Chapter 22

Freight

Introduction

This chapter examines the importance of freight transportation to the Nation, the effects of highways on freight transportation, and the different demands placed by freight on the surface transportation system. Freight transportation is a critical enabler of economic activity, and trucking is a key element of freight transportation.

The condition and performance of the highway system is crucial to the efficiency and effectiveness of trucking, and the growth of truck traffic is placing greater burdens of the condition and performance of the highway system. This web of relationships becomes the basis for representing freight transportation more robustly in the HERS model and in supplemental investment analyses. This chapter describes special freight needs not fully explored earlier in Chapter 7.

This chapter covers investment analyses not included earlier in Chapter 7 on general investment requirements or in Chapter 12 on national security implications. Special analyses of investment requirements of National Highway System (NHS) connectors and rail-highway grade crossings are covered in Chapters 25 and 26, respectively.

Freight Transportation and the Economy

Nearly seven million businesses rely on the U.S. transportation network to conduct local business, engage in interstate commerce, and carry out international trade. At the same time, more than 100 million households rely on freight transportation to provide access to goods and services produced by businesses both here and abroad. The extensive U.S. transportation network allows Americans to buy fresh fruits, vegetables, send packages overnight, and purchase merchandise that is manufactured and assembled in different plants all over the world.

The benefits of freight transportation to the economy are enormous. From a macroeconomic perspective, transportation is a significant share of the U.S. gross domestic product (GDP). In 1999, purchases of transportation-related goods and services accounted for 10.6 percent ($980 billion) of GDP. The diverse and extensive list of purchases includes the services of for-hire freight carriers, vehicles, parts, maintenance, and fuel. Only housing, health care, and food account for a greater share of GDP.

For-hire transportation services, which include warehousing, contributed $303 billion or 3.3 percent to GDP in 1999. Nonetheless, many industries and businesses depend on their own transportation operations (primarily trucking) to move goods. The agriculture, forestry, and fisheries industries, for example, rely more heavily on in-house transportation than on for-hire services to support their production. In 1996 (the latest year for which data are available), in-house transportation contributed $142 billion to the economy.

Freight transportation also contributes to the economy by providing jobs to millions of people. In 2000, more than 10 million people were employed in transportation-related industries, including for-hire services, vehicle manufacturing, service stations, and parts suppliers. Of that total, for-hire transportation (including warehousing) employed more than 4.4 million workers, a majority of whom worked in freight transportation-related jobs.

Another 5.5 million people worked in transportation occupations in nontransportation industries, such as truck drivers for grocery stores. Truck drivers, alone, accounted for nearly 70 percent of the total number of transportation occupational workers. When this number is added to transportation-related industry employment figures, about 1 out of 8 U.S. civilian jobs are related to transportation.

Improvements in freight transportation productivity contribute to the economy by helping the United States remain competitive in international trade. (In the freight sector, output is usually measured by quality-adjusted ton-miles, and input is measured by the number of employees or employee-hours). The Bureau of Labor Statistics reports that productivity for the intercity trucking, railroad, air, and petroleum pipeline industries has improved over the last 20 years. The railroad industry has posted the most impressive gains, followed by the pipeline and air modes. Improvements in railroad productivity came, in large part, from deregulation, divestiture of uneconomic lines, reduction in the labor force, and technological and logistical changes.

Finally, freight transportation infrastructure is a significant and integral part of the nation's wealth and productive capacity. With the exception of railroads and pipelines, transportation infrastructure relies, to a large extent, on public investment and joint partnerships between the public and private sectors.

The Effects of Highways on Freight Transportation

Highways are a critical component of the freight transportation system. In 1997, trucks carried 72 percent of the value and 69 percent of the tons of everything shipped by manufacturers, wholesalers, and selected other industries in the United States. An additional 12 percent of the value of everything shipped by those establishments went by mail and courier services that used trucks for at least part of their trip. The Nation's highways carried over 1 trillion ton-miles of commodities in 1997.

The performance of the highway system has a direct bearing on the effectiveness and efficiency of truck transportation. As noted in Chapter 21, reliable travel times are critical to truckers who serve just-in-time manufacturing and distribution systems and carry time-sensitive cargo. The effects of recurring and nonrecurring delay discussed in Chapter 21 are thus greatly magnified on the costs of trucking, and therefore on the role trucking plays in the economy.

FHWA has undertaken a number of efforts to measure the performance of trucking, which reflects how the highway system affects freight transportation and which in turn affects the economy. They include measuring commercial vehicle cost per mile and commercial vehicle travel time and delay.

Estimates of Commercial Vehicle Cost

In an effort to evaluate national highway freight transportation performance and efficiency, FHWA reviewed a sample of motor carriers' expenses associated with the physical movement of cargo. Based on this review, FHWA found that the annual average of actual expenses per mile for all types of for-hire trucking (less-than-truckload, truckload, specialized carriers) had risen slightly from $1.76 in 1990 to $1.78 in 2000. Specific costs that had pushed up average motor carrier expenses were increasing diesel fuel prices and insurance fees. During the decade, average costs per mile were about $1.60. When these expenditures were adjusted for inflation, average cost per mile in constant dollars actually declined during the 10-year period. Overall, freight rates were found to be relatively stable during the last decade.

By 2005, motor carrier expenses per mile are predicted to average 5 to 6 cents per mile higher than today. However, motor carrier rates should continue to fall in constant dollars by 2 to 3 cents-per-mile by 2005. This assumes no substantial shock in motor carrier operational costs, such as those resulting from a significant jump in diesel fuel prices. Potential upward pressures could stem from labor cost increases, higher employee benefits, and escalating truck insurance premiums. Despite these influences, the continuing competition for freight shipments and the strong bargaining position of shippers will likely stifle excessive rate increases.

Delays at International Border Crossings

The FY 2003 FHWA Performance Plan aims to improve the economic efficiency of the U.S. transportation system, thereby enhancing the Nation's position in the global economy. One way to promote improvement is to ensure the continuing mobility and efficiency of cargo shipments as they move along the surface transportation system. An objective of this goal, therefore, is to reduce the hours of delay for commercial motor vehicles entering and leaving the United States at its northern and southern ports-of-entry with Canada and Mexico. The border crossing process is one of the few elements in logistical planning and execution that is almost completely beyond the control of both motor carrier and the shipper. Predicting with certainty the time needed to cross a border crossing is difficult.

In 2001, coordinated, on-site reviews were made at seven ports of entry that handle 60 percent of U.S. truck trade among the three NAFTA nations. Linked with research now underway to model border crossings activity, these site reviews will enable the FHWA to make informed recommendations about crossing improvements. The results will also help the agency to engage with other Federal, State and local jurisdictions in constructive dialogue about how, together, they can improve the performance, security, and mobility of commerce at these important international locations. Exhibit 22-1 summarizes the results.

The seven ports of entry reviewed in 2001 were: Otay Mesa, California; El Paso, Texas; Laredo, Texas; Blaine, Washington; the Ambassador Bridge (Detroit), Michigan; Blue Water Bridge (Port Huron), Michigan; and Peace Bridge (Buffalo), New York. The measurement chosen to monitor commercial vehicle activity on-site was "travel delay per truck trip." This encompasses the time taken by the individual commercial vehicle from the initial queuing point in the exporting country, *through* the exporting country's final checkpoint, and up to and through the first inspection point in the importing country. Travel in both directions was assessed (i.e., truck travel into and out of the United States.)

The on-site reviews found that the time needed for processing commercial vehicles entering the United States (inbound clearances) was confirmed to be significantly longer than that for departing (outbound clearances) at almost every location. The controlled substance incursion and illegal immigration inspections performed by U.S. inspection agencies on the Southern Border required reviews of incoming cargoes and their operators that led to unavoidable time delays.

The actual extent of delays encountered in *both* directions, and the reasons for them, however, tended to vary by individual port-of-entry. There is no single trend across sites beyond the noted tendency (1) for inbound clearances to take longer than outbound, and (2) for Southern border delay times to exceed Northern border delay times.

The results of the 2001 reviews revealed site-specific findings that may not readily lend themselves to a "one size fits all" corrective action initiative. Nevertheless, procedural changes, application of advanced technologies, and facility design modifications at selected ports-of-entry—some already underway—offer the possibility of greater productivity in the processing of commercial vehicles and reduced travel delay.

Increased traffic volume did not necessarily correlate with significantly increased delay. For example, commercial vehicle activity sampled at the Otay Mesa, California crossing found significant variations in peak periods of delay from one day to the next. Increases in traffic *volume*, however, did not necessarily result in greater processing time at this location, apparently because administrative actions were taken in response to the growing back-up that met the volume challenge. By contrast, at the Peace Bridge, New York crossing, increases in vehicle volume tended to be a precursor for increased average delay times, with an increase in one leading directly to an increase in the other.

Exhibit 22-1

Comparison of Outbound and Inbound Times Obtained (in minutes)

CROSSING	BASELINE TIME	AVERAGE TIME	95th PERCEN-TILE TIME	BUFFER TIME	BUFFER INDEX (%)
All Outbound Crossings	N/A	14.2	37.4	23.3	164.1%
All Inbound Crossings	N/A	26.8	70.1	43.3	161.6%
All Northern Outbound Crossings	N/A	12.6	34.3	21.7	172.2%
All Northern Inbound Crossings	N/A	24.1	70.3	46.2	191.7%
All Southern Outbound Crossings	N/A	17.2	45.2	28.1	163.4%
All Southern Inbound Crossings	N/A	33.8	64.9	31.1	92.0%
Ambassador Bridge Outbound	5.7	8.8	13.7	4.9	55.7%
Ambassador Bridge Inbound	12.9	20.4	33.9	13.4	65.7%
Blaine Outbound	4.8	21.5	35.3	14.3	66.5%
Blaine Inbound	8.1	17.3	35.6	18.3	105.8%
Blue Water Bridge Outbound	5	6.2	9.1	2.9	46.8%
Blue Water Bridge Inbound	11.1	34.2	80.3	46.1	134.8%
Peace Bridge Outbound	9	21.7	38	16.2	74.7%
Peace Bridge Inbound	8.3	23.3	83.4	61.9	265.7%
El Paso Outbound	9	13.2	34	24.7	187.1%
El Paso Inbound	7.6	37.2	77.4	40.2	108.1%
Laredo Outbound	1.8	17.2	45	27.8	161.6%
Laredo Inbound	12.2	31.2	54.9	23.7	76.0%
Otay Mesa Outbound	9.5	19.1	36.9	17.8	93.2%
Otay Mesa Inbound	6.4	35	64.3	29.3	83.7%

Source: FHWA Office of Freight Management and Operations.

In total, for *all* seven ports of entry, the average *inbound* delay time was 16.0 minutes, while the average *outbound* delay time was 8.1 minutes. For the four northern ports in the survey, the average *inbound* delay time was 12.5 minutes. The average *outbound* was 6.2 minutes. For the three southern ports, the average *inbound* delay time was 24.9 minutes. The average *outbound* delay time was 11.6 minutes.

A "buffer time" and "buffer index" for each port-of-entry also was also calculated. The buffer time represents the *difference* between the 95th percentile crossing time (i.e., the time within which 95 percent of all surveyed trucks passed through the survey checkpoints) and the average crossing time for all trucks. The buffer index is the buffer time expressed as a percentage of average time (i.e., the extra percentage of time that must be budgeted by shippers and motor carriers planning to cross the border at a particular location). As such, the buffer index eliminates differences among the actual, physical length of crossings. It provides a standardized measure among the 7 ports-of-entry of the significantly longer transit times that may befall a motor carrier crossing the border—often well above the average time calculated—depending upon the site being used.

The buffer time for all inbound crossings is almost twice that for outbound traffic. The average buffer time for all outbound crossings was 23.3 minutes, with an average buffer index of 164 percent. The average buffer time for all inbound crossings was 43.3 minutes, with an average buffer index of 162 percent. These aggregated times camouflage the wide variations in the buffer indices at the individual ports-of-entry, however. For example, at the Ambassador Bridge, the buffer index for inbound truck traffic was just over 65 percent, reflecting a 95th percentile time of 33.9 minutes during the average travel time of 20.4 minutes. This indicates that, even with its substantial volume of traffic, operators of the Ambassador Bridge sustained movement across the bridge without imposing lengthy increases in delay times. Contrasting markedly with this was the inbound buffer index at the Peace Bridge of 266 percent, where the 95th percentile time (83.4 minutes) far exceeded the calculated average crossing time (23.3 minutes).

The buffer index is only an indicator of potential crossing times that could be experienced. It does not reveal *why* the extended times occur at the various sites.

Gateway Infrastructure

Much of the increase in truck activity is related to international trade growth, which is concentrated at international gateways. Since the 1970s, international trade has emerged as a major component of the U.S. economy, as imports of consumer goods, and petroleum have increased significantly. At the same time, exports have also increased, led by shipments of raw materials, agricultural products, and manufactured goods. With the expected growth in traffic and increased attention to cargo security, a large number of gateway infrastructure projects are planned. The numbers presented here are drawn from numerous sources, including several port authorities, State departments of transportation, and other governmental bodies. These studies contain varying time frames and scopes. This summary of projects has been compiled using several guidelines.

First, projects needed to be closely tied to ports. General freight projects that were not directly connected to port access were excluded. Second, previously funded projects were excluded if possible. The reports analyzed did not always distinguish between projects that needed funding and those that do not. Third, both port of entry projects and ocean port projects were included.

Exhibit 22-2 presents a summary of the total spending required for port access projects by area. The list does not identify specific projects, but instead represents the best information available for a given State or port. Many of the sources used provided no more information than is available here, while others listed specific projects. More complete information would likely require interviewing representatives of port authorities and State departments of transportation.

Q. What are some additional findings from the review of the seven ports of entry?

A. The review reached several other conclusions. For example, the number of inspection and processing booths open at each port-of-entry at any given time has significantly influenced travel time and delay. At many ports, there appeared to be significant variability during the day with respect to the number of booths open at any given time. There is a definite relationship between the number of booths open, the travel demand, and the travel time through the crossing. Decisions on how many to open at any given time are apparently not made purely with mobility or crossing times in mind and are not always made by the transportation agencies.

Before the September 11, 2001 terrorist attacks, U.S.-Canadian ports-of-entry generally processed inbound trucks with less delay, and with less variability, than did U.S.-Mexican ports-of-entry. Southern crossings generally handled more traffic, but with generally more variability in the times required for crossing. (The exception to this pattern was the Blue Water Bridge port-of-entry at Port Huron, Michigan). As noted, concerns about drug traffic and illegal immigration apparently contribute to extended inspection times at the Southern border. However, other influences on travel time and delay are less self-evident and may need further consideration.

A study on urban mobility prepared by the Texas Transportation Institute indicates that delay times are more predictable and not as volatile in their swings across the sample day as those witnessed at the seven ports-of-entry in 2001. This confirms the earlier statement that international border crossings offer a considerable challenge for those parties planning commercial cargo movement departures, transit times, and arrivals than do most other links in the national transportation system.

Speed is an important factor in the movement of cargo, although the security of shipments is now of great concern. Crossing times at Detroit's Ambassador Bridge port-of-entry, as noted above, were markedly different from others in the sample. Despite the bridge's dramatically higher volume of traffic, generally shorter crossing times were achieved. While inbound crossing times exceeded outbound, as at the other six locations, the margin of difference was significantly narrower and more consistent across the sample period. Whether the reason for this difference in performance is a function of policy, bridge ownership, tactics, infrastructure, capacity, or facility design remains to be determined.

The Peace Bridge at Buffalo was found to have the greatest similarity between inbound and outbound average crossing times, registering relatively low among the 7 ports-of-entry in this regard. However, it also demonstrates the highest inbound buffer index (265.7 percent). Thus, while its average crossing times are similar in both directions, the *potential* exists for motor carriers to be significantly delayed when traveling from Canada into the United States at this location.

Three of the ports-of-entry included in the study (Otay Mesa, Blaine, and Laredo) have some form of "truck only" crossing, with the El Paso crossing (the Ysleta-Zaragoza bridge) being primarily trucks. In terms of the time required to transit the facilities and the volumes of traffic processed, however, "truck-only" crossings do not appear to perform significantly differently from those other crossings where automobile and truck traffic are intermingled. This finding was unexpected and deserves further evaluation.

How Freight Transportation Affects the Highway System

Trucks carry freight throughout the highway system. Although commercial vehicles account for less than 10 percent of all vehicle-miles of travel, truck traffic is growing faster than passenger vehicle traffic and having major effects on intercity highways. Trucks already account for more than 30 percent of traffic on about 20 percent of Interstate System mileage. This share is likely to grow substantially if the demand for freight

Exhibit 22-2

International Gateway Projects

SOURCE	AREA	$ (MILL)	DATE	NOTES
Texas Border Transportation Task Force	Texas	1,800	1999	land crossings; $600 million programmed, $1.2 billion recommended
Trade and Traffic Across Eastern US Canada Border	Maine	61	1997	near and long term projects
Trade and Traffic Across Eastern US Canada Border	Michigan	2,942	1997	near and long term projects; includes $1.3 billion of corridor needs
Trade and Traffic Across Eastern US Canada Border	New York	2,257	1997	land crossings; near and long term; includes $1.7 billion of corridor needs
Trade and Traffic Across Eastern US Canada Border	Vermont	123	1997	near and long term only; includes $123 million of corridor needs
Case studies for freight funding (Casgar)	California	13,400	2002	might include some non-port related investments; includes Ports of Los Angeles, Long Beach, Oakland, and Ports of Entry; at least $8 billion
Washington Freight Mobility Strategic Investment Board	Washington state	241	2001	only directly port relevant projects ($1.9 billion total freight projects)
Intermodal Connector Needs for OR highway plan	Oregon	163	1997	all intermodal projects (mostly water port related)
Arizona Trade Corridor Study (AZ-MEX commission)	Arizona	1,879	1999	land crossings; truck only, no numbers given for rail
Florida Landside Access Study	Florida	1,327	1997	highway and rail improvements planed, not funded
Port Authority of NY/NJ	Elizabeth seaport access	750	unknown	may or may not include $110 million for cross-harbor tunnel project
Hampton Roads MPO	Virginia Hampton Port	3,700	2001	Total relevant projects, but truck trips are only 10-15% of trips; improvements proposed are not freight specific

Source: FHWA Office of Freight Management and Operations.

transportation doubles over the next 20 years, as has been predicted.

To understand and forecast nationwide patterns of freight activity on both highway network and complementary modes, several databases have been integrated into a Freight Analysis Framework by FHWA's Office of Freight Management and Operations. The Framework estimates county-to-county flows of goods by truck, rail, water, and air at the four-digit level of the Standard Transportation Commodity Classification system, and assigns those flows to individual segments of the transportation network for 1998, 2010, and 2020. The future years are based on macroeconomic forecasts, described in Exhibit 22-3.

The total volume of freight and related truck traffic will grow with the economy. Expected future freight volumes are based on forecasts by WEFA, Inc. that expect GDP to grow at an average annual compound growth rate of 3.5 percent in constant dollars between 1998 and 2010. WEFA expects a slower average annual compound growth rate of 2.8 percent in constant dollars between 2010 and 2020. Overall, the U.S. GDP is expected to growth at an annual rate of 2.9 percent in constant dollars between 1998 and 2020. Based on these economic assumptions, the Freight Analysis Framework projects that freight volumes will nearly double, increasing from 9 billion tons to almost 17 billion tons over this period. This translates into an average annual compound growth rate of 3.4 percent from 1998 to 2010, and 2.4 percent from 2010 to 2020.

The WEFA forecast also included two alternative forecasts predicting high and low levels of economic growth. Under the high growth scenario, shipments are expected to grow an average of 3.7 percent annually from 1998 to 2010 and 2.7 percent annually from 2010 to 2020. Freight tonnage in 2020 would reach almost 19 billion tons, a doubling of 1998 levels. By comparison, freight shipments would grow an average of 3.1 percent annually between 1998 and 2010 and 2.0 percent annually between 2010 and 2020 under the low growth scenario. Even under the low growth scenario, freight volume still increases by 74 percent to almost 16 billion tons.

Q. **What are the WEFA long-term baseline forecast assumptions?**

A. Key assumptions are outlined in Exhibit 22-3.

Exhibit 22-3

The WEFA Long-Term Baseline Forecast Assumptions

Population and Labor Force	Population growth will slow from 1 percent to 0.8 percent annually, slowing civilian labor force growth.
Employment and Unemployment	Manufacturing employment will continue to decline as a share of total employment, while service sectors will generate an increasing share of employment growth.
Productivity and Aggregate Supply	Potential GDP growth will slow relative to historical rates due to slower growth in the labor force, while productivity growth will remain steady.
Government Policy	The government sector share of GDP will decline due to slower growth in defense spending and a reduction in the share of interest payments relative to the federal budget.
Monetary and Financial	The Federal Reserve Board will remain watchful of inflation while ensuring growth in output consistent with potential output.
Consumption	The share of real consumption devoted to services and durable goods will rise, while it falls for nondurable goods, such as energy.
Business Investment	The investment share of structures will decline, while equipment's share will rise. The fastest growing sector of the economy for investment will be producers' durable equipment.
International Trade	Real export growth will slow growth in the trade deficit due to a decline in the value of the dollar and a reduction in US real unit labor costs relative to the rest of the industrialized world.
Industrial Production	Manufacturing of durable goods, particularly non-electrical machinery such as computers, will grow faster than nondurable goods. Plastics and paper will lead nondurable goods production.

Source: WEFA, Inc.

The top ten commodities in 1998 are predicted to remain about the same in 2020, as shown in Exhibit 22-4. Secondary traffic—which includes products moving out of warehouses or other terminals—is expected to remain the largest commodity category in terms of weight, generating about 31 percent of total growth in U.S. freight tonnage between 1998 and 2020. With an average annual compound growth rate of 4.4 percent for secondary traffic over the period, this forecast supports the trend that smaller, and more frequent shipments will remain important to the U.S. economy. Shipments of the Clay, Concrete, Glass, and Stone commodity group and Food Products would become the second and third largest commodities carried by the year 2020, with both commodity groups enjoying average annual growth rates of 3.7 percent. Coal, the second largest commodity carried in 1998, would fall to fourth, largely from modest growth in coal shipments until 2020.

On a modal basis, the top three commodity groups are expected to move primarily by truck. Coal is projected to remain the largest single commodity moved by rail, followed by chemicals and farm products; petroleum products, coal, and scrap metals are expected to be the top three commodities moved by the waterborne mode in 2020.

Exhibit 22-4

Top Commodities in 1998 and 2020

1998 TOP COMMODITIES		2020 TOP COMMODITIES	
ALL MODES	**TRUCK**	**ALL MODES**	**TRUCK**
Non-metallic Minerals	Non-metallic Minerals	Non-metallic Minerals	Small Package
Small Package	Small Package	Small Package	Non-metallic Minerals
Coal	Clay/Concrete/Glass/ Stone	Clay/Concrete/Glass/ Stone	Clay/Concrete/Glass/ Stone
Clay/Concrete/Glass/ Stone	Food/Kindred	Food/Kindred	Food/Kindred
Food/Kindred	Lumber/Wood	Coal	Lumber/Wood
Petroleum/Coal	Petroleum/Coal	Lumber/Wood	Chemicals/Allied Products
Lumber/Wood	Chemicals/Allied Products	Petroleum/Coal	Petroleum/Coal
Chemicals/Allied Products	Primary Metal	Chemicals/Allied Products	Primary Metal
Primary Metal	Pulp/Paper/Allied	Primary Metal	Pulp/Paper/Allied
Farm	Coal	Farm	Fabricated Metal

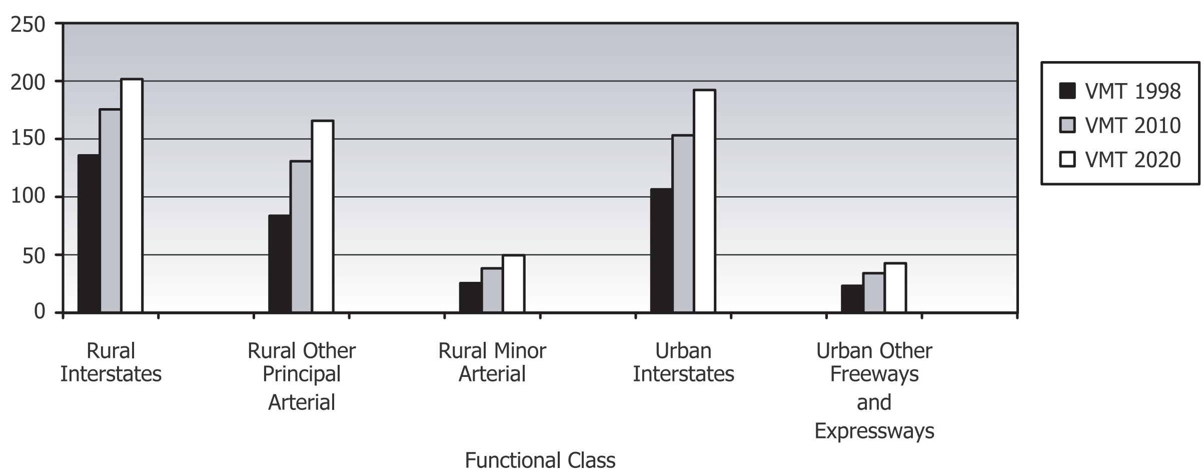
Source: FHWA Office of Freight Management and Operations.

These forecasts assume that transportation infrastructure capacity does not constrain demand for freight shipments, and that the shares carried by each mode of a given commodity do not change. Modal shares change only because the mix of commodities changes.

The result of these forecasts is a significant increase in truck traffic over the next two decades on all classes of highways. More than 25,000 miles of highway will carry more than 5,000 commodity-carrying trucks per day. Approximately one-fifth of that mileage will be significantly congested. [See Exhibit 22-5]

Exhibit 22-5

Comparison of Growth in Truck VMT, Millions of Miles per Day, 1998 to 2020



Source: FHWA Office of Freight Management and Operations.

Rest Areas

The deregulation of the U.S. trucking industry in the early 1980s led to significant changes in the way goods and products are moved. A proliferation of commercial carriers followed the relaxation of entry and operating requirements. Consequently, by 2000, approximately 500,000 interstate motor carriers were operating in the United States. That number continues to grow. During the same period, freight logistical systems have evolved to put more emphasis on reliable, "just-in-time" cargo deliveries and reduced, "zero-inventory" levels at shipper locations. Moreover, the need to access cargo terminals at specific hours, along with restrictions imposed by some urban areas, has compelled drivers to look for "staging" areas in which they may wait for terminal, loading dock, or port openings.

In addition, crash data generated by the Federal Motor Carrier Safety Administration estimates that driver fatigue is a primary factor in 4.5 percent of truck-related crashes and a secondary factor in an additional 10.5 percent. The lack of parking for fatigued drivers may be a factor in these incidents. Therefore, the probability that a insufficiency of safe parking places contributes to crashes, along with the public recognition of the greatly expanded level of commercial vehicle activity and the tighter time frames for product delivery, has helped to highlight the need for abundant, safe, and secure commercial vehicle parking for off-duty rest.

In response, TEA-21 called for a study of commercial vehicle rest parking facilities to inventory available spaces nationwide, determine current and projected shortages, and recommend solutions that could help satisfy the need for more parking, especially at night. Now completed, the "Report to Congress on the Adequacy of Parking Facilities" makes four recommendations.

First, the report found that there is an estimated peak demand for approximately 287,000 truck parking spaces at both privately owned truck stops and travel plazas (hereinafter referred to as "privately run facilities") and at public rest areas serving those Interstate highways and National Highway System (NHS) routes carrying more than 1,000 trucks per day.

Second, the report found that an estimated 315,850 public and privately owned parking spaces are currently available to serve Interstate and NHS routes carrying more than 1,000 trucks daily. Roughly 10 percent of these available spaces are found at public rest areas and 90 percent at the privately owned facilities.

Third, surveyed drivers overwhelmingly prefer privately run facilities for rest of two hours or more. Public rest areas are preferred for stops of less than 2 hours (45 to 19 percent). Private parking is preferred for its amenities (e.g., showers, food service), while public is preferred for ease of access and convenience to the roadway.

Finally, 21 percent of the parking now used by drivers to obtain required rest appears to come from non-traditional rest parking locations (e.g., loading docks, company terminals, fast food restaurants, shopping centers).

Results of a driver survey, inventory, and modeling activity indicated that shortages of both public and private spaces may exist in at least 12 States, with shortages generally far less common at the privately run facilities. Similarly, 23 percent of the demand for truck parking spaces was determined to be at public rest areas, although only 10 percent of the supply is available there, according to surveyed drivers. To the extent that drivers will substitute available parking at a privately run facility for that unavailable at a public one, privately run facilities may be able to offset identified shortages at public rest areas in up to 35 States.

In the "Report to Congress on the Adequacy of Parking Facilities," the U.S. Department of Transportation recognized that the larger, privately-run facilities should continue to be the principal suppliers of commercial parking. Actions to expand or improve both public and private facilities, however, should be supported through innovative funding initiatives; cultivation and expansion of joint public-private initiatives to supply needed spaces; looking into greater use of non-traditional parking sites for truckers; use of emerging technologies to provide "real-time" information to drivers about parking availability; and improved signage along NHS rights-of-way to inform drivers about upcoming facilities.

FHWA and Freight Transportation

As demand for freight service grows, increasing pressure will be placed on a transportation system that is already strained in some locations. By the year 2020, freight tonnage is expected to nearly double, with even higher growth rates anticipated in and around key ports of entry, major corridors, and intermodal connectors and hubs. In order to better understand the challenges that come with increasing demand for freight transportation and improve efficiency, FHWA's Office of Freight Management and Operations (HOFM) developed a Freight Productivity Program. The Freight Analysis Framework is an important part of this program.

Recognizing that freight can be moved more expeditiously and securely across our borders, HOFM is working with other government agencies and NAFTA partners to improve freight transportation productivity. For example, FHWA initiated the development of border simulation software to facilitate planning operations among U.S., Canadian, and Mexican transportation agencies and inspection services. The product of this joint effort is Border Wizard Pro, a dynamic simulation capability for land and water ports of entry. With Border Wizard Pro, NAFTA countries will be able to test alternative physical, operational, and staffing improvements to enhance efficiency, safety, and security. The Peace Arch, at I-5 in Washington/British Columbia will be the first crossing simulated in both directions.

HOFM also has launched a multiyear effort to collect and analyze border crossing travel time and delay data. This information will help identify trends in freight movement and needed changes in infrastructure and/or procedures at specific locations to reduce avoidable delays. At the same time, HOFM formed the North American Strategy Team (NAST) to address emerging issues and concerns at border crossings. The long-term objective of NAST is to develop a coherent strategy for the open, safe, and efficient movement of freight and passengers in North America.

As part of its efforts to improve freight transportation efficiency, HOFM evaluated the condition of NHS intermodal connectors, which provide vital links to ports and terminal facilities. Although intermodal freight connectors account for less than 1 percent of total NHS mileage, they are the "front door" to the freight community for a broad array of transportation services and options. They also support defense mobilization and national security goals. Because of the military's increasing reliance on commercial transportation to move supplies and personnel, intermodal linkages to ports and airports has become an integral part of national defense planning. The findings of HOFM's evaluation are reported in *NHS Intermodal Freight Connectors: Report to Congress.* This report noted that intermodal connectors are in relatively poor condition and do not get adequate attention in the planning and programming process. HOFM is now doing a follow-on study to identify deficiencies and needs. Information from this follow-on study is presented separately in Chapter 25.

Other HOFM initiatives hold promise in helping the Department of Transportation meet national security objectives, such as establishing an information system that will help those with the need to know what is in a container, or trailer at any time, anywhere. These activities are described in Chapter 12.

Finally, HOFM is leading a Department-wide policy initiative to address freight's unique challenges and to improve national productivity and competitiveness. This initiative involves the Maritime Administration, Federal Railroad Administration, Bureau of Transportation Statistics, Federal Motor Carrier Safety Administration, and the Office of Intermodalism. As part of this effort, HOFM has identified several key areas that merit further research and analysis. They are 1) the nature and geography of capacity needs, 2) systems operations and asset management, 3) planning and financing freight improvements, 4) multijursidictional approaches to improving freight flows, 5) professional capacity development, and 6) national security. Workshops and other outreach events were held throughout 2001 to examine current and emerging trends in these areas and to discuss policy options for improving productivity through TEA-21 reauthorization and other policy or legislative initiatives. The results of these efforts will be discussed in an upcoming HOFM publication on freight issues and challenges.

Investment Requirements

Most investment requirements related to truck movement are captured in the estimates presented in Chapter 7, which are largely derived from the HERS and NBIAS models. The modeling procedures used in HERS take into account such factors as trucks' share of average daily traffic on each segment, and ascribe higher values of time to commercial truck movements than to trips by passenger vehicles. The impact of an increasing truck share in the future is also addressed in the sensitivity analyses presented in Chapter 10.

The HERS and NBIAS models, however, estimate only a portion of the investment requirements related to freight transportation. Additional investment requirements related to intermodal freight connectors to the NHS are covered in Chapter 25, and investment requirements related to rail-highway grade crossings are estimated in Chapter 26. Reconstruction of intersections to accommodate large trucks, deployment of information system to support commercial vehicle operations, and investments in alternative modes to carry freight around congested highway facilities warrant consideration as well, but are beyond the scope of this report.

One emerging area in freight transportation is the need to create effective, public-private partnerships to plan and implement freight-oriented investments. The Freight Analysis Framework provides a multimodal basis for identifying current and prospective problems for the freight transportation system. Planned enhancements to HERS and related analytical systems will identify more completely the investments in infrastructure and operations needed to support a vibrant economy.