

New Jersey Department of Transportation  
Bureau of Research

## Technical Brief



### Impact of Freight on Highway Infrastructure in New Jersey

*This study addressed the impact of overweight trucks on the infrastructure systems in New Jersey. This study developed a unified database with all available data regarding pavement, bridge, and weigh-in-motion (WIM). The team proposed and the pavement and bridge deterioration models to evaluate the effect of overweight trucks on the service life of pavement and bridge structures. Furthermore, the RIME Team conducted a life-cycle cost analysis (LCCA) to analyze the associated cost due to the movement of freight on the highway network. Based on the results obtained from the developed models and various data, the team established a decision-making tool incorporating future traffic growth, service life prediction models, and impact of changes in truck regulations and policy.*

### Background

The impact of overweight trucks traveling on the highway network, especially on side routes, is adversely affecting the performance of the road infrastructure and would disrupt the traffic pattern in small cities. Major decisions must be made to allocate limited funds available for the repair, rehabilitation, and replacement of bridges and pavements. Thus, more robust methodology and framework is needed to incorporate various data into the accurate evaluation of the impact caused by overweight trucks on the infrastructure systems.

### Research Objectives and Approach

The main objective of this study is to assess the impact of overweight trucks on New Jersey infrastructures, specifically highway pavements and bridges. The research work to achieve this objective includes the following tasks:

1. Review state-of-the-art practice and collect all available data;
2. Develop deterioration models for typical pavements and selected bridges with detailed inspection reports and National Bridge Inventory (NBI);
3. Design a unified database and develop a decision-support tool to utilize Bridge and Pavement data from inspection reports and NBI, and Weigh-In-Motion (WIM) truck weight data from over 80 WIM stations;
4. Perform a Life-Cycle Cost Analysis (LCCA).

### Findings

- For bridges, most of the damage cost incurred by overweight trucks is attributed to the bridge decks. Figure 1 shows the deterioration models for bridge decks for three types of highways based on NBI data. Deck damage costs are about 6-7 times of the girder damage costs. For bridge girders, overweight trucks cause more damage in Interstate highway bridges. For bridge decks, however, overweight trucks cause more damage on NJ state highway bridges

due to the presence of a larger proportion of overweight trucks, larger wheel loads from overweight trucks, and fewer axles per truck.

- For pavements, a linear relationship is found between the overweight percentage and the reduction ratio of pavement life regardless of the variation in traffic loading and pavement structure. In general, one percent increase in percentage of overweight truck may cause 1.8 % reduction of pavement life.
- The RIME Team utilizes a web-based application, ASSISTME-WIM, that the team developed during previous research project to assist NJDOT personnel in the analysis of WIM data. Since WIM data forms the bulk of the unified database, the team utilizes features of ASSISTME-WIM for developing a new module shown in Figure 2. This module analyzes the damage costs for a given vehicle configuration and route. Single trip cost function can calculate the damage caused by a single vehicle for a single trip considering conditions on pavement segments and bridges along the route. This tool can calculate the unit cost due to overweight for multiple roadways.

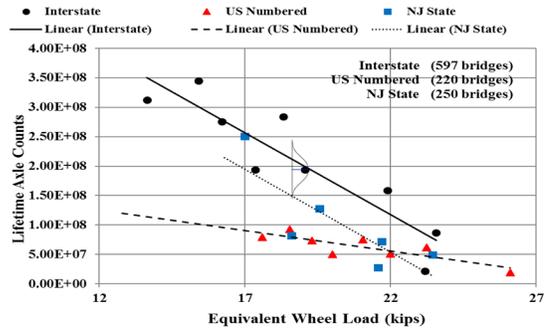


Figure 1. Bridge deck deterioration model

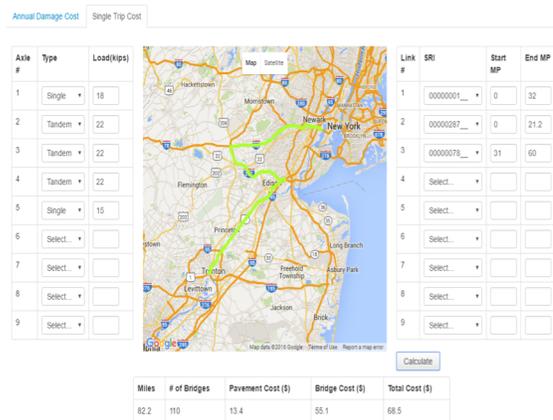


Figure 2. Module for calculating damage cost

- The estimated state-wide average cost of moving one ton of overweight load per one mile is about \$0.33, in which about 60% of the damage cost is attributed to pavement and 40% to bridges. Based on the current permit fee structure from NJDOT, the damage cost for loads exceeding legal limit is not covered by the weight-based fee.
- Future study is needed to establish a fee structure based on overweight tons and trip miles.

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A final report is available online at: <http://www.state.nj.us/transportation/refdata/research/>  
If you would like a copy of the full report, send an e-mail to: [Research.Bureau@dot.nj.gov](mailto:Research.Bureau@dot.nj.gov).

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