Guiding Capacity Expansion Strategies with Intermodal Facility Simulation

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BNSF Railway at a Glance

- Product of nearly 400 railroad mergers or acquisitions
- 32,500 miles of track
- 41,000 employees
- 8,000 locomotives
- More than $60 billion invested in network since 2000

TOTAL VOLUME (2017)
10.2 M
+5.3%

Intermodal & Auto
5.4 M
+6.3%

Agricultural Products

Industrial Products

Coal
Core team (25+) with advanced degrees (mostly PhDs)
• OR/IE, Statistics, Mathematics, Computer Science
• Internal consultants

Skills
• Optimization
• Machine Learning / Deep Learning
• Simulation
• Business Consulting
• General Programming

In 2017, our group saved the business $110 million

We’re Hiring!
Intermodal Overview

Intermodal involves the shipping of containers/trailers over 3 modes of transportation (ship, rail, truck)

International

Domestic
Hub Capacity Planning

- Train schedule & variability
- Locomotives
- Traffic mix
  - Container/trailer
  - INTL vs. DOM
  - Priority levels
- Mainline delays
- Planning processes/systems

Compared against several competitors back in 2015 - AnyLogic was clear winner
Flexible, Java-Based – many interns w/o simulation experience, but do know Java
Able to use model as a testbed for planning algorithms and then roll out to production systems
Hub Modeling Process

Understand Current Operation
- Historical data
- Field visits

Update Model
- Add logic
- Set up layout (tracks, roads, crane specs, etc.)

Calibrate
- Existing layout, peak historical week of volume
- Measures: train performance, service level, etc.

Design Potential Layouts

Model Future Volumes and Compare Performance
Objective: Increase annual lift capacity to keep up with demand; determine if storage capacity must be increased as well

Key Challenge: Facility is landlocked – no options for expanding footprint. Must do one of the following:
- Densify production tracks
- Convert parking space and/or storage tracks into production tracks

**Standard Rubber Tire Gantry (RTG)**
- Fast operation
- Fewer tracks

**Cantilevered Rubber Tire Gantry (CRTG)**
- Potentially the “best of both worlds”

**Widespan**
- Many tracks
- Slower operation
**Results**: CRTGs provide the best combination of additional track footage and operational speed/flexibility
Objective: Determine bottlenecks to capacity and evaluate strategies for mitigating

Key Challenges:
- 20+ arrivals/departures per day – all from the east end
- Truck traffic congestion
- Already nearing storage capacity constraints on Monday/Tuesday
Southern California - Hobart

Results:
Significant capacity can be added through a multi-faceted strategy:
1. Capital expansion – production tracks, wide-span cranes, stacking cranes
2. Operational improvements through optimization – route trucks through facility based on real-time congestion
3. Customer behavior – smooth volume over day/week
Objective:
• Expand capacity through the implementation of new (to BNSF) automated technologies
Thank you!