



Optimizing Product Transportation at Frito Lay

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Agenda

- ▶ Company Overview
- ▶ Current Situation
- ▶ Objective
- ▶ Model
- ▶ Results
- ▶ Recommendations



Company Overview: Frito Lay



- ▶ Division of PepsiCo that manufactures corn chips, potato chips and other snack foods.
- ▶ Brands: Doritos, Tostitos, Cheetos, Ruffles, Munchies, Grandma's
- ▶ Headquarters: Plano, TX
- ▶ Revenue: \$15 billion



Company Overview: Gamesa



- ▶ Largest cookie company in Mexico
 - ▶ Division of PepsiCo.
- ▶ Brands: Emperador, Marias, Mamut, Chokis....
- ▶ Revenue: \$2 billion
- ▶ Headquarters: Monterrey, MX



Current Situation

- ▶ In order to satisfy the large Hispanic market in the US, Frito Lay imports Gamesa brands from Mexico.
- ▶ Several Frito Lay brands are also produced in Mexico and imported into the US as well.



Current Situation

Company Overview

Current Situation

Objective

Model

Results

Recommendations



- ▶ Plants in Monterrey, Vallejo, Celaya and Obregon.
- ▶ All pass through Obregon to be consolidated. Then, exported all across the U.S.



Current Situation - Products

- ▶ Our project was narrowed down to focus specifically on two products.
 - ▶ Munchies Mini Sandwich Crackers
 - ▶ Grandma's Mini Fudge Chocolate Chips



Current Situation

- ▶ All products are produced in Vallejo.
 - ▶ Demand in 5 cities for each of the 4 products.
 - ▶ Cucamonga CA
 - ▶ Modesto CA
 - ▶ Dallas TX
 - ▶ Frankfort IN
 - ▶ Pulaski TN
 - ▶ Only plants with consolidation capabilities are Dallas and Obregon.
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Current Situation - Transportation

Company Overview

Current Situation

Objective

Model

Results

Recommendations



Objective

Company Overview

Current Situation

Objective

Model

Results

Recommendations

- ▶ Help Frito Lay reduce transportation costs by finding the optimal routes to export/import from Mexico into the different cities in the United States
- ▶ Things to consider:
 - ▶ Geography
 - ▶ Production Capabilities
 - ▶ Space to consolidate



Model – Multi-Commodity Fixed Charge Network Flow Problem

Company Overview

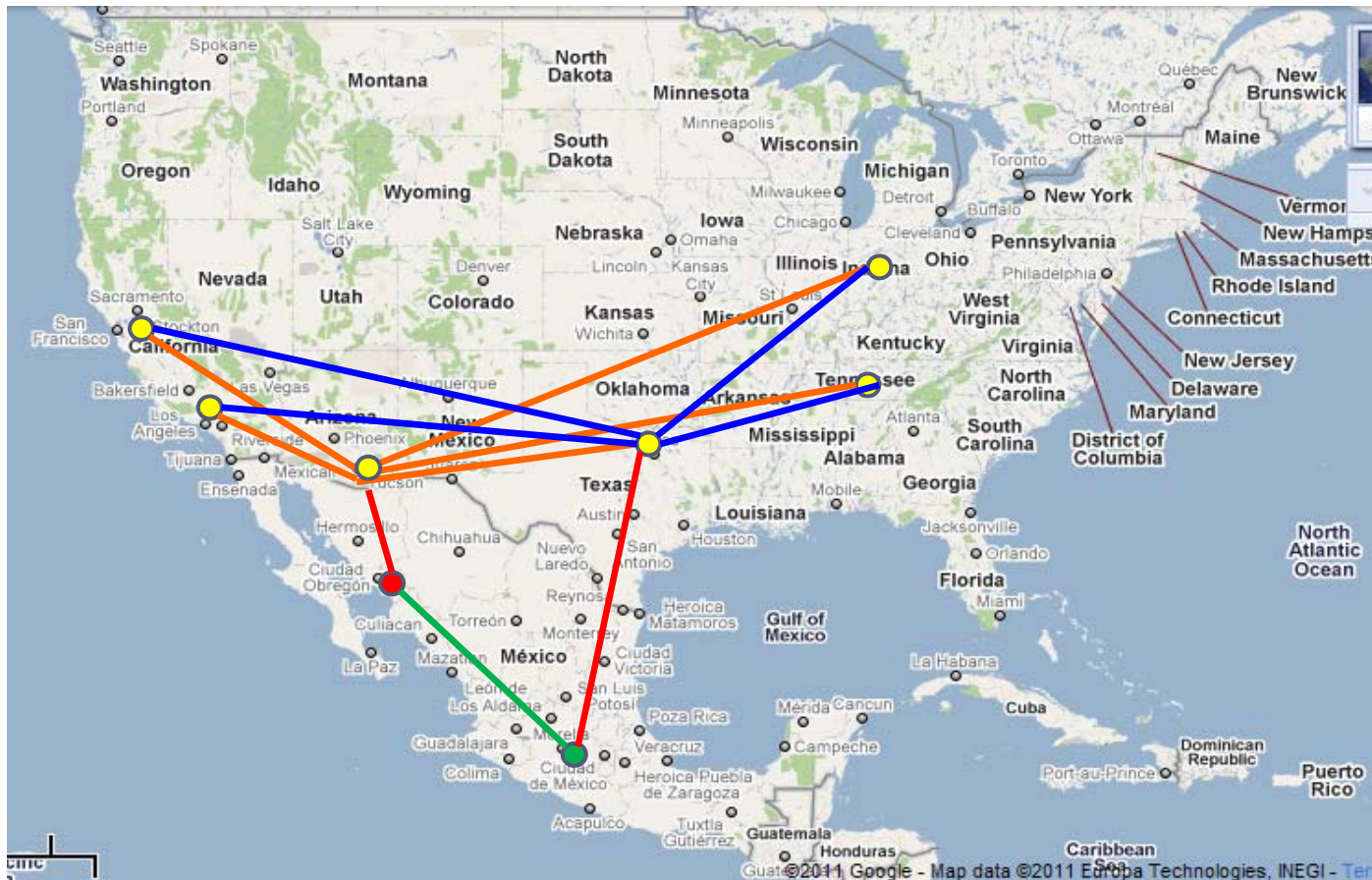
Current Situation

Objective

Model

Results

Recommendations



Model - Inputs

Company Overview

Current Situation

Objective

Model

Results

Recommendations

- ▶ **Sources: All products manufactured in Vallejo**
 - ▶ Infinite production capacity for current demands.
- ▶ **Demands: All 5 cities**
 - ▶ Couldn't create accurate forecast
 - ▶ Have only 8 months of past data.
 - ▶ Insufficient for seasonality analysis.
 - ▶ Used Average of the 8 months as the future demand.



Model - Inputs

Company Overview

Current Situation

Objective

Model

Results

Recommendations

- ▶ **Arcs (Cost):**
 - ▶ Got current quotes from Swift, Magellan, Schneider. (International transportation includes border fees).
 - ▶ Crossing fees:
 - ▶ Mty-Laredo: \$600, Obregon-Nogales: \$1200



Model - Algorithm

Company Overview

Current Situation

Objective

Model

Results

Recommendations

Code

```
param Demand {Destinations, Commodities}, default 0.0;
param Cost {Arcs};

data e:FL_Data.txt;

var x {Arcs, Commodities} >= 0;
var bx {Arcs} binary;

display Nodes;
display Sources;
display Destinations;
display Commodities;
display Arcs;
display Demand;
display Cost;

minimize OBJ: sum{(i,j) in Arcs} Cost[i,j] * bx[i,j];

subject to C1{k in Sources, c in Commodities}:
    sum{(k,j) in Arcs} x[k,j,c] - sum{(i,k) in Arcs} x[i,k,c] <= 999999;

subject to C2{k in Destinations, c in Commodities}:
    sum{(k,j) in Arcs} x[k,j,c] - sum{(i,k) in Arcs} x[i,k,c] = Demand[k,c];

subject to C3{(i,j) in Arcs}: sum{c in Commodities} x[i,j,c] <= 100000000*bx[i,j];

solve;
# expand;
display x, bx;
```

Data

```
set Nodes := 1 2 3 4 5 6 7;
set Sources := 1 2 3;
set Destinations := 2 3 4 5 6 7;
set Commodities := q w e r;
set Arcs := (1,2) (1,3) (2,4) (2,5) (2,6) (2,7) (3,4) (3,5) (3,6) (3,7);

param Cost :=

1 2 2200
1 3 1838.59
2 4 2074.66
2 5 2728.75
2 6 1053.60
2 7 1262.96
3 4 2461
3 5 3212
3 6 4730
3 7 4511;

param Demand :=

# q is product 62700 (Chokis 85g)
# w is product 62800 (Chokis 35g)
# e is product 63200 (Munchies 35g)
# r is product 63300 (Munchies 85g)

2 q -25117.38
2 w -6957.48
2 e -10284.53
2 r -26633.75

4 q -10343.83
4 w -5142.49
4 e -5434.41
4 r -10973.75
```

Results – AMPL/CPLEX

Company Overview

Current Situation

Objective

Model

Results

Recommendations

Results

```
CPLEX 10.0.0: optimal integer solution; objective 9319.97
0 MIP simplex iterations
0 branch-and-bound nodes
x [1,*,*]
:      e      q      r      w      :=
2  60742.3  89802.9  99600.5  48130.3
3      0      0      0      0

[2,*,*]
:      e      q      r      w      :=
4  5434.41  10343.8  10973.8  5142.49
5      0      3685.02  5083.73  0
6  30438.6  22828.2  24906.1  23848.1
7  14584.8  27828.5  32003.2  12182.2

[3,*,*]
:      e      q      r      w      :=
4  0      0      0      0
5  0      0      0      0
6  0      0      0      0
7  0      0      0      0
;

bx :=
1 2  1
1 3  0
2 4  1
2 5  1
2 6  1
2 7  1
3 4  0
3 5  0
3 6  0
3 7  0
;
```

Results - Map

Company Overview

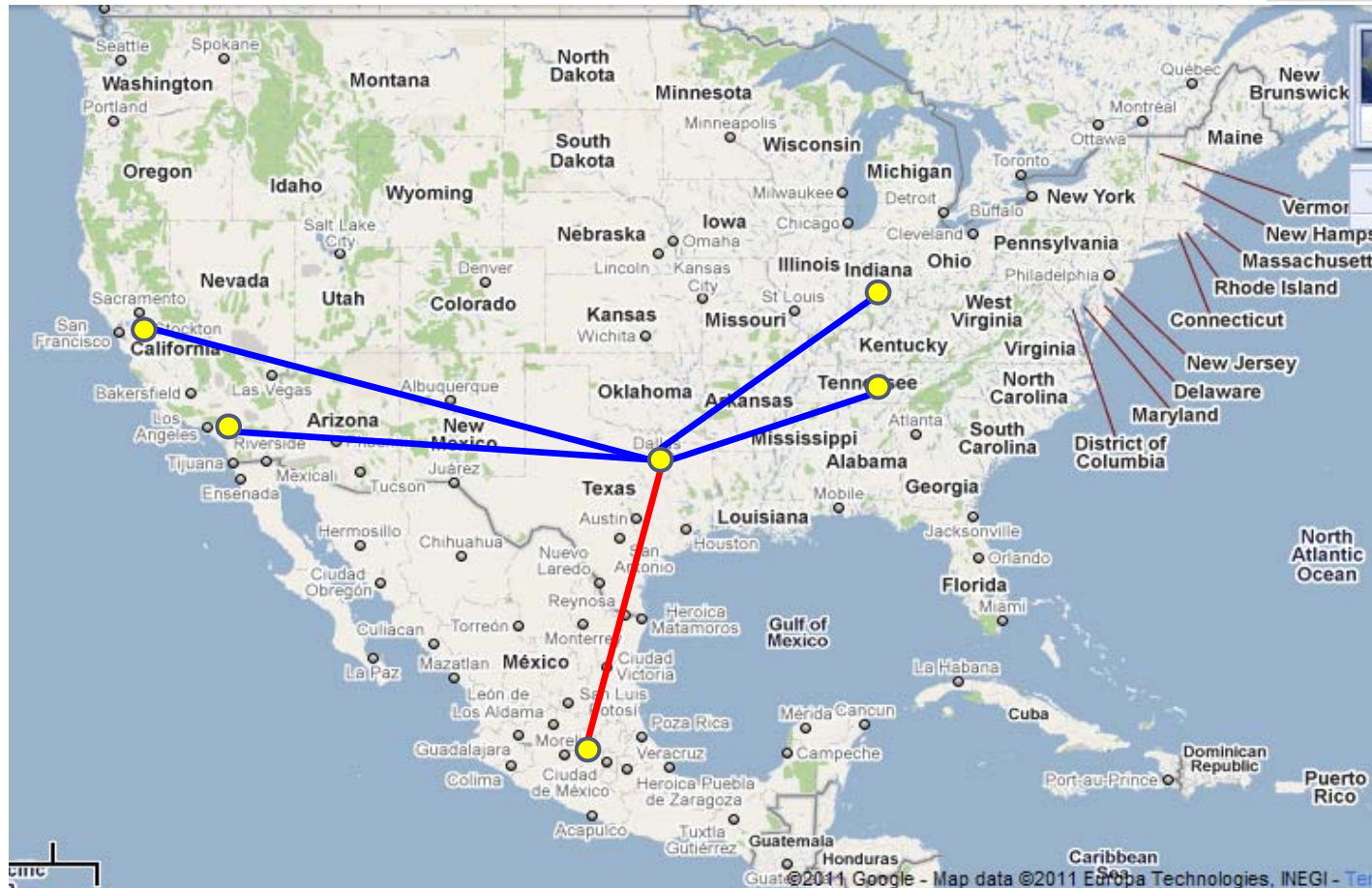
Current Situation

Objective

Model

Results

Recommendations



Results - Costs

Company Overview

Current Situation

Objective

Model

Results

Recommendations

Presentation

| | | |
|---|---------------------|--------------|
| | 85g | 35g |
| | 36 bags | 64 bags |
| | 36 bales | 48 bales |
| | 60 platforms | 60 platforms |
| Total bags per truck | 77,760.00 | 184,320.00 |
| TOTAL | | 521,233.57 |
| Total Trucks per Month | 6.70 | 2.83 |
| Transportation Cost (9319.97 per truck) | \$62,472.75 | \$26,355.69 |
| Total Cost | \$88,828.44 | |
| TOTAL Real Cost (10 Trucks) | \$93,199.70 | |
| Current Cost | \$167,125.90 | |
| Savings per Month | \$73,926.20 | |
| Savings per Year | \$887,114.40 | |

Recommendations

Company Overview

Current Situation

Objective

Model

Results

Recommendations

- ▶ **Consolidate products in Dallas**
 - ▶ Driving distance: 22 hours in total
 - ▶ Vallejo - Laredo: 14
 - ▶ Laredo - Dallas: 8
- ▶ Train employees in Vallejo to export (fill out paperwork).
- ▶ Teach new route to drivers.



CONTACTS

- ▶ Alberto Galvan— Frito Lay Marketing Director
- ▶ Greta Medina— Gamesa/Quaker International Supply Chain Manager
- ▶ Heather Diamond— Frito Lay National Supply Chain Integration Manager



QUESTIONS?

