Using Advanced Modeling and Analytics to Plan for Supply Chain Resiliency

Center for Transportation Studies
22nd Annual Freight and Logistics Symposium:
Natural Disaster Disruption in the Freight System
December, 2019

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What is Network Optimization Modeling?

- Mathematical approach to identify a “best” solution
- A common data analytics practice in private sector
  - Many firms use optimization to identify a network design that results in the lowest supply chain cost.
  - Contingency or multi-objective optimization seeks to balance risk and cost in the supply chain

Base Case Network

Disruption Case Network

- Rail Link
- Highway Link
The Iowa Freight Network Optimization Model (IFROM) was used to test several disruption scenarios:

- Loss of the I-80 bridge over the Mississippi
- Closure of I-80 between Grinnell and Malcom

<table>
<thead>
<tr>
<th>Scenario</th>
<th># of Trucks Diverted</th>
<th>Additional Route Miles</th>
<th>Cost per mile</th>
<th>Annual Additional Cost</th>
<th>Probability of Closure*</th>
<th>Annual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-80 Bridge</td>
<td>2,784</td>
<td>6.97</td>
<td>$2.12</td>
<td>$15.33 M</td>
<td>0.13 days per month</td>
<td>$66,000</td>
</tr>
<tr>
<td>I-80 Closure</td>
<td>5,210</td>
<td>8.2</td>
<td>$2.12</td>
<td>$33.58 M</td>
<td>0.09 days per month</td>
<td>$100,000</td>
</tr>
</tbody>
</table>

* Closure probability was based on historical highway records
Contingency Planning for Exports

Gateway Benchmark Costs for Moving Iowa Exports to Asian Markets
Iowa Propane Model
NCHRP 20-125: Strategies for Incorporating Resilience in to Transportation Networks

- Objective is to develop a toolkit to improve the resiliency of the multi-modal freight network at various geographic levels.

- Standing committee on Logistics of Disaster Recovery and Business Continuity