Development of a Freight Transportation Network Optimization Strategy – An Overview

August 4, 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

GSA Contract Holder  VOSB  FLEETTEAM™
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
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 Iowa.

- 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

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

- ~80% of the landed costs are locked in with the supply chain network
Opportunities in Current Freight Transportation

The chart shows the percentage breakdown of tonnage by mode in 2012 domestic freight in 5 states. Iowa has the highest % of tonnage in truck among the five states. Opportunities exist to improve rail and intermodal transportation to reduce transportation costs for Iowa businesses.

Data Source: FAF 3.5, Federal Highway Administration
Optimization Analysis

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

- **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 businesses
  - Leverage current transportation network to deliver optimized results
  - Identify new infrastructure opportunities to optimize freight transportation network
- Identify economic development opportunities to recruit new companies to Iowa
- Provide a foundation model to help existing Iowa businesses optimize their supply chains
- Identify opportunities to improve network resiliency
## 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
Business Architecture Overview

- Supply Chain Cost
- Domestic Freight Flow
- Import / Export
- County-Level Socio-Economic

Cleanse, Consistency Check, Analyze, Disaggregate, Verify and Aggregate Data

Network Design & Optimization Data Model

- Constraints, Design Alternatives & Simulation Results

Computer Simulation

What-if Scenario Analysis

Design Alternatives

Preliminary Evaluation

Qualitative Measurements

Design Evaluation

Recommended Optimization Strategy & Business Case
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 other waterborne shipping opportunities
- Trade routes for import/export
- Risk quantification and network resilience optimization
Case Study 1 – Cross-Dock Facility
Cross Dock Overview

Distribution Center

- Suppliers
- Receiving
- Sorting
- Shipping
- Customers

Before Cross-Docking
- Suppliers
- Less than Truckload
- Customers

After Cross-Docking
- Less-than Truckload or Full Truckload
- Full Truckload
- Cross-Docking Distribution Center
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>
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</table>
Case Study 1 - Cross-Dock Network Impact

Current State

Future State

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

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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

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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.
Case Study 2 - Intermodal Facility
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>
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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

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## 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>
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</table>
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
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.
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>
</tr>
<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>
<th>% of Tonnage</th>
<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>
Comparable Transload Facility – Trans Load Carriers, Inc.

- Served and switched by BNSF, Norfolk Southern and CSX
- Located within two miles of the major highways and interstates in Birmingham, AL
- Approximately 30 acres, 130,000 sqft of enclosed warehouse space, two rail spurs providing 8 boxcar spots and 12 combined centerbeams and flatcar spots
Comparable Transload Facility – Patriot Rail

- Along the 68-mile Louisiana and North West Railroad that connects with Kansas City Southern and Union Pacific
- Near I-20 in Gibsland, LA, about 100 miles east of Shreveport
- Approximately 40 acres, expected to handle over 5,000 carloads in the first year
- Patriot Rail invested $3.3 million in developing the facility in 2011
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

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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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