

# Using Advanced Modeling and Analytics to Plan for Supply Chain Resiliency

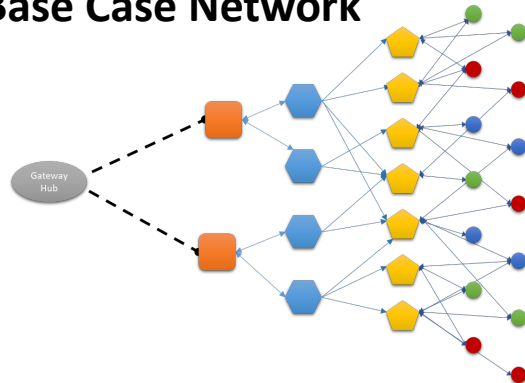
Center for Transportation Studies  
22nd Annual Freight and Logistics Symposium:  
Natural Disaster Disruption in the Freight System  
December, 2019

# What is Network Optimization Modeling?

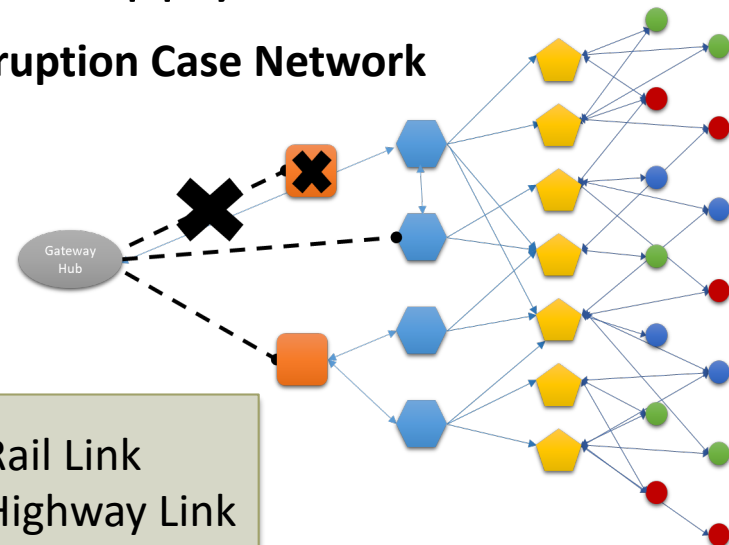
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- Mathematical approach to identify a “best” solution
- A common data analytics practice in private sector
  - ▣ Many firms use optimization to identify a network design that results in the lowest supply chain cost.
  - ▣ Contingency or multi-objective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

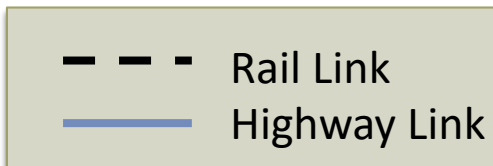
Base Case Network



Disruption Case Network



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# Iowa Example

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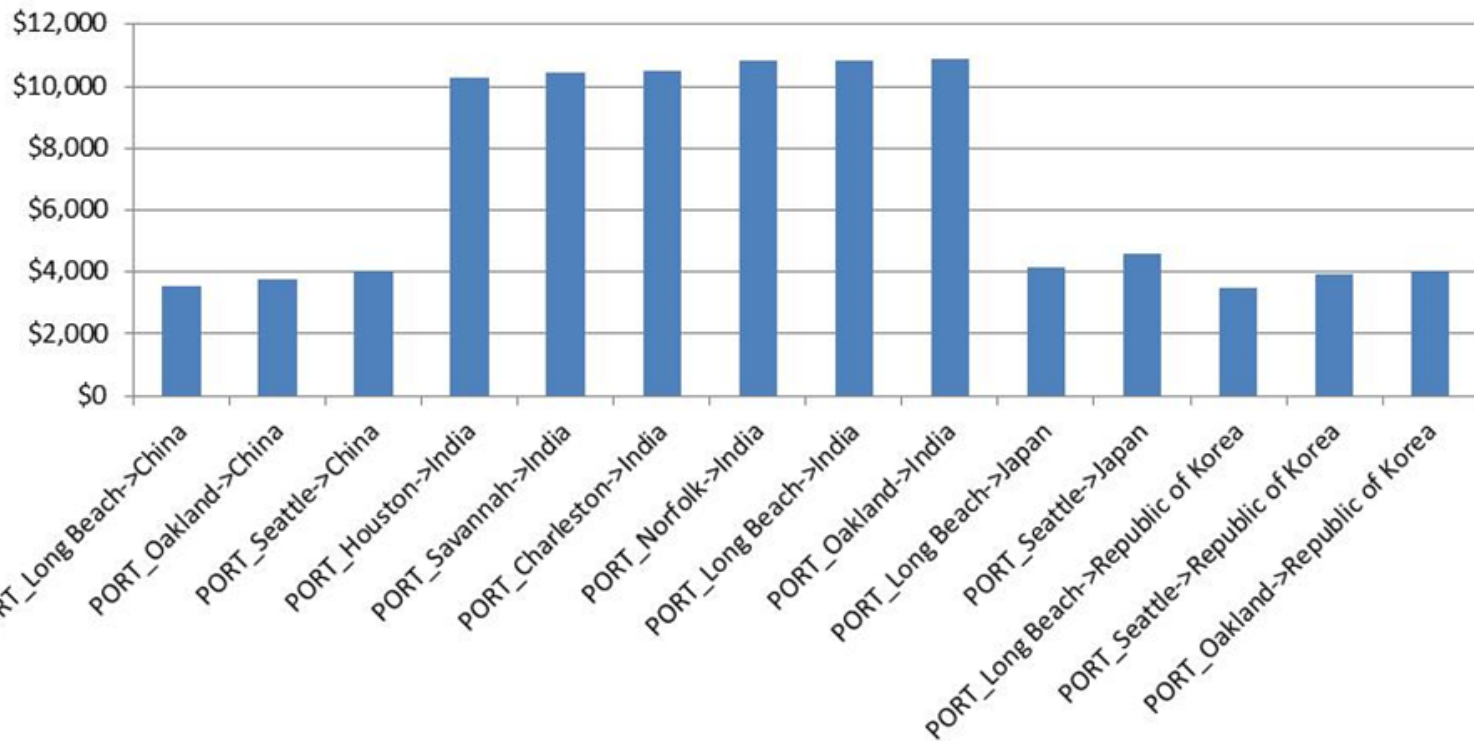
- The Iowa Freight Network Optimization Model (IFROM) was used to test several disruption scenarios:
  - ▣ Loss of the I-80 bridge over the Mississippi
  - ▣ Closure of I-80 between Grinnell and Malcom

Scenario	# of Trucks Diverted	Additional Route Miles	Cost per mile	Annual Additional Cost	Probability of Closure*	Annual Risk
I-80 Bridge	2,784	6.97	\$2.12	\$15.33 M	0.13 days per month	\$66,000
I-80 Closure	5,210	8.2	\$2.12	\$33.58 M	0.09 days per month	\$100,000

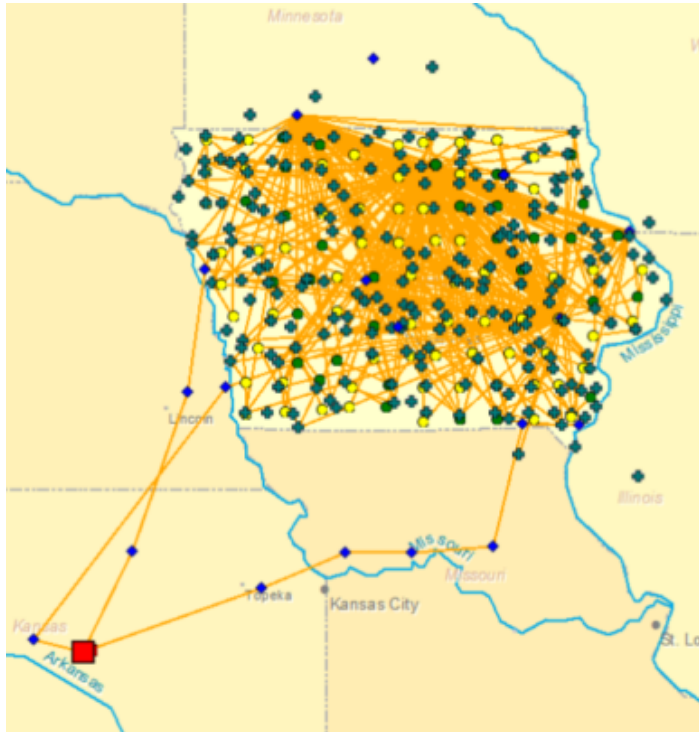
\* Closure probability was based on historical highway records

# Contingency Planning for Exports

## Gateway Benchmark Costs for Moving Iowa Exports to Asian Markets



# Iowa Propane Model

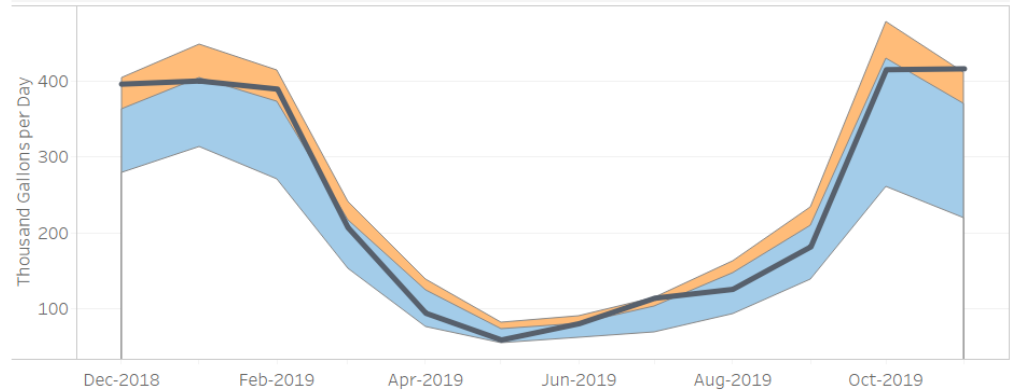


Current Period Dashboard	<b>Demand</b>	Inventory	Days of Supply	Spot Prices at Hub	Residential Prices	Heating Deg..
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Iowa Product Supplied of Propane and Propylene, Weekly, Estimated

12/1/2018 to 12/31/2019

## Propane Demand



Source: U.S. Energy Information Administration

### Legend

- 5 Year Minimum
- 5 Year Range
- Current Value
- Within 10% Risk Area

### Proximity to Maximum

(20%)  0%

	Oct-25	Nov-01	Nov-08	Nov-15	Nov-22	Nov-29
Current Value	376.2	329.4	441.6	414.8	368.7	527.6
% Change from Last Period		(12.5%)	34.1%	(6.1%)	(11.1%)	43.1%
Proximity to Maximum	Oct-25	Nov-01	Nov-08	Nov-15	Nov-22	Nov-29
<10% Under or Exceeds Max		(9%)	(2%)		(3%)	37%
>10% Under Maximum	(28%)			(13%)		

# National Research Activities

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- 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

