EXHIBIT F

United States Government Accountability Office

GAO

Report to the Subcommittee on Select Revenue Measures, Committee on Ways and Means, House of Representatives

January 2011

SURFACE FREIGHT TRANSPORTATION

A Comparison of the Costs of Road, Rail, and Waterways Freight Shipments That Are Not Passed on to Consumers

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GAO-11-134

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Highlights

Highlights of GAO-11-134, a report to the Subcommittee on Select Revenue Measures, Committee on Ways and Means, House of Representatives

Why GAO Did This Study

Road, rail, and waterway freight transportation is vital to the nation's economy. Government tax, regulatory, and infrastructure investment policies can affect the costs that shippers pass on to their customers. If government policy gives one mode a cost advantage over another, by, for example, not recouping all the costs of that mode's use of infrastructure, then shipping prices and customers' use of freight modes can be distorted, reducing the overall efficiency of the nation's economy.

As requested, this report (1) describes how government policies can affect competition and efficiency within the surface freight transportation sector, (2) determines what is known about the extent to which all costs are borne by surface freight customers, and (3) discusses the use of the findings when making future surface freight transportation policy. GAO reviewed the transportation literature and analyzed financial and technical data from the Department of Transportation (DOT), the Army Corps of Engineers (Corps), and the Environmental Protection Agency to make cross-modal comparisons at a national level. Data limitations and assumptions inherent in an aggregate national comparison are noted in the report.

GAO is not making recommendations in this report. GAO provided a draft of this report to DOT and the Corps. DOT provided technical suggestions and corrections, which were incorporated as appropriate. The Corps had no comments.

View GAO-11-134 or key components.
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What GAO Found

Public spending, tax, and regulatory policies can promote economic efficiency in the freight transportation sector when they result in prices that reflect all marginal costs (the cost to society of one additional unit of service). These costs include private costs; public costs, such as infrastructure maintenance; and external costs, such as congestion, pollution, and accidents. When prices do not reflect all these costs, one mode may have a cost advantage over the others that distorts competition. As a consequence, the nation could devote more resources than needed to higher cost freight modes, an inefficient outcome that lowers economic well-being. Inefficient public investment decisions can result when all construction and other fixed costs are not passed on to the beneficiaries of that investment.

GAO's analysis shows that on average, additional freight service provided by trucks generated significantly more costs that are not passed on to consumers of that service than the same amount of freight service provided by either rail or water. GAO estimates that freight trucking costs that were not passed on to consumers were at least 6 times greater than rail costs and at least 9 times greater than waterways costs per million ton miles of freight transport. Most of these costs were external costs imposed on society. Marginal public infrastructure costs were significant only for trucking. Given limitations in the highway, rail, and waterway economic, financial, technical, and environmental data available for the analysis, GAO presents conservative estimates.

While freight costs are not fully passed on to consumers across all modes, a number of issues are important for decision makers to consider when proposing policy changes to align prices with marginal costs or reduce the difference between government fixed costs and revenues. Costs can vary widely based on the specific characteristics of an individual shipment, such as the geography and population density of the shipment's route, and the fuel-efficiency of the specific vehicle carrying it. Policy changes that align prices with marginal costs on a shipment-by-shipment basis would provide the greatest economic benefit, but precisely targeted policy changes can result in high administrative costs. By contrast, less targeted changes—such as charging user fees based on average costs, subsidizing more efficient alternatives, or broadly applying safety or emissions regulations—can change the overall distribution of freight across modes, but may provide fewer benefits. Although the current configuration of transportation infrastructure can limit the shifting of freight among modes, price changes can prompt other economic responses. Over the longer term, there is greater potential for responses that will shape the overall distribution and use of freight services.

Table 4: Cross-Modal Comparisons of Externalities[a]

Category	Type	Trucking	Railroad	Waterways	Trucking to rail ratio[b]	Trucking to waterways ratio
Air pollution[c]	Tons of particulate matter per million ton-miles, 2002	0.1191	0.0179	0.0116[d]	6.7	10.2
	Tons of nitrogen oxide per million ton-miles, 2002	3.0193	0.6747	0.4691[d]	4.5	6.4
	Tons of CO2 equivalents per million ton-miles, 2007	229.8	28.96	17.48	7.9	13.1
Accidents[e]	Fatalities per billion ton-miles, avg. 2003-2007	2.54	0.39	0.01	6.4	208.8
	Injuries per billion ton-miles, avg. 2003-2007	55.98	3.32	0.05	16.9	1,239.6
Congestion[f]	Cost of delay to road users in 2000, (in billions of constant 2010 dollars)	$10.86	$0.58	Not available	18.6	Not available

Source: GAO analysis of data from DOT, EPA, and the Texas Transportation Institute.

[a]Federal Highway Administration, *Freight Facts and Figures 2009; and Bureau of Transportation Statistics, National Transportation Statistics.*

[b]A ratio of 1.0 indicates equal amounts of negative effect per unit of freight moved. For example, the ratio of 6.7 in the table indicates that truck freight produces, on average, six and seven-tenths times the particulate matter emissions as movement of the same unit of freight by rail.

[c]Environmental Protection Agency, *National Emissions Inventory*, data provided to GAO by correspondence, and Inventory of *U.S. Greenhouse Gas Emissions and Sinks*: 1990 – 2008.

[d]Estimate is for inland waterways freight only because comprehensive data were not available. Emissions data for waterways freight are for 2005 and were obtained from the Texas Transportation Institute, *A Modal Comparison of Domestic Freight Transportation Effects on the General Public.*

[e]Federal Motor Carrier Safety Administration, *Large Truck and Bus Crash Facts 2007*; Federal Railroad Administration, Office of Safety Analysis online accident/incident data; and Federal Highway Administration, *Freight Facts and Figures 2009.* Trucks are defined as over 10,000 gross vehicle weight, which can include some non-freight activity. For example, in 2007, 12.3 percent of large trucks involved in a fatal accident and 13.2 percent in accidents with injuries were dump, garbage, or concrete-mixer trucks.

[f]Federal Highway Administration, 1997 Federal Highway Cost Allocation Study Final Report.

Emissions and Air Pollution

EPA and DOT have not produced recent estimates of the economic costs of air pollution on a ton-mile basis for any of the freight modes.[45] Therefore, we applied EPA's estimates for the human health benefits of

[45]Available external cost estimates from other sources shown in appendix IV indicate that air pollution and climate change from all surface freight transportation could be as high as 7.6 cents per ton-mile of freight.

reducing one ton of fine particulate matter and one ton of nitrogen oxide to the emissions data. We estimated for freight trucking an emissions cost of $44,000 per million ton-miles, as shown in table 3.[46] Given the even greater uncertainty surrounding the economic costs of CO2 emissions, we did not produce our own estimate. The omission of these costs, as well as the omission of other nonhealth costs associated with emissions of nitrogen oxide and particulate matter, means that the estimates in table 3 are likely to understate the extent to which some marginal costs are not passed on to final consumers. This understatement would be the greatest for trucking.

According to our synthesis of EPA's latest national emissions inventory data (2002), freight trucks produced over six times more fine particulate matter and over four times more nitrogen oxide on a ton-mile basis than freight locomotives,[47] and over 10 and six times more of each type of emission, respectively, on a ton-mile basis than inland waterway vessels.[48] And, according to our analysis of EPA data on greenhouse gases, trucks emitted the highest levels of greenhouse gas (CO2 equivalents) among the freight modes—about eight times more per unit of freight than freight rail, and thirteen times more than waterways freight, as shown in table 4.[49,50]

[46]The EPA's benefit estimates are from EPA, *Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards: Regulatory Impact Analysis*, EPA-420-R-10-009 (April 2010). See appendix I for more detail on GAO's computations.

[47]According to EPA, fine particulate matter can lodge in the lungs, aggravate respiratory conditions such as asthma and bronchitis, cause lung damage and premature death, and may even be a cause of cancer. Nitrogen oxide is a precursor of ground-level ozone, which can contribute to health problems similar to those caused by fine particulate matter, although less acute. In addition to physical health risks, these pollutants also contribute to haze and reduced visibility, and a variety of other environmental impacts.

[48]Ocean-going vessels involved in coastwise freight movements have significantly different performance with respect to emissions than do inland waterways vessels. However, data are not available to isolate the differences, and thus we do not provide separate estimates in this report.

[49]For more information about estimating freight air pollution, see Transportation Research Board, *Representing Freight in Air Quality and Greenhouse Gas Models*, NCFRP Report No. 4 (Washington, D.C., 2010); and GAO, *Climate Change: The Quality, Comparability, and Review of Emissions Inventories Vary Between Developed and Developing Nations*, GAO-10-818 (Washington, D.C.: July 30, 2010).

[50]Greenhouse gases trap the sun's heat within the earth's atmosphere and contribute to climate change. The dominant greenhouse gas emission for the transport sector is CO2, but other important manmade greenhouse gases include methane, nitrous oxide, and fluorinated gases.

Recent EPA regulatory changes require that freight carriers for all the modes upgrade to technologies that reduce particulate matter and nitrogen oxide emissions.[51] EPA expects these standards to reduce diesel engine emissions of particulate matter and nitrogen oxide by 80 and 90 percent, respectively, for locomotives and waterborne vessels and 90 and 95 percent, respectively for heavy duty trucks over the next 20 to 30 years as older engines are taken out of service. While these regulations are expected to reduce the overall level of air pollution external costs, overall emissions will not be reduced to the estimated levels until 2030 or later because older, more polluting diesel engines will still be in use for years to come as each mode's fleet converts to the new technology.

Accidents

According to our analysis of DOT data shown in table 4, nationwide between 2003 and 2007, large trucks were involved in about six times more accidents with fatalities and 17 times more accidents with injuries, per billion ton-miles, than freight rail. Rates of fatalities and injuries involving a waterways vessel were much lower than those involving both trucks and freight rail.[52] The economic costs of transportation accidents reflect the value assigned to the loss of a human life and the reduced productive life and pain and suffering related to serious injuries.[53] The external portion of those costs excludes any amounts borne by the freight service providers (e.g., through insurance premiums or court settlements). Available cost estimates from the literature, shown in appendix IV, indicate that truck external accident costs could be as much as 2.15 cents per ton-mile, almost nine times higher than rail external accident costs. However, these estimates are dated and do not reflect the reduced rate of truck and rail accidents in recent years, or the much higher economic value now assigned to loss of human life. To obtain our conservative estimate of $8,000 per million ton-miles in table 3, we started with the number of fatalities in table 4, multiplied by the latest value for human life used by DOT in guidance for its own analysts, and then assumed that carriers are

[51] 40 C.F.R. parts 80, 86, 92, 94, 1033, and 1042.

[52] Our accident data for freight trucking covers trucks of over 10,000 pounds gross vehicle weight, and may include dump trucks, cement mixers, and garbage/refuse haulers. We selected freight vessels that were defined as tows, tugs, ships, or barges as representing domestic waterborne freight.

[53] Economists and other researchers have worked to establish specific values for the loss of life and serious injuries. Currently DOT uses $6 million in its analysis when determining the Value of a Statistical Life, which is defined as the value of improvements in safety that result in a reduction by one in the expected number of fatalities that a regulatory action provides.

already compensated for 50 percent of these costs (see app. I for details on our scope and methodology). We identified four studies that attempted to determine the extent to which accident costs were compensated through insurance premiums, payments, and other compensation.[54] These studies ranged from 50 to 62 percent in uncompensated or external costs. We chose to use 50 percent of the portion of costs that were not compensated as a reasonably conservative estimate since our calculations do not include estimates for uncompensated costs for injuries and property damage.

Congestion

Most of the available information on road congestion, in particular the costs of delay for all highway users, does not specify external costs associated with freight traffic.[55] We found only one study that provides a cross-modal estimate of freight congestion costs nationally, indicating that in 2000, congestion delay costs from intercity freight trucking were approximately five times those of intercity rail freight, per ton-mile.[56] In its 1997 Highway Cost Allocation Study, FHWA estimated that in 2000 trucks were responsible for $10.9 billion (constant 2010 dollars) in congestion costs to other highway users nationwide. We used that figure in computing our conservative estimate (given that the costs associated with road congestion have grown since 2000) of $7,000 per million ton-miles shown in table 3. We found no national estimates of the external congestion costs waterways freight causes to passenger, recreational, and other nonfreight

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[54]See Jason D. Lemp and Kara M. Kockelman (2008). "Quantifying the External Costs of Vehicle Use: Evidence from America's Top-selling Light-duty Models," *Transportation Research Part D*,; 'Transportation Research Board, *Paying Our Way, Estimating Marginal Social Costs of Freight Transportation*, (1996); Forkenbrock, David J. (1999). "*External Costs of Intercity Truck Freight Transportation*," Transport Research part A 33, 505-526; and David J. Forkenbrock, "Comparison of external costs of rail and truck freight transportation," *Transport Research*, Part A, 35 (2001): 321-337.

[55]See, for example, Congressional Research Service, *Surface Transportation Congestion: Policies and Issues*, RL33995 (Feb. 6, 2008); and Federal Highway Administration, *Estimated Cost of Freight Involved in Highway Bottlenecks* (Nov. 12, 2008). Congestion can also add to air pollution and other secondary costs, but we did not find separate estimates for these types of effects.

[56]Beyond estimating the external costs of road freight, this study also estimates the congestion costs imposed on highway users by freight rail at road crossings. See Michael F. Gorman, "Evaluating the public investment mix in US freight transportation infrastructure," *Transportation Research*, Part A 42 (2008): 1-14.

waterways users.[57] There is no national policy to charge transportation infrastructure users for their contribution to congestion.

Taxes and Fees Associated with Marginal Freight Activity

Federal, state, and local governments levy certain taxes and user fees on road users that increase with the payers' use. These levies include taxes on motor fuels and tires, as well as tolls. FHWA provided us with underlying data from its forthcoming highway cost allocation study that estimates how much of the various federal highway user taxes and fees are attributable to trucks. We combined this data with our own estimates for state and local fuel taxes and tolls in order to obtain our estimate of the total tax and fee payments that trucks make for their marginal use of highways, which amounts to about $11,000 per million ton-miles.[58] In comparison, estimates by TRB and CBO suggest that marginal fees paid by waterways freight service providers are less than $500 per million ton-miles. Railroads do not pay taxes or fees for the marginal use of their own infrastructure.

Consumers of Freight Services Pay Less of the Fixed Costs Associated with Trucking than with Railroads or Waterways

We examined the extent to which fixed costs are not passed on to final consumers separately from our table 3 comparison of marginal costs and marginal taxes and fees because unpriced fixed costs will not cause inefficient use of existing infrastructure as unpriced marginal costs do; however, unpriced fixed costs can lead to inefficient investment decisions (as discussed in the following section). Fixed public infrastructure costs are those, such as investments in new roads or the dredging of a waterway, which would exist regardless of whether an additional shipment is made on the route. Fixed taxes and fees, such as excise taxes on vehicle purchases and registration fees, do not vary with the number of VMT. Our estimates in table 5 indicate that the unpriced fixed social costs per ton-mile are largest for trucking—$7,000 per million ton-miles—and smallest for waterways freight—$2,000 per million ton-miles. Railroad

[57]Truck and waterborne freight carriers may add to congestion that affects other carriers within the same mode. However, we do not consider congestion costs borne by other carriers within the mode as external costs for that mode. Nevertheless, there still may be misallocation of freight services or resources, even if these costs are not considered an external cost.

[58]We estimated the state and local revenues attributed to freight trucks using yearly share ratios compared to a 2000 ratio. The revenue estimate is an average across VMT from 2000 to 2006. See appendix I for details.

Appendix IV: Freight External Cost Estimates from the Literature

Cost per ton-mile (in 2010 cents)			
Type	**Trucking**[a]	**Railroads**	**Waterways**
Congestion delay	0.24 to 0.58	0.03	Not estimated
Accident	0.11 to 2.15	0.24	Not estimated
Air pollution, health	0.11 to 1.67	0.01 to 0.38	0.09 to 1.87
Climate change	0.03 to 2.95	0.01 to 0.51	0.00 to 0.25
Noise	0.05	0.05	Not estimated

Source: Data reproduced primarily from Mark Delucchi and Don McCubbin, "External Costs of Transport in the U.S.", Handbook of Transport Economics, eds. by A. de Palma, R. Lindsey, E. Quinet, and R. Vickerman (Edward Elgar Publishing Ltd., forthcoming).

[a]Data are largely representative of intercity freight portion, not necessarily local freight.

Appendix VI: GAO Contacts and Staff Acknowledgments

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Staff Acknowledgments

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