Statewide Freight Transportation Network Optimization Strategy Overview
September 21, 2016

© 2016 Quetica, LLC. All rights reserved
Freight Network Optimization Model (FOM)

- **Vision:** To effectively identify & prioritize investment opportunities for an optimized freight transportation network to lower transportation costs & promote business growth.

- State DOT can optimize statewide freight transportation network to reduce transportation costs
  - Traditional approaches focus more on capacity planning
  - Traditional methods don’t quantify cost saving opportunities in a multimodal network

- FOM and Travel Demand Modeling are complementary tools for State DOT planning

© 2016 Quetica, LLC. All rights reserved
Supply Chain Network and Optimization

- Up to 80% of the landed costs are locked in with the supply chain network.
Business Architecture Overview

Network (Supply) Module
- **Freight Nodes:**
  1. In-state nodes
  2. Domestic nodes
  3. Foreign nodes (import/export)
- **Freight Modes:**
  1. Highway
  2. Railroad
  3. Inland waterway/barge/ocean

Demand Module
- **Freight Flows:**
  1. Domestic (mode & volume)
  2. Import/export (mode & volume)
  3. Current year / forecast year
- **Shipment Attributes:**
  1. Equipment type (private)
  2. Shipment cost (private)
  3. Routing (private)

Network Design Alternatives

Freight Optimization Model

Computer Simulation

What-if Scenario Analysis

Lowest cost shipment alternatives / Highest value constraints
Optimization Analysis

- Quantitative Analysis
  - Cost and network capacity
  - Economic viability
  - Improved network resilience

- Qualitative Analysis
  - Strategic alignment
  - Funding availability
  - Job creation and local buy-in
  - Service levels / transportation time
  - Road mile reduction
  - etc.
Complementary Tools for Transportation Planning

- FOM uses network data from the Travel Demand Model TDM)
- Optimization results fed back to the TDM to analyze future traffic pattern changes

<table>
<thead>
<tr>
<th></th>
<th>Network Optimization</th>
<th>Traditional Freight Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>Design / redesign the network (to-be)</td>
<td>Use the current network (as-is)</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>Identify highest cost (value) constraints in regional freight network</td>
<td>Identify bottlenecks based on stakeholder input and/or travel demand models (shortest path).</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Strategic planning of critical components in supply chain network (site, capacity, inventory, mode, etc.)</td>
<td>Long range planning (primarily policy planning) based on highly aggregated commodity data</td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td>Network Optimization Model</td>
<td>Travel Demand Model</td>
</tr>
<tr>
<td><strong>Network Detail</strong></td>
<td>Defines origin-destination pairs in to-be network (lanes, modes, equipment, capacity, etc.)</td>
<td>Determines modal choice, major markets; makes assumptions on interchanges and routing.</td>
</tr>
</tbody>
</table>
Benefits of Multi-Modal Freight Network Optimization

- **Benefits to State DOT**
  - Safety & Environment: reducing truck traffic
  - Mobility: improving transportation network resiliency
  - Economy & Preservation
    - Investment opportunities with high ROI
    - Identifying commercial freight road networks that are irrelevant

- **Benefits to State DOT & private partners**
  - Determine the highest value multi-modal infrastructure public and private investments that are measured by:
    - Lowering the cost of transportation for businesses
    - Increasing transportation responsiveness and predictability
    - Incenting business expansion
  - Provide a foundational model to help businesses optimize their supply chains

© 2016 Quetica, LLC. All rights reserved
Transportation Modal Choice: CA vs. U.S.

Data Source: FAF 4.1 2014, Federal Highway Administration

© 2016 Quetica, LLC. All rights reserved
Iowa Case Study
Cross Dock

- Truck freight arrives via LTL or FTL
- Freight is unloaded and sorted based on destination
- Outbound trucks are loaded with freight going to the same area
- LTL freight is consolidated to long-haul FTL
- Can offer packaging / palletizing services
Cross-Dock Opportunity Analysis

- Identified four regions based on freight density
- Central Iowa – S has the highest cost saving, but Central Iowa – A and Eastern Iowa are more viable options because of existing access to interstate highways
- Selected Eastern Iowa as the primary site candidate with the concept to co-locate cross-dock and intermodal facilities in a logistics park

<table>
<thead>
<tr>
<th>Location</th>
<th>Total Annual Saving Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Iowa – A</td>
<td>$867 Million</td>
</tr>
<tr>
<td>Central Iowa – S</td>
<td>$870 Million</td>
</tr>
<tr>
<td>Eastern Iowa</td>
<td>$852 Million</td>
</tr>
<tr>
<td>Western Iowa</td>
<td>$670 Million</td>
</tr>
</tbody>
</table>
Cross-Dock Network Impact

Benefits:
- Leverage freight consolidation to reduce transportation costs
- Reduce long distance truck traffic and improve environmental sustainability
# Iowa Case Study

## Intermodal Facility

The total market opportunity for high volume traffic lanes:

<table>
<thead>
<tr>
<th>Item</th>
<th>Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Outbound Container</td>
<td>377,000</td>
</tr>
<tr>
<td>Est. Number of Inbound Containers</td>
<td>139,000</td>
</tr>
<tr>
<td>Est. Container Shortage</td>
<td>238,000</td>
</tr>
<tr>
<td>Est. Annual Loaded Containers</td>
<td>516,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Gross Transportation Saving</td>
<td>$340 Million</td>
</tr>
<tr>
<td>Empty Container Reposition Cost</td>
<td>($143 Million)</td>
</tr>
<tr>
<td>Annual Net Savings</td>
<td>$197 Million</td>
</tr>
</tbody>
</table>
Case Study 2
IM Facility Network Impact

Current State

Future State

Benefits:
- Leverage rail network to reduce transportation costs
- Reduce truck traffic and improve environmental sustainability

© 2016 Quetica, LLC. All rights reserved
Iowa Case Study
Transload Facility

- Transload facilities allow shippers to transfer freight between two modes and leverage lower cost shipment options.
- In the statewide model, three locations are identified as candidates for transload facilities to provide largest cost saving opportunities.

![Bar chart showing transportation cost savings](chart1.png)

![Bar chart showing tonnage](chart2.png)
## Iowa Case Study
### A Logistics Park Business Case

<table>
<thead>
<tr>
<th>Facility</th>
<th>Commercial Benefits</th>
<th>Public Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Case Est. Annual Savings</td>
<td>Items</td>
</tr>
<tr>
<td>Cross-Dock</td>
<td>$34.2 Million</td>
<td>Crash Cost Savings in 2021</td>
</tr>
<tr>
<td>Intermodal</td>
<td>$15.5 Million</td>
<td>Carbon Reduction Savings in 2021 (3% Discount Rate)</td>
</tr>
<tr>
<td>Transload</td>
<td>$3.2 Million</td>
<td>Reduction of Long-Haul Truck Freight in 2021</td>
</tr>
<tr>
<td>Combined LP</td>
<td>$52.9 Million</td>
<td>Truck Mile Reduction in 2021</td>
</tr>
<tr>
<td></td>
<td>52,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>68,500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6,900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>127,400</td>
<td></td>
</tr>
</tbody>
</table>
Application to Commercial Supply Chains
Leveraging Big Data for Optimization & Benchmarking

- Assists commercial companies to design & optimize their supply chains
  - Baseline Optimization
    - Identify opportunities in current network to reduce transportation costs
    - Make specific recommendations to improve the supply chains
  - Greenfield Scenario Analysis
    - Identify locations of new facilities in the supply chains
    - Assess cost savings and build business case for investment
- Many companies challenged to collect relevant data and lack expertise
- Quetica’s unique approach merges public data from its state multi-modal network optimizations with a company’s supply chain data
  - Product category
  - Demand (location of customers, product, and volume)
  - Supplier (location of suppliers and volume)
  - Private transportation network capacity
  - Facility construction and operation cost
- More effective commercial supply chain network design & optimization
  - Leverages techniques, tools & computer algorithms proven with Fortune 500
  - More robust dataset overcomes internal data limitations
<table>
<thead>
<tr>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard Langer, Managing Director</td>
</tr>
<tr>
<td>Quetica, LLC</td>
</tr>
<tr>
<td>651-964-4646 x800</td>
</tr>
<tr>
<td><a href="mailto:richard.langer@quetica.com">richard.langer@quetica.com</a></td>
</tr>
<tr>
<td><a href="http://www.quetica.com">www.quetica.com</a></td>
</tr>
</tbody>
</table>