUGS OR MATS	31	6
INDUSTRIAL TRUCKS, ETC.	31	6
FROZEN FRUIT, VEG OR JUICE	30	24
MILLWORK OR CABINETWORK	30	22
PAPER WASTE OR SCRAP	30	202
MILLED RICE, FLOUR OR MEAL	30	58

ELEC EQ FOR INTERN COMB ENGINE	29	3
CITRUS FRUITS	28	41
MISC FRESH FRUITS OR TREE NUTS	28	11
Commodity	**Millions $**	**Thousands Tons**
BROOMS, BRUSHES, ETC.	28	7
WINE,BRANDY OR BRANDY SPIRIT	28	13
POTASSIUM OR SODIUM COMPOUND	28	80
FABRICATED PLATE PRODUCTS	28	10
RADIO OR TV TRANSMITTING EQUIPMENT	27	1
PRIMARY COPPER SMELTER PRODUCTS	27	7
APPAREL, NEC	27	3
BOLTS, NUTS, SCREWS, ETC.	26	16
LIGHTING FIXTURES	26	6
TEXTILE MACHINERY OR PARTS	26	4
PAPER INDUSTRIES MACHINERY	26	2
NONCURRENT WIRING DEVICES	25	2
PRINTING TRADES MACHINERY	25	2
MACHINE TOOLS, METAL CUTTING	25	2
NONFERROUS WIRE	25	4
PRIMARY ALUMINUM SMELTER PRODUCTS	25	9
PICKLED FRUITS OR VEGETABLES	24	22
MISC HOUSEHOLD APPLIANCES	24	3
ORTHOPEDIC OR PROSTHETIC SUPPLIES	23	2
MISC FABRICATED PRODUCTS	23	6
COSMETICS,PERFUMES, ETC.	22	2
TABLES OR DESKS	22	5
MISC SPECIAL INDUSTRY MACH	21	2
COPPER OR ALLOY BASIC SHAPES	21	3
MALT LIQUORS	21	36
CONDENSED, EVAP OR DRY MILK	21	5
SILVERWARE OR PLATED WARE	21	7
RAILROAD CARS	20	4
FOOD PROD MACHINERY	20	1
CRUDE PROD OF COAL,GAS,PETROLEUM	19	38
PULP OR PULP MILL PRODUCTS	19	42
MISC ELECTRICAL INDUSTRIAL EQUIPMENT	19	1
FARM MACHINERY OR EQUIPMENT	18	4
ELECTRIC LAMPS	18	2
MISC. FIELD CROPS	18	

		92
COSTUME JEWELRY OR NOVELTIES	18	2
BARKS OR GUMS,CRUDE	18	8
FERTILIZERS	17	94
ELECTRICAL EQUIPMENT, NEC	17	2
Commodity	**Millions $**	**Thousands Tons**
MEAT, FRESH OR CHILLED	17	5
ELECTROMETALLURGICAL PRODUCTS	16	19
STEEL WIRE, NAILS OR SPIKES	16	14
PAPER OR BUILDING BOARD	16	20
REFRACTORIES	16	18
MINING MACHINERY OR PARTS	15	1
PRIMARY METAL PRODUCTS, NEC	15	4
X-RAY EQUIPMENT	15	0
GLASS CONTAINERS	15	24
PAPER BAGS	14	6
SPECIAL DIES,TOOLS,JIGS,ETC.	14	2
PAINTS, LACQUERS, ETC.	14	4
MISC MACHINERY OR PARTS	14	2
ANIMAL BY-PROD,INEDIBLE	13	9
SOAP OR OTHER DETERGENTS	13	6
MISC OFFICE MACHINES	13	2
KNIT FABRICS	13	3
HAND SAWS OR SAW BLADES	12	1
AIRCRAFT	12	0
CUT STONE OR STONE PRODUCTS	12	20
INDUSTRIAL GASES	12	3
HOISTS, INDUSTR CRANES, ETC.	12	3
HEATING EQUIP,NOT ELECTRICAL	12	2
DECIDUOUS FRUITS	12	14
SANITARY PAPER PRODUCTS	12	5
MACARONI,SPAGHETTI, ETC.	11	11
PREPARED OR CANNED FEED	10	40
PHONOGRAPH RECORDS	9	1
ELEVATORS OR ESCALATORS	9	3
GRAVEL OR SAND	9	88
CHEESE OR SPECIAL DAIRY PRODUCTS	9	2
PORTLAND CEMENT	9	

		171
ELECTRIC MEASURING INSTRMTS	9	0
YARN	9	4
MISSILE OR SPACE VEH PARTS	9	0
ROASTED OR INSTANT COFFEE	8	2
METAL SHIPPING CONTAINERS	8	3
LEATHER GOODS, NEC	8	1
Commodity	**Millions $**	**Thousands Tons**
TRANSPORTATION EQUIPMENT, NEC	8	2
MACHINE TOOLS, METAL FORMING	8	1
BLAST FURNACE OR COKE	8	27
OPHTHALMIC OR OPTICIANS GOODS	8	0
WELDING APPARATUS	8	1
ABRASIVE PRODUCTS	8	7
WOOD CONT. OR BOX SHOOKS	8	6
CURTAINS OR DRAPERIES	8	1
DENTAL EQUIPMENT OR SUPPLIES	7	1
MECH MEASURING OR CONTROL EQUIPMENT	7	0
WOODWORKING MACHINERY	7	1
MEAT PRODUCTS	7	2
STEEL SPRINGS	7	3
SOLID STATE SEMICONDUCTS	7	0
PRIMARY BATTERIES	7	1
ENGRG, LAB OR SCIENTIFIC EQUIPMENT	7	0
METAL LOCKERS,PARTITIONS, ETC.	7	4
AUTOMATIC TEMPERATURE CONTROLS	7	0
CABINETS OR CASES	7	0
LEATHER LUGGAGE OR HANDBAGS	7	1
MARGARINE,SHORTENING, ETC.	6	7
DRESSED POULTRY, FRESH	6	6
MISC PRINTED MATTER	6	1
OPTICAL INSTRUMENTS OR LENSES	6	0
TRUCK TRAILERS	6	2
SOYBEAN OIL OR BY-PRODUCTS	6	9
PRIMARY FOREST MATERIALS	6	19
MOTOR BUS OR TRUCK BODIES	6	1
METAL STAMPINGS	5	1
COTTON BROAD-WOVEN FABRICS	5	1
SMALL ARMS AMMO,30MM OR LESS	5	0
DOG,CAT OR OTHER PET FOOD,NEC	5	5
SUGAR, REFINED, CANE OR BEET	5	21
CERAMIC FLOOR OR WALL TILE	5	12
PRINTING INK	5	1

RUBBER OR PLASTIC FOOTWEAR	5	1
COATED OR IMPRINTED FABRIC	5	1
VITREOUS CHINA KITCHEN ARTICLES	5	2
MISC METAL WORK	5	5
CLAY CERAMIC OR REFRAC MINERALS	5	39
MISC CONVERTED PAPER PRODUCTS	4	1
MUSICAL INSTRUMENTS OR PARTS	4	0
Commodity	**Millions $**	**Thousands Tons**
MISC POTTERY PRODUCTS	4	1
WOVEN CARPETS,MATS OR RUGS	4	1
CARBON PAPER OR INKED RIBBONS	4	1
MINERAL WOOL	4	3
NARROW FABRICS	4	0
GASKETS OR PACKING	4	1
SPECIALTY CLEANING PREPARATIONS	4	1
INDUSTRIAL CONTROLS OR PARTS	4	0
STRUCTURAL WOOD PROD, NEC	4	2
CHILDRENS VEHIC OR PARTS, NEC	4	1
COTTONSEED OIL OR BY-PROD	4	11
VITREOUS CHINA PLUMBING FIXTURES	3	3
INDUSTRIAL PROCESS FURNACES	3	0
CARPETS,MATS OR RUGS, NEC	3	1
FLOUR OR OTHER GRAIN MILL PRODUCTS	3	15
HOUSEHOLD OR OFFICE FURNITURE	3	2
METAL SANITARY WARE	3	1
LOCOMOTIVES OR PARTS	3	1
CONTAINERS OR BOXES,PAPER	3	2
GUM OR WOOD CHEMICALS	3	2
CAPS OR HATS OR HAT BODIES	3	0
BOOT OR SHOE CUT STOCK	3	0
SEWING MACHINES OR PARTS	3	0
PORCELAIN ELECTRIC SUPPLIES	2	1
CORD OR FABRICS,INDUSTRIAL	2	1
CANVAS PRODUCTS	2	1
PREFAB WOOD BUILDINGS	2	1
SWITCHGEAR OR SWITCHBOARDS	2	0
HOUSEHOLD LAUNDRY EQUIPMENT	2	0
PLUMBING FIXTURES	2	0
CHEM OR FERTILIZER MINERI CRUDE	2	45
WATCHES, CLOCKS, ETC.	2	0
ASHES	2	3
CIGARETTES	2	0
NONMETAL MINERALS, PROCESSED	2	4
HORTICULTURAL SPECIALTIES	2	1

AUTOMATIC MERCHANDISING MACHINES	2	0
CONCRETE PRODUCTS	2	2
PRIMARY ZINC SMELTER PRODUCTS	2	1
ALUMINUM OR ALLOY CASTINGS	2	0
EXPLOSIVES	2	0
IRON OR STEEL FORGINGS	2	1
LEAFY FRESH VEGETABLES	2	2
WALLPAPER	2	1