Development of a Freight Transportation Network Optimization Strategy – An Overview

June 19, 2015
Quetica History

- **1997** Founders of PowerTrack™ Business
  - Architected, developed & operated B2B technology & transaction processing platform
    - Freight Audit and Payment Network
    - Transportation and Supply Chain Automation Solutions
    - Third Party Logistics (3PL)
    - Global Trade Bank
    - Transportation and Supply Chain Technology Consulting practices
  - 220 of Fortune 1000 customers, government agencies and 12,000+ service providers
  - Operations in NA, AP, EU and India supporting 42 countries in 23 languages

- **2009** Founders of the Syncada© from Visa, Global Multi-Bank Network
  - Visa bought JV of global payment and financing business

- **2011** Consulting business branded as Quetica™
  - Provide solution-neutral, technology and management consulting to commercial, government and industry service provider clients

- **2014** Re-launched Web-based Fleet Team Fleet Management SaaS Solution
Quetica Principals

- **Rick Langer, Managing Director & President**
  - Founder and general manager of PowerTrack network.
  - A visionary leader to translate business strategy into maximum profits.
  - Expert in growing revenue; reducing costs; and enhancing profitability.

- **Holly Zimmerman, Executive Director & COO**
  - Led PowerTrack new program expansion efforts.
  - Leader in new product and business innovation.
  - Expert in converting complex problems into practical solutions for clients.

- **Weiwen Xie, Ph.D., Executive Director & CTO**
  - Chief architect and CIO of PowerTrack
  - Leader in innovating and developing new products
  - Expert in planning and delivering technology solutions to improve client’s revenue and profitability

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Approach Overview
Project Background

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

- State DOT can optimize statewide freight transportation network to enable companies to better meet customer demand and reduce transportation costs
  - Existing approach focuses on capacity planning
  - Existing research doesn’t produce a practical business value measurement framework due to:
    - Data complexity and data normalization challenges in the research
    - Lack of multimodal freight movement data available to public sector
    - Existing freight performance measures don’t focus on optimizing transportation network for businesses
  - Current planning methods don’t identify and quantify cost saving opportunities in a multimodal network

- Quetica uses a demand-based supply chain network design and optimization approach to assisting state DOT planning

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Supply Chain Network and Optimization

- 80% of the landed costs are locked in with the supply chain network

- Diagram showing the physical and behavioral policies in supply chain management:
  - PHYSICAL - 1-Products, 2-Sites, 3-Demand
  - BEHAVIORAL POLICIES - 4-Inventory, 5-Sourcing, 6-Transportation
Opportunities in Current Freight Flow

- The chart shows the percentage breakdown of tonnage by mode in 2012 domestic freight in 5 states.
- MN has lower % of truck shipments than neighboring states, mainly due to higher % in pipeline shipments.
- MN has opportunities to improve rail and water-borne transportation to reduce transportation costs for MN businesses.

Data Source: FAF 3.5, Federal Highway Administration
Optimization Analysis

- **Quantitative Analysis**
  - Cost, lead time requirement, capacity, etc.
  - Economic viability

- **Qualitative Analysis**
  - Strategic alignment
  - Increasing network capacity and resiliency
  - Tax incentive / funding availability
  - Job creation and local buy-in
  - Service levels / transportation time
  - Road mile reduction
  - Project implementation risks
Benefits of Multi-Modal Freight Optimization

- Effectively identify and prioritize investment opportunities to lower transportation costs for Minnesota businesses
  - Leverage current transportation network to deliver optimized results
  - Identify new infrastructure opportunities to optimize freight transportation network
    - e.g. intermodal yards, commodity consolidation points, rail transload facilities/rail spurs, barge terminals, roadways, rail lines
- Assess current and forecasted transportation network constraints
- Identify opportunities to develop a more robust transportation network by enabling alternative modes and routes
- Identify economic development opportunities to recruit companies
- Provide a foundation model to help Minnesota businesses optimize their supply chains
## Project Approach

| Analysis of Network Demand and Capacity | • Identification and prioritization of demand areas  
• Analyze network demand and capacity |
|----------------------------------------|--------------------------------------------------------------------------------------------------|
| Performance Measurement and Constraints Analysis | • Use quantitative and qualitative measurements  
• Identify and prioritize current and forecasted network performance constraints |
| Creating and Prioritizing Optimization Strategies | • Develop pragmatic short-term and long-term optimization strategies  
• Does not intend to identify and evaluate all optimization strategies |
| Business Case Development | • Conduct financial analysis and develop financial models  
• Develop actionable recommendations with justifications |

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Business Architecture Overview
Analysis Examples

- Road network and truck transportation
  - Truck cross-docking facilities for freight consolidation
  - Road corridor resiliency
- Rail network and transportation
  - Assessing values of short line rails
  - Intermodal facilities to enable low cost, reliable rail shipments
  - Transloading facilities to provide better rail access
- Waterborne transportation network
  - New terminals for better access to barge transportation
  - Leveraging Great Lakes shipping
- Trade routes for import/export
Case Study 1 – Cross-Dock Facility
Cross Dock Overview

Before Cross-Docking

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Less than Truckload</th>
<th>Customers</th>
</tr>
</thead>
</table>

After Cross-Docking

<table>
<thead>
<tr>
<th>Less-than Truckload or Full Truckload</th>
<th>Cross-Docking Distribution Center</th>
<th>Full Truckload</th>
</tr>
</thead>
</table>

Distribution Center

- Suppliers
- Receiving
- Sorting
- Shipping
- Customers
Case Study 1 - Cross-Dock Opportunity Analysis

- Evaluated total cost saving opportunities in four regions
- Region 1 has the highest cost saving, but Regions 2 & 3 are more viable options because of existing access to interstate highways
- Selected Region 2 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>Region 1</td>
<td>$909 Million</td>
</tr>
<tr>
<td>Region 2</td>
<td>$883 Million</td>
</tr>
<tr>
<td>Region 3</td>
<td>$908 Million</td>
</tr>
<tr>
<td>Region 4</td>
<td>$713 Million</td>
</tr>
</tbody>
</table>
Case Study 1 - Cross-Dock Network Impact

- **Benefits:**
  - Leverage freight consolidation to reduce transportation costs
  - Reduce long distance truck traffic and improve environmental sustainability
Investment Analysis – A Mid-Sized Cross Dock in Region 2, Iowa

- **Assumption**
  - Build a 150-door, 600 trailer parking, 120,000 sq. ft. cross dock facility on 15 acres
  - 200 truck pickups daily, 52,000 truck pickups yearly (5 days a week, 52 weeks a year)
  - 5.30% of overall market opportunity
  - Cross-docking fee ($450/truck) covers all operational expenses and profit margin

- **Initial Investment:** $21 million

- **Annual Net Saving Opportunities:** $24.4 MM to $44.3 MM; Average $36.2 MM

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td>$5 million</td>
</tr>
<tr>
<td>Doors</td>
<td>$1 million</td>
</tr>
<tr>
<td>15 acres of land</td>
<td>$5 million</td>
</tr>
<tr>
<td>Sortation and support systems</td>
<td>$10 million</td>
</tr>
</tbody>
</table>

![Cost Saving Sensitivity Analysis - Stop-Off](image)
Comparable Cross-Dock - Memphis

- Carrier-owned transportation cross-docking
- Old Dominion, a $535.5 MM trucking company, operates a 150-door cross-docking facility on ~16 acres in Memphis employing 308 people
- Old Dominion plans to replace the 150-door site by building a 229-door cross-docking facility, creating 188 new jobs and spending $31.3 million
- The average salary of the new hires will be $52,111
Comparable Cross-Dock – Breinigsville, PA

- Provider-owned transportation cross-docking
- NFI is $1B provider of logistics, warehousing, transportation, and distribution services
- Facility Features:
  - Square Footage: 254,000
  - Building Height: 38'-47'
  - Trailer Spots: 550
  - Dock Doors: 150
  - ~40 acres
  - Close proximity to CSX and Norfolk Southern intermodal rail yards
- Other Services provided: Contract Packaging & Decorating, Light Manufacturing / Assembly, Product Labeling, Reverse Logistics, IT Integration
- Breinigsville was a Ag and Mining town, turned into logistics hub (Home Depot, Amazon, Shoprite, etc.)
Comparable Cross-Dock – Fontana, CA

- Provider-owned distribution cross-dock provided to L&L Nursery Supply to consolidate shipments from over 60 manufacturers to deliver full truckloads to major retailer
- Reddaway Fontana Service Center is owned by Reddaway, a $335 million subsidiary of YRC Worldwide
- L&L is West Coast's leading manufacturer and distributor of lawn and garden products
- The 160-door facility is located on 17.6 acres

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Case Study 2 - Intermodal Facility
Opportunity Size – Focusing on High Volume Origin-Destination Pairs

The total market opportunity for high volume Origin-Destination pairs: $289 million net annual savings

<table>
<thead>
<tr>
<th>Item</th>
<th>Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Gross Transportation Saving</td>
<td>$412 Million</td>
</tr>
<tr>
<td>Empty Container Reposition Cost</td>
<td>($123 Million)</td>
</tr>
<tr>
<td>Total Outbound Container Number</td>
<td>247,000</td>
</tr>
<tr>
<td>Total Inbound Container Number</td>
<td>42,000</td>
</tr>
<tr>
<td>Total Container Shortage</td>
<td>205,000</td>
</tr>
<tr>
<td>Annual Net Saving</td>
<td>$289 Million</td>
</tr>
<tr>
<td>Annual Lift Number</td>
<td>494,000</td>
</tr>
</tbody>
</table>
Container Count by Commodity

Top 3 commodities: Animal Feed, Other Ag Products, and Mixed Freight

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Case Study 2 – IM Facility Network Impact

- **Current State**
- **Future State**

**Optimization Benefits:**
- Leverage rail network to reduce transportation costs
- Reduce truck traffic and improve environmental sustainability
## Investment Analysis – a Mid-Sized Intermodal Facility in Iowa

### Conservative Case vs. Base Case

A Mid-Sized Intermodal Facility in Iowa

<table>
<thead>
<tr>
<th></th>
<th>Annual Lift No.</th>
<th>Annual Net Cost Saving</th>
<th>Facility Size</th>
<th>Initial Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative Case</td>
<td>32,000</td>
<td>$23 million</td>
<td>16 to 20 acres</td>
<td>&lt; $15 million</td>
</tr>
<tr>
<td>Base Case</td>
<td>56,000</td>
<td>$40 million</td>
<td>30 to 35 acres</td>
<td>$15 million</td>
</tr>
</tbody>
</table>

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Comparable Facility – CSX Louisville, KY

- Investment Example
  - In 2011, CSX invested $15MM to build a 34-acre IMF in Louisville, KY
  - 34-acre intermodal facility – capacity to handle 68,000+ lifts per year
Comparable Facility – NS Louisville, KY

One of the three IM terminals in KY, 9 miles away from CSX terminal

- 30-acre facility
- The capacity of the terminal is ~55,000 lifts per year
- In 2012, the IM terminal handled 40,000 lifts
Comparable Facility – UP Council Bluffs

- Existing Council Bluffs Intermodal Facility
  - Shared by UP and Iowa Interstate Railroad System
  - COFC facility processing <65,000 lifts per year (62,000 in 2012)
Case Study 3 - Transloading Facility
Opportunity Analysis

Annual Saving Opportunity

Annual Transload Tonnage
## Investment Analysis – Transload Facility

- **Base case financial**

<table>
<thead>
<tr>
<th>Region</th>
<th>Annual Railcar</th>
<th>% of Tonnage</th>
<th>Annual Saving</th>
<th>Facility Investment</th>
<th>Land Cost</th>
<th>Total Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>1634</td>
<td>11.98%</td>
<td>$5,462,720</td>
<td>$4.2 Million</td>
<td>$1.31 Million</td>
<td>$5.5 Million</td>
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<tr>
<td>Location 2</td>
<td>1634</td>
<td>15.17%</td>
<td>$4,966,715</td>
<td>$4.2 Million</td>
<td>$1.31 Million</td>
<td>$5.5 Million</td>
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<tr>
<td>Location 3</td>
<td>817</td>
<td>15.65%</td>
<td>$2,611,274</td>
<td>$4.2 Million</td>
<td>$1.31 Million</td>
<td>$5.5 Million</td>
</tr>
</tbody>
</table>

- **Conservative case financial**

<table>
<thead>
<tr>
<th>Region</th>
<th>Annual Railcar</th>
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<th>Annual Saving</th>
<th>Facility Investment</th>
<th>Land Cost</th>
<th>Total Investment</th>
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</thead>
<tbody>
<tr>
<td>Location 1</td>
<td>583</td>
<td>4.27%</td>
<td>$2,788,109</td>
<td>$4.2 Million</td>
<td>$1.31 Million</td>
<td>$5.5 Million</td>
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<tr>
<td>Location 2</td>
<td>427</td>
<td>3.97%</td>
<td>$1,885,382</td>
<td>$4.2 Million</td>
<td>$1.31 Million</td>
<td>$5.5 Million</td>
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<tr>
<td>Location 3</td>
<td>317</td>
<td>6.08%</td>
<td>$1,402,065</td>
<td>$4.2 Million</td>
<td>$1.31 Million</td>
<td>$5.5 Million</td>
</tr>
</tbody>
</table>
Case Study 4 – Propane
Iowa Propane Supply Chain

- Severe propane shortage and sharp price increases for residential and commercial users in 2013-2014 due to supply chain issues
- Applying same scientific principles to propane supply chain:
  - To be better informed when demand for propane reaches critical levels and Iowa faces potential shortages
  - To proactively define viable contingencies to better manage extreme fluctuations and disruptions in propane supply in future
- Propane supply chain optimization analysis focuses on:
  - Ability to handle current demand with current infrastructure
  - Ability to handle future increases in demand with current infrastructure
  - Impact of changing and/or new infrastructure constraints
- Identifies thresholds for when changes in demand or constraints limit ability to meet propane demand at reasonable price
Optimization Approach

- Obstacles are constraints in:
  - Transportation network (e.g. pipeline and terminal capacity, truck availability)
  - Inventory management (e.g. storage in market centers, in bulk in Iowa and at end users)

- Requires understanding of propane supply chain infrastructure including:
  - Demand fluctuations for crop drying and heating
  - Storage requirements (e.g. capacity, reorder points)
  - Sourcing practices (e.g. contracting, contingency supply)
  - Transportation capacity across modes

- Analyzing objectively using network optimization methodology to run simulations and conduct what-if analysis to identify constraints and evaluate alternatives
Questions

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