EXECUTIVE SUMMARY

The Principles and Guidelines used by the U.S. Army Corps of Engineers to evaluate the economic benefits of navigation projects direct analysts to assume that competing transport modes have sufficient capacity to accept any diverted traffic unless there is clear reason to suspect otherwise. In most settings, there is no reason to challenge this assumption. In the case of the Upper Mississippi basin, however, current traffic volumes and projected traffic growth are such that even marginal diversions could place significant volumes of additional traffic on the nation's rail system. Consequently, to simply assume that rail carriers could absorb this traffic without increasing the rates charged to all shippers is imprudent. It is for this reason that the Corps of Engineers has engaged the Tennessee Valley Authority in a lengthy investigation of railroad capacity and incremental rail capacity costs in the Upper Mississippi Basin.

TVA's analysis has consisted of two phases. Initially, the theoretical underpinnings that lead profit-maximizing firms to add new transport capacity were carefully examined. Additionally, this first phase contained a pilot study intended to determine whether or not Geographic Information

Systems (GIS) data could be effectively employed to analyze line-haul railroad capacity. Using Federal Railroad Administration (FRA) traffic density categories as the dependent variable, an ordered probit model was constructed to statistically associate traffic density with network link characteristics. This novel application of GIS data proved remarkably successful. The configuration and physical characteristics of a specific segment of railroad trackage proved to be an extremely reliable predictor of traffic density as measured by the FRA. Consequently, the decision was made to proceed with a more extensive investigation of railroad capacity in the Upper Mississippi basin. The second phase was intended to not only associate railroad traffic levels with route characteristics, but also gage the cost of incrementally expanding current capacity in order to accommodate additional traffic. Additionally, the Phase II analysis was to provide an, at least, cursory consideration of potential traffic diversions and terminal capacity.

In order to obtain a continuous measure of railroad traffic nearly one-half million records from the Surface Transportation Board's 1995 Carload Waybill Sample were routed over 75,000 distinct routings based on origin, destination, shipment length, and interchange locations. Once routed, associated car-loadings and predicted empty car movements were aggregated to measure the

traffic on each of roughly 2,500 specific route segments. These cross-sectional traffic volumes were once again statistically associated with the characteristics of the trackage that supports them and, again, this association proved to be very reliable.

Given the continuous relationship between traffic levels and route characteristics, it is possible to identify the set of physical alternatives that will increase track capacity. The next step in the analytical process is then to determine which of these alternatives will yield the desired new capacity at the lowest cost. In order to assess the cost of infrastructure improvements, TVA consulted with civil engineers from the University of Tennessee's Transportation Center. These engineers provided a generic set of costs for constructing or upgrading trackage to various standards under a number of different topographical conditions. In the final stage of the line-haul analysis these costs were combined with available alternatives to determine the incremental cost of line-haul capacity.

Unlike line-haul capacity, it is not possible to assess the potential of network terminals through cross-sectional statistical analysis. The capacity and limitations of each terminal are uniquely determined. Thus, a comprehensive analysis of terminal capacity would be both lengthy

and expensive. In the current context, this sort of extensive analysis is not possible. This does not mean, however, that the matter of terminal capacity is ignored. Current traffic flows were combined with potential traffic diversions to identify those terminal locations that might expect to see the greatest amount of traffic growth in the event that barge transport on the Upper Mississippi becomes economically unfeasible. While a number of locations throughout the Mid-West, Gulf-Coast, and Pacific Northwest regions could expect to see incremental increases in railroad traffic, the location that would seem to be most effected is St. Louis. Because many rail routings to the Gulf of Mexico pass through the St. Louis area and because the option of transloading rail shipments to barge at St. Louis is economically attractive, the diversion of traffic off of the Upper Mississippi River could place considerable pressure on terminal facilities at that location. No other significant terminal problems were identified.

The results of the analysis suggest that accommodating all the current Upper Mississippi barge traffic on the nation's rail system would require an incremental expenditure on capacity of between one-half and three-quarters of a cent per ton-mile. In order to assess the impacts of these costs on railroad rates it is necessary to compare incremental capacity costs to the capacity costs

presently embodied within rail rates. Rail rates vary considerable across commodities and origin/destinations pairs. Currently unit train shipments of dry-bulk commodities move at between 1.5 and 4 cents per ton-mile, while rates for smaller shipments of higher valued commodities may earn revenues of 6 or 7 cents per ton-mile. For 1996, the average per ton-mile rate across all rail movements was roughly 4.5 cents. Rule of thumb estimates suggest that average fixed costs equal about one-third of the average rate or about 1.5 cents per ton-mile. Thus, it would appear that the average variable costs for large volume shipments are extremely low and that revenues from some shipments may not cover all costs. Of the roughly 1.5 cents in per ton-mile fixed costs, it is estimated that perhaps as much as one cent reflects the cost of line-haul and terminal facilities. Any further division of fixed costs is impossible within the current context. When estimated incremental capacity costs are compared to the capital costs currently embodied within railroad rates, it would appear that this new capacity would sometimes lower extant rates and sometimes necessitate their increase. These results do not, however, provide the irrefutable evidence necessary to forego the traditional assumption of adequate railroad capacity.