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NCITEC
National Center for Intermodal Transportation for Economic Competitiveness

TECHSUMMARY

SIO No. 30000762 / LTRC Project No. 13-3SS

Development of Performance Measurement for Freight Transportation

This project is associated with the Louisiana Transportation Research Center (LTRC) partnership with the National Center for Intermodal Transportation for Economic Competiveness (NCITEC). The NCITEC is a University Transportation Center housed at Mississippi State University funded by the Research and Innovative Technology Administration (RITA) of the U.S. Department of Transportation (DOT).

INTRODUCTION

With increased emphasis on intermodal transportation development, the issue of how to evaluate an intermodal system has been receiving intensive attention since the enactments of the Intermodal Surface Transportation Efficiency Act (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21). All administrations in the U.S. Department of Transportation (USDOT) report the performance for their transportation systems in terms of different measures. The Federal Highway Administration (FHWA) uses truck travel times in freight-significant corridors. The Maritime Administration uses port and waterway performance measures (e.g., port throughputs, shipping, and port availability), and the U.S. Class I railroads use three measures: cars on line, train speed, and terminal dwell hours. However, all these measures are defined for different modes and thus none of them can be used to measure a freight network that often involves multiple modes. The ISTEA requires all states to implement a performance-based planning process, and the new Moving Ahead for Progress in the 21st Century Act (MAP-21), requests the national freight network to "incorporate concepts of performance, and accountability into the operation and maintenance of the national freight network." The Act specifically requires the USDOT and all states to "establish performance measures for freight movement." Once established, all states are expected to use those performance measures to select freight management projects for federal funding and demonstrate the benefits of improvement investments.

OBJECTIVE

The objectives of this project were to build a set of performance measures that are unified, user-oriented, scalable, systematic, effective, and calculable for intermodal freight management, and to develop methodologies to calculate and use the measures. The measures needed to be able to evaluate an arbitrary freight network and to fairly compare intermodal designs with different sizes and modes.

SCOPE

Once established, state DOTs are expected to use those performance measures to evaluate their freight networks and select freight management projects for federal funding and demonstrate the benefits of improvement investments, which limits suggestions to only measures that can be annually updated with reasonable effort of the administration without any major new investment in data gathering and software development.

LTRC Report 522

Read online summary or final report:
www.ltrc.lsu.edu/publications.html

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METHODOLOGY

Four tasks have been conducted with detailed methodology descriptions to achieve the project objectives:

Task 1: Summarization of existing intermodal freight transportation measures

Task 2: Identification of performance measures using systems engineering approaches

Task 3: Procedure development for calculation, data collection, and application

Task 4: Case Study, demonstration, and technology transfer

A case study has been conducted to evaluate the freight network of the state of Louisiana to demonstrate the application of the proposed performance measure system. TransCAD was used to conduct traffic assignment and display the study results. Based on this study, the performance of Louisiana's freight network is summarized below.

Performance Measures	Value
Mobility (M) (hours per geographic mile)	0.0515
Reliability (R, R_u) (no unit)	To be calculated based on the simulation project
Fatality Rate (S_F) (fatalities per 10 billion TMR)	7.46
Injury Rate (S_I) (injuries per 10 billion TMR)	247.92
Energy Consumption Rate (EC) (BTU per TMR)	839
Transportation Pollutants (P) (tons per TMR)	1.41×10^{-4}
Direct Cost Efficiency (C) ($ per TMR)	More data are required
Employment Improvement (J) (job years per million dollar) (only for the Port Program)	16.336

CONCLUSIONS

The audience of this research mainly targets state DOTs, who need the developed metrics for selecting freight network improvement projects and demonstrating the benefits of investment on freight management. The results could also benefit the USDOT for transportation planning and promotion of intermodal solutions and the DHS for transportation resilience and protection. The private sector, such as Class-I and short-line railroads, may use the metrics to guide their investment and seek government supports. There are two major outcomes from this project:

- An intermodal performance measurement system for freight management, including metrics definition, calculation procedure, and methodologies of data collection.
- A case study that demonstrates how to apply the proposed performance measurement system to evaluate an intermodal network for freight management.

RECOMMENDATIONS

The following measures for freight transportation systems are suggested to address the needs of transportation users.

1. *Mobility:* Reducing transportation time and delay is a major concern for most transportation users.
2. *Safety:* The objectives related to transportation safety and security includes improving traffic safety, i.e., reducing traffic accident rates, injuries, fatalities, and risks. They also include increasing traffic security and reducing crime rates, improving accident detection and response, and increasing public security and homeland security.
3. *Environmental Stewardship:* The objectives include reducing the amount of transportation-related pollutants, promoting the community livability near major transportation infrastructures, and decreasing energy consumption.
4. *Direct Cost Efficiency:* The objectives include developing cost-efficient transportation systems that have low cost/benefit ratios and high sustainability.
5. *Economic Growth:* The objectives include promoting local or regional economic growth and increasing local or regional employment opportunities.

It is recommended that state DOTs adopt the proposed performance measurement system to evaluate their freight transportation system. Although most measures can be calculated based on publically available data and commercially available software, state DOTs still need to provide their investment and job creation data. Once adopted, the proposed measures and calculation procedures can be used to compare the performance of freight networks across states and across years. The system can be further used to evaluate freight network projects.

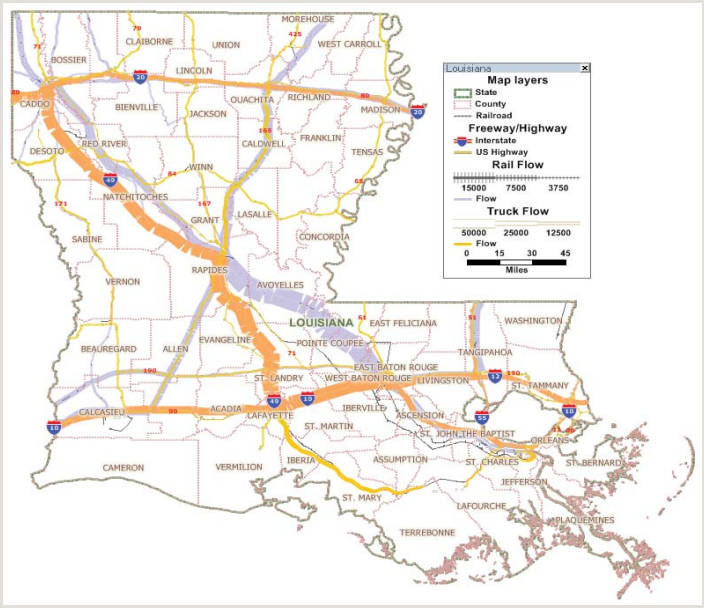

Figure 1
Louisiana intermodal transportation