Impact of a Port Disruption on Intermodal Connections

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Outline

- Introduction
- Port Mapper
- Methodology
- Port Analysis
- Scenario Development
- Movement of Goods
- Research Results
Introduction

- Maritime commerce is one of the top contributors to national economy

- Port resilience is a critical aspect on maritime systems nowadays
  - Closure of port can impact both local and global economies
  - In order to build plans for resilience, understanding the impact of the disruption from a local, national and global perspective is needed
    - One way to accomplish this is through scenario analysis to develop tools to evaluate resiliency plans
Port Mapper: The Tool

Through CSR, MIT CTL developed a tool for port resilience called the Port Mapper:

- Displays suggested locations where goods could go in the event a port shut down operations
- Commodity selection based on group and/or family
- Port to fail – all of them or top 10 that handle the selected commodity
Port Mapper: The Tool

http://portmap.mit.edu/
Methodology

- Develop a scenario as a virtual exercise to help identify potential issues and needs
  - Factors to consider when rerouting
  - Develop a system for the necessary calculations needed
  - Create suggestions for further implementation of the online Port Mapper tool
- Test the online Port Mapper tool once further implementations occur
Port Analysis: Port Selection

- Compare 5 different ports
- Consider the constraints of each port region – open water constraints, channels, terminals and intermodal connections

<table>
<thead>
<tr>
<th>Port (and commodity)</th>
<th>Open Water Connection</th>
<th>Channels</th>
<th>Terminals</th>
<th>Rail</th>
<th>Road</th>
<th>Waterway</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Orleans Area (F&amp;F)</td>
<td>Yes</td>
<td>Possibly</td>
<td>Yes</td>
<td>No</td>
<td>Few roadways that connect the two sides of the port.</td>
<td>Depends on the scenario, if a lock or levee is damaged or a port upstream</td>
</tr>
<tr>
<td>Plaquemines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Orleans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Louisiana</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Beach (petroleum)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Roah connection prod</td>
<td>N/A</td>
</tr>
</tbody>
</table>


Focus on the New Orleans area

3 separate ports that will be considered the New Orleans area

Port of Plaquemines

Port of New Orleans

Port of South Louisiana
Scenario Development: Disruption Sequence

1st Event: Hurricane
2nd Event: Power outage
3rd Event: Levee fail
4th Event: Boats break free
5th Event: Oil spill
Scenario Development: Disruption Effects

- Port of Plaquemines and New Orleans are both closed to movement of any goods
- Port of South Louisiana remains functional but is unable to process imports or exports on its own
- How is the movement of goods changed? – consider only food & farm exports
Scenario Development: Areas of Interest

- 10 states contribute to the exports of Port of New Orleans: Arkansas, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, Wisconsin

- Europe/Africa Destinations: Netherlands, Chile, Egypt, Brazil, Gibraltar

- Asia Destinations: China, Japan, Singapore, Canada, Mexico
## Movement of Goods: Travel Time

<table>
<thead>
<tr>
<th>State</th>
<th>China</th>
<th>Mexico</th>
<th>Japan</th>
<th>Netherlands</th>
<th>Canada</th>
<th>Chile</th>
<th>Egypt</th>
<th>Singapore</th>
<th>Brazil</th>
<th>Gibraltar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wisconsin</td>
<td>20.083333</td>
<td>6.70833333</td>
<td>16.208333</td>
<td>23.75</td>
<td>6.625</td>
<td>16.16667</td>
<td>27.5</td>
<td>23.541667</td>
<td>22.75</td>
<td>22.54167</td>
</tr>
</tbody>
</table>

*Data for vessel travel time found from SeaRates*
Assume that movement to New Orleans area ports occurs via barge.

Movement to all other ports would be done via rail or roadways.
Movement of Goods: Roadway Impact

- Increased use of roads leads to concerns
  - Capacity limitations
    - Equipment
    - Relocation of equipment
    - Personnel
    - Infrastructure
  - Environmental concerns
    - Emissions
    - Fuel Consumption
Movement of Goods: Capacity Limitations

- 1,334,634 tons f&f moved on barge annually = 59,318 trucks
  - Converts to 163 trucks to move these goods per day

- 137,234,610 total f&f tons moved through the 3 ports annually
  - Half of the cargo is moved via road, translates to 134,223 trucks daily

- Daily impact of 134,386 trucks

- Increase may not be seen at states of origin, but could be seen more at the US ports goods will travel through
Movement of Goods: Environmental Concerns

Source: MARAD
Movement of Goods: Exports Port Selection

- Selection of outbound port is a function of ultimate destination
  - Eastern seaboard outbound ports used for Europe/Africa destinations
  - Western seaboard outbound ports used for Asia destinations
- State of origin has little impact on the overall time of transportation
Due to the criticality of ports to local and global supply chains, any disruption could impact economy and daily life.

Port disruptions can have corresponding impacts on modes of transportation and the supporting infrastructure.

The geographical destination and modes of transportation are the primary factors for the rerouting of cargo.

The team’s research focused on one location. In order for the research to be applicable on a national level, further scenarios and assumptions would need to be considered.
Research Results: Observations and Conclusions

- Scenario analysis allows for development of recommendations for improvement of the Port Mapper tool, and may eventually be used to test the online tool.
- With further development the Port Mapper could be used as a planning tool, in order to improve port security and resilience.
Port Mapper Tool
Recommendations

- The Port Mapper tool have great potential for stakeholders that deal with prevention and resiliency plans

- Recommendations for the Port Mapper tool improvement:
  - Input data capabilities
    - Implementing this in the online version would give users a more dynamic and flexible way to manage the tool
    - Add other variables: available budget for resiliency actions and approximate numbers of trains, trucks and vessels available for rerouting
  - Rerouting options for affected commodities
    - Rerouting of goods can be improved by adding the capability of giving alternative routes for the vessels going into the port and for the cargo sitting on the port; the last via rail and/or road
  - Real-time capabilities
    - Rerouting via roads and rails real-time implementation using Google Maps
    - Display alternative ports’ actual capacity