Agenda

- Project Overview
- Key Recommendations
- Next Steps
Project Overview
Iowa Statewide Freight Network Optimization

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

- Iowa 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

- Project uses a demand-based supply chain network design and optimization approach to Iowa DOT planning
Supply Chain Network and Optimization

- Up to 80% of the landed costs are locked in with the supply chain network
Demand-Based Supply Chain Network Design and Optimization Strategy Development

- Commonly used to design and optimize global commercial supply chains
- Focuses on meeting end users’ demand
- Identifies opportunities to invest in 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

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.
Benefits of Multi-Modal Freight Network Optimization

- Determine the highest value multi-modal infrastructure public and private investments
- Reduce road freight truck traffic
- Improve transportation network resiliency
- Provide a foundational model to help Iowa businesses optimize their supply chains

© 2016 Quetica, LLC. All rights reserved
Complementary Tools for DOT Planning

**Travel Demand Modeling (iTRAM)**

- Trip generation (how many trips will be made?)
- Trip distribution (where will the trips go?)
- Mode choice (what modes of transportation will the trips use?)
- Trip assignment (what routes will the trips take?)

- Freight optimization uses network data from the travel demand model
- Optimization results fed back to the travel demand model to analyze traffic pattern changes

**Freight Optimization (iFROM)**

- Analyze high value constraints
- Quantify opportunities to lower transportation costs and improve service levels
- Design multimodal and freight consolidation solutions to reduce truck miles and carbon emissions
Scope of the Iowa Freight Optimization Model (iFROM)

- Modes included: Truck, Rail, Water, multimodal
- 43 commodities
- Data is disaggregated to 99 Iowa counties and 40 foreign countries/groups
- Domestic commodity flow data primarily from Federal Highway Administration’s Freight Analysis Framework
- Import/Export commodity flow data from EDR Group/U.S. Customs & Border Protection
- Base year: 2010; Forecast year: 2040
Iowa Freight Volume by Mode

Over 98% of the freight volume is included in the scope
Comparing Iowa Domestic Freight Flows with Adjacent States

Data Source: FAF 3.5, Federal Highway Administration

© 2016 Quetica, LLC. All rights reserved
Recommendation – Cross Dock Facility
Cross Dock Overview

- 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>
### Target Market Segment in Eastern Iowa
#### Estimated 2021 Numbers

<table>
<thead>
<tr>
<th>Item</th>
<th>Within 100-Mile Radius</th>
<th>Within 50-Mile Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Annual Consolidated Loads</td>
<td>500,000</td>
<td>170,000</td>
</tr>
<tr>
<td>Average Distance to Cross-Dock</td>
<td>66 Miles</td>
<td>34 Miles</td>
</tr>
<tr>
<td>Average Weighted Distance to Cross-Dock</td>
<td>52 Miles</td>
<td>15 Miles</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
Recommendation - 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

Benefits:
- Leverage rail network to reduce transportation costs
- Reduce truck traffic and improve environmental sustainability
# Business Case – An IM Facility

## Volume Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Annual Lifts</td>
<td>68,488</td>
</tr>
<tr>
<td>Number of Outbound Containers</td>
<td>34,244</td>
</tr>
<tr>
<td>Number of Inbound Containers</td>
<td>11,527</td>
</tr>
<tr>
<td>Total Number of Loaded Containers</td>
<td>45,771</td>
</tr>
<tr>
<td>Total Number of Container Deficit</td>
<td>22,717</td>
</tr>
</tbody>
</table>

## Cost Saving Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Net Cost Saving Opportunities</td>
<td>$15.5 Million</td>
</tr>
<tr>
<td>Estimated Transportation Cost Saving from Truck to IM Conversion</td>
<td>$29.5 Million</td>
</tr>
<tr>
<td>Empty Container Reposition Costs</td>
<td>-$14 Million</td>
</tr>
</tbody>
</table>

© 2016 Quetica, LLC. All rights reserved
Recommendation - Transloading Facility
Opportunity Analysis

- 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.
## Business Case – A Transload Facility in Eastern Iowa

<table>
<thead>
<tr>
<th>Scenario</th>
<th>% of Total Market Opportunity</th>
<th>Annual Railcar Number</th>
<th>Facility Size</th>
<th>Initial Investment</th>
<th>Annual Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative Case</td>
<td>7.78%</td>
<td>1,002</td>
<td>15 acres</td>
<td>$5.5 million</td>
<td>$2.5 million</td>
</tr>
<tr>
<td>Base Case</td>
<td>10%</td>
<td>1,837</td>
<td>15 acres</td>
<td>$5.5 million</td>
<td>$3.2 million</td>
</tr>
</tbody>
</table>

Note: $8 per ton transloading fee is included in the cost estimate
Target Market Segment
Eastern Iowa vs. Central Iowa
Recommendation – Logistics Park
## A Logistics Park Business Case

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-Dock</td>
<td>$34.2 Million</td>
<td>$22.4 Million</td>
<td>52,000</td>
<td>52,000</td>
</tr>
<tr>
<td>Intermodal</td>
<td>$15.5 Million</td>
<td>$12.8 Million</td>
<td>68,500</td>
<td>58,800</td>
</tr>
<tr>
<td>Transload</td>
<td>$3.2 Million</td>
<td>$2.5 Million</td>
<td>6,900</td>
<td>3,300</td>
</tr>
<tr>
<td>Combined Logistics Park</td>
<td>$52.9 Million</td>
<td>$37.7 Million</td>
<td>127,400</td>
<td>114,100</td>
</tr>
</tbody>
</table>

© 2016 Quetica, LLC. All rights reserved
# Additional Benefits

<table>
<thead>
<tr>
<th>Items</th>
<th>Annual Savings/Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash Cost Savings in 2021</td>
<td>$31.3 Million</td>
</tr>
<tr>
<td>Carbon Reduction Savings in 2021 (3% Discount Rate)</td>
<td>$81.6 Million</td>
</tr>
<tr>
<td>Reduction of Long-Haul Truck Freight in 2021</td>
<td>170,000 Trucks</td>
</tr>
<tr>
<td>Truck Mile Reduction in 2021</td>
<td>150 Million Miles</td>
</tr>
</tbody>
</table>
Next Steps
Next Steps

- Data refresh
  - 2014 domestic commodity flow database from Federal Highway Administration
  - 2014 import/export data from US. Customs and Border Protection
  - Aggregated private datasets
- Expands the study’s geographic scope
  - Includes counties within 100 mile radius of Iowa border in 7 adjacent states
- Reruns the iFROM
- Develops data visualization capabilities for freight data analytics
Questions

Richard Langer, Managing Director
Quetica, LLC
www.quetica.com
651-964-4646 ext. 800
richard.langer@quetica.com

Weiwen Xie, Executive Director
Quetica, LLC
www.quetica.com
651-964-4646 ext. 803
weiwen.xie@quetica.com