Generation of Improved Milk-runs for the Mexican Maquiladora Industry

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Logistics of the Maquiladora Industry

• Business Model:
  – Raw material originates in the US
  – Assembly is performed in Mexico
  – Final product is sold all over the world

• Increased Transportation Costs:
  – Retrieval of raw materials
  – Transfer parts between plants
  – Deliver finished products
TRW-Chihuahua

• Problems:
  – No focus on transportation costs
  – No checks on Third Party Logistics company
  – Poor truck utilization

• Solutions:
  – Assessment of Third Party Logistics company
    • Cost comparison with other providers
    • Route analysis
  – Bring routing in-house (develop application)
Technical Implications

• A special case of the Traveling Salesman Problem
  – Constraints (truck capacity, supplier time windows)
  – Multiple trucks (“salesmen”)
  – One-way trips (not round trips)

• Binary integer programming is possible but $NP$ hard.

• A combination of alterations of the following algorithms were used:
  - Savings Method
  - Sweep Heuristic
  - Closest Insertion Algorithm
  - 2op Exchange (city swap)
  - Simulated Annealing
  - Balancing Heuristic (EAL)
Sweep Heuristic Alterations

chooses the closest unrouted city to the vector connecting the first and last cities.

chooses the city in a wedge with the smallest “Savings” distance.
Sample Routes
Since the project began...

– Over 30% savings in transportation costs
– More awareness of logistics issues throughout the plant
– Recognized importance of monitoring outsourcing companies