

# The MetalWorks Corporation

## A Network Configuration Project Using LogicNet Software<sup>1</sup>

### **THE BUSINESS PROBLEM**

MetalWorks is a company that produces and distributes steel file cabinets and lockable steel storage boxes, known in the industry as *safety boxes*. Currently the company runs two manufacturing facilities, one located in Des Moines, Iowa which manufactures both products and the other located in Dover, Delaware that produces just the file cabinets. These two facilities serve all of the approximately 120,000 accounts (retailers and stores) throughout the United States and a small number of additional accounts in Canada. The company currently operates out of two warehouses, one at each manufacturing facility.

MetalWorks was established in 1964 as a family venture and grew throughout the '70's and '80's at a fairly steady rate. Until 1991, the company only operated one manufacturing facility, a plant in Des Moines, Iowa. Approximately five years ago, MetalWorks purchased a competitor, which operated a manufacturing facility in Dover, Delaware. MetalWorks decided to keep the plant, so there are now two facilities that manufacture the same file cabinets. MetalWorks is currently owned by 12 shareholders and is managed by a newly appointed CEO.

The file cabinets are sold to retail stores for \$75 each and the safety boxes are sold for \$107 each. Despite the high profitability of both products, the new CEO is concerned that the company's distribution network is not as efficient as it could be. At a recent shareholder meeting, he pointed out that the current distribution strategy employed by MetalWorks is a result of the merger of the two distribution networks that existed before 1991, the year that MetalWorks purchased its competitor.

The shareholders decided to engage a consulting firm to determine if the MetalWorks logistics network should be altered and if so, how. Your company, Advanced Logistics Consulting (ALC), was awarded the contract after six months of continuous work by your marketing division, competing primarily with Anderson Consulting, A.T. Kearney, and Booz-Allen. You have agreed to "improve the effectiveness of the distribution network and align cost of service with account profitability." In your original proposal, you mentioned that this concept of re-engineering the entire distribution network, together with the fact that you committed not only to design but also to implement the new distribution strategy made your proposal attractive to the MetalWorks shareholders.

Your team has collected the following data:

1. Year 2001 through 2003 forecast demand in units for each major customer accounts.
2. 60 potential locations for warehouses. These locations represent the most populated metropolitan areas in the United States,
3. A number of possible sizes for each new warehouse.
4. The set-up cost for establishing a warehouse, which is a function of both warehouse size and location.
5. Labor cost in dollars per unit per year for each potential new warehouse and each existing warehouse.
6. Inventory turnover ratios for each existing and potential warehouse.
7. Carriers that MetalWorks uses:
  - Rail and truck carriers to transport products from the manufacturing facilities to the warehouses
  - A combination of TL (truck load) carriers and small trucking companies to distribute the products from the warehouses to the retailers.
8. Transportation costs:
  - Rail-Midwest charges transportation cost per mile for each car shipped.
  - Private Fleet and ABC Fleet Co. charge transportation cost per mile for each truck.

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- Commercial TL rates are given in dollars per mile per truck. These rates are given zone to zone as defined by the carriers.
  - XYZ Trucking has a rate that changes as a function of the distance for each truck.
9. Variable manufacturing costs at each of the manufacturing facilities.
  10. An estimated increase in demand for 2001, 2002, and 2003. It is estimated that the demand for safety boxes will increase 7% annually and demand for file cabinets will increase 10% annually.

You have already created an Excel spreadsheet with all of this information so that you are able to import it into LogicNet. This spreadsheet allows you to ensure that you are able to meet MetalWorks current needs (2001) as well as that in 2002 and 2003.

Customer service is a crucial component to MetalWorks business since there are a number of competing products on the market. Although no specific dollar figure can be attributed to a specific level of customer service, the customers have been divided into two groups, the Tier One, or priority, customers and the Tier Two, or normal, customers. The CEO insists that to remain competitive, the delivery time to Tier One customer shall be no more than 60 hours and the delivery time to Tier Two customers shall be no more than 72 hours. This implies that the distance between a warehouse and a Tier One customer should be no more than 1,100 miles and the distance between a warehouse and a Tier Two customer should be no more than 1,300 miles.

## **STRATEGIC ALTERNATIVES**

The CEO and shareholders are considering two possible strategies in order to accommodate the increase in demand.

1. The first possibility is to expand the cabinet manufacturing, the safety box manufacturing, or both, at the facility in Des Moines. Both capacities can be expanded independent of the other.
  - The steel cabinet production can be increased by 50% at a cost of \$1,500,000. Once the new equipment is installed, the variable production cost will be decreased by \$0.05 per steel cabinet. Some plant shutdown time is involved, but can be ignored in the analysis.
  - The safety box production can be increased by 25% at a cost of \$750,000. Once the equipment has been installed, the variable production cost for the safety boxes will be reduced by \$0.10 at this facility. Again, plant shutdown time can be ignored
2. The alternative to expanding production at Des Moines is to open a new facility in Juarez, Mexico, a small border town that has the infrastructure for this manufacturing facility.
  - The cost to build and open this facility is \$5,000,000.
  - It will take one year to build this facility.

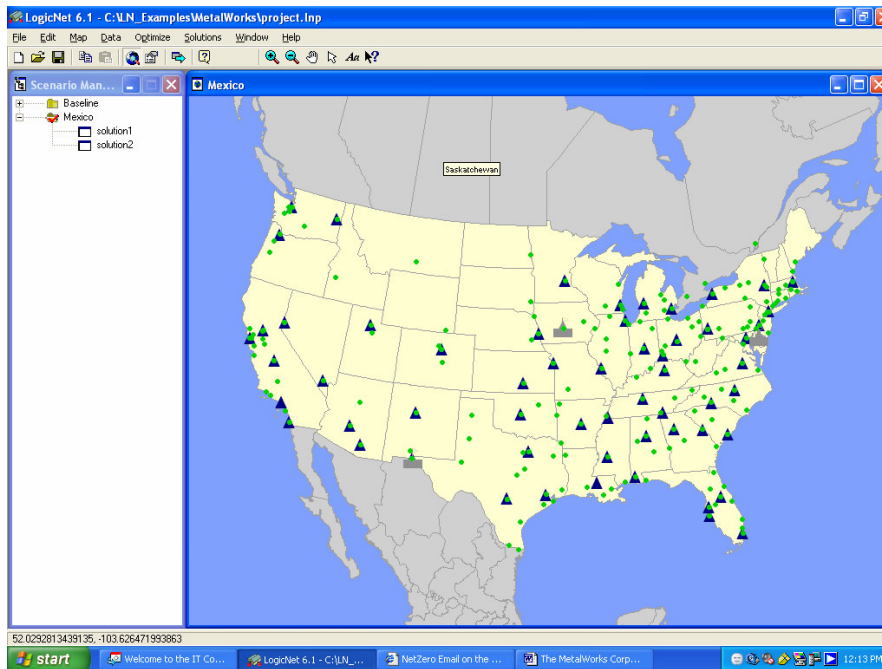
Your final recommendation should address the following issues:

1. Should the capacity for file cabinets be expanded at the Iowa facility? Should the safety box capacity be expanded? If so, when? Or, should a new manufacturing facility be established in Juarez? If so, when?
2. Should new distribution centers be established? If so, how many?
3. If new distribution centers are going to be established, where should they be located? What size is appropriate for each facility?
4. How should each plant's production be allocated among the distribution centers?
5. What issues did you take into account when answering the previous questions? What additional issues need to be taken into consideration? How do your responses account for the long-term future, i.e. beyond 2003?
6. After visiting Juarez, Mexico, the potential location for a new manufacturing facility, you receive additional information about transportation taxes in Mexico. It turns out that if you decide to open a facility in Juarez, each truck crossing the border into the United States will be taxed \$50. How would you modify the analysis of the case?  
**No need to do this analysis: just describe how you would take additional taxation into consideration.**
7. Keep in mind that you need to compare baseline total costs (i.e., the total cost of the current network) against the total cost of other alternatives. There are quite a few alternative scenarios that can be modeled as available options center around the number of warehouses, when warehouses should be opened, the size of these facilities, and capacity expansion. Cost decreases should ultimately be compared to capacity expansion expenditures.

## **GETTING STARTED**

### **Logging In:**

- Double-click on the “LogicNet” icon in order to open the program. Note: If LogicNet has not been used in a while on that particular computer, it will automatically install the program. However, this may take a few minutes.
- If the program asks, “Do you want to re-license the application?” click no.
- Click on the open folder icon.
  - Click on project. Your screen should now appear similar to the following:

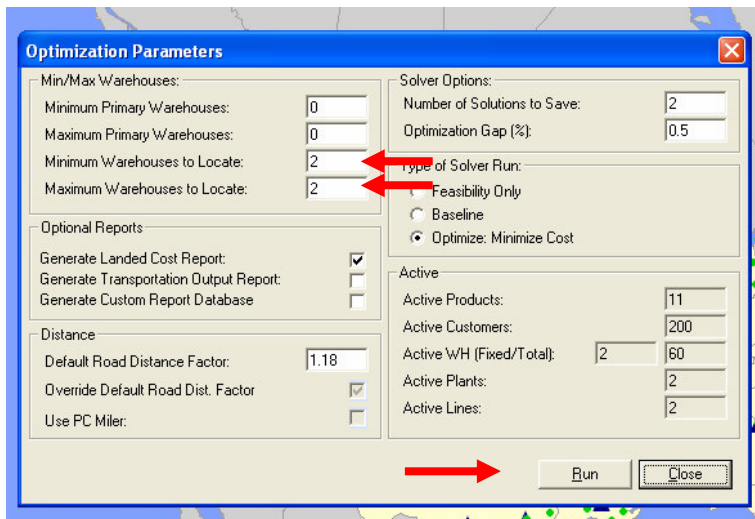


### Logging Out:

- In order to “Log Out” of LogicNet select “File”, then “Exit”, then “OK”. Note: When asked the question: “Do you want to re-license the application now?” always select “NO”

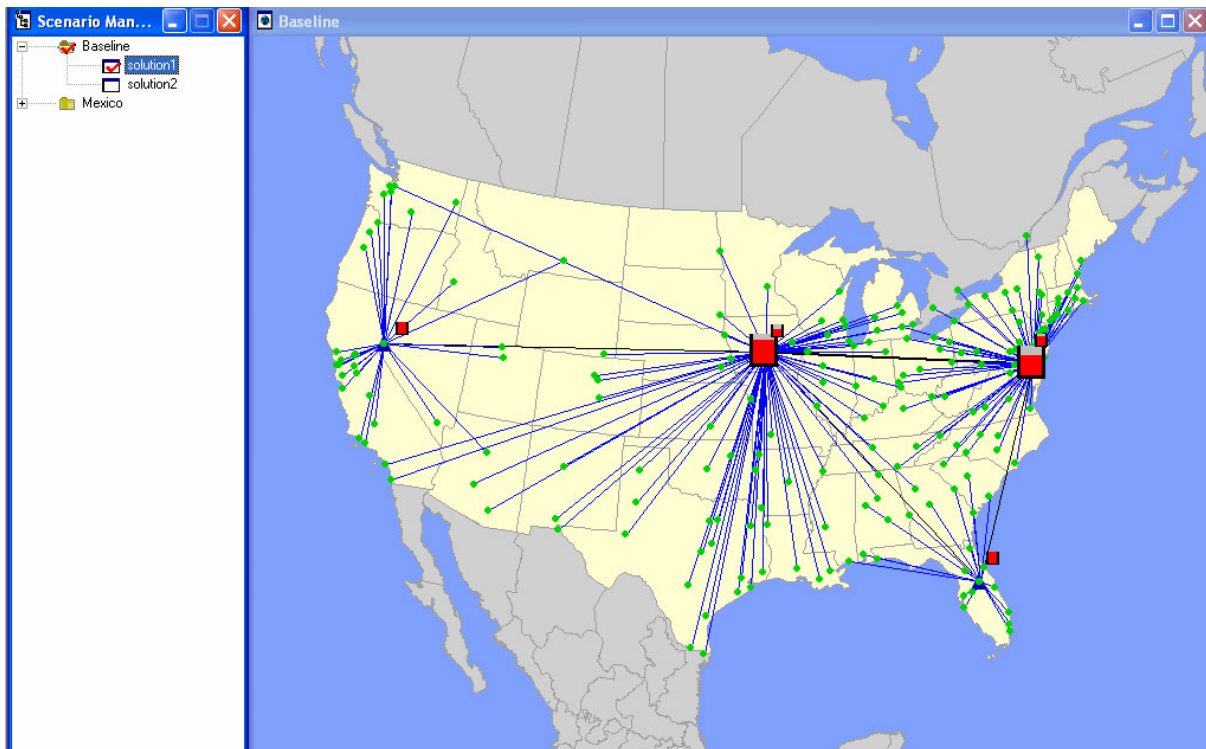
### Your First Run & Optimizing the System:

- In order to optimize the system start from the main screen and select “Optimize” then select “Parameters.” Input the number of warehouses you wish for LogicNet to calculate a solution for first in “Maximum Warehouse to Locate” then in “Minimum Warehouses to Locate”. Click on “Run”. Run the system as it currently exists (i.e., two plants, two plant warehouses). This is your baseline model.
  - If you input the number of warehouses first into the “Minimum Warehouses to Locate” and are inputting a number greater than the number of warehouses in “Maximum Warehouses to Locate,” LogicNet will not allow you to move the cursor off of this data field and you will not be able to continue.
  - In order to minimize the amount of time LogicNet spends calculating the solution, it is recommended that you input the same number in both data fields.



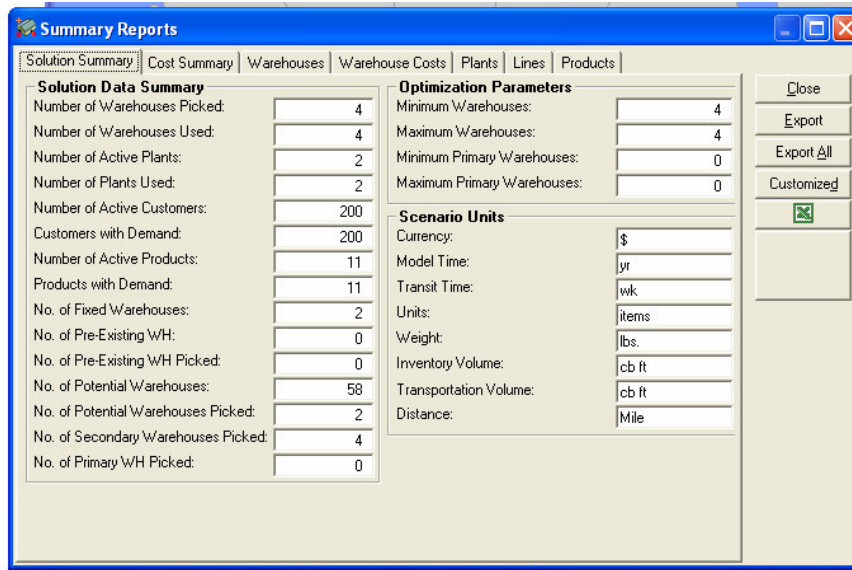
### Viewing the Solution:

- First highlight / select "Solution 1" or if another solution is also offered, "Solution 2" (Solution 2 is the 2<sup>nd</sup> best solution identified by the software). Right click on the desired solution and select "Select Solution". Now, right click on the chosen Solution and select "Display Solution" and it should appear similar to that shown below. This will show which cities host the optimal solution for operating a warehouse.

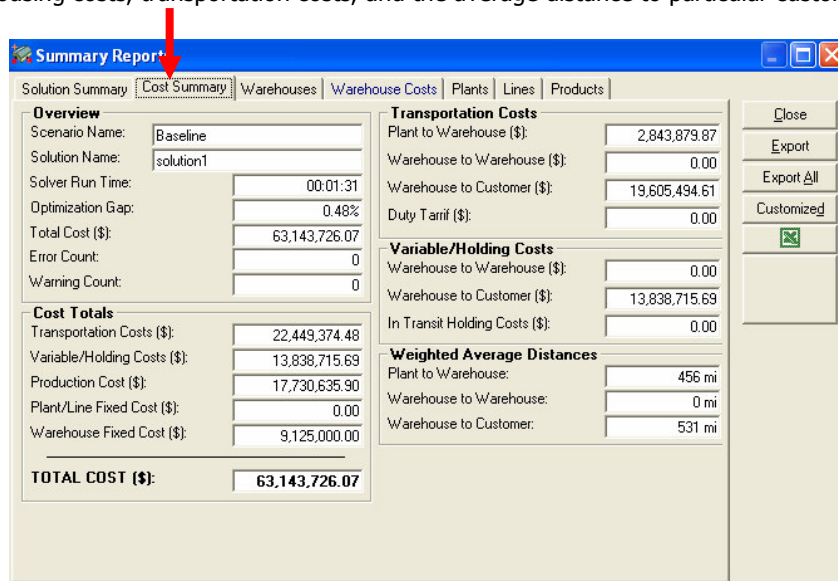


### Viewing the Output Summary:

- To view the output summary select "Solution", then "View Report", and finally select "Summary Report". The output summary as shown below will provide information about warehouses selected, number of customers, and product information.

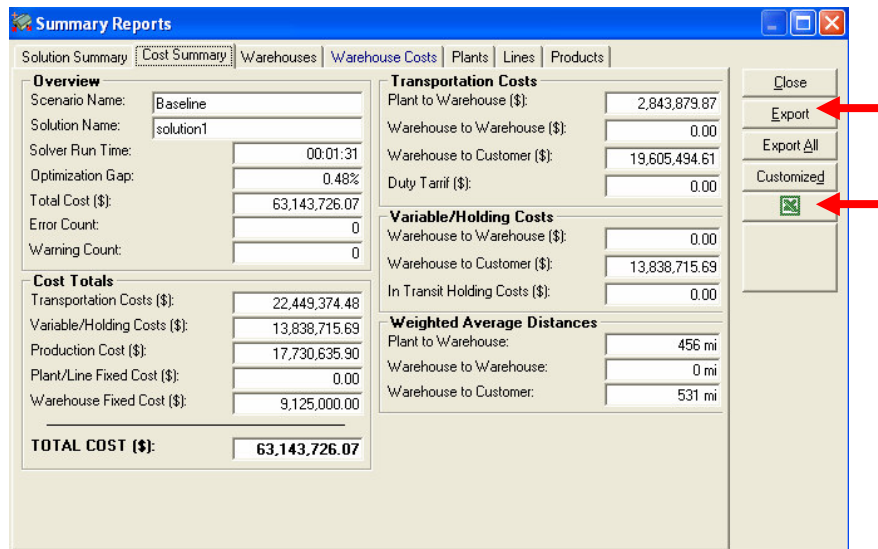


- To view a summary of the costs associated with a particular solution, from the "Solution Summary" screen described previously click on "Cost Summary." This will provide you with information such as the total cost for this particular solution, warehousing costs, transportation costs, and the average distance to particular customer sites.



### Saving the File and Information:

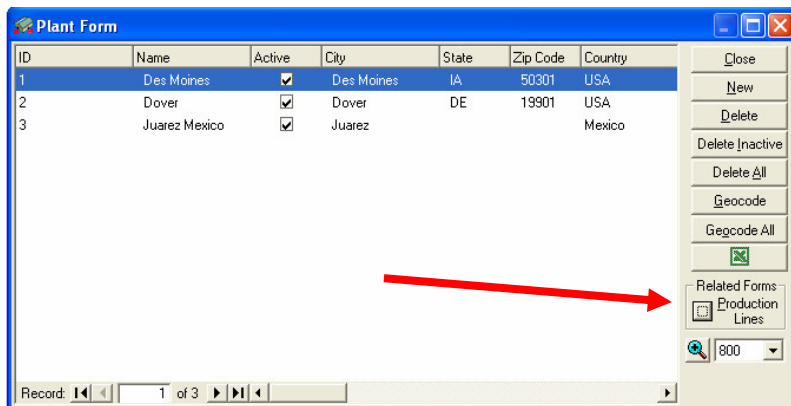
- The LogicNet version being used is a demo version that will not allow you to save any project information. If you want to save any file, you must export it to "Excel".
- For example: If you want to save the "Cost Summary" for a number of warehouses that you ran, first select "Solutions", then "View Reports" and then select "Summary". In the cost summary report (as shown below), either select "Export" or click on the Excel icon. LogicNet will now either save the file as an ".xls" in the directory that you specify or will open the file in Excel respectively.



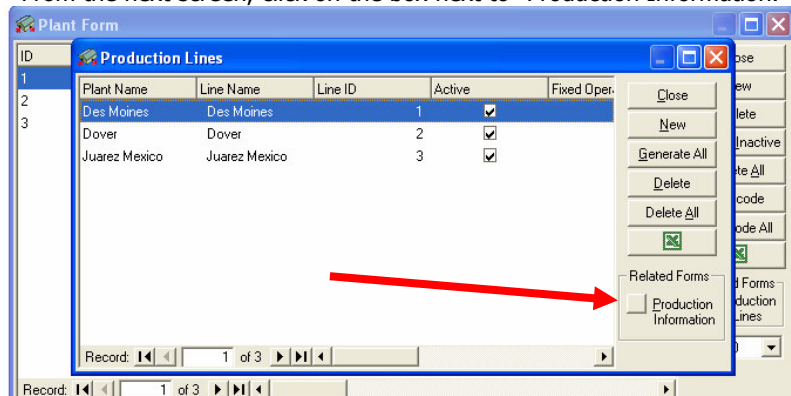
## ADJUSTING AND FIXING FACILITIES AND DATA

### Manufacturing Facilities:

- The data on all of the available manufacturing facilities can be found by clicking on "Data", then "Sites", then, "Plants." The information included here is the addresses of the sites, their geographic coordinates, and their fixed operating costs.
- You can look at all available production costs and capacities for each of the manufacturing facilities in the project. From the screen with the geographic information on the manufacturing facilities, click on the box located next to "Production Lines".



From the next screen, click on the box next to "Production Information."



This will result in you being able to view all products that each facility is capable of producing, the production capacity for each product, the unit cost of production, and the hours of production each unit takes.

**Note: This is where you will be able to expand capacity at specific production facilities and reduce unit production cost.**

### Product Information:

- You are able to look up the specifications of each of the products that the MetalWorks Corporation offers. First, you need to click on "Data" and then click on "Products". You will then be able to view the name of each product, its weigh, adjusted weight, volume transportation, warehouse holding cost, in transit holding cost, freight class, and value.

ID	Name	Active	Weight (lbs.)	Adjusted Weight (...)	Volume (sq ft)
1	64" Steel Cabinet	<input checked="" type="checkbox"/>	30.00	1.00	1.00
2	72" Steel Cabinet	<input checked="" type="checkbox"/>	33.00	1.00	1.00
3	48" Steel Cabinet	<input checked="" type="checkbox"/>	18.00	1.00	1.00
4	Basic Steel Cabi...	<input checked="" type="checkbox"/>	25.00	1.00	1.00
5	Deluxe Steel Ca...	<input checked="" type="checkbox"/>	30.00	1.00	1.00
6	Premium Steel C...	<input checked="" type="checkbox"/>	24.00	1.00	1.00
7	Small Safety Boxes	<input checked="" type="checkbox"/>	26.00	1.00	1.00
8	Dbl. Str. Safety B...	<input checked="" type="checkbox"/>	45.00	1.00	1.00
9	Large Safety Box...	<input checked="" type="checkbox"/>	48.00	1.00	1.00
10	Digital Safety Bo...	<input checked="" type="checkbox"/>	36.00	1.00	1.00
11	Standard Safety ...	<input checked="" type="checkbox"/>	30.00	1.00	1.00

### Warehouse Locations:

- Each potential warehouse location can be viewed on the map as a blue triangle. The data on all available warehouse locations can be found by clicking on, "Data", then clicking on, "Sites", and finally by clicking on "Warehouses". The information included here is the addresses of the sites, their geographic coordinates, the warehouse type, the sizing factor, and their fixed operating costs for every possible warehouse location.
- You can look up all possible sizes for each potential new warehouse included in the project. From the screen with the geographic information, click on "Sizes".

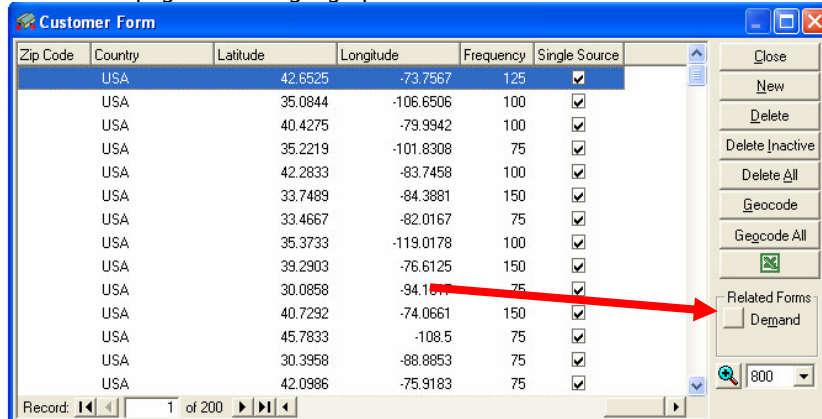
ID	Name	Active	Status	City	State	Zip Code
1	Albany	<input checked="" type="checkbox"/>	Potential	Albany	NY	12201
2	Albuquerque	<input checked="" type="checkbox"/>	Potential	Albuquerque	NM	87101
3	Atlanta	<input checked="" type="checkbox"/>	Potential	Atlanta	GA	30301
4	Augusta	<input checked="" type="checkbox"/>	Potential	Augusta	GA	30901
5	Baltimore	<input checked="" type="checkbox"/>	Potential	Baltimore	MD	21201
6	Baton Rouge	<input checked="" type="checkbox"/>	Potential	Baton Rouge	LA	70801
7	Birmingham	<input checked="" type="checkbox"/>	Potential	Birmingham	AL	35201
8	Boston	<input checked="" type="checkbox"/>	Potential	Boston	MA	02101
9	Buffalo	<input checked="" type="checkbox"/>	Potential	Buffalo	NY	14201
10	Charleston	<input checked="" type="checkbox"/>	Potential	Charleston	SC	29401
11	Charlotte	<input checked="" type="checkbox"/>	Potential	Charlotte	NC	28201
12	Chattanooga	<input checked="" type="checkbox"/>	Potential	Chattanooga	TN	37401
13	Chicago	<input checked="" type="checkbox"/>	Potential	Chicago	IL	60602
14	Cincinnati	<input checked="" type="checkbox"/>	Potential	Cincinnati	OH	45201
15	Columbus	<input checked="" type="checkbox"/>	Potential	Columbus	OH	43085
16	Dallas	<input checked="" type="checkbox"/>	Potential	Dallas	TX	75201

This will result in you being able to view all of the possible options for sizing for each warehouse location as well as the fixed cost to open the warehouse, the fixed cost to close the warehouse, and all fixed operating costs.

**Note: This is where you go to create existing warehouses: e.g., suppose you open a warehouse in 2001 and you are now examining scenarios for 2003. After importing 2003 demand data, you will need to indicate that the warehouse opened in 2001 exists.**

### Customer Facilities:

- Each of the customer facilities is represented on the map by a green dot. The data on all of the available customer facilities can be found by clicking on "Data", then "Sites", then, "Customers." The information included here is the addresses of the sites, their geographic coordinates, and their frequency.
- Demand information for each customer is provided in the project. In order to view this information, you click on the box next to "Demand" on the page with the geographic information for each customer.

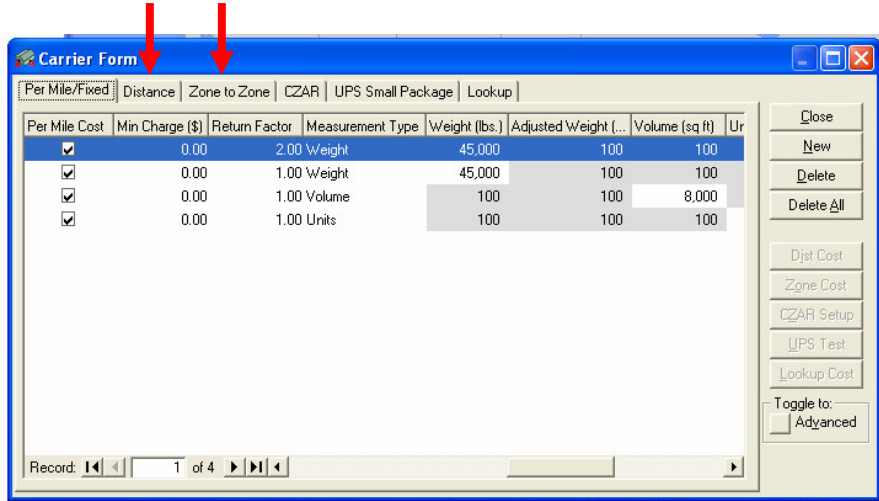


### Carrier Information:

- The information on all of the carriers that MetalWorks uses is available by clicking on "Data", then clicking on "Transportation", and finally clicking on "Carriers". This screen will give you all of the minimum charge, the return factor, the type of measurement, the maximum weight, the maximum adjusted weight, the maximum volume, and the maximum number of units that can be carried in each load.

**Note:** The different transportation modes used by the MetalWorks Corporation are:

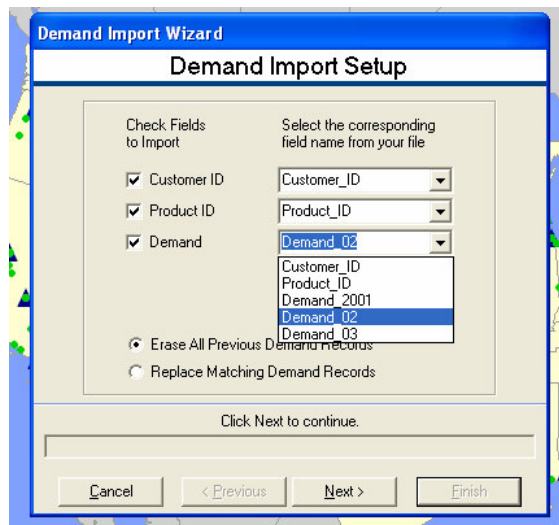
1. **Rail-Midwest:** You can view the cost in the Per Mile/Fixed form.
2. **Private Fleet and ABS Fleet Co:** You can view the cost in the Per Mile/Fixed form.
3. **Commercial TL:** You can view the cost and capacities in the Zone-to-Zone form.
4. **XYZ Trucking:** You can view the cost and capacities in the Distance form. The cost here is in \$ per mile and is a function of the distance traveled.



### Importing Demand & Changing Demand:

- When the project file is opened, you automatically begin with the demand for Year 2001.
- If you would like to view your results with demand data for Year 2002 or Year 2003, you must import the demand for these years. To do this, you must first click on "Data", then on "Import", and finally click on "Demand". You will now have a Windows Explorer box in front of you that offers many different programs to choose from. Click on "LN\_Examples", then on "MetalWorks", and finally "Future\_Demand\_Data". Select the "Demand" worksheet, then, click on the pulldown arrow next to "Demand". Select the data that you wish to import.

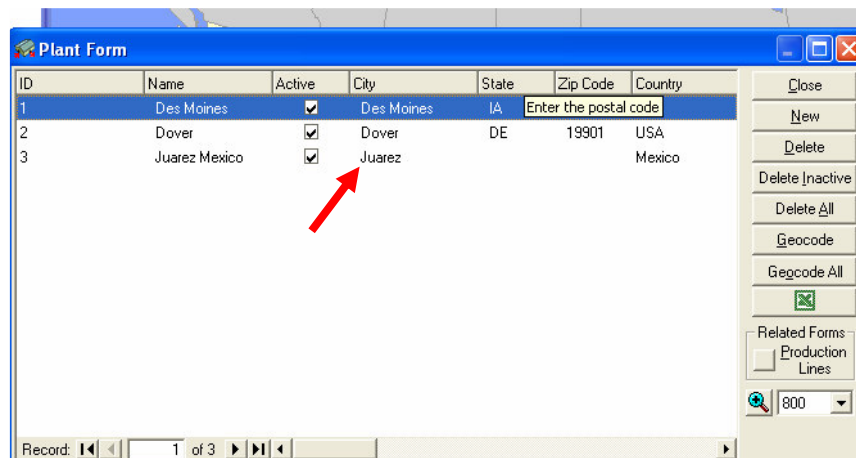




Click on "Next". You will be asked, "You have selected the "Erase All Previous Demand Options" on this form. Any Previously recorded Demand data will be erased. Do you want to continue?" Click on "Yes". Click on "Finish" then click "OK". All of the demand data will now be for the selected year.

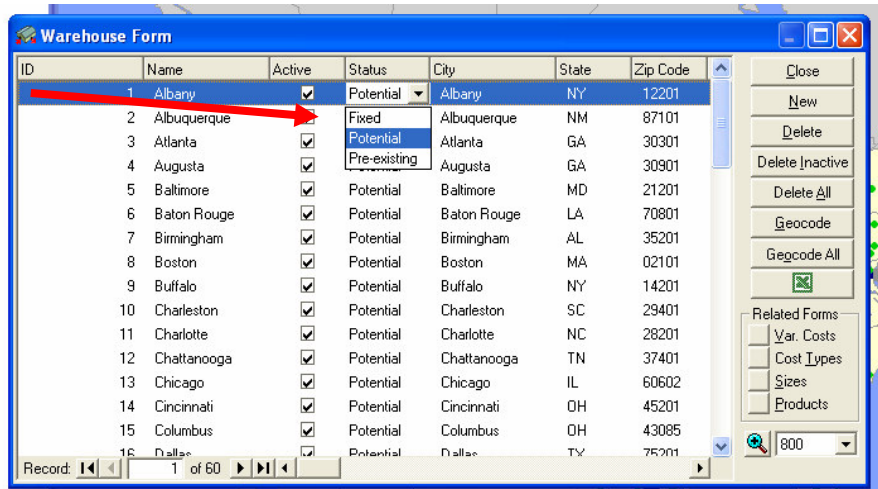
### Activating the Manufacturing Facility in Juarez:

- There are two ways to do this:
  - You can change in the active scenario on the main menu.
  - You can select "Data", then "Sites", and then select "Plants". Now click on the Juarez row and "Check" the "Active" dial box.



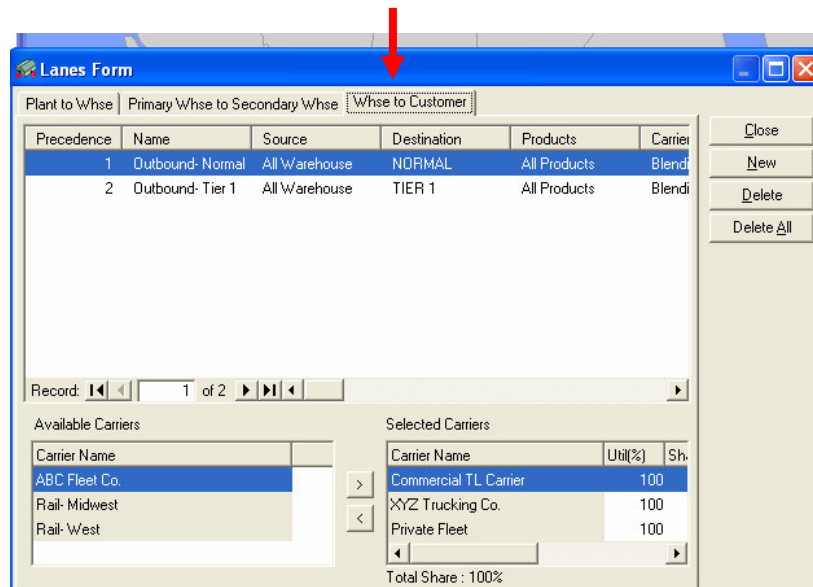
### Editing the Size of Any Single Warehouse:

- For example, if you wanted to set up a 600,000 square foot warehouse in Albany first you would select "Data", then "Sites", and then "Warehouses". Now select the row for "Albany" and change "Status" from potential to pre-existing and change the "Current Size" to 600,000 and change the cost to \$318,750 (which is 75% of \$425,000)



### Analyzing Distance Constraints that are Placed on the Supply Chain:

- First, select "Data", then "Transportation" and then "Lanes". Now select "Warehouse to Customer."



### TIPS, ISSUES, & CONSTRAINTS

- The basic decision concerns the number of facilities (warehouses and plants) to operate.
- When starting the program the demand always starts for the year 2001 and your planning horizon concerns 2001, 2002, and 2003. Although you'll optimize each year separately, you need to make a decision based on the entire planning horizon.
- A warehouse that you decide to establish in a specific location at a given year is going to stay with MetalWorks until the end of the planning horizon.
- The plant warehouses cannot be closed. Also, it is not possible to open a warehouse in 2001 and close it in 2003.
- When you optimize for every year, do not forget to edit the data (customer demand, existing warehouses, and manufacture facility) so that they reflect the scenario in that year.
- Your recommendation follows from a cost benefit analysis. The baseline model (2001 with two plants and two plant warehouses) provides the starting cost. The alternative investments concern plant expansion in the USA or plant creation in Mexico (these are one-time costs). Your benefit is the overall total cost reduction from the baseline model (these are estimated annual savings).