Center for Excellence in Logistics and Distribution (CELDi)

James S. Noble, MU Site Director
Industrial and Mfg Systems Engineering
E3437 Lafferre Hall
Columbia, MO 65211
573-882-9561
noblej@missouri.edu

A National Science Foundation sponsored
Industry/University Cooperative Research Center (I/UCRC)

Reverse Logistics Network Design in a PBL Environment

The Boeing Company

Research Team: James Noble (PI), Wooseung Jang

CELDi Center for Excellence in Logistics and Distribution

We are exploring component repair and distribution facility location in order to minimize cost and time performance with respect to capability, capacity, and other constraints.

Problem context

Broader Applicability

- Design of reverse logistics networks for a wide range of maintenance operations
- Scenario analysis to explore cost – time performance trade-offs

Business and project objectives

- Evaluate maintenance facility location & transportation cost versus service time trade-offs
- Determine key problem constraints
- Network design within a Performance-based Logistics (PBL) environment

Important/Expected Results

- Maintenance location strategy to support PBL
- Reverse logistics network evaluation tool
  - Network configuration
  - Network operation

University of Missouri-Columbia

An Inventory Replenishment Strategy Using International Shipment Consolidation

Research Team: Wooseung Jang (PI), James Noble, Na Deng

CELDi Center for Excellence in Logistics and Distribution

University of Missouri-Columbia

Sponsor: **Leggett and Platt, Inc.**

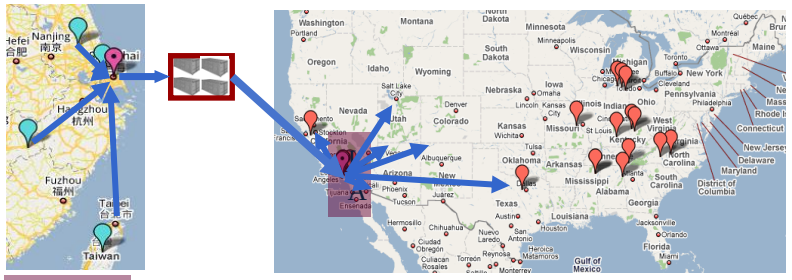
Problem in context: **Each branch of Leggett & Platt places orders to China independently. They have low order frequencies and high inventory. Coordinated inventory replenishment strategy will reduce inventory a lot. The project is to minimize the total cost by consolidating small international shipments when the coordinated inventory policy is taken.**

Important/Expected Results

- **Coordinated inventory replenishment and shipment policy for international logistics network**
  - **Shipment assignment**
  - **Inland transportation mode selection**
  - **Reduced inventory levels**
  - **Reduced cycle time**
  - **Increased flexibility**

Technical Approach

- **Analyze purchase order history data of each branch**
- **Improve current logistics network**
- **Formulate a mathematical model**
- **Solution algorithms**
- **Test various scenarios**
- **Develop feasible implementation practices**



Optimizing MoDOT Winter/Snow Removal Operations

Sponsor: Missouri Department of Transportation

Research Team: W. Jang, J.S. Noble, C.J. Nemmers

CELDi Center for Excellence in Logistics and Distribution

Research Objectives:

Develop an integrated systems, optimization based approach to winter road maintenance planning decisions

Approach:

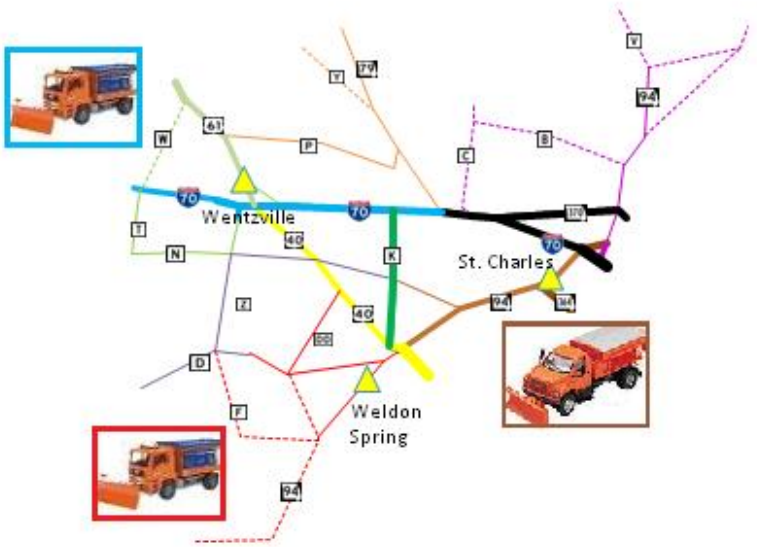
1) Develop a protocol for determining the desired level of service and the required constraints.
2) Develop an integrated model and efficient algorithms for large scale applications.
3) Validate the model/algorithms and apply results to the state of Missouri.

Broader Impact:

An integrated model that can be applied to a wide range of DOT operations (e.g. snow removal, pavement striping, herbicide application).

Significant Results:

Able to maintain current high level of service with fewer resources (20-30% savings)



On Demand Logistics System Design

Bayer CropScience

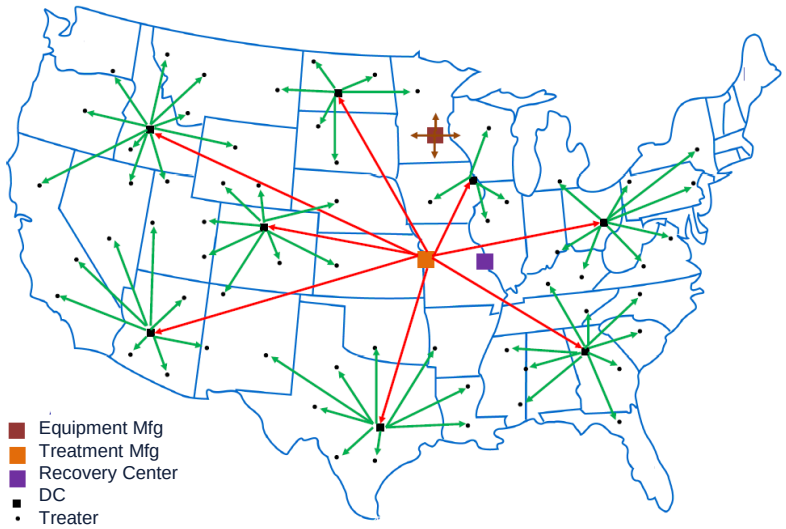
Research Team: M Sir (PI), J Noble, P Wutthisirisart, M Pariazar

CELDi Center for Excellence in Logistics and Distribution

We are developing decision-support tools to support the overall logistics / supply chain design for Bayer CropScience's new On Demand treatment delivery system

University of Missouri-Columbia

Problem context



Business and project objectives

- Supporting product launch of a revolutionary new seed treatment system
- Analyze projected product demand network.
- Develop data visualization tools for scenario analysis.
- Develop optimization tools to support design of supply chain network – both product and reverse logistics.

Important/Expected Results

- Tool to support configuration of supply chain network
- Software to optimize production and transportation
- Multi $M transportation, inventory and facility savings over product life-cycle

Supply Chain Design for Energy Conservation

Research Team: James Noble (PI), Wooseung Jang,

CELDi Center for Excellence in Logistics and Distribution

University of Missouri-Columbia

Sponsor: **The Boeing Company**

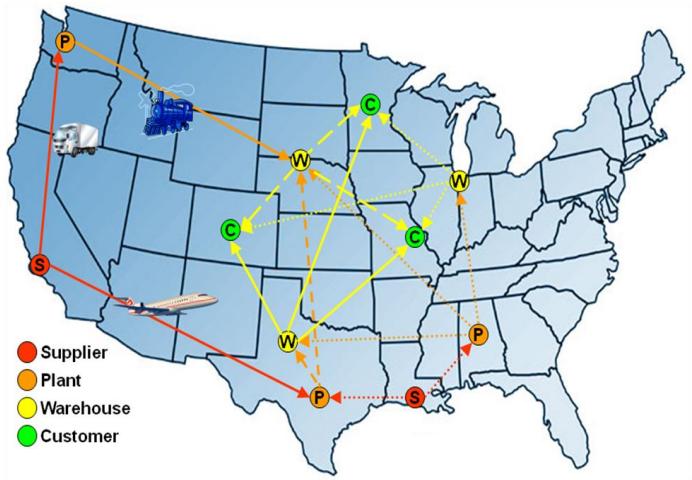
Problem in context: **Overall supply chain performance is impacted by energy cost which has significantly increased in the past 10 years. Supply chain decisions such as supplier and mode selection, routing, inventory profile and load consolidation, can all be impacted by energy cost.**

Important Results

- **Identification of key supply chain trade-offs with respect to energy issues**
- **Development of supply chain reconfiguration approaches as energy cost changes**
- **Reduced overall supply chain cost**
- **Design of more robust supply chains from a energy consumption perspective**

Technical Approach

- **Supply chain and transportation data collection**
- **Supply chain evaluation model development**
- **Formulation of energy based supply chain optimization models**
- **Solution algorithm development**
- **Model sensitivity analysis**
- **Supply chain reconfiguration strategies**



Demand Forecasting Models for Dynamic Material Requirements

Research Team: Wooseung Jang (PI), James Noble, Matt Roman, Na Deng

CELDi Center for Excellence in Logistics and Distribution

University of Missouri-Columbia

Sponsor: Ameren UE

Thrust Area: Inventory

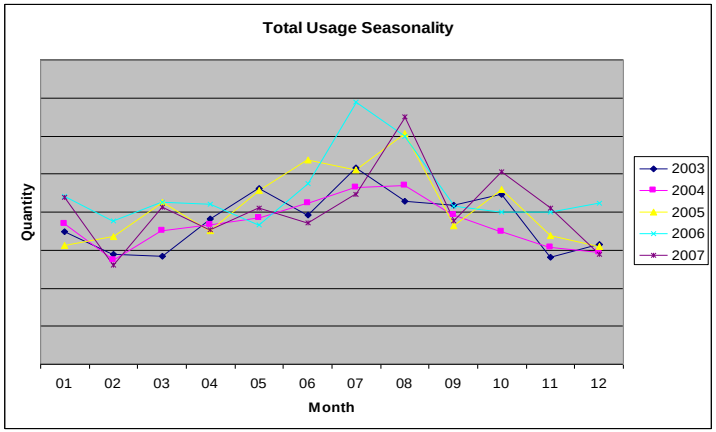
Problem in context: Thousands of transformers across several different storerooms are used by Ameren every year. These transformers consist of hundreds of different types with widely varying individual demands

Important/Expected Results

- Production of accurate forward looking forecast results
- Creation of a forecast that can be easily applied when scheduling production slots from vendors
- Increase in customer satisfaction by limiting monthly stock outs over a 1 year planning horizon

Technical Approach

- Examine existing problem
- Gather relevant data
- Analysis of historic usage data
- Aggregate similar groups of transformers and choose individuals to forecast
- Review different forecasting techniques used on similar demand
- Create forecasting algorithm
- Evaluate forecast accuracy



Integrated Material Flow Analysis

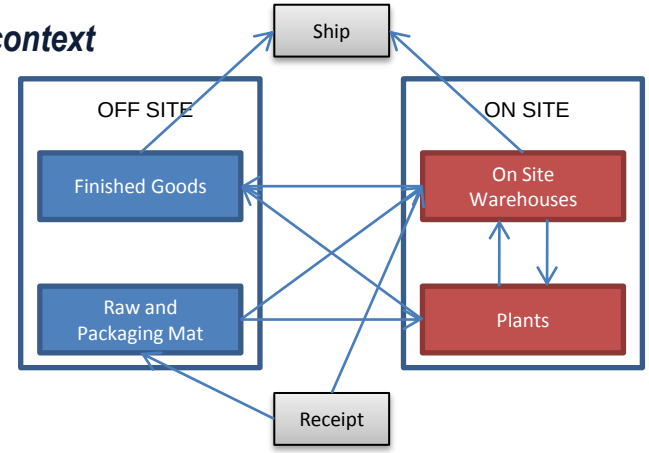
Bayer CropScience

Research Team: Mustafa Sir (PI), James Noble, Phichet Wutthisirisart, Tyler Keel

CELDi Center for Excellence in Logistics and Distribution

We are developing decision-support tools to identify opportunities to improve the logistics operations of the Bayer CropScience Kansas City Plant

Problem context



Broader Applicability

- The trade-off between onsite warehousing vs. off site warehousing through 3PLs is an important consideration for many companies.
- Warehouse capacity and material handling analysis.
- Decision-support tools using Microsoft Excel/Access.
- Cost-benefit analysis of various alternative scenarios.

Business and project objectives

- Analyze current state-of-the-art material flow models.
- Analyze the current material flow/inventory situation.
- Develop a set of material flow improvement alternatives.
- Evaluate the material flow improvement alternatives with respect to the trade-offs between performance and cost.

Important/Expected Results

- Capacity planning for off site and on site warehousing.
- Identification inefficient material handling practices.
- Graphical representation of alternative material flows
- Alternative material flow and allocation strategies
- Estimated annual transportation, material handling and space savings of $2.8M over 3 years

University of Missouri-Columbia

Warehouse Floor Layout Optimization

Research Team: Jim Noble (PI), Alec Chang, Almas Ospanov,
Phichet Wutthisirisart, Sam Trevino, Sarah Harper, Nichole Hillstrom

CELDi Center for Excellence in Logistics and Distribution

University of Missouri-Columbia

Sponsor: **Hallmark Cards.**

Thrust Area: **Distribution**

Problem in context: **Hallmark Cards operates a very large distribution center (> 80k SKU and 220M items/year). The project objective is to develop a user-friendly warehouse floor layout tool that addresses the trade-offs between picking, stocking, shipping and retail stocking costs in order to reduce overall operating cost.**

Technical Approach

- **Analyze current Hallmark warehouse picking and stocking practices and supporting data.**
- **Analyze current filling floor layout practices and develop performance metrics.**
- **Formulate and analyze an integrated warehouse layout model.**
- **Develop a user-friendly warehouse floor layout tools and provide database integration support.**

Important/Expected Results

- **Effective and efficient methodology for optimal filling floor layout.**
- **Significant cost savings through explicit analysis of cost trade-offs between picking/stocking/shipping.**
- **Effective implementation strategy for filling floor relayout timing.**