A MODAL COMPARISON OF DOMESTIC FREIGHT TRANSPORTATION EFFECTS ON THE GENERAL PUBLIC

EXECUTIVE SUMMARY

December 2007

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U.S. DEPARTMENT OF TRANSPORTATION MARITIME ADMINISTRATION ***and*** **NATIONAL WATERWAYS FOUNDATION**

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DISCLAIMER

This research was performed in cooperation with the U.S. Maritime Administration (MARAD) and the National Waterways Foundation (NWF). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of MARAD or NWF. This report does not constitute a standard, specification, or regulation.

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BACKGROUND

This report examines many of the same aspects as the 1994 Maritime Administration report, "Environmental Advantages of Inland Barge Transportation", but using more current data, and—in some cases—new data sources.

The following topics areas were covered in this research:

- Cargo capacity
- Congestion
- Emissions
- Energy efficiency
- Safety impacts
- Infrastructure impacts

The analysis is predicated on the assumption that cargo will be diverted to rail or highway (truck) modes in the event of a major waterway closure. The analysis considered the possible impacts resulting from either a diversion of 100% of the current waterborne cargo to the highway mode OR a diversion of 100% of the current waterborne cargo to the rail mode.

This report presents a snapshot in time in order to focus on several vital issues. The data utilized in this research are publicly available and can be independently verified and utilized to support various analyses. Further detail about the information contained in this summary can be found in the full project report, which is available at www.nationalwaterwaysfoundation.org/TTIreport.htm.

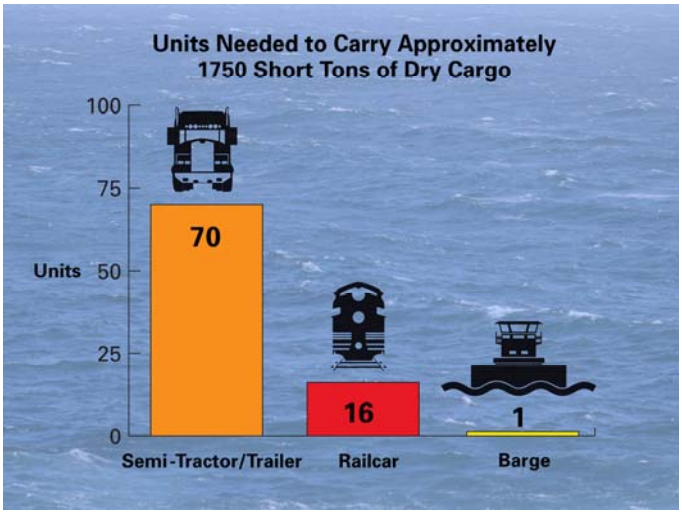
CARGO CAPACITY

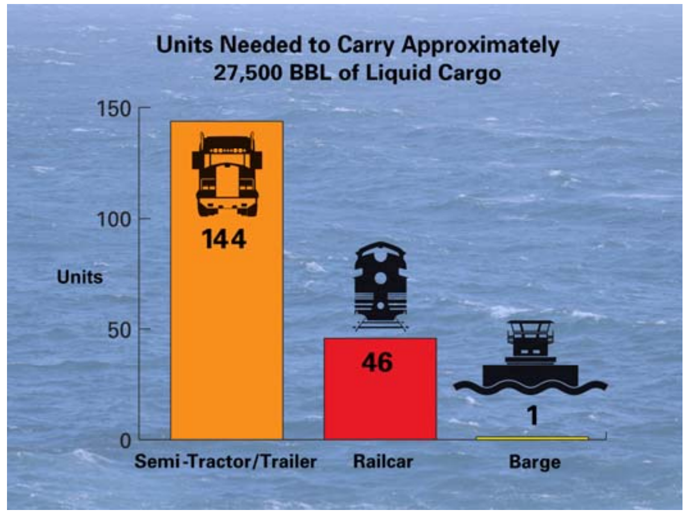
The "standard" capacities for the various freight units across all three modes used in this analysis are summarized in the following table.

Standard Modal Freight Unit Capacities.

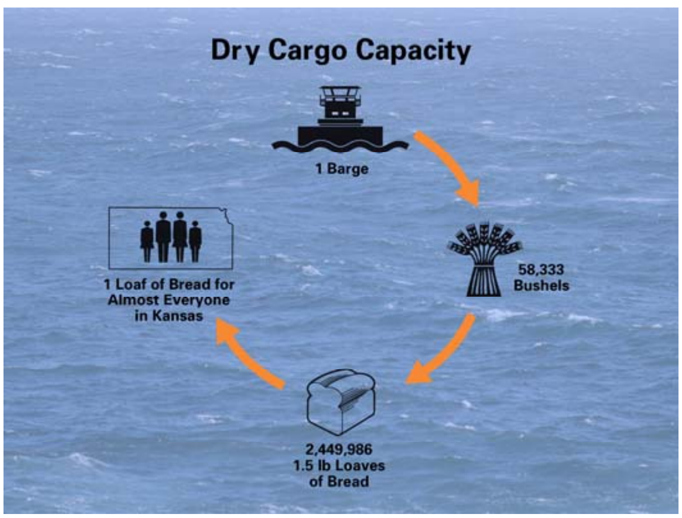
Modal Freight Unit	Standard Cargo Capacity
Highway – Truck Trailer	25 tons
Rail – Bulk Car	110 tons
Barge – Dry Bulk	1,750 tons
Barge – Liquid Bulk	27,500 bbl

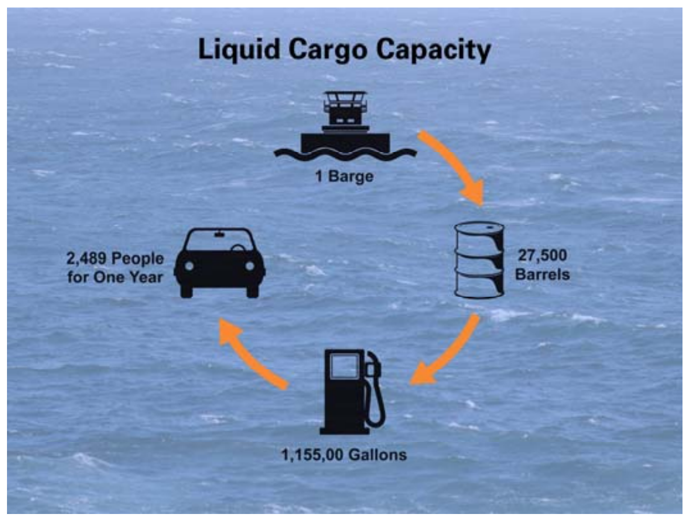
The following figures illustrate the carrying capacities of dry and liquid cargo barges, railcars, and semi-tractor/trailers.





It is difficult to appreciate the carrying capacity of a barge until one understands how much demand a single barge can meet. For example, a loaded covered hopper barge carrying wheat carries enough product to make almost 2.5 million loaves of bread, or the equivalent of one loaf of bread for almost every person in the state of Kansas. A loaded tank barge carrying gasoline carries enough product to satisfy the current annual gasoline demand of approximately 2,500 people.





CONGESTION ISSUES

HIGHWAY

The latest national waterborne commerce[1] data published by the U.S. Army Corps of Engineers Navigation Data Center were obtained for calendar year 2005. The tonnage and ton-mile data for the following major rivers were extracted:

- Mississippi River - Minneapolis to Mouth of Passes
- Ohio River
- Gulf Intracoastal Waterway (GIWW)
- Tennessee River
- Cumberland River
- Columbia River system – Columbia and Snake rivers

The amount of cargo currently transported on these rivers is the equivalent of 58,000,000 truck trips annually that would have to travel on the nation's roadways in lieu of water transportation. The hypothetical diversion of current waterway freight traffic to the nation's highways would add 1,160 combination trucks (to the current 874) per day per lane on a typical rural interstate. The percent combination trucks in the Average Annual Daily Traffic on rural interstates would rise from the current 16% to 31%, or almost double. This increase in truck trips would cause the Weighted Average Daily Combination Trucks per Lane on segments of interstate between urban areas to rise by 133% on a nationwide basis. The impact in the vicinity of the waterways considered in this study would logically be much more severe than the national average, especially during the heavier truck travel periods of the year, month, week, or day.

RAIL SYSTEM CONGESTION IMPACTS

The tonnage moved on the inland river system would amount to an addition of nearly 25% more tonnage on the railroad system. This new burden would not be evenly distributed. The primary burden would be placed on the Eastern U.S. railroads with little real opportunity to take advantage of excess capacity that may exist on the Western U.S. railroads.

EMISSIONS ISSUES

The emission comparison between the three modes is shown in the following table.

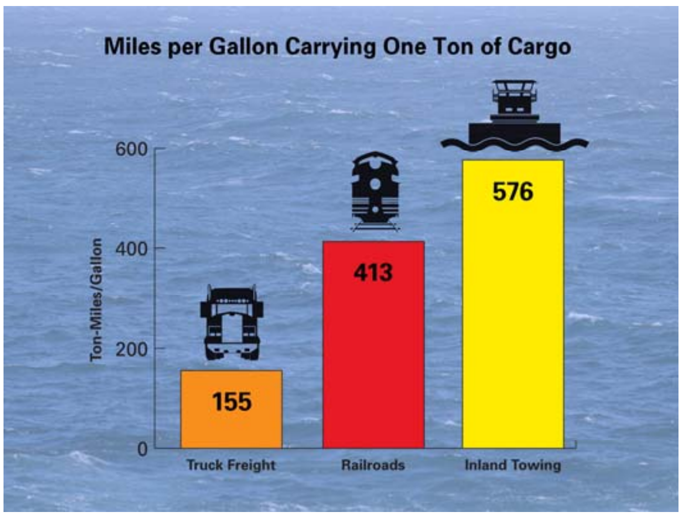
[1] U.S. Army Corps of Engineers. Navigation Data Center. Waterborne Commerce of the United States 2005.

Summary of Emissions - Grams per Ton-Mile.

Emissions (grams/ton-mile)				
	HC	CO	NO_x	PM
Inland Towing	0.01737	0.04621	0.46907	0.01164
Eastern Railroad	0.02419	0.06434	0.65312	0.01624
Western Railroad	0.02423	0.06445	0.65423	0.01621
Truck	0.020	0.136	0.732	0.018

ENERGY EFFICIENCY

The following figure presents the average fuel efficiency results for each of the modes on a national industry-wide basis.



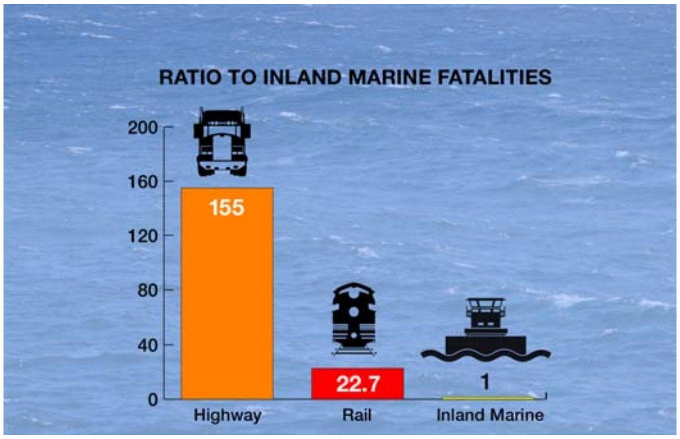
The marine fuel efficiency rates are based on Tennessee Valley Authority (TVA) energy consumption data; the railroad efficiency rates are based on an analysis of railroad industry, Surface Transportation Board (STB), and Security and Exchange Commission (SEC) data; and truck efficiency rates are based on EPA MOBILE6 data.

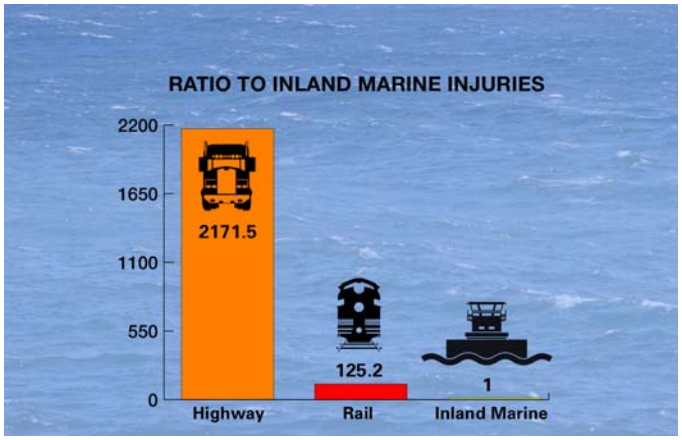
SAFETY IMPACTS

FATALITIES AND INJURIES

Both rail and truck statistics include incidents involving only vehicular crashes or derailments. However, the waterborne database reports incidents resulting from a wide variety of causes. In order to conduct a valid modal comparison for this study, a definition of "incident" analogous to the one used in the surface mode data was adopted. Data pertaining only to waterborne incidents involving collisions, allisions (vessels striking a fixed object), or capsizings were further extracted and used in analysis.

The data for rail fatalities and injuries respectively were obtained from *Railroad Statistics: National Transportation Statistics - 2006, Table 2-35: Railroad and Grade-Crossing Fatalities by Victim Class* and *National Transportation Statistics - 2006, Table 2-36: Railroad and Grade-Crossing Injured Persons by Victim Class.* Data for truck-related incidents were obtained from *Large Truck Crash Facts, 2005*, a publication of the Federal Motor Carrier Safety Administration. The data for waterborne incidents were taken from the *Marine Casualty and Pollution Database, July 2006*, a database that is maintained by the U.S. Coast Guard. The comparisons of fatality and injury rates are shown below.



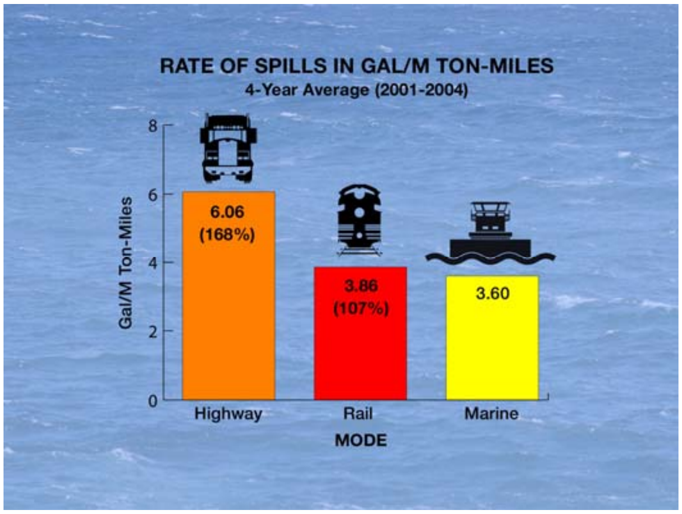


HAZARDOUS MATERIALS INCIDENTS

Data on hazardous materials incidents for rail and truck were taken from the Pipeline and Hazardous Materials Safety Administration's *Hazardous Materials Incident Reporting System, 2001-2005*. Data for inland waterway incidents were extracted from the Coast Guard's *Marine Information for Safety and Law Enforcement (MISLE)* system.

Due to the fact that all three reporting systems basically rely on self-reporting, and the definitions of materials that require reporting are very complex, much of the spill data are suspect. However, for larger spills, it seems reasonable to assume that the accuracy of the data improves, due to the severity of the incident and public scrutiny; therefore, the research team decided to analyze only large spills as a measure of the overall safety of the modes in the area of spills. The threshold quantity was set at 1,000 gallons.

The following figure provides a comparison of spills across the modes:



INFRASTRUCTURE IMPACTS

PAVEMENT DETERIORATION

In the event of waterborne freight diversion to highway transport, approximately 2-inches of asphalt would have to be added to the pavement of 126,000 lane-miles of rural interstate given the higher levels of expected 20-year truck loadings, assuming an even truck traffic distribution over the national highway system. Corridors that are parallel to the major rivers considered would undoubtedly receive a higher concentration of the additional truck traffic, and would be impacted to a higher degree than the national average. Other improvements would be required, such as capital expenditures on new construction of infrastructure and facilities such as bridges, ramps, highway geometric features such as horizontal and vertical curves and shoulders, truck stops, service stations, rest areas, weigh stations, and signage. In addition, routine maintenance costs associated with the new infrastructure as well as with the existing, which would be used more heavily, would likely be significantly higher.

RAILROAD INFRASTRUCTURE IMPACTS

With substantial diversion of inland waterway cargo traffic to railroads, the following effects could be expected in almost every case:

- Increased demand for rail cars and locomotives
- Higher freight rates
- Need to expand infrastructure (rail lines)
- Potentially slower and less reliable delivery time

For example, the minimum cost for rail equipment to handle just the diversion Ohio River coal to the CSX rail line is estimated at over $581 million. Furthermore, an additional group of trains would need to be added in order to recover the reduced train trip efficiency from adding so many new train sets to this single route.

A CASE STUDY – ST. LOUIS, MO

To illustrate the potential impacts a waterway closure could have on an adjacent community, a case study was performed of the potential impacts of a total closure of the Mississippi and Illinois Rivers in St. Louis, MO, with a resultant shift of all cargo that normally transits the city by river to the city's north-south interstate arteries.

The analysis uses the Federal Highway Administration's "HERS-ST" model to estimate the resultant impacts on highways. The analysis was performed under two assumed conditions: first, that no improvements would be made to the road infrastructure to account for this new traffic, and second, that road improvements would be undertaken to account for the additional traffic. Assuming all cost-effective improvements (benefits exceed costs) were undertaken, the analysis concluded that highway improvement costs over 10 years would increase from $345 million to $722 million. Truck traffic would almost triple. Traffic delays would increase by almost 500%. Injuries and fatalities on these highway segments would increase by 36-45%. Maintenance costs would increase by 80-93%.

While a permanent shutdown of the waterway certainly cannot be anticipated, this case study demonstrates some of the impacts a loss of the waterways would cause. The following table highlights the impacts to the general public that would be most notable.

Summary of Significant Impacts - General Public.

	Category	CURRENT Initial	10 YEARS AFTER WATERWAY CLOSURE			
			w/o Improvements	% Change	w Improvements	% Change
1	Combination Trucks per Lane-Mile per Day*	1218	3736	207%	3781	210%
2	Average Speed - Peak (mph)	69.9	62.0	-11%	65.5	-6%
3	Average Speed - Off Peak (mph)	70.8	66.1	-7%	70.6	0%
4	Delay - Total (hrs per 1000 VMT)	0.07	0.42	466%	0.44	495%
5	Crashes (annual)	3448	4688	36%	4999	45%
6	Injuries (annual)	1692	2301	36%	2454	45%
7	Fatalities (annual)	13	18	36%	19	45%
8	Maintenance Costs ($ million per 1000 miles)	0.79	1.53	93%	1.42	80%
9	Emissions Costs ($ per 1000 VMT)**	12.28	16.86	37%	18.68	52%
10	Improvement Costs ($ million)***	345.0	--	--	721.5	109%

* Calculated from HERS Output as: VMT Combination Trucks / (Lane-Miles x 365)
** Value from Current w/ Improvements FP2 output. Cleaner vehicles are expected to be in use 10 years from now, under either scenario.
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