Logix 8.1®
Supply Chain Optimization and Distribution Network Design

User Guide and Documentation

Version 8.1

Logistix Solutions
On-Demand Solutions for Logistics Professionals

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Logix – Supply Chain Optimization and Distribution Network Design

Your supply chain and distribution network of suppliers, distribution facilities, in-transit ports, cross docks and consolidation centers can mean the difference between a costly, bottleneck ridden operation barely able to keep up with your customers' demands or a smooth running process that meets your customers' needs and gives you a competitive advantage.

Logix is a full-featured supply chain optimization, site location and distribution network modeling application from Logistix Solutions® that you can easily set up to quickly solve even your most complex supply chain problems:

- **Distribution Network Design** … What is the optimum number and location of distribution centers and product flows that reduce your transportation, warehousing, and inventory costs?

- **Lean and Green Supply Chain Operations** … How should you balance supply chain costs against customer service, "green" distribution and lead time considerations?

- **Efficient Customer Service** … What service areas provide the most efficient and cost effective distribution from each of your distribution facilities?

- **Sourcing** … Which combination of suppliers (including domestic or offshore suppliers and entry ports) produce the lowest total landed cost and best service time considerations at the lowest risk?

- **Cross Docking and Shipment Consolidation** … Should you consolidate shipments through cross dock and pooling facilities to reduce your total supply chain costs?

- **Transportation Optimization** … How should you deploy, route and schedule transport vehicles across an optimized distribution network for best service and lowest cost?

Logix is the product of years of experience working with companies in retail, chemical, high-tech, pharmaceutical, food and beverage and manufacturing in addition to considerable supply chain expertise and innovative mathematical and optimization techniques.

- **Easy Setup** … Download the latest version of Logix and import your data for demand, distribution centers, suppliers, plants, ports and cross docks as well as transportation, inventory and warehousing rates using the ready-to-use templates and entry screens
- **Powerful** … Automatically optimize the number and location of distribution facilities, the most efficient distribution network and assignment of customers, markets and products to distribution facilities and the lowest cost carriers, modes and other shipping strategies.
- **Fast** … Logix provides solution in seconds letting you try different distribution scenarios for complex problems.
- **Unique Features …** Logix can show you your perfect distribution solution from scratch ("Greenfield solution") without being tied down to your legacy operations.
- **What-if** … Logix lets you try different "What-if" supply chain and distribution scenarios, sourcing options, product and material flows, carriers, entry ports and transport modes and simulate their effects on cost, service, supply chain risk and operational efficiency.

Logix is an On-Demand (Software-As-A-Service) solution. This means you have no up front costs, no annual maintenance fees and no implementation fees.   You simply subscribe to and use Logix for the period of time you need and pay a monthly fee.

Contact the Logistix Solutions Business Center at info@LogistixSolutions.com or go to www.logistixsolutions.com to download the free Trial Version. We'll be glad to walk you through the demo on-line or to provide consulting support if you need to get you started.

1. Getting Started

Logix is available to download from the Logistix Solutions web site at www.logistixsolutions.com. Just download the installation instructions RM-LS.DOC and INS-LS[Date].zip to install the most recent version on your computer – either the demo or the full-featured version.

Once installed, click on the **Logix** icon on your desktop and the entry screen will look like this.

If you're a new user, you will be prompted to register for a unique password. If you are an existing user, you simply enter your password.

You should also check "Remember Me" so that, next time you login, you won't have to reenter the password. Logix will remember exactly where you left off including all your project data and parameters.
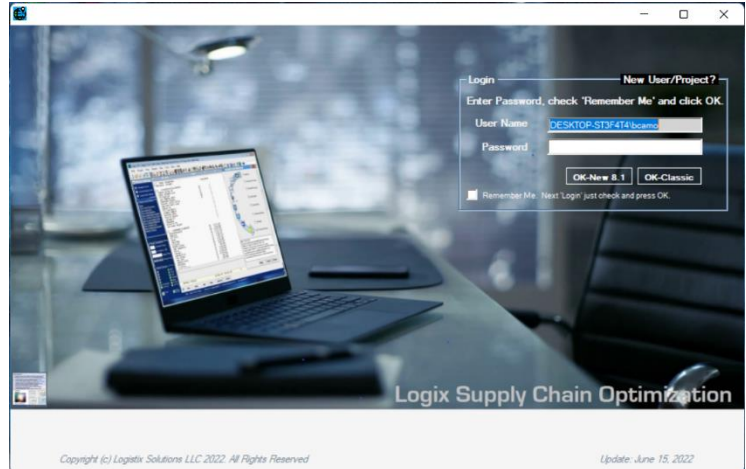
Figure 1-1
Login Screen

Next, the **"Getting Started"** screen gives you an idea of Logix' layout. Familiar looking MicroSoft® Windows icons and prompts across the top access all the major functionality of the system, including the usual File Save and Edit features. Other icons and prompts let you view, add or modify data, launch various optimization models or see results in reports, maps, dashboards and charts.

The latest version 8.1 introduced the "Design Center" in the left panel of the Logix screen. The Design Center lets you choose from any of the familiar looking icons grouped by Network Design, Transport Optimization, Reports, Scenarios and Settings. This manual will focus on the new Design Center and its functionality.

Getting Started lets you pick from several options, allowing you to:

o *View the Demo*

o *Start a New Project*

o *Continue with the Current Project*

o *Open any Recently Saved Project*

Press **Demo** for now and we'll get started.
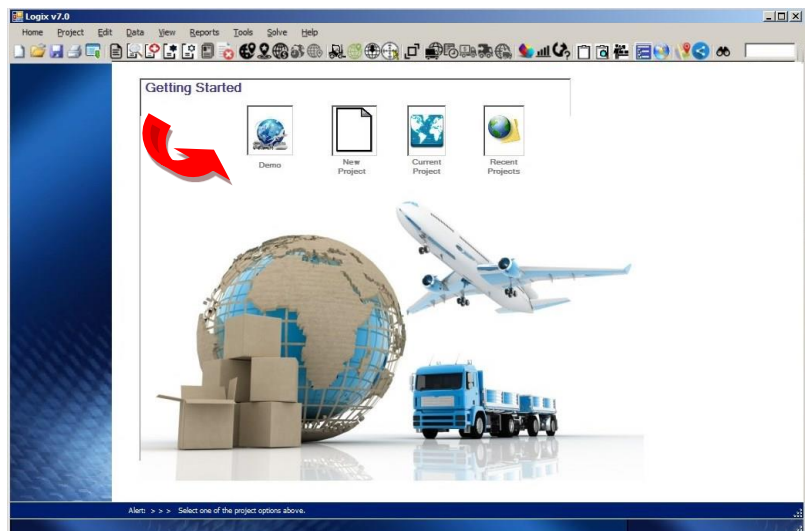
Figure 1-2
Getting Started

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* *Logix8.0 introduced a new way of navigating using icons. Press or hover over any of the menu items – Project, Edit, Data, View, Reports, Tools and Solve – and only the icons for that subset of functions are displayed. To show all the icons, press or hover over Home or Help.*

2. Manage My Data

Logix utilizes mathematical algorithms to optimize even complex supply chains in seconds based on your choice of distribution models and the data you supply. This data describes your existing or candidate distribution facilities, warehouses, pooling centers, suppliers, in-transit ports and intermodal facilities, customers, stores, products and markets. With a minimum of customer demand and cost data, you can easily use Logix to optimize your supply chain.

Logix lets you enter your own data using the data entry screens, import your data directly from Excel, select the built-in, ready-to-use demo data, or read any data you have previously entered and saved.

Figure 2-1
Managing My Data
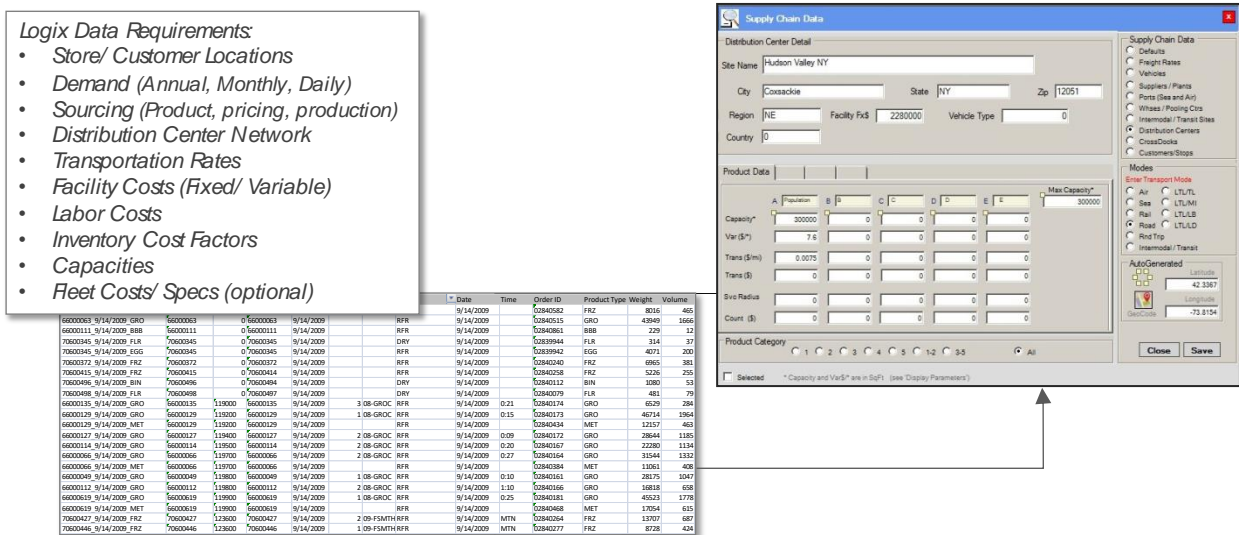
ProLogix, the latest version for "power users", supports Dynamic Memory Allocation which means you can solve any size problem up to the total memory of your computer. Generally Logix has been used to solve very large problems with thousands of total supply chain entities including distribution centers, customers, suppliers, cross docks, etc.

We'll start by walking through some of Logix' data management functionality and show you how you can modify and actually use the demo data for your own distribution problems.

2.1 Demo Data

The Demo is an example of a nationwide distribution problem and includes "product demand" or quantities for market areas denoted by cities in each of the 48 contiguous United States and the 2016 population census for that state. Logix can model up to five product categories and an unlimited number of products – user generally choose fast moving A products, medium moving B and slow moving C products or grocery, perishable and non-perishable items, etc. ProLogix ups this to 25 product categories. *Note: the "Demo Version" is limited and only works with a single product category.*

When you press Demo, Logix immediately takes you to the Show Data screen in Figure 2-2. This shows your entire project and supply chain at a glance including a summary view of all your data and a map showing all your locations and customers. The basic demo includes several candidate distribution facilities; demand represented by population density throughout the US and associated transportation rates, product costs, warehousing rates we'll need for this problem.
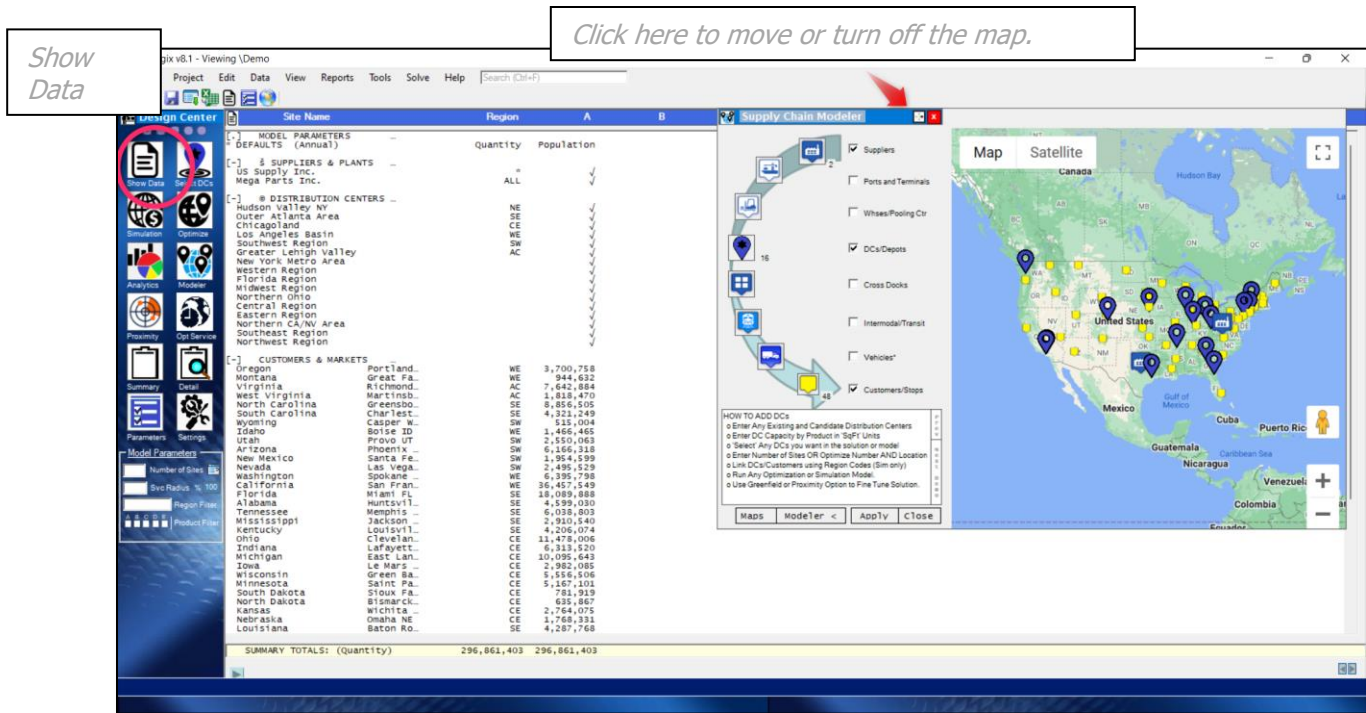
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Figure 2-2
Show Data

Logix allows you to view, modify and enter information about each of your sources of supply, in-transit points, distribution facilities, markets/customers, products and freight costs. You can modify the Demo to jump start your own supply chain analysis. The Demo allows only a limited ability to add some of your own data.

Show - At any time, click on the Show icon to return to this summary view of your data as in Figure 2.2. Use the scroll bar on the right to view all of the data.

Edit - Click any line to select a particular site. Immediately the "Quick Edit" dialog box will pop up. Quickly Edit any of the data and press Save.

Or click "Details" or hover over the Edit menu item and click the "Show Site Details" icon to view all the site details as in Figure 2-3.   Modify any of your data including demand, transportation rates, warehouse rates or even site locations.

Add – Hover over the Edit Menu Item and press Add Sites to add more sites. Then press Save.

Delete - Hover over the Edit Menu Item and press the Delete icon to delete a selected site or click Delete x—x at the bottom of the Logix screen to delete that item or a range of items.
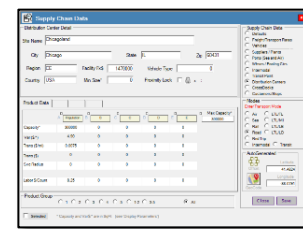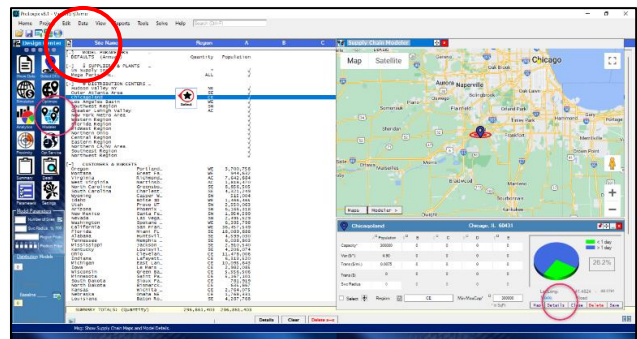

Figure 2-3
Site Details

Modeler – Show a map of the selected Site location.

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2.2   Viewing the Demo

The demo represents a fairly typical supply chain with multiple distribution centers serving markets in the 48 contiguous United States.

Press Maps or Hover over the View menu item and click the ![icon] Map icon see the Google online maps as in Figure 2.4. You can Zoom In/Out, move left, up, down, right and change to Satellite or Hybrid to view highways, buildings and streets.

The typical distribution network design problem we want to solve is:

- **How many** distribution centers are needed?
- **Where should they be located** to optimize distribution and warehousing costs?
- **What service areas** should each facility serve?

The data we'll need to solve this problem includes:

Existing distribution sites
- NE Hudson Valley – Coxsackie, NY
- SE Atlanta Area – Macon, GA
- CE Chicagoland – Joliet, IL
- WE Los Angeles, CA
- SW Houston, TX
- AC Lehigh Valley – Allentown, PA

Additional candidate sites
- New York Metro Area – Summit, NJ
- Denver, CO
- Jacksonville, FL
- Louisville, KY
- Northern Ohio – Springfield, OH
- Bloomington, IN
- Ashland, KY
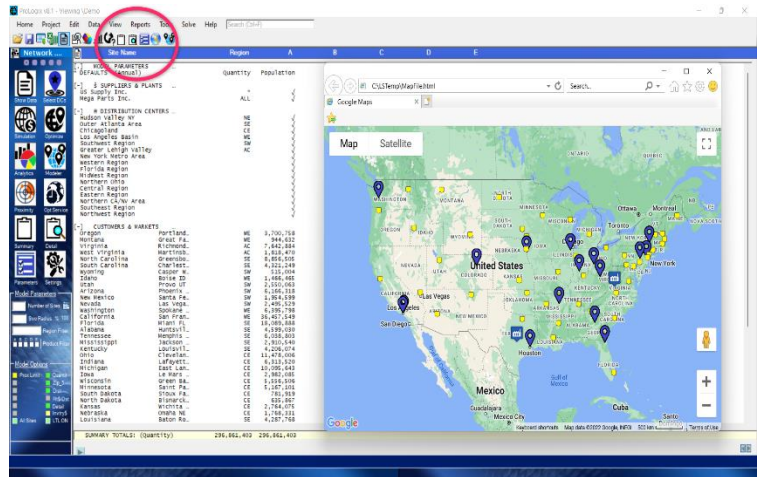- Pasadena, CA
- McKenzie, TN
- Tacoma, WA

Figure 2-4
Demo Data Map Display

Demand Data
- Customers located in major cities throughout the US.
- Demand is "state population" taken from the 2007 US census.

Transportation rates can be entered for each distribution facility (outbound) and each supplier, warehouse and port (inbound). Variable rates are per mile per ship unit (i.e., per pound, per hundred weight, etc.). Fixed rates are per ship unit (i.e., per pound) or flat rates (i.e., per truckload). In the demo, we use a variable rate for each distribution site (outbound) of $0.0075 per mile per hundred weight (CWT).   We'll get into adding point-to-point freight rates and LTL rates later in the documentation.

Warehouse rates for each facility. Variable rates are per cubic or square foot or per pallet or case or any other user entered "size" measure and can include storage, equipment and other costs. Fixed rates are annual lease costs, etc. Labor rates are per hour, per piece or any other "count" measure. In the demo facilities have a capacity of 300,000 sqft and use Industrial Space Costs ($ per sqft per year) from 2017 ranging from $2.87 to $14.70.

Region identifiers for each of the existing distribution facilities and each customer are designated with an appropriate Region ID which will be useful later when we simulate the current distribution operations.

Figure 2-5
Data Entry and Edit Screen

Default record includes transportation and warehouse rates and costs used as a default if you don't enter this data for each facility, a conversion factor for each product type to convert the demand/quantity into cubic or square feet, a shipping unit measure for each product (i.e., 100 for CWT or 40,000 for truckload), and other factors we'll get to later in this example.

2.3   Entering New Data

Use the Add icon if you want to enter your own data from scratch. First press New to start a new project then enter your data for each site in the Detail screen (Figure 2.3).   Remember, press **Save** after each entry. *Save will also save your data to the temporary "Remember Me" file but will not save the project to any designated project file.*

See Appendix A – to Import your Data using Excel.

Customers or Market Areas
- Site Name, City, State, Zip Code
- Region (up to 20 digit alphanumeric code – used in simulations and sourcing)
- Quantity - Demand (i.e., 12 months or similar data for up to 5 product categories).
- Size – Cases, pallets, Cubic or Sq Feet or any other measure of size or space.
- Count – Number of shipments, loads or orders represented by Quantity or Pallets, cases, etc.
- Mode/SKU – Transport Mode for each product category OR SKU for additional product detail (optional)
- Lock – customer to a DC by Region ID or prevent assignment to a secondary DC in the Capacity algorithm.

Existing or Candidate Distribution Centers
- Site Name, City, State, Zip Code
- Region (20 digit alphanumeric code or less – used in simulations and sourcing)
- Fixed "Facility" cost
- Maximum Capacity (in the same <u>Size</u> units you enter in Customer or Default data – usually cases, cubic or square feet for each Product Category and Total Capacity. Total Capacity can be entered as Minimum-Maximum (for example, 100000-300000) capacity or simply as a Maximum Capacity (eg. 300000).
- Warehouse Rates per Size measure (i.e., $ per sq ft or $ per case).
- Transportation Rates in $/ mile per unit of measure and/or $ per unit for each product from this site.

Suppliers/Plants, Warehouses or Ports and Other In-Transit Points
- Site Name, City, State, Zip Code
- Region (20 digit alphanumeric code or less – used in simulations and sourcing)
- Mode … transportation mode for next in-transit facility (Air, Sea, Rail, Road).
- Ship Unit (i.e., 100 for CWT or hundred weight or 40000 for full truck load).
- Max Throughput (Supplier & Plant) OR Capacity (Warehouse) OR Ship Unit (Port)
- Product Costs (Supplier & Plant) OR Warehouse and Inventory Rates (Warehouse) OR Fees (Port).
- Transportation Rates in $/mile per unit of measure and/or $ per unit for each product from this site.

Defaults
- Default "Fixed Facility" Cost and Warehouse or Inventory Rates in $/Size (i.e., sqft, cuft, cases, pallets, etc.) measure. Fixed facility cost can be for less than or greater than a threshold Size.
- Variable facility cost (for all products) in cost per <u>Size</u> measure (i.e., $/sq ft).
- For each product category A - E:
  o Ship Unit (i.e., per hundred weight or 40000 for full load).
  o Default Transportation Rates in $/mile per unit of measure for each product.
  o Size conversion (i.e., sq ft per weight) for each unit of demand for product categories A, B, C, D and E.
  o Labor $ (i.e., $/hr) or per Count measure ($/piece).

Figure 2.6
Default Record Detail

Freight Rates (optional)

- FROM – City and State (no comma – Boston MA), Zip Code or the exact Site Name of the origin.
- TO – City, State, Zip Code. Freight rates will be from the Origin to this City and State or Zip Code.
- OR – Region. Freight rates can be entered from an Origin to all Destinations with this Region code. A freight rate from an Origin to a City and State or Zip Code will override a Region code rate.
- Distance (optional) – Actual distance from the origin to the destination. If this is left blank, Logix will estimate the approximate road miles or use the PC Miler/Distance table you provide.
- Ship Unit (i.e., 100 for CWT or hundred weight or 40000 for full truck load).
- Transportation Rates in $/ mile per unit of measure and/or $ per unit for each product.
- Flat Rate – check if this is a flat rate from the Origin to the Destination (i.e., a truckload rate.)

Remember, all **Transurportation** rates must be entered in units consistent with the **Ship Unit** measurement you enter in the Default record. All **Warehouse** data must be in units consistent with the **Size** measurement. For example, if you enter a Ship Unit of 100, transportation rates for that product are in hundred-weight (CWT). If you enter a ship unit of 40000, transportation rates are full 40,000 lb truckload. Warehouse rates and capacity are in Size units such as SqFt or even pallets. If Ship Unit or Size is blank, the default is 1.

Logix automatically **"geocodes"** your data (Latitude and Longitude for each location based on 3-Digit or 5-Digit Zip Code or City/State). If Logix can not find the Latitude/Longitude (including international cities), you will need to provide them in decimal degrees (readily available from many web sites including www.Google.com/maps or just click on any position on the map for instant coordinates).

Logix estimates **highway distances** between any two points (i.e., supplier to DC, DC to customer, DC to intermodal facility, etc.) and either uses the fixed and variable transportation rates you provide or the **freight rates** and actual distances you can enter for each Origin and Destination pair for even greater accuracy. Actual O-D pair freight rates are entirely optional and can be obtained from your logistics service provider or from a number of rate sources. If Logix does not find a freight rate for a matching O-D pair, transportation costs will first be estimated using the origin point's transportation rates or secondarily using the Default record cost per mile transportation rates.

When you've completed data entry, click on the Show icon to view a listing of all of your sites and display key data and parameters as in Figure 2-2.

2.4   Save and Retrieve Project Data

Before you Log Off, you must "Save" your data as a project or the data you have entered or modified will be lost ("Save Site" only saves that one site not the project data set).

Save your project data by pressing the "Save" icon or click the Project pull down menu and click on File Save or Save As. The File Save screen will pop up as in Figure 2-7 and allow you to create a new file name or enter an existing file name to overwrite it.

Open and retrieve any saved project by pressing the File icon or click the Project pull down menu and press Open. The Open File screen will pop up (Figure 2-8) and allow you to open any "How to … " demo or any project you have previously saved.

Recent Projects, shown in the initial screen when you first enter Logix (see Figure 1-2), also allows you to select and retrieve any previously saved project.

Figure 2-7
Save Project *Data*

Save Work saves the current project and all parameters for automatic retrieval when you log back in if you clicked "Remember Me". Logix automatically saves your work when you exit but it's a good practice to periodically save your work.

You can save and retrieve as many separate projects as you want and to any folder you create.

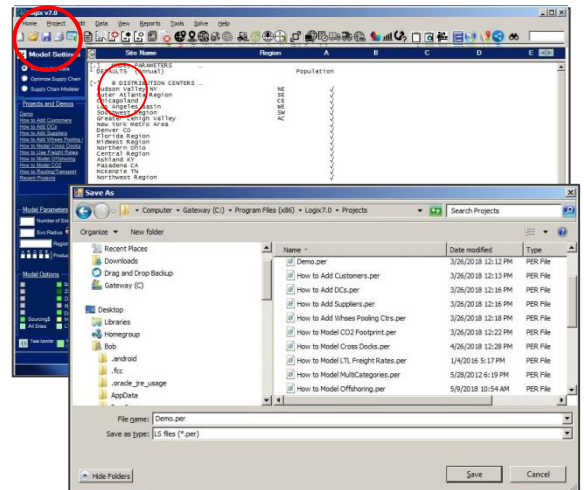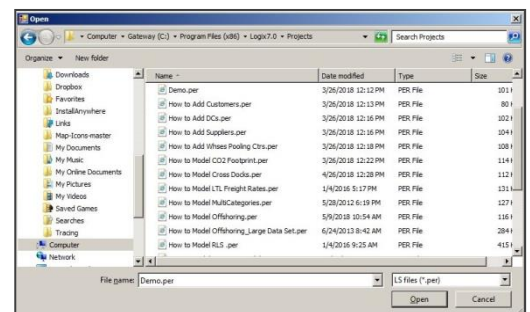***Data Import and Formats using Excel are covered in Appendix A.***

Figure 2-8
Retrieve Projects and Data

3. *Optimizing My Supply Chain*

Distribution network optimization, site location, and supply chain management applications are designed to optimize the movement of materials and products through the supply chain from suppliers or plants, through in-transit points such as ports and merge in transit facilities, on to central warehouses (if appropriate) and finally to distribution centers and then to customers, stores or final markets.   This movement and storage of goods is a balance between number of facilities, proximity to the customer or to the supplier, plant or port of entry, in-transit times or service time to the customer, inventory and warehousing costs, transportation costs, capacities and other competing costs and considerations.

Logix is a powerful, **supply chain optimization and simulation tool** that uses your input and costing parameters as well as your choice of distribution network structure or model to automatically calculate the optimum number and location of distribution sites, the allocation of customers to distribution centers, the optimum use of existing or candidate distribution centers, the optimum flow of products from suppliers, plants, cross docks and ports to distribution facilities and central warehouses and the cost and service times associated with each solution.

Logix is unique in that it uses proprietary mathematical algorithms and other optimization techniques to derive answers very quickly (generally in seconds) and can derive the optimum location for distribution centers based on existing facility locations, your selection of candidate locations or from scratch (we call this a **"Greenfield Solution"**). This means, for example, that Logix may derive that the optimum location for a distribution facility based on balancing inbound and outbound transportation costs and other inventory and warehousing costs is exactly 23 miles East and 57 miles North of one of your existing or candidate Distribution Centers or one of your Customer sites … in other words, from any of the sites in your problem set.

Note: Some models provide this type of solution or "centroid" in Latitude/Longitude. We simply think it's more useful to provide a "wide open" or "Greenfield solution" in miles from your known sites and then show you the location(s) on the map.

Logix will not know with certainty what the exact transportation and warehousing rates would be for sites other than for the existing and candidate sites for which you provide this information. Generally, Logix will use the rates you provide in "Defaults" for these "Greenfield" sites or it will use your "Freight Rates" for the appropriate Zip Code or City/State Greenfield site location if you turn this option on. In addition, Logix will not know very important details like access to highways and rail facilities, available building or lease sites, etc. You are free to refine the solution by providing exact transportation, inventory and warehousing rates for any location and running the analysis again with these refinements.

You may **select from a number of distribution models** to optimize both your inbound and outbound supply chains simultaneously or look at only your outbound ("DC to Customer") distribution network. You may restrict your analysis to only your existing and any user provided candidate sites, all potential sites ("Greenfield") or only sites you select ("Selected Sites Only"). Or you may decide to simply simulate your own supply chain network and a user-provided set of facilities ("Simulation").

The optional **Transportation Optimization module** also allows you to optimize private fleet distribution and carrier transport operations calculating distances, times and costs based on powerful routing and scheduling algorithms. Logix will accurately provide split loads, arrival/departure schedules and load consolidation solutions based on driver and arrival time constraints, vehicle capacities and other routing parameters. See the Transportation Optimization section of this document for more details.

In any case, Logix provides a complete picture and calculates the solution in seconds which you can modify, select alternatives to determine the inherent risk in your optimum solution, or remodel given another set of parameters or distribution model(s).

3.1   Distribution Models

Logix lets you select from a number of distribution models in order to permit a variety of management decisions. These options may provide varying levels of customer service, cost containment and inventory management. Ultimately, the goal is to provide greater flexibility in terms of setting up the most efficient distribution network structure or combination of structures for different products, divisions, or markets.

Logix is an extremely powerful and flexible modeling tool in that it uses a single data set to model any of these options. You simply set up the data as previously described and select any of the following distribution models by choosing the appropriate button or icon. The options include:

Supply Chain Network Optimization – Optimize the entire supply chain from suppliers to warehouses, ports, intermodal facilities and cross docks to distribution centers serving customers or market areas. Logix uses a proprietary optimization algorithm to simultaneously optimize the entire network based on supplier, transportation, warehousing, inventory and labor costs as well as any tariffs, fees and accessorial costs.
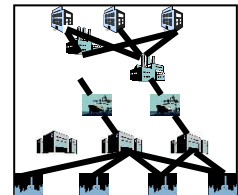
Distribution Network only – Optimize Distribution Centers outbound to customers or market areas only. Suppliers are not included in the results even if supplier data is entered in the project.

Simulation – Calculates all costs and service results for user provided distribution flows and DC-Customer assignments. Simulation uses your assignment of customers to DCs designated by the same "Region ID" for each customer and its respective DC.
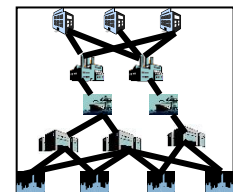

Use Selected Sites – User selects specific distribution sites that must be in the solution while optimizing the rest. You can also select all the distribution sites and calculate the resulting distribution network.
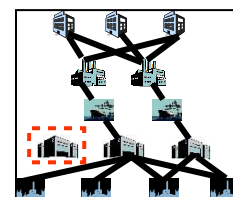
Best Service – Optimizes best service or least transit time. This option uses transit time as the principal optimization criteria as well as cost in order to model your best customer service option.

Cross Dock or **Hub and Spoke** – Warehouses, Consolidation Centers, Pooling Facilities and Regional Distribution Centers (RDCs) consolidate shipments (inbound) to distribution centers OR from distribution centers transshipped through Cross Docks (outbound) to individual customers or market areas.
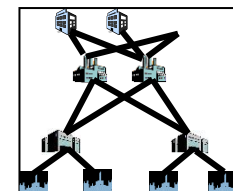
Turn (click) on "Cross Dock" and then select any of the Distribution Models shown to optimize.

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You can run successive models with any of these options and instantly see changes in transportation costs, inventory costs, service levels, transit times and overall supply chain costs. You can set up the problem so that some products or commodities utilize a particular distribution network (eg., fast moving products) while other products follow other distribution patterns.

3.2   Running an Optimization

Before you begin an optimization, you can select any of the following model parameters:

Number of Sites … Leave this blank or enter an ***** and Logix will optimize BOTH the number and location of distribution facilities. Enter the "Number of Sites" you want in the current solution and Logix will ONLY optimize the location of that number of sites. Enter any number from 1 to the maximum number of "Distribution Center" sites in your project. You can also enter Number of Sites and an ***** to optimize both the number and location of sites STARTING FROM this number of sites.

Radius of Service … Enter maximum allowable distance. Depending on the Radius of Service option selected (see Appendix D.3 Display Parameters-Radius of Service options) Logix will (1) assign customers no further from a distribution center than the Radius of Service or (2) select the closest site and display a violation if there are no distribution sites within this radius, (3) omit any customer site not within the Radius of Service from any distribution site, or (4) report violations if "Info Only" is selected.

Greenfield Option … Logix will use only the facilities you designate as an existing or candidate "Distribution Center" unless you turn on "Greenfield". Greenfield finds the exact location of the optimum in miles E, W, N and S from any Distribution Center or Customer location in the data set. You can use Greenfield with any of the Distribution Models.

Proximity Radar View… With this unique option, Logix will zero in on the exact optimum site location based on the current location of any candidate or existing distribution center site.

Sourcing Optimization … With this option on, Logix optimizes product quantities and assignment of supplier(s) to distribution centers. Logix first optimizes the outbound supply chains and then optimizes sourcing. This option DOES NOT USE "Sourcing %". See Appendix B, Sourcing (Inbound) Optimization, for details.

Region Filter … Enter a Region or the first letters/numerals followed by an * (i.e., S* for SE and SW) to display and/or optimize only sites and customer that have this Region code. For example, a Region Filter of SE will only show and optimize customers in the SouthEast in the demo example shown below.

Product Filter … Click on any product(s) A, B, C, D or E to display and/or optimize only those product categories and only customers that have a non-zero product quantity for that product category.

Just click any of the Distribution Model icons at the top of the screen OR you can use the Design Center and click on the corresponding icon under Network Design (the first Design Center screen) or Scenarios (the third screen)

Figure 3-1
Optimizing Solutions

Optimization Process … Logix analyzes your supply chain using proprietary mathematical algorithms to optimize cost and service considerations based on your data. Optimization should take only a few seconds or minutes depending on the size of the problem – the number of sites you have asked to optimize, the number of suppliers, plants, ports, customers and distribution centers in the current problem set as well as the number of product categories.

Logix has incorporated a useful feature that allows you to adjust the amount of time it takes to "solve" a problem – from a few seconds to several minutes for a fully optimized, final result.

Quick/Optimum Solution … Display Parameters/Network Optimization screen. With the bar over to the left, Logix calculates a "Quick" solution generally within an 80% confidence level of the bounds that are displayed after the solution is derived. Use a "Quick" solution when you are just setting up the problem and want to quickly validate the structure of the problem and data.
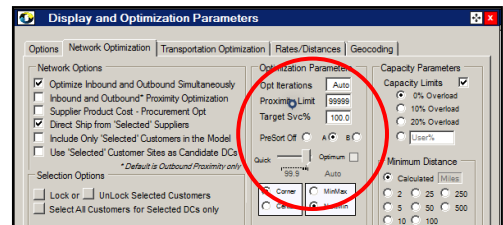
Figure 3-2
Confidence Level

With the bar to the right, Logix produces a solution within a 99.9% confidence level taking a bit more time. Confidence levels at or above 95% will typically produce a good or optimal solution. The default setting is 99.9%. Check the "Optimum" box for a 100% confidence level.

You can also check the "Task Monitor" 🛈 button in the lower left corner of the Model Settings box to launch the Task Monitor which will allow you to Pause or Stop the optimization and to view the results of the current optimization iteration at any time. **See Appendix C for details on this feature.**

Optimization Results … Select any Distribution Model icon and, after a few moments, Logix displays the solution including the optimally selected distribution centers (three sites in this case) and customer assignments as well as the quantity,
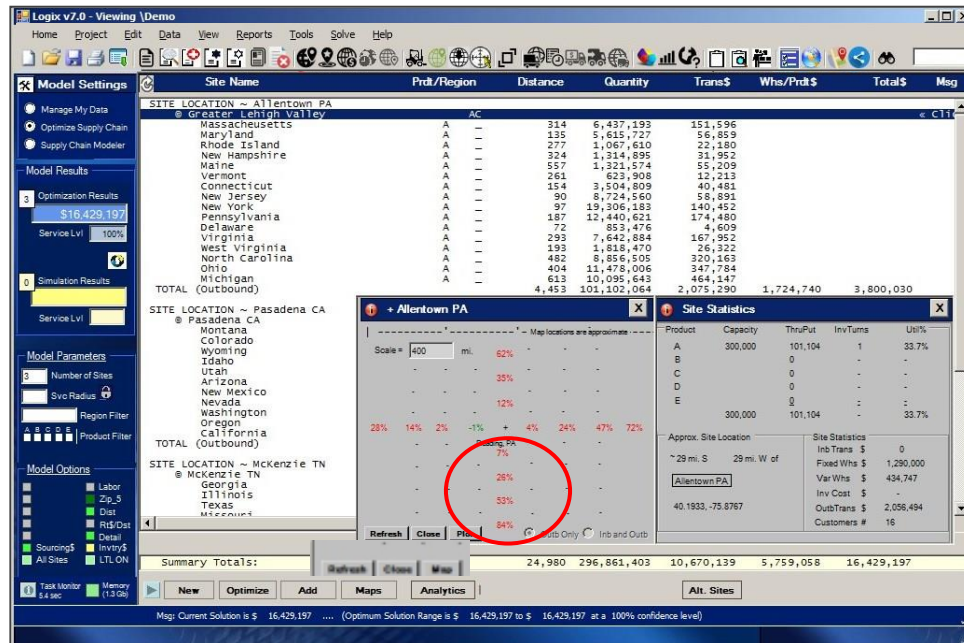
Figure 3-3
Optimization Results

transportation and warehousing costs and the subtotals for each distribution center (see Figure 3-3). The bottom line shows the Summary Totals for this solution.

You can also click on the line marked "**< click here**" for any Distribution Site and a pop-up window instantly displays the decreasing (-) or increasing (+) percentage cost in the primary directions (E-W-N-S) from the selected site as well as the location of the true optimum. Enter a new "Scale" and press "Refresh" to zoom in or out as appropriate. Each calculation is ¼ of the Scale distance shown.

Proximity Radar View Screen is a unique feature of the Logix system. In this example, Logix has located three optimum sites and, as can be seen in Figures 3.3 and 3.4, one of the optimum sites is located 29 miles South and West of Allentown, PA with a reduction of -1% of the transportation cost shown.

Pressing the Map button displays a map and green (decreasing) or red (increasing) cost.
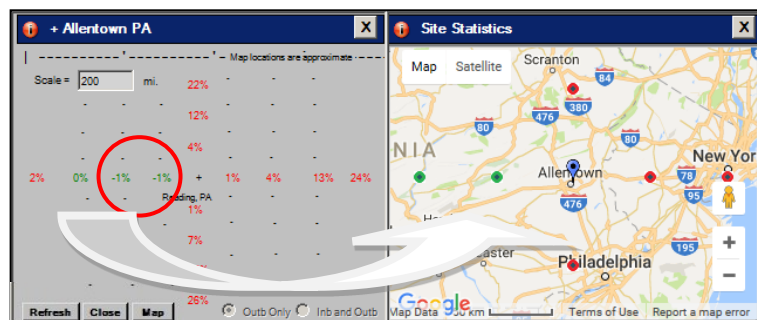
Figure 3-4
True Optimum

Selecting the **Proximity** option when optimizing this problem would have given you the same results automatically.

3.3   Selecting Distribution Sites

Users can also select distribution sites or force the solution to include user specified sites as well as any other optimum sites by simply "selecting" these facilities and running the "Supply Chain Network

Optimization" or "Use Selected Sites" optimization option. In the following example, to **optimally locate an additional distribution facility**, the user "selects" three existing sites, sets the Number of Sites to four and runs "Use Selected Sites" or "Supply Chain Network" optimization.

To "Select" a site, either highlight that site in the listing and check the "Select" box and press Save in the Quick Edit screen or click on the "Select" button to automatically select and save that site at the same time or highlight one or more sites and click on the Select Sites icon in the menu bar to select a range of sites. Refresh the Summary Listing to show all of the selected sites.
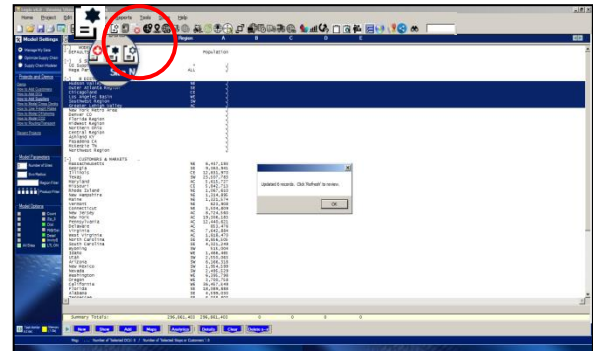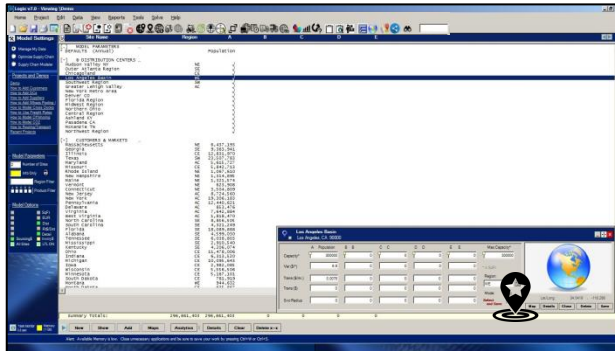
Figure 3-5
Selecting Sites

You can also Deselect one or more sites by unchecking the "Select" box or highlight the sites and click on the Deselect Sites icon. Refresh the Summary Listing by clicking the Show icon.

3.3   Optimizing Distribution Sites

Next, use either Supply Chain Network OR Selected Site Optimization and Logix quickly provides the optimum answer as shown in Figure 3-6 using three user-selected sites located in Chicago, Los Angeles and Houston (Southwest) marked with an * and optimizing the distribution location of an additional site in Allentown, PA.
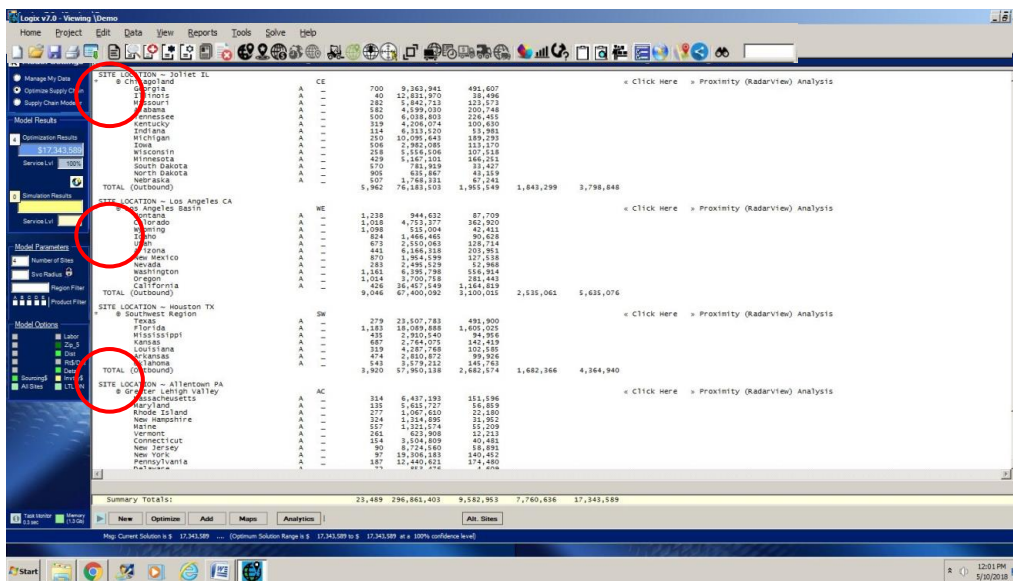
Figure 3-6
Optimization Using Selected Sites

Unless you also select "Show Proximity", selected sites will be shown at their current locations and Greenfield sites will be shown at the optimum location E, W, N or S of a current site.

Note: The "Cross Dock" distribution model requires you to "select" the candidate Warehouse/RDC or local Cross Dock locations from the sites you entered in order for these facilities to be considered by the optimization process. You may select all of the Whse/RDC or Cross Dock facilities or simply the ones you want to analyze. If you "turn on" the Cross Dock option, you should be aware that Logix will try to use one or more of your selected facilities in the solution even if this proves to be more costly than not using Cross Docks. Logix will simply set up the least costly "Cross Dock" solution.

3.4. Modifying the Solution

After running an optimization, users can modify the assignment of customers/markets to distribution facilities and instantly observe the effect on cost and service levels. In this case, sourcing costs and quantities will be changed as well as relevant distribution facility costs and service levels to reflect the modification.

To **modify service area assignments**, click on any customer in the solution display. Immediately, a pop-up window appears showing the current assignment as well as all of the other distribution facilities in the current solution as in Figure 3-7. To change a Distribution Center assignment for any product category, select or click the button for another facility. You can continue to modify other assignments in a similar fashion. Or you can immediately view the resulting impact on costs and service levels by pressing the "Save" button.
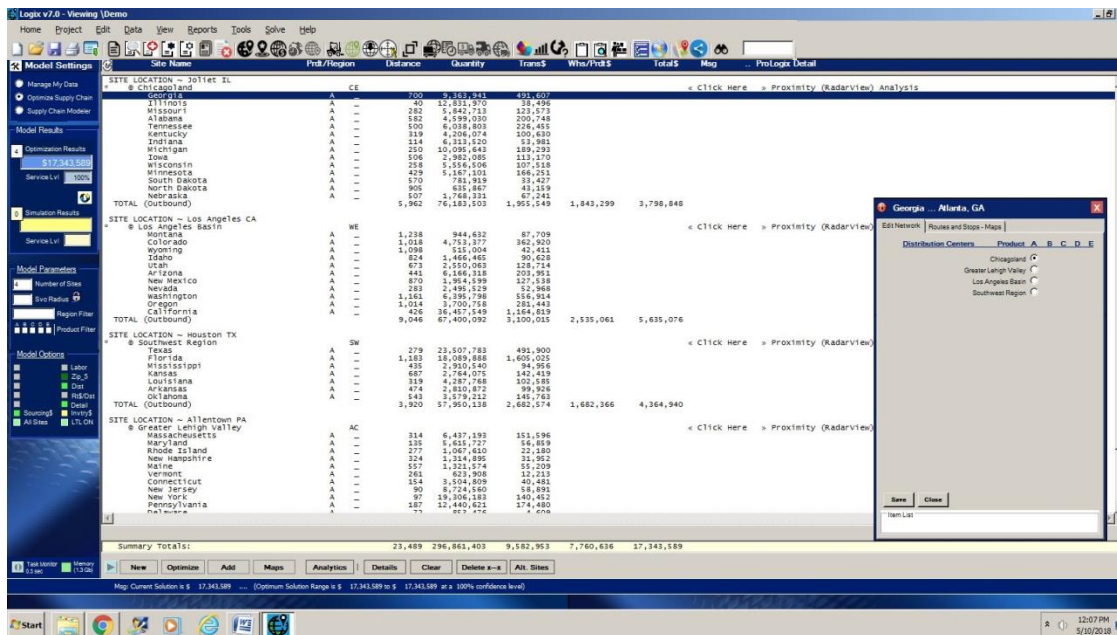
Figure 3-7
Modifying the Solution

3.5   Running a Simulation

Logix allows you to simulate any distribution scenario from the same data that you are using to develop optimum distribution solutions. To do so, __enter an identical Region name or ID in the Region field for each Customer Site and its corresponding Distribution Center site__ (up to 20 alphanumeric characters). In our demo example, the Region for the Allentown, PA Distribution Center and each of the corresponding Customer Sites including West Virginia, Virginia, Delaware, etc. is "AC" for Atlantic Coast. The Region now links the Distribution Center to each of its assigned Customer Sites.

Select "Simulation" and Logix performs all the calculations and connections to display your solution.In Figure 3-8, the regions have been aligned geographically with the six facilities tied to their respective service areas by the same region designation.
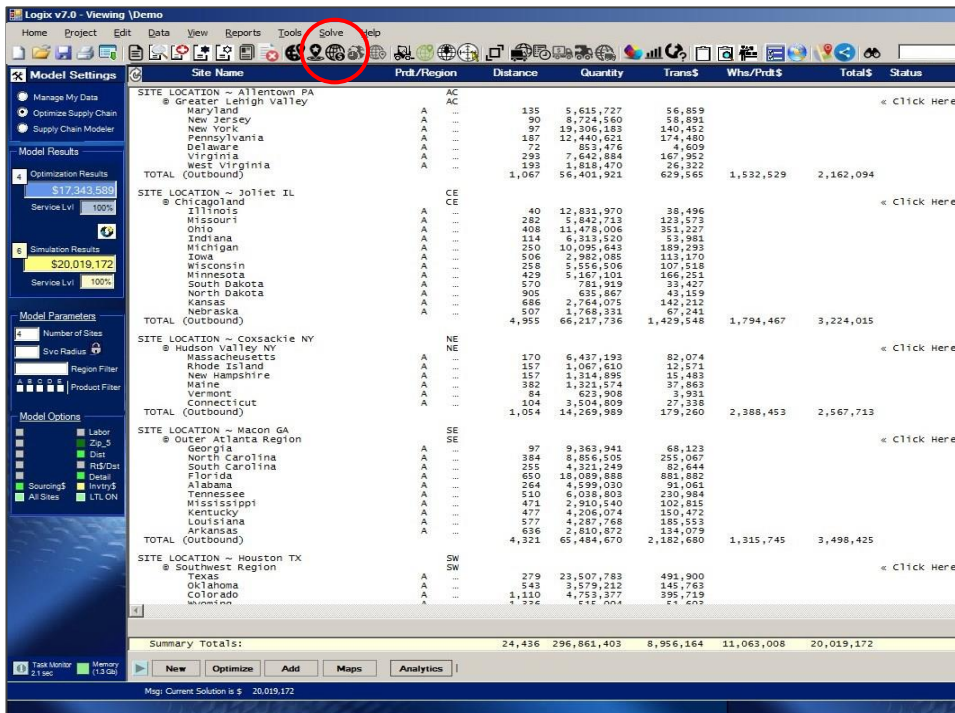
Figure 3-8
Simulation Results

You can also include suppliers in your solution and, in the same way, tie these suppliers to individual distribution centers using the Region ID. To do so, enter the same Region for a Supplier and its corresponding Distribution Center.

Note: In Simulation Mode, Logix does not adhere to the "Number of Sites" you enter or to the "Capacity" of each Distribution Site for any product. Logix selects sites to include in the solution by matching the Region ID for a Distribution Site and respective Customers in your project.

Customer Region IDs that __start__ with the same DC Region ID and end with a "*" are considered a match. Therefore:

- Customer Region NW matches DC Region NW
- Customer Region NW2 matches DC Region NW*****
- Customer Region NW does not match DC Region NW2.

3.6. Maps and Charts

Logix instantly shows maps and charts of your data and each solution so you can visualize your entire supply chain and distribution network and develop presentations and reports for each scenario. The map key displays different sized icons for your customers depending on demand size as well as icons for:

- Suppliers
- Ports
- Intermodal Facilities
- Warehouses
- Distribution Centers
- Cross Docks
- Customers

Distribution centers and their assigned customers are in the same color.

Zoom in or out and move in various directions and even change the image to show a **satellite view** of roads, buildings and terrain thus providing an excellent way to visualize transportation infrastructure, business parks and other points of interest.
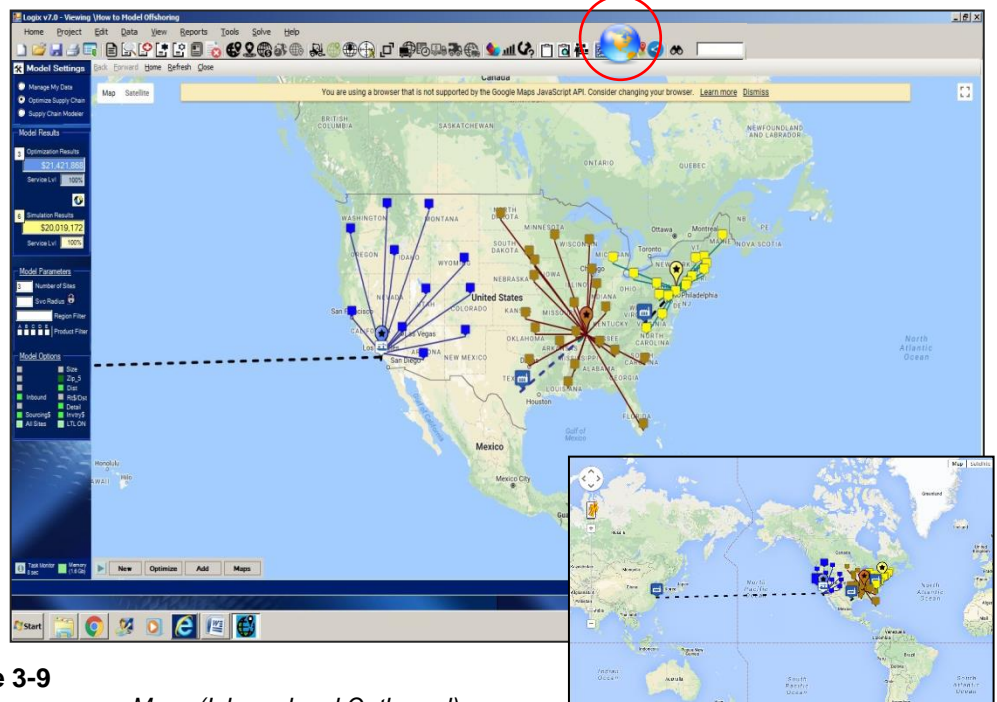
Figure 3-9

Maps (Inbound and Outbound)

Press the Map icon display supply chain links from suppliers, ports and cross dock facilities inbound to distribution centers and outbound links from distribution centers to customers. Zoom + and display road structures and buildings to find an appropriate distribution facility location. Press Close to return to the solution or data listing.

Display Parameters icon - select to view any of the "Display Objects" shown:
- o All Sites
- o Sources Only
- o DCs Only
- o Customers Only
- o Combinations of Sources, DCs and Network Points

Turn Connection (lines) and Site Information ON or OFF, show only inbound or outbound or selected DCs.

Select the "Candidate DCs" option to show the optimum distribution centers that comprise the solution in colors as well as any other existing and/or candidate distribution sites in black.

See Appendix D – Display and Optimization Parameters for more information
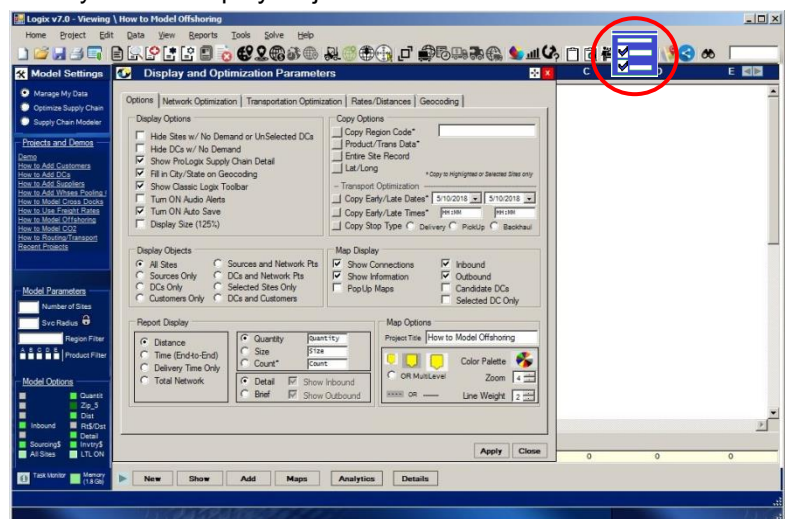
Figure 3-10
Display Parameters

Analytics Monitor - Click ![pie chart icon] to view the Analytics Monitor or ![bar chart icon] to view Charts of various critical **performance metrics** associated with the current solution, simulation solution or any solution which you have previously saved in the Clipboard memory   You can compare any two solutions including transportation, warehousing and product costs, number of distribution facilities, cost metrics, lead time metrics, CO2 emissions and per shipment cost metrics.

Select "Charts" to view graphics of key performance metrics for each solution including Total Cost, Cost per Ship Unit, Cost per Size Unit, Product Quantity, Capacity Utilization, Transit Time and Average Weighted Distance for each distribution center in the solution. Click "< Prev Metric" or "Next Metric >" to switch between each of these metrics. If your solution includes more than 20 distribution centers, click Sites +20 and Sites -20 to view charts for each group of sites in your solution.
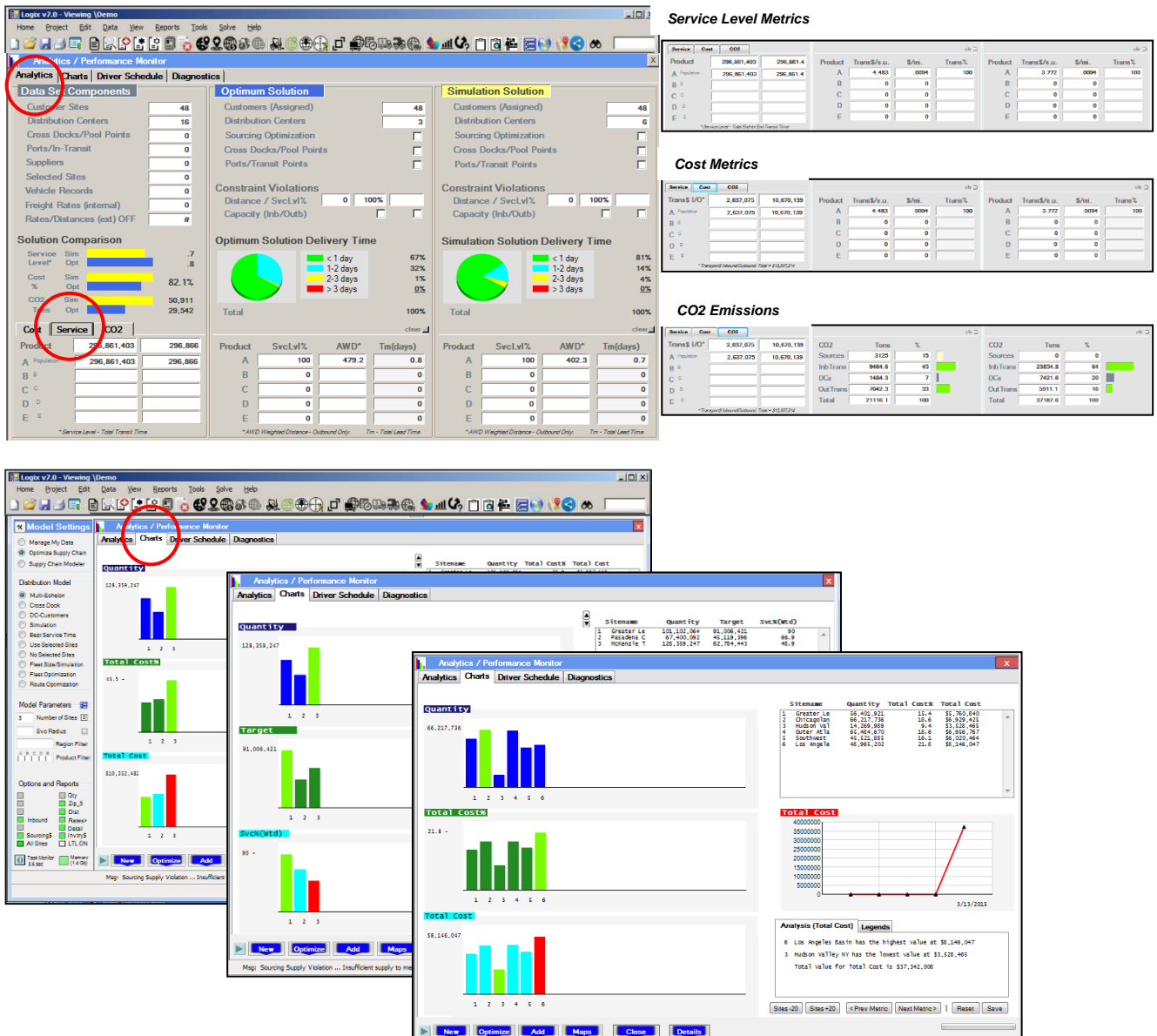
Figure 3-11
Analytics, Charts and Comparing Solutions

3.7. Printing Your Solution

To print the Current Data, press the Print button or Select File Print or File Print Preview. File Print will ask you to select the correct printer and other print details.
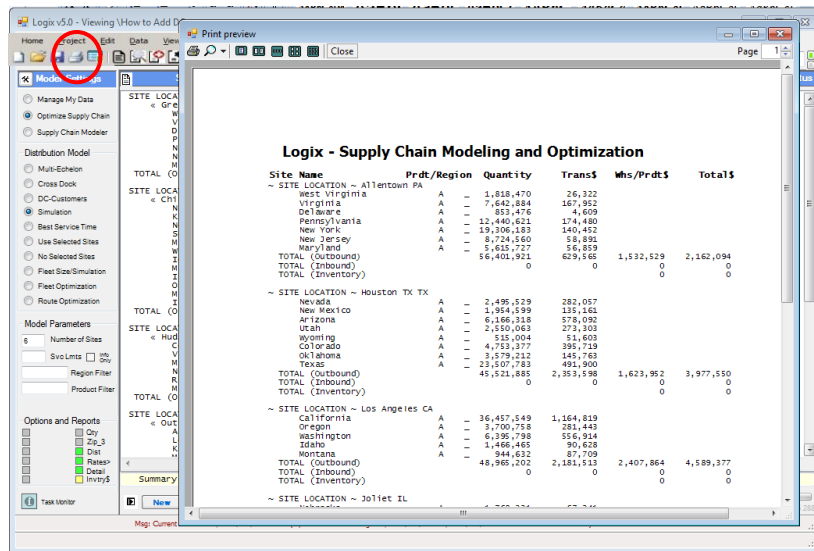
Figure 3-12
Printing the Results

To print the Current Solution, select the Clipboard Summary ⬚ or Clipboard Detail 🔍 reports and print the solution from the Notebook application.

To save the Current Detailed Solution or Solution Summary in any folder and with any name you choose, use the Clipboard and the Notebook application. The Clipboard Summary and Detail are also accessible from the Reports pull down menu for Optimization Summary and Detail as well as Simulation Summary and Detail only for the current results. Once you run another solution, the previous Clipboard results for either Optimization or Simulation are overwritten.

4. *End-to-End Supply Chain Optimization*

When you're done with the current scenario and have printed the maps, the solution and analyses, you can select a different distribution model, a different number of sites or different parameters and continue to solve another problem or input another data set and start from there.

You can add **suppliers, plants, cross dock facilities, entry ports** and the associated product costs for each supplier, tariffs for each source and product (new in Logix 7.0), port entry fees for each port, cross docking fees, etc. You can model an entire supply chain from overseas suppliers/plants, through optimally selected port facilities and cross docks to optimally located/selected distribution centers to optimally assigned stores and customers … all in one optimization.

The demo data set for this problem can be found under <u>Projects</u> with the file name "How to Model Offshoring". Simply click Manage My Data and choose this file under Projects.

Figure 4-1 displays the summary data listing including:
- Default Parameters
- Freight Rates
- Suppliers (overseas and domestic)
- Ports (East/West Coast)
- Distribution Centers (existing and candidate)
- Customers (demand)

Also shown is the "Supply Chain Modeler" which displays a count and a short description of each of the entities in the model.

Click on the [icon] icon or from the View\Supply Chain Modeler menu or the Supply Chain Modeler selection under Model Settings.
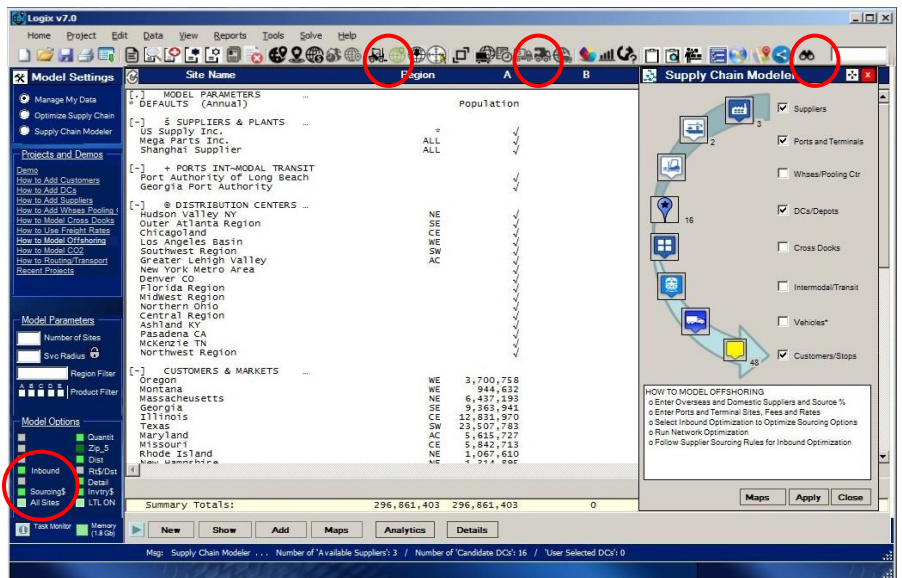
Figure 4-1
End-To-End Supply Chain Demo

In this problem, turn on the "Sourcing Optimization" option by pressing the "Sourcing Optimization" icon as indicated under "Options and Reports". This algorithm will allocate available supply optimally among the distribution centers included in the solution. Using this option, the solution will indicate how much supply should be sourced from overseas vs domestic suppliers, which distribution centers should be sourced from overseas, what ports should be used in transit and at what cost, and the overall service level in terms of lead time. Note that "SourceOpt" is displayed under Model Options. If it is already displayed, there is no need to click on the Inbound Optimization icon.

Follow the same steps and processes described earlier in the documentation to solve this end-to-end supply chain problem. Select the number of distribution centers to include in the final solution or set "Number of Sites" to ***** or leave this blank so that Logix will optimize both the number and the location of the optimum distribution facilities. Then press the Supply Chain Network Optimization icon to optimize this end-to-end supply chain distribution problem.

*For your own supply chain sourcing problems, you will need to enter similar inbound transportation rates, product costs, cross dock fees, entry port fees, etc. You should also note that point-to-point **freight rates** were entered for this problem from Shanghai China to each of the entry port locations including container shipping rates and transit time and distance details for a more accurate representation of this data.*

Figure 4-2 displays the **optimum supply chain and sourcing solution** for this problem including optimum distribution from an overseas supplier in Shanghai, China through either the entry port in Long Beach, CA or Savannah Georgia (GPA) to the optimum distribution center locations. The allocation of inbound supply is optimized up to the availability limits from each supplier and is shown to fall short of the total demand indicated by a Q/ under Msg.
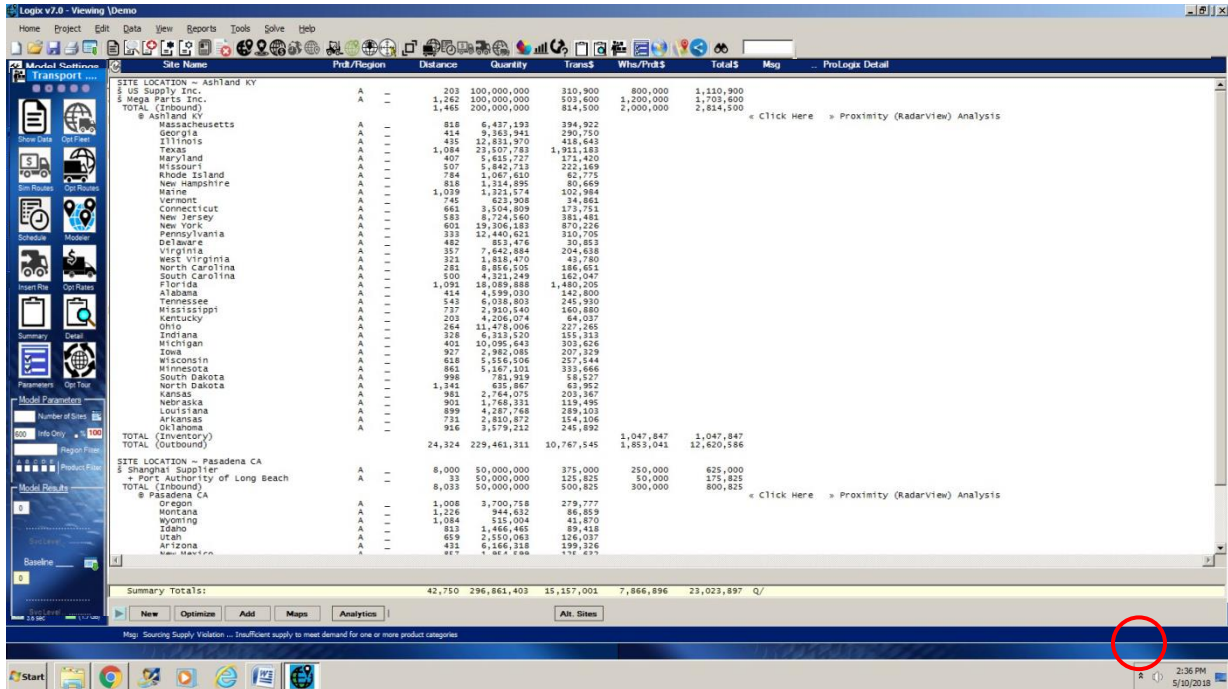

Figure 4-2
End-To-End Supply Chain Solution

You can also obtain alternative views of the solution by clicking the Display Parameters icon ⊞ and selecting either the **"Detailed"** or the **"Summary"** Report Display and **"Show Inbound"** or **"Show Outbound"** button as shown in Figure 4-3. For example, the "Summary" and "Show Outbound" settings will show a summary report by Product Categories. Inbound or Outbound can be turned OFF for the Detail Report. The map setting can also be changed from the default setting Map Display "Outbound" to "Inbound" or both as in the bottom map image.
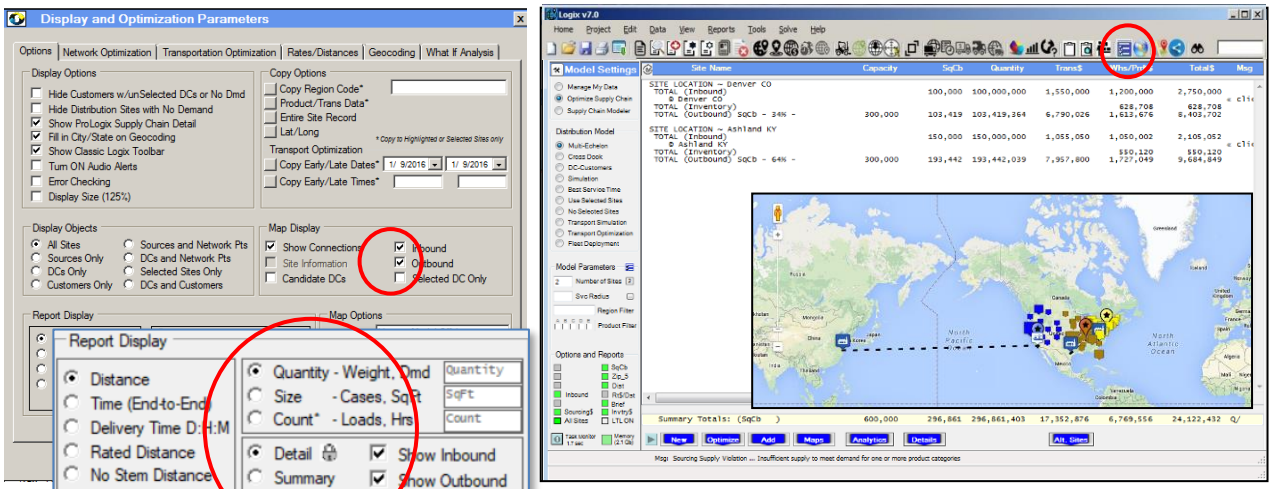
Figure 4-3
Alternative Views of the Solution

5. Transportation Optimization Module

One of the unique capabilities of the Logix software solution is the ability to model End-to-End Supply Chain and Distribution Network Design problems for **fleet applications** as well as the traditional transport cost approach. For fleet applications, route miles, driver and vehicle capacity constraints, split and consolidated load considerations and even detailed delivery information are critical elements of the strategic distribution planning process.

With the Transportation Optimization option Logix can internally optimize routes and schedules for fleet applications and use these transportation costs and considerations as part of the distribution planning analysis thus producing a much more accurate and robust solution. The resulting transportation costs take into account the number and cost of vehicles, route mileage, stem mileage (from the depot to the first customer and from the last customer to the depot) and the non-driving and driving times.   In effect, **Logix incorporates robust routing and scheduling technology and algorithms** to support its strategic planning capabilities for transportation planning and distribution network optimization.

Companies that operate their own fleet of vehicles and deliver products and/or services to individual stores, markets and customers (i.e., beverage, food and grocery distributors, propane and bottled gas delivery) and companies that plan Less Than Truckload (LTL) and Truckload (TL) shipments should use the Transportation Optimization Module for distribution and transportation planning and network optimization.

The Transportation Optimization module is an additional software module and requires the Logix Supply Chain Optimization and Distribution Network Design base application.
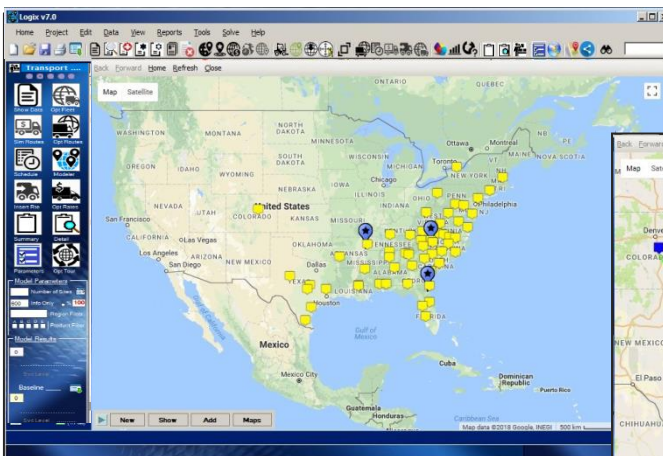
Figure 5-1
Logix Data Map View
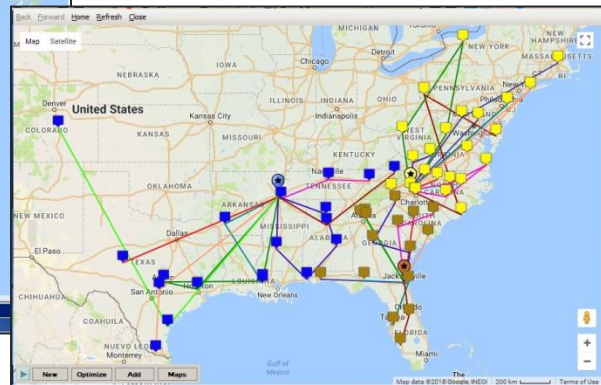
Figure 5-2
Logix Routing Map View

5.1   Data Requirements

The data for Transportation Optimization applications is largely the same as for other traditional distribution network optimization applications and includes:

- Location Data - Depot (distribution center), Stop (store, supplier and/or customer) locations
- Quantity Data - Delivery or pickup quantities to individual stores or customers for up to five product or commodity types (eg., weight, cube and cases for grocery, dairy and perishables items) or 25 product categories in the ProLogix version.
- Fixed and variable transportation, warehousing, facility and labor rates
- Capacities, parameters and regulations such as:.

- – *DOT regulations (maximum work time and drive time and required layover time)*
- – *Stop time windows (opening/closing times or preferred service times)*
- – *Vehicle capacity (weight and cube)*
- – *Fixed and variable service times*
- – *Cost per mile by vehicle type (i.e., not per shipment or shipping unit)*
- – *Average vehicle speed*
- – *Earliest and latest delivery/pickup dates or Ship Date and Due Date.*
- Maximum wait time per stop and per route, maximum number of layovers per route
- Team drivers or single driver with or without layovers
- Earliest route start time or latest route start time
- Delivery/Pickup frequency per week (when using periodic or annual demand data).

Logix can optimize inbound pickups, outbound deliveries, as well as mixed pickup and delivery routes and can also optimize backhauls (these are always the last stops on a delivery and/or pickup route.

If the delivery or store locations are known, the individual delivery quantities and constraints are entered for each store. If individual store/customer data is not known or too voluminous (i.e., over 1000 -1500 stops), market area data can be entered including demand at the 5-digit zip code level, average miles between stops and average delivery quantity per stop. Logix will use this approximate data to similarly create routes and vehicle loads with a reasonable amount of accuracy for strategic planning purposes.

The information is entered as Distribution Center data, Vehicle data and Customer data. If the demand is for individual stores/stops, the demand data is generally entered as individual daily orders. If the demand is for an aggregate of customers in a certain market area (e.g., 5-digit zip area) or periodic or annual data, the data is generally described as annual, semiannual, quarterly or weekly quantities Logix will use approximation methods to construct daily stop quantities and transportation costs.

The additional data elements that are used in the Transportation Optimization module are:

Vehicle Record (Figure 5.3) including:

- Veh Type – unique identifier for each vehicle type (i.e., 53ft Trailer). Veh Type can contain an * so that Veh Type GRO* matches Distribution Centers with a Vehicle Type of GRO1 as well as GRO2.
- Frequency (Delivery/Pickup) per week (only if data is in annual, semiannual or quarterly quantities).
    - o Check Frequency "xSatSun" to exclude Saturday or Sunday pickup from the depot.
    - o Check "Only This Day" to select a specific day on which this vehicle operates.
- Capacity in weight, cube, pallets, etc. (up to three different measures)
- Fixed stop time per stop in minutes (i.e., 5 minutes)
- Variable stop time per stop in minutes per primary quantity (i.e., 0.01 minutes per pound)
- Maximum driver work hours per day (usually per DOT regulations)
- Maximum driver drive time per day (usually per DOT regulations)
- Start Time – Depot open time or the earliest departure time from the depot
- End Time – Depot close time or the latest arrival time at the depot

Distribution Record: *Veh Type must match the corresponding Vehicle Type for each Distribution Center or Cross Dock record for which this vehicle is used.* You can limit the number of vehicles for each vehicle type by entering the number of vehicles by product category in parenthesis. For example, entering **53ft Trailer (10,5)** limits the number of vehicles to 10 for product category A and 5 for product category B.

- Open Time – check if Start Time is the same as depot Open Time. Otherwise, Open Time defaults to 00:00.
- Layovers - check if layovers are permitted
- Team Drivers – check if team (changes DOT regulations to 24 hour operation)
- Single Driver - check if single
- Average vehicle speed
- Hourly driver cost (adjust this cost to reflect team drivers, if appropriate).

Note: Display Parameters/ Transportation Optimization/ Vehicle Parameters can also include a vehicle weight and cube capacity in case the vehicle record is missing.

Figure 5-3
Vehicle Record

Split Data (optional):

- Min Delivery (Stop is visited half as often if the computed quantity is below the minimum)
- Maximum number of splits (0 – do not split, 1 – only 1 permitted, 2+ - more than 1 permitted)
- Split Minimum Required (minimum quantity required in order to split a load – e.g., 900 cft)
- Split Limit (minimum remaining or resulting quantity in order to split a load – e.g., 150 cft)

Customer Record - data required for Transportation Optimization (Customer/Order Data - Figure 5.4):

The same data you enter for Distribution Network Design applications can generally be used for Transportation Optimization. If you enter a Stop Type, Logix makes the determination that you intend to use the Transportation Optimzation tools and then expects Time Windows and Pickup/Delivery Dates to be provided.

You can also enter Rte-Seq information in the Customer record to create a simulation of your intended routes. Rte must be unique for each route and Seq must be sequential and separated by a dash (for example: Trk1-1, Trk1-2, Trk1-3 indicate the three sequential stops on route Trk 1.

Customer Data for Route Optimization

- Stop Type – Delivery, Pickup, Backhaul, Transfer, Dispatched, CPU or None.
- Time Windows – Earliest Time and Latest Time in 24-hour format (HH:MM).
- Pickup/Delivery Dates – Earliest Date and Latest Date (MM/DD/YYYY or DD/MM/YYYY)
- Vehicle Type Restriction.
- Commodity Type Restriction
- If Time Windows are left blank, Logix defaults to 00:00 and 23:59.

- <u>Region: The customer region must match one of the Distribution Center Regions as the designated depot,</u>

Figure 5-4
Customer/Order Record

5.2   Transportation Optimization Models

Logix lets you select from a number of Distribution Network Design models (Multi-Echelon, Cross Dock, etc.) or Transportation Optimization models in order to permit a variety of management decisions. Ultimately, the goal is to provide greater flexibility and accuracy in terms of setting up the most efficient distribution for your products, divisions and markets.

Logix is an extremely powerful and flexible modeling tool in that it uses a single data set to model any of these options. You simply set up the data as previously described and select any of the following distribution models by choosing the appropriate button or icon. The options include:
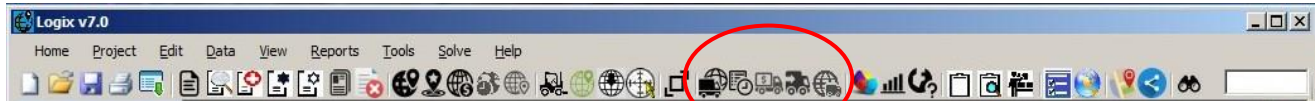
- Transport Optimization – Less than Truckload/Truckload Load Optimization and Route Scheduling. Uses order/customer data for detailed route cost calculations, fleet deployment and distribution modeling.

- Vehicle/Driver Schedule – Optimum allocation of vehicles and drivers across a specific time horizon.

- Transport Simulation   – Refresh Routes based on user modifications to Logix routes and simulate fleet operations based on user defined route sequences.

- Fleet Deployment   –   Optimize distribution network, fleet deployment and fleet size. Uses average quantities and miles per stop to estimates routes.

- Insert Router   –   Insert <u>unrouted</u> stops onto existing routes.

With these Transportation Optimization models and the base Logix Distribution Network Design software, Logix will set up the optimum number and location of distribution centers, cross docks and will optimize sourcing and customer/store assignments for the optimum distribution network.

5.3   Running a Transportation Optimization Problem

All of the features and functionality of the base Logix Supply Chain Optimization and Distribution Network Design application are available to you in the Transportation Optimization module. Refer to Section 3.3 in this documentation for "Running an Optimization".

Transportation Optimization problems require more solution time than most Distribution Network Design problems since each solution requires algorithms to optimize a "multi-vehicle/multi-depot" process. Therefore, several considerations pertain to the Transportation Optimization module:

- **Select Candidate Distribution Centers**
    … You must select distribution centers to consider in the transportation optimization process from any of the Distribution Centers in the problem set. Simply "select" the Distribution record as described

earlier in this document and run the "Fleet Deployment" or the "Transport Optimization" option and these sites will automatically be considered in the optimum solution (i.e., you don't need to enter the "Number of Sites" … Logix will do this for you).

- **Cross Docks** … Turn on "Cross Dock" or click and select either the "Fleet Deployment" or "Transport Optimization" option to optimize the selection of cross dock facilities outbound from any of your current distribution centers, through optimally selected cross dock facilities and then to the individual customers or market areas*.   This option optimizes those customers that will be served **directly** by each distribution center and those customers that will be served **indirectly** from a cross dock with one of the distribution centers serving as a sourcing point for the optimum cross dock*.

  Cross Dock facilities must be "selected" in order to be considered in the optimization process. Users can select any number of cross dock facilities (or all the cross dock facilities) but should be aware of the amount of time required to solve each problem.

- **Problem Size Limitations** … Logix supports Dynamic Memory Allocation which means you can solve any size problem up to the total memory of your machine.   Generally Logix has been used to solve very large problems up to and exceeding 10,000 total supply chain entities including distribution centers, customers, suppliers, cross docks, etc. and solve for up to 250 distribution center locations.

  The Transport Simulation and Fleet Deployment options can be used up to this limit. The Transport Optimization option should be limited to approximately 250 to 1000 orders/stops per model.

- **Split Loads and Consolidated Loads** … The Fleet Deployment and the Transport Optimization options allow the user to specify split load parameters to be used by the Logix optimization routines. Split load processing performs the following functions:

  - If the specified demand quantity exceeds the vehicle's capacity for that product, Logix will first split the demand into one or more loads up to the vehicle capacity limit for one or more full truckloads. The remaining partial load will generally be loaded with other stores/customers and delivered on a multi-stop route.
  - During the route optimization process, if a load exceeds the remaining weight and/or cubic capacity on a multi-stop route, this load will be split based on the user-specified split load parameters/limitations. This will generally create higher vehicle load factors and lower number of vehicles and cost.
  - If multiple products are entered and if vehicles are entered with capacity for more than one product, Logix will attempt to consolidate (combine) products to the same store/customer up to the vehicle capacity and split load limitations.

- **Route Limits** … The Fleet Deployment and Transport Optimization options will limit the routes to the user-specified total route time and drive time limitations and vehicle capacity limitations. If the user permits **Layovers** for Single Drivers by entering a Maximum Number of Layovers greater than zero, the total route time and drive time limitation is up to this maximum, permitting the driver to rest the prescribed DOT requirement (currently 8 hours). If Team Drivers is selected, Logix will permit routes to extend 24 hours a day.

- **Start Time** … Enter the "Start Time" or departure time of the route at the distribution center or leave this blank and Logix will calculate the required departure time of the route at the distribution center. (Figure 5.3)

Logix provides several options for optimizing your fleet and transportation operations:

Transport Simulation / Route Refresh … Uses your current distribution center locations and Stop Route-Sequence assignments to simulate or benchmark the current distribution operations, costs and service parameters. Logix calculates the number of vehicles required and resulting load factor based on the vehicle data provided by the user.

You can also use **Route Refresh** at any time to display the current Transport Optimization solution or the results of any of your route edits. Route Refresh will usually take much less time than a full Transport Optimization and will provide you with the same level of detail and results.
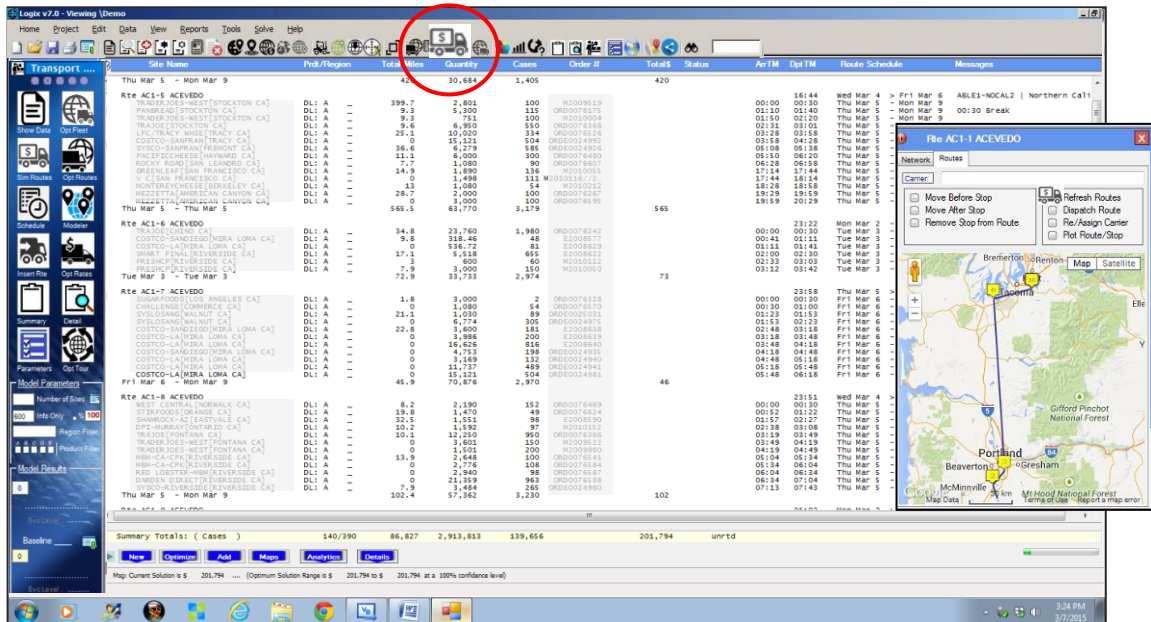
Figure 5-5
Transport Simulation (Route Refresh)

This option should be used to determine the current number of vehicles and drivers required based on the current distribution network structure and delivery requirements and to **benchmark** the current solution for comparison with the Fleet Deployment and Transport Optimization results. The **Analytics/Performance Monitor** will display the results in the Simulation section.

To simulate your current transportation operations, you must include a Route-Stop (Route number and Sequence) for each stop/customer and designate the customer as a Delivery, Pickup or Backhaul. Logix will automatically calculate the appropriate routes, sequences, costs and any violations in the routing simulation. If you do NOT include Delivery, Pickup or Backhaul designation for the stops/customers, Logix will approximate the distribution network using your input of "Out of Route Mileage", Vehicle Utilization Percentage and Vehicle Capacities and provide fleet sizing and estimated fleet costs only without creating routes.

*You can also use Transport Simulation **AFTER** you run a Transport Optimization and perhaps make any modifications to the routes in order to "Refresh Routes" and regenerate the solution. This will require much less time than a full optimization since Logix will use the Rte-Seq information it stores in each stop record to regenerate the routes.*

Be sure to check the box for "Save Opt Rte-Seq/Depot Date" in the Display Parameters/ Transportation Optimization screen so that Logix will save the optimum route and sequence solution for each stop. Do not change this data (use the Route Modification dialogue box instead) since Logix must be able to match the route sequences in order to generate a feasible solution.

Fleet Deployment … Uses your current and candidate distribution center locations and any selected Customer sites or "Greenfield" locations to optimize distribution operations, costs and service parameters. Logix calculates the number of vehicles required and resulting load factor based on the vehicle data provided by the user as well as the number and location of optimally located distribution centers and cross dock facilities.

- ▪ **Market Level Analysis** - Use this option if Customer demand is represented by market area quantities (i.e., 3- or 5-digit zip code areas, etc) and average Miles per Stop and Quantities per Stop are used. Logix will compute approximate routes based on this data including vehicle loads, number of stops per day, and total route time and driver work time as well as all associated costs and service metrics.

- ▪ **Edit** - Use this option if Customer demand is represented by individual store or customer demand data and you want to Edit the optimum assignment of customers to distribution centers before proceeding with final route optimization using the Transport Optimization option. In this case, run Fleet Deployment first, change any distribution assignment using the "Service Area Assignment" popup window and then use Transport Optimization with the new service area assignments.
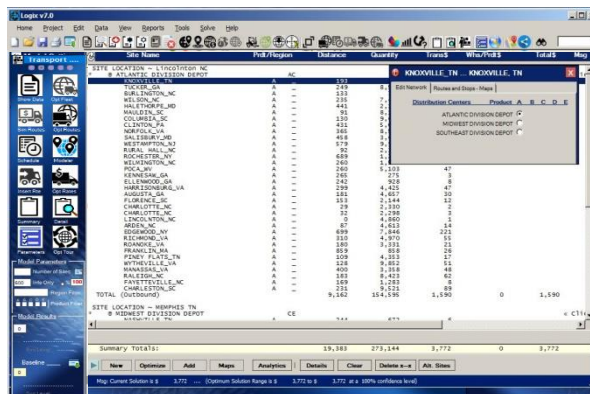
Figure 5-6

Service Area Assignment

Transportation Optimization … the Transportation Optimization option uses sophisticated routing and scheduling algorithms to optimize route sequencing and vehicle loading for each of the distribution centers, cross docks and customers/stores that make up the distribution problem. Logix creates the least cost routes, filling the vehicles as close to capacity as possible within the driver, vehicle capacity and time limitations of the problem. Utilized as a strategic planning tool, the user is able to change input values, demand levels and distribution locations or modify parameters like service areas, load factors and split parameters and quickly obtain alternative solutions.

Although the results are extremely useful as optimized route schedules, the output is intended to support strategic transportation and distribution network planning that is easy to set up, quick to solve, and easy to change for what-if and alternative solutions.

Results are **accurate route sequences and costs for delivery route operations**. Products can be consolidated for single shipment to individual customers/stores with this designated as a single line delivery in the report (i.e., the first stop on Rte 2.1 is a single stop with multiple, consolidated products shown as ABC and a quantity of 20,402 lbs. as in Figure 5.8.

Route Insert …. After you have generated routes using either Transport Simulation or Transport Optimization, Logix will automatically insert any stops that have not been routed onto existing routes. Logix will insert stops where feasible according to all the problem constraints including time windows, vehicle and commodity restrictions and vehicle capacities.

Route Output can also be printed, displayed or imported into an Excel model directly from Logix. After running a simulation or optimization, immediately go to Data/Export Transport Simulation or Transport Optimization and save the file name. Otherwise, the solution will be overwritten.

Data for the Transportation Optimization option is generally input as **daily or weekly order quantities** for each product/commodity group. Orders can represent Deliveries, Pickups, Customer Pickups, Transfers or Backhauls and routes can be set up to include only Deliveries and feasible Backhauls, Pickups and Backhauls (last stop on the route) or a mix of Deliveries, Pickups and Backhauls if the user selects Mixed Pickup and Delivery in the Display Parameters/Transportation Optimization screen. Customer Pickups or CPUs can also be included and pickups are grouped together by Distribution Center (depot) and pickup date.

Customer or stop data can also be entered with the region code representing the day of the week (i.e., MON, TUE, etc.) so that the Region Filter can be used to select the desired day or a different depot can be used for each day of the week (i.e., DC-1 [MON], DC-2 [TUE], etc.) with the region code matching the customer or stop region (i.e., MON, TUE, etc.).

In this case, each day can be balanced using depot capacities and analyzed to determine the best daily distribution pattern across an entire week.
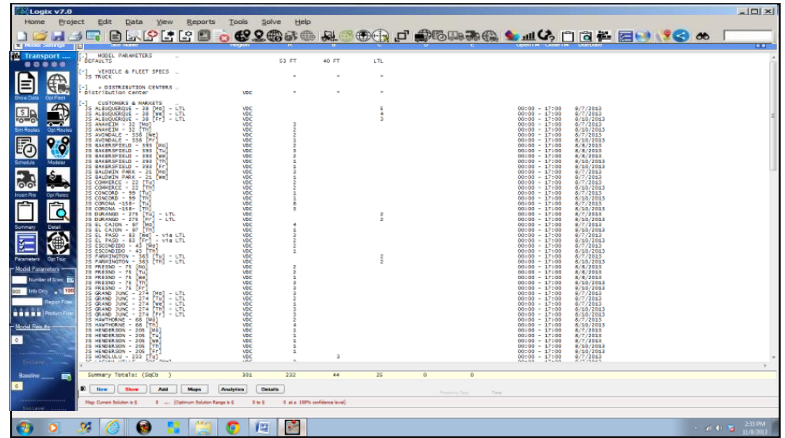
Figure 5-7
Transport Optimization Data

Figure 5.8 shows each of the routes and details for each depot or terminal including:

- Sitename for each stop
- Stop Type (DL-Delivery, PU-Pickup, BH-Backhaul, CP-Customer Pickup, DX-Transfer, DS-Dispatch)
- Product Type
- Quantity (either Quantity, Quantity and Size, or Quantity and Count as selected by the user)
- Transportation Cost (per mile and/or per stop)
- Warehouse and/or Product Cost
- Messages (unrtd – Unrouted stops)
- ArrTM and DptTM (Arrival Time and Departure time at each stop and at the terminal)
- Route Schedule (Date of Arrival and/or Departure – the first date is usually used although the schedule may show a range of allowable arrival and departure dates)
- Status (Layovers, Break Time, etc.)
- Total Distance or Route Time, Quantity and Cost.
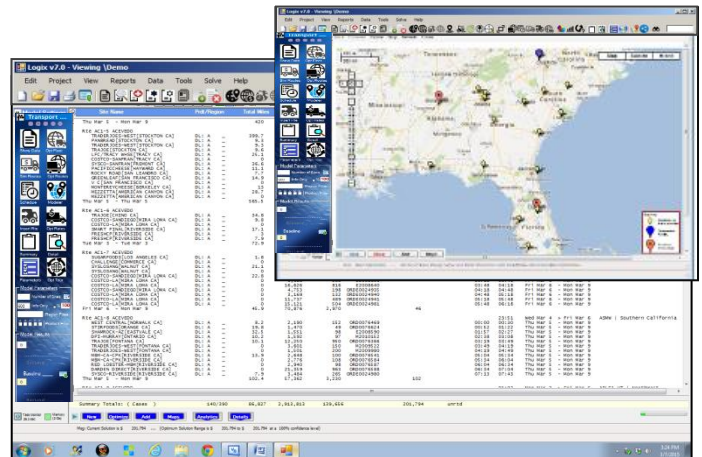
Figure 5-8
Route Optimization Results

Press the Driver Scheduling icon to display the optimum driver assignment to routes across a week or other planning horizon. Driver schedules adhere to arrival and departure times at the depot as well as DOT Hours of Service and show the following detail:

- Route name and depot
- Total route distance
- Quantity (either primary or secondary)
- Utilization percentage
- Total route time and DOT work and drive time expended since the last layover or break
- Arrival and Departure time at the depot
- Weekly Schedule

Driver Scheduling must use "Rnd Trip".
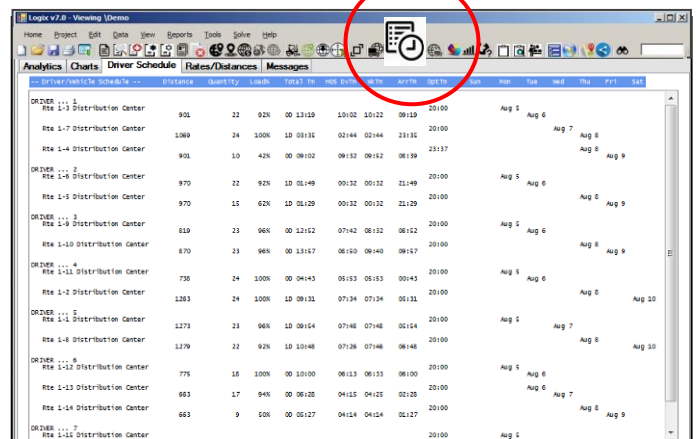
Figure 5-9
Driver Scheduling Results

6. *Who Should Use Logix?*

Companies are increasingly facing challenging questions about their logistics costs and customer service and the most innovative are using their supply chains as a competitive advantage.

Whether you are:

- a retailer concerned with product sourcing and transit time issues to make sure your product is on the shelf in sufficient quantities and at the right price at the right time;

- a food and beverage company optimizing their own fleet to handle consolidated deliveries of products from efficiently located distribution facilities and cross docks;

- a high-tech manufacturer speeding product to market and fighting high obsolescence and inventory costs;

- a logistics service provider convincing prospective clients to use your distribution facilities;

Logix can provide solutions in minutes that drive down logistics costs 10%-30% and enable you to improve customer service levels and fine-tune supply chain performance. Typically, supply chain optimization and modeling tools provide exceptional ROI value and network improvements should be implemented first before installing other transportation, warehousing or inventory solutions.

Logix provides optimum solutions, clear reports and presentation maps with a minimum of data setup and without complex customization requirements. Once you have created a fairly simple data set you can use it to answer every-day questions about your distribution network, vendors, carriers, product flows, inventory, warehousing and transportation issues or more complex, strategic planning and business issues.

Logix aids in carrier negotiations, what-if analyses, sourcing and supply chain strategies. Logix analyzes your transport modes, carriers, and ports of departure/entry including transit times and effects on inventory and service levels, inventory buffer and safety stocks and total end-to-end supply chain costs.

Logix' On-Demand web-based solution is supported by experienced supply chain professionals who can provide consulting services and training to fit your schedule.

For a free Trial Version or to download the latest version, go to
www.LogistixSolutions.com or call (703) 796 0141.

Appendix A – Entering and Importing Data

Entering New Data, Section 2.3, covered the basics of entering your own data using Logix' data entry screens. This is a straightforward way to enter dozens of records including data for:

- Suppliers and Plants
- Ports and Intermodal Terminals
- Warehouses, Regional Distribution Centers (RDSs) and Cross Dock locations
- Existing and Candidate Distribution Centers
- Customers/Demand
- Freight Rates
- Vehicle and Fleet Specifications (Transportation Optimization option only)
- Other Default information (Default record).

Of course, if you want to use the built-in Demo data and the US Census population demand data, simply load the Demo and modify, delete or add records to fit your own distribution modeling scenarios.

Otherwise, if you have quite a few demand points or data or have this data in an Excel or similar format, you can use the Logix Data Import Wizard to convert Excel data and import it directly into Logix.

The following sections show you how to format and save your data using Excel and the templates that come with Logix, convert the data using the built-in utility and import the data directly into Logix.

A.1 Importing Data – the Basics

Logix uses an XML format to import external data that has been previously saved as a Comma Separated Variable File (CSV) in Excel.   This process is mostly transparent to the user (you don't need to know anything about XML) and takes just a few steps that are outlined below.
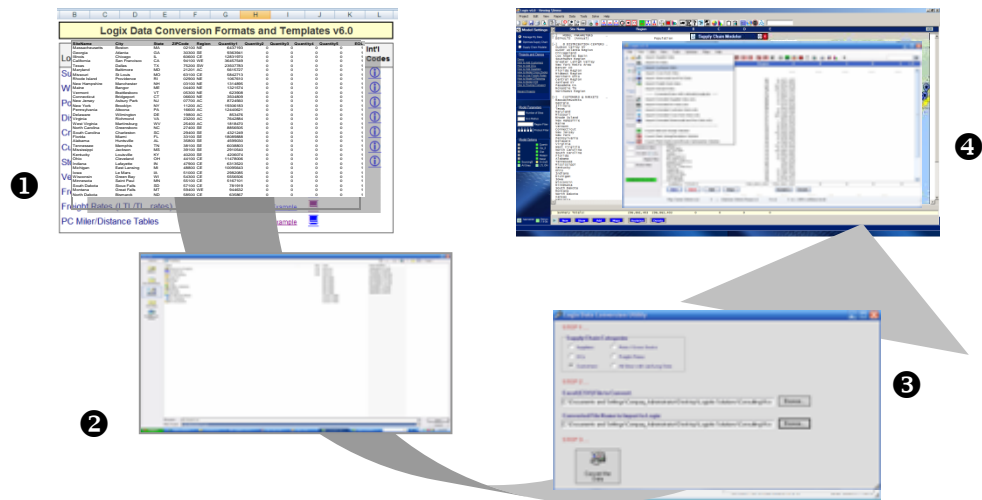
Logix comes with the **Logix Excel Import Templates –** an Excel workbook complete with instructions, templates, examples and links to the Logix Data Import Wizard. Simply enter or copy your data into the templates provided in the workbook for each supply chain category (i.e., suppliers, distribution centers, ports, cross docks, customers, freight rates, etc.). Make sure you end each record or line with an End of Line or EOL character (we used "1" - any non-special character will do) and do **NOT** enter any special characters like commas, @, $, &, ; or % signs. Do **NOT** format the data to include these characters.

❶ **Create an Excel spreadsheet <u>separately</u> for each supply chain category** with your data for:
- Suppliers, Plants, Overseas Sources, etc. (e.g., Suppliers.csv)
- Ports and Intermodal Terminals (e.g., InTransit.csv)
- Whses/RDCs and Cross Docks (e.g., Cross Dock.csv)
- Distribution Centers (e.g., DCs.csv)
- Customers and Demand (e.g., Customers.csv)
- Freight Rates (e.g., Rates.csv)

❷ **Save your file as a Comma Delimited file or CSV file**.   Use "Save As" in Excel and select a file name and the CSV "File Type" option.

❸ **Install and run the Logix Data Import Wizard** that comes with the Logix software. You can run the utility directly from the Logix program by selecting menu option "Data\Import – Logix Data Import Wizard" or click on Logix Data Import Wizard in the Program Files (x86)\Logix8.0 folder.
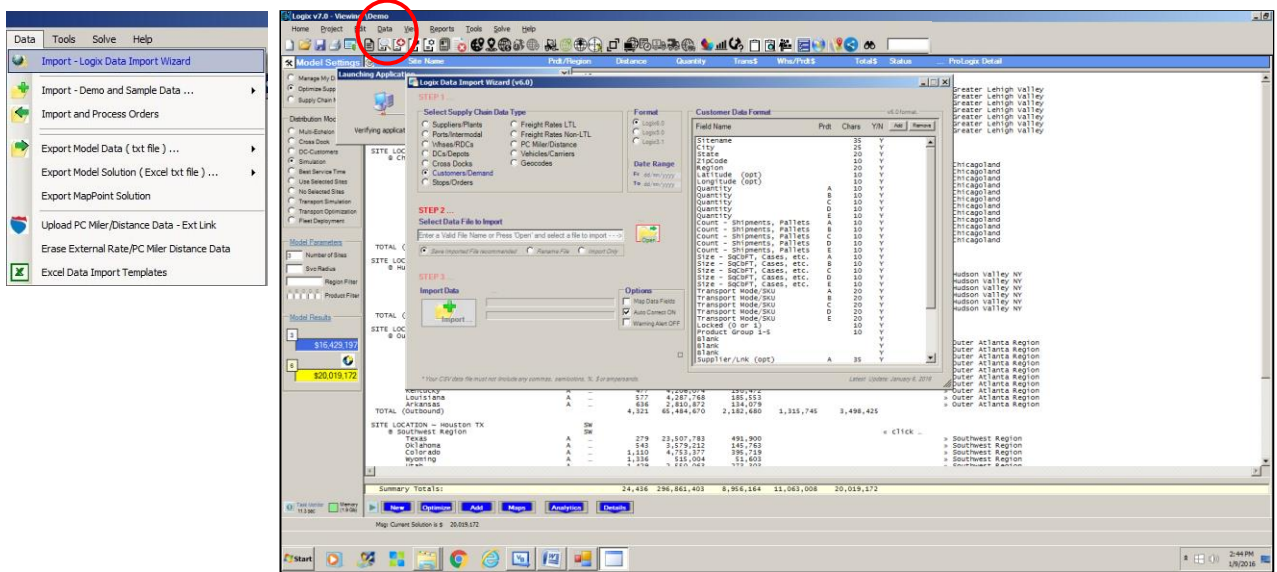
Step 1 … Select the appropriate supply chain category you are entering/converting.
Step 2 ... Enter or Browse for the Excel CSV file you want to import.
Step 3 … Press the "Import the Data" button.

If the conversion utility finds any special characters or commas in your CSV data file, it will flag and display the line and character violation. Go back to your original Excel file, correct the problem, resave the CSV file and repeat Step 3.

❹ **Upload XML Data File (optional) …** alternatively, you can click on "Rename File" in the Data Import Wizard and save the resulting file in XML format to "Upload" directly from Logix. In this case, you will be prompted for an XML filename or just use the default which will be the original CSV file name with .XML. At any time, you can "Upload" the file using Upload – Previously Converted Data

** The data import utility may not **Find** the proper conversion template. If you get this message, Press Browse and find the appropriate file (i.e., Customer.xslt, Supplier.xslt, etc.) in the original folder where you installed Logix (usually this is c:\Program Files (x86)/Logix8.0/Data/Upload) and return to Step 3 to **Import the Data**.*
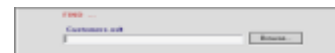
A.2 How to Add Customers

The minimum amount of data Logix needs is demand or "Customer" data.   Logix includes a "Customer.csv" template with demand data used in the demo representing the 2007 census population data for cities in each of the 48 states in the continental US (partially shown below in Figure A-1).

You can follow the steps outlined above to modify and convert the "Customer.csv" file which has already been created for you or create your own "Customer" data file using the format in Figure A-1. Entering Latitude/Longitude data is optional and can be left blank for later geocoding in Logix.

You can enter specific products or SKU's sourced from individual suppliers by entering the Supplier Code, SKU or other identifier in the Supp/Lnk field for each product category and Customer record.   This code must match the REGION, SITENAME or the corresponding Supp/Lnk code in a supplier record. Logix will then match that supplier and product with the correct customer through the optimum or simulated distribution network.

Figure A-1
Importing Customer/Demand from Excel®

Next, press New Data 🗋 if you wish to clear the current data set or skip this step if you want to append Customer/Demand data to the current data listing.

From the Logix Data Import Wizard, select Customers, enter the data file you want to import and press "Import Data".
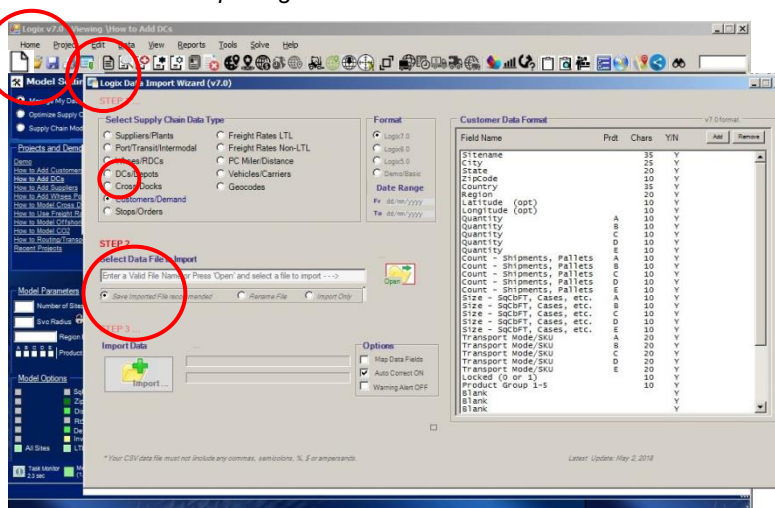
Figure A-2
Import Customer Data

Make sure your CSV data file uses the format shown for this data type and that you have no special characters in your data. If any data field is missing, highlight that record in the format window and click on "Remove".

Once you have successfully imported Customer/Demand data, you may still need to geocode one or more sites indicated with an L/L flag in the data listing. Click on the Geocode key 📍to automatically fill in latitude and longitude by City/State, 5-digit zip or 3-digit zip. If you provided Latitude/Longitude data in the

Excel file, you can skip this step. Activate 5-Digit Zip Code (Postal Code) data if you'd like or leave the 3-Digit Zip Code (Postal Code) data as the default.
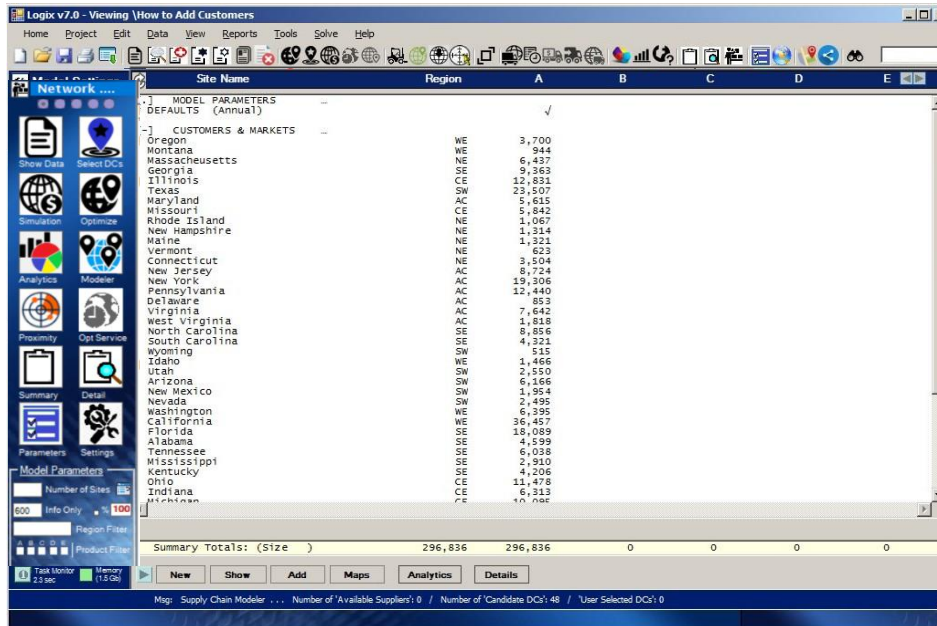
Figure A-3
"How to Add Customers"

You can add new customers, modify the data or delete customers directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon 💾. (see section 2.4). This way, next time you need this data, you can simply read it using the "File Open" icon 📂 read the file you have saved.

We've already gone through this process to create the Demo's Customer Data file. You can avoid importing and geocoding this data by simply selecting **"How to Add Customers"** from the Projects list.

The Customer Data from the "How to Add Customers" project list comes complete with a "Default Record" which provides default transportation rates, facility or warehouse rates/costs, and other data. **You should always enter or include a Default record with this minimum amount of information. Otherwise, Logix will use a transportation rate of $1.00 per CWT per mile.**

Once you have entered Customer Data, you can turn the "Greenfield" option on and, without entering any other data, Logix can optimize the number and location of potential distribution centers "from scratch" using the cost parameters from the Default record.

If you want to incorporate candidate or existing distribution sites as part of your analysis or to fine tune your solution, see the next section.

ProLogix Users – Matching Individual Suppliers/Products with Customers

You can enter specific products or SKU's sourced from individual suppliers by entering the Supplier Code, SKU or other identifier in the Supp/Lnk field for each product category and Customer record. This code must match the REGION, SITENAME or the corresponding Supp/Lnk code in a supplier record. Logix will then match that supplier and product with the correct customer through the optimum or simulated distribution network.

A.3 How to Add Distribution Centers

Logix lets you enter candidate and/or existing distribution centers directly (see section 2.1) or you can import an Excel spreadsheet with this data using the steps outlined above and in this section.   Logix includes a "DCs.csv" template with the distribution centers used in the demo representing some of the prime distribution areas in the United States.   Entering Latitude/Longitude data is optional and can be left blank for later geocoding in Logix.

Distribution Centers

FORMAT	... no special characters (i.e., NO commas, semicolons, $, % or &)		Max Chars
SiteName	Distribution Center Name		35
City	City		25
State	State		20
ZipCode	Zip Code		10
Country	Three-letter International Country Code (see International Codes.xlsx) or Country Name (i.e., USA or United States)		35
Region	Region Code		20
Latitude	Decimal Degrees N-S (Note: Degrees S are negative numbers)	optional	10
Longitude	Decimal Degrees E-W (Note: Degrees W are negative numbers)	optional	10
	------- for each product category A-E (fill in 0 if no value) -------		
Capacity A	Capacity for Product A in any user defined "Size" units (i.e., SqFT, CbFT, cases, pallets, sales, etc.)		10
Trans Var	Variable Transportation cost per mile per ship unit. Ship unit is defined in the Default record (e.g., per LB. or CWT)		10
Whs Var	Variable Facility Cost per user defined "Size" unit (i.e., SqFT, CbFT, cases, pallets, sales, etc. as defined in "Capacity")		10
Trans Fix	Fixed Transportation cost per ship unit as defined in the Default record (e.g., per CWT) per truckload or per stop		10
Whs Fix	Fixed Facility Cost - lease cost, administrative labor cost, utility cost, IT cost		10
Capacity B	(Product B - see definitions above)		10
Trans Var	(see above)		10
Whs Var	(see above)	Capacity is a measure of "Size" as defined in the Customer data record by the user.	10
Trans Fix	(see above)		10
VehType	Vehicle Type - must match 'Veh Type' in one of the Vehicle Records. Only used for Transportation Optimization.		10
Capacity C	(Product C - see definitions above)		10
Trans Var	(see above)		10
Whs Var	(see above)		10
Trans Fix	(see above)		10
Group	Enter Product Group 1, 2, 3, 4 or 5, 6 (1-2), 7 (3-5), 8 (All) or blank (defaults to All)		10
Capacity D	(Product D - see definitions above)		10
Trans Var	(see above)		10
Whs Var	(see above)		10
Trans Fix	(see above)		10
Mode	Air, Sea, Rail, Road or LTL/TL for all products. Use Rnd Trip instead of Road if returning to depot.		10
Capacity E	(Product E - see definitions above)		10
Trans Var	(see above)		10
Whs Var	(see above)		10
Trans Fix	(see above)		10
Total Cap	Total Capacity in SqFT or CbFT for all products A-E		10
SrvRadius A	Service Radius for Product A (optional)		35
SrvRadius B	(Product B - see definition above)		35
SrvRadius C	(Product C - see definition above)		35
SrvRadius D	(Product D - see definition above)		35
SrvRadius E	(Product E - see definition above)		35
Labor Rate A	Labor Rate or other cost applied to the total Count transiting through the Distribution Center for Product A-E		35
Labor Rate B	(Product B - see definition above)		35
Labor Rate C	(Product C - see definition above)		35
Labor Rate D	(Product D - see definition above)		35
Labor Rate E	(Product E - see definition above)		35
EOL	End of Line - Any non-special character (e.g., 1) OR Transaction Date MM/DD/YYYY or DD/MM/YYYY format.		Required

Figure A-4
Excel Distribution Center Format

You can follow the steps outlined above to modify, add to and import this file which has already been created for you in Excel or create and import your own "Distribution Center" Excel data file.

Next, you can simply **ADD** to a previously imported data set or data already entered into Logix by importing the file using the Data\Import – Logix Data Import Wizard (do **NOT** press the New Data icon).

Otherwise, if you **DO** press the New Data icon you can **import the DC file into a blank data set**.

From the Open File dialog, select the appropriate .CSV Data File you have created using the basic steps in section A.1.
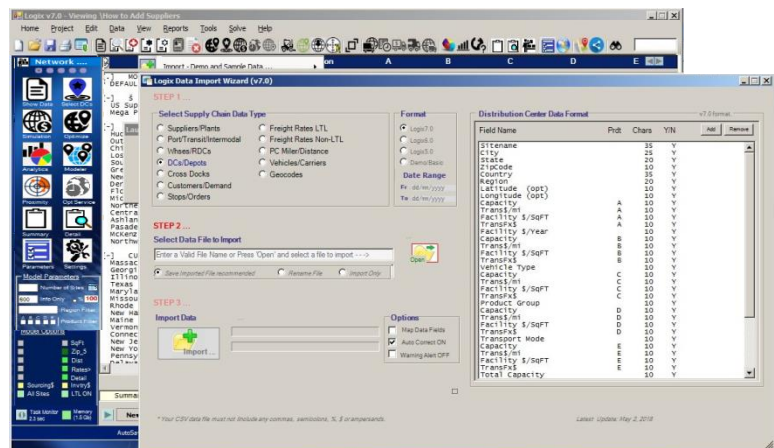
Figure A-5
Import Distribution Center Data
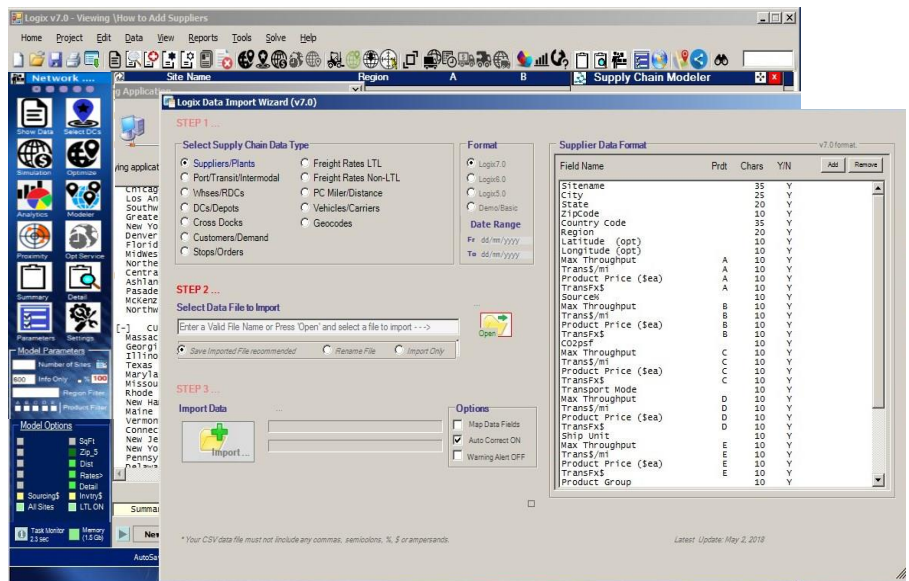
Once you have successfully imported the data, you may still need to geocode all of the sites. Use the "Geocode" icon   to automatically fill in latitude and longitude by City/State, 5-digit zip or 3-digit zip.

You can add new distribution centers, modify the data or delete DCs directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon 🖫. (see section 2.4). This way, next time you need this data, you can simply read it using the "File Open" icon and read the file you have saved.

We've already gone through the process to create the Demo's customers and DC's data file. You can simply **select "How to Add DCs"** from the Projects list.
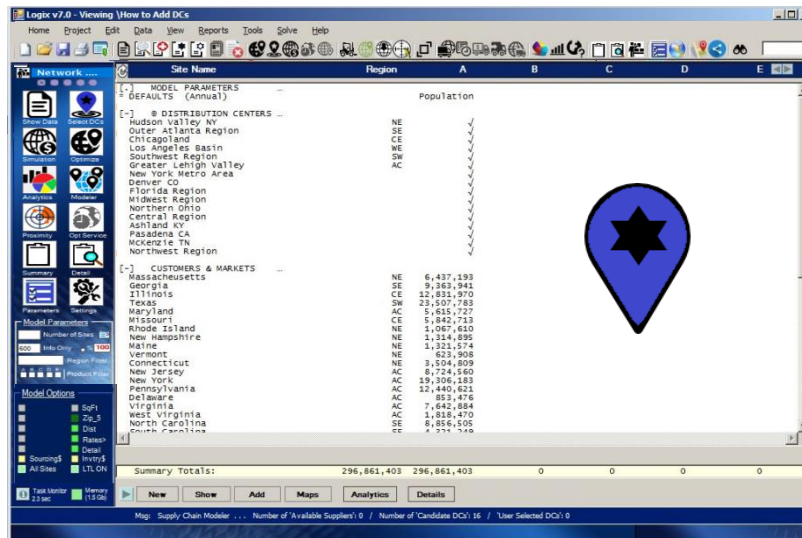
Figure A-6
"How to Add DCs"

The data from the "How to Add DCs" project list comes complete with:

- Default data with transportation rates, facility or warehouse rates/costs, and other default data
- Customer/demand data from the previous section
- Distribution Center data from this example.

Now, Logix can **optimize the number and location of distribution centers** using any or all of the candidate and existing distribution sites from this example, you can add your own distribution sites directly in Logix or you can turn on the "Greenfield" option and include any of the Greenfield sites as well as the candidate or selected Distribution Centers in the solution.

If you want to add sources (i.e., suppliers, manufacturing plants, etc.) as part of your analysis, see the next section.

A.4 How to Add Suppliers

Logix lets you enter sources such as suppliers and manufacturing plants directly (see section 2.1) or you can import an Excel spreadsheet with this data using the steps outlined above and in this section. Logix includes a "Suppliers.csv" template with the suppliers included in the demo (shown below in Figure A-7). Latitude/Longitude data is optional and can be left blank for later geocoding in Logix.

Suppliers and Manufacturers

FORMAT	... no special characters (i.e., NO commas, semicolons, $, % or &)		Max Chars
SiteName	Supplier Name		35
City	City		25
State	State		20
ZipCode	Zip Code		10
Country	Three-letter International Country Code (see International Codes.xlsx) or Country Name (i.e., USA or United States)		35
Region	Region Code		20
Latitude	Decimal Degrees N-S (Note: Degrees S are negative numbers)	optional	10
Longitude	Decimal Degrees E-W (Note: Degrees W are negative numbers)	optional	10
------- for each product category A-E (fill in 0 if no value) -------			
Product A	Max product supply or production capacity in "Quantity" units for product category A		10
Trans Var	Variable Transportation cost per mile per Ship Unit (e.g., per CWT or truckload)		10
Price	Product cost or price per unit of demand		10
Trans Fixed	Fixed Transportation cost per Ship Unit (e.g., per CWT or truckload) or per stop		10
Source %	Percentage of demand sourced from this supplier. Default is 100%. Do not enter percent sign.		10
Product B	(Product B - see definitions above)		10
Trans Var	(see above)		10
Price	(see above)		10
Trans Fixed	(see above)		10
CO2 psqf	CO2 and GHG Emissions per square or cubic foot for Products A-E		10
Product C	(Product C - see definitions above)		10
Trans Var	(see above)		10
Price	(see above)		10
Trans Fixed	(see above)		10
Mode	Air, Sea, Rail, Road, Rnd Trip, Veh Type or LTL/TL for all products. Use Rnd Trip instead of Road if returning to supply point		10
Product D	(Product D - see definitions above)		10
Trans Var	(see above)		10
Price	(see above)		10
Trans Fixed	(see above)		10
Ship Unit	Average Shipping Size, Weight or Load for All Products (i.e., 100 for hundred weight, 40000 for Truckload, 20000 for co		10
Product E	(Product E - see definitions above)		10
Trans Var	(see above)		10
Price	(see above)		10
Trans Fixed	(see above)		10
Group	Enter Product Group: 1, 2, 3, 4 or 5, 6 (1-2), 7 (3-5), 8 (All) or blank (defaults to All)		10
Supp/Lnk A	Supplier Link A - Product Code or designator linking this Supplier to a specific Customer in the Customer Record (optional		35
Supp/Lnk B	(Product B - see definition above)		35
Supp/Lnk C	(Product C - see definition above)		35
Supp/Lnk D	(Product D - see definition above)		35
Supp/Lnk E	(Product E - see definition above)		35
Tariff A %	Tariffs and other import fees, taxes and duties for products A-E as a percentage of the Price. Do not enter percent sign.		35
Tariff B %	(Product B - see definition above)		35
Tariff C %	(Product C - see definition above)		35
Tariff D %	(Product D - see definition above)		35
Tariff E %	(Product E - see definition above)		35
EOL	End of Line - Any non-special character (e.g., 1) OR Transaction Date MM/DD/YYYY or DD/MM/YYYY format.		Required

Figure A-7
Excel Supplier Format

You can follow the steps outlined above to modify, add to and convert this file which has already been created for you in Excel or create and convert your own "Supplier" Excel data file.

Next, you can **Add** one or more previously imported data sets or data already entered into Logix by importing the file using the Data\Import – Logix Data Import Wizard … Import Supplier Data key (do **NOT** press the New Data icon).

Otherwise, if you **DO** press the New Data icon you can **import the new Supplier file into a blank data set** and add to this your customer and distribution center data.

From the Open File dialog, select the appropriate Supplier (CSV) Data File using the steps in section A.1.

Figure A-8
Import Supplier Data

Once you have successfully imported the data, you may still need to geocode all of the sites. Use the "Geocode" icon 🌎📍 to automatically fill in latitude and longitude by City/State, 5-digit zip or 3-digit zip.

You can add new sources, suppliers and plants, modify the data or delete suppliers directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon 💾 (see section 2.4). This way, next time you need this data, you can simply read it using the "File Open" icon 📁 and read the file you have saved.

We've already gone through the process to create the Demo's suppliers data file including customers, distribution centers and inbound sources. You can simply select **"How to Add Suppliers" from the Projects list** and open the file from the File Dialog.
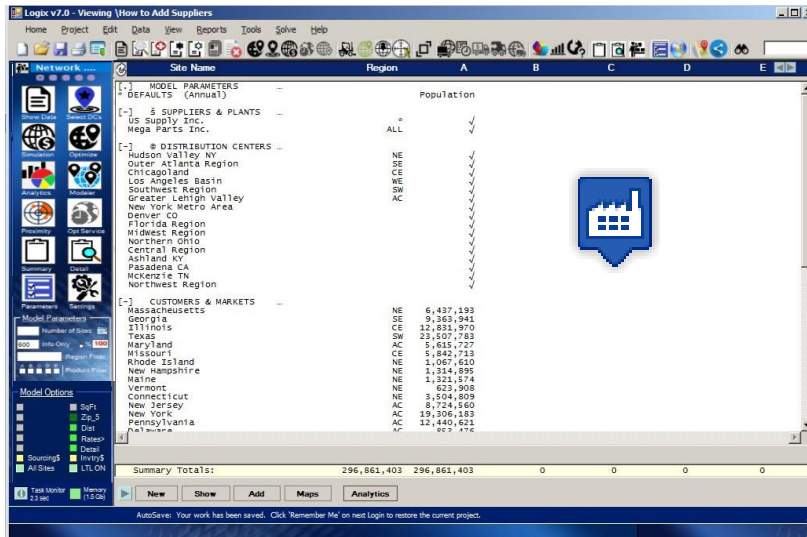
Figure A-9
"How to Add Suppliers"

The data from the "How to Add Suppliers" project list comes complete with:

- Default data with transportation rates, facility or warehouse rates/costs, and other default data.
- Customer/demand data from section A-2.
- Distribution Center data from the previous section.
- Suppliers from this example.

Logix can **optimize both the outbound supply chain** (number and location of distribution centers) **and the inbound supply chains** (suppliers and plants) from this example or you can add your own suppliers and distribution centers in Logix and optimize your own supply chain and sourcing options.

If you want to add Cross Docks (i.e., Cross Docks, National Warehouses, Pool Point and Intermodal Facilities, etc.) as part of your analysis, see the next section.

ProLogix Users – Matching Individual Suppliers/Products with Customers

You can enter specific products or SKU's sourced from individual suppliers by entering the SKU or other identifier in the Supp/Lnk field for each product category and Customer record. This SKU code must either match the REGION code, supplier SITENAME or Supp/Lnk code in a supplier record. Logix will then match that supplier and product with the correct customer through the optimum or simulated distribution network.

SiteName	City	State	ZipCode	Region
Shanghai Supplier	Shanghai	China	00000	ALL
US Supply Inc.	Salem	VA	24153	ALL
Mega Parts Inc.	Austin	TX	78700	ALL
Supplier XYZ	Athens	GA	30607	SKU9876

*Note: Shanghai Supplier uses Freight Rates from Shanghai, China to the port

Logix – User Guide and Documentation

A.5 How to Add Warehouses and/or Cross Docks

Logix lets you enter potential Warehouse (Inbound) and/or Cross Dock (Outbound) locations such as consolidation/deconsolidation centers, intermodal facilities and regional warehouses directly (see section 2.1) or you can import an Excel spreadsheet with this data using the steps outlined above and in this section.   Logix includes a "Cross Dock.csv" template with the Cross Docks included in the demo. Entering Latitude/Longitude data is optional and can be left blank for later geocoding in Logix.

Figure A-10
Excel Whse and Cross Dock Format

You can follow the steps outlined above to modify, add to and import this file which has already been created for you in Excel or create and import your own "Cross Dock" Excel data file.

Next, simply **add to one or more previously imported data sets** or data already entered into Logix by importing the file using the Data\Import Logix Data Import Wizard (do NOT press the New icon) or you can press the New icon and **import the new Cross Dock file into a blank data set** and add your customer, supplier and other data.

From the Open File dialog, select the appropriate Cross Dock or Whse Data File (.CSV) you have created using the basic steps in section A.1.
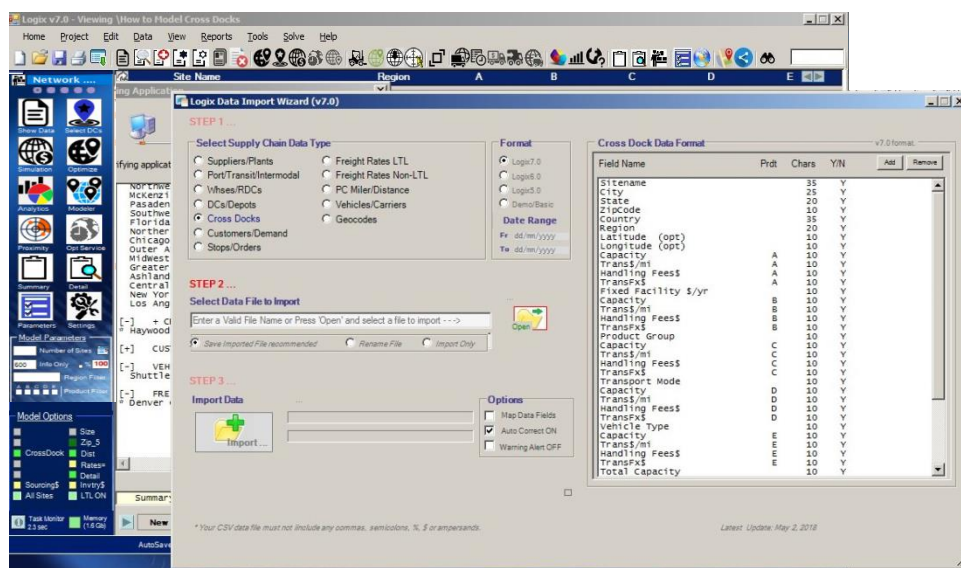
Figure A-11
Import Whse and/or Cross Dock Data

Once you have successfully imported the data, you may still need to geocode all of the sites. Use the "Geocode" icon 🗺️📍 to automatically fill in latitude and longitude by City/State, 5-digit zip or 3-digit zip.

You can add new warehouses, consolidation centers and cross docks, modify or delete the data directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon 💾 (see section 2.4). This way, next time you need this data, you can simply read it using the "File Open" icon 📁 and read the file you have saved.

We've already gone through the process to create the Demo's Cross Dock data file including customers, distribution centers, inbound sources, warehouses and cross docks. You can simply select **"How to Model Cross Docks" from the Projects list** and open the file from the File Dialog.
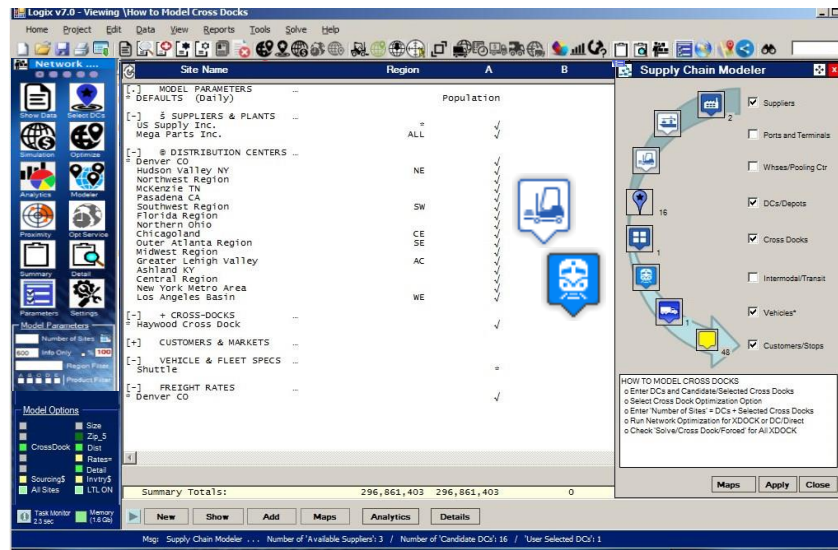
Figure A-12
"How to Model Cross Docks"

The data from the "How to Model Cross Docks" project list comes complete with:

- Default data with transportation rates, facility or warehouse rates/costs, and other default data.
- Customer/demand data from section A-2.
- Distribution Center data from section A-3.
- Suppliers from the previous section.
- Cross Docks, Intermodal and Warehouse facilities from this example.

Now, Logix can **optimize the outbound supply chain** (i.e., number and location of distribution centers) **and the inbound supply chains** (i.e., suppliers and plants) **transiting through cross dock, warehouse and intermodal facilities** from this example or you can add your own suppliers, cross dock and distribution centers directly in Logix and optimize your own supply chain and more complex sourcing and distribution options.

If you want to add Freight Rates (i.e., point-to-point freight rates and actual distances, region-to-region, point-to-region, city-to-city, etc.) as part of your analysis, see the next section.

A.6 How to Add Freight Rates

Logix calculates distances and transportation costs using accurate distance algorithms which the user can adjust using the Mileage Factor in the Default Record and user supplied rates. If greater accuracy is required, Logix lets you enter Freight Rates and Distances directly (see section 2.1) or you can import an Excel spreadsheet with this data using the steps outlined above and in this section.   Logix includes a "Rates.csv" template with the Freight Rates included in the demo (partially shown below in Figure A-13).

Figure A-13
Excel Freight Rate Format

You can follow the steps outlined above to modify, add to and convert this file which has already been created for you in Excel or create and convert your own "Freight Rate" Excel data file.

Next, you can simply **add to previously imported data** or data already entered in Logix by importing the file using the Data/Logix Data Import Wizard (do NOT press the New icon).

Or you can press the New icon and **import the new Freight Rate file into a blank data set** and add to this your customer, supplier and other data.

You can also "Upload" previously converted .XML Freight Files. Using the "Internal Link" option, the rate data will be incorporated and saved with your current data set.
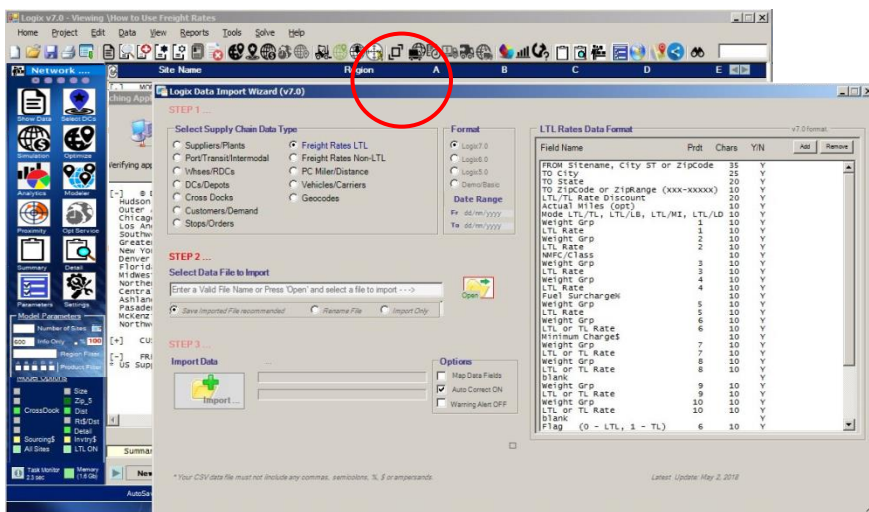
Figure A-14

Import Freight Rate Data

If you choose the "External Link" option, the rate data will not be visible to you and can not be saved with the current data set. The External Link option is useful when you have many freight records and will improve processing speed. In either case, the rate data will be active in the background rating each of the appropriate freight lanes and supply chain links.*

Rates can be entered FROM a particular Sitename, City and State, Zipcode <u>OR</u> Region TO any Sitename, City and State, Zipcode <u>OR</u> Region. Rates can also be entered in distance "bands" (i.e., FROM 201 miles TO 300 miles). See the next section on how to enter LTL and Truckload rates.

Once you have successfully imported the data*, you can add new rates, modify the data or delete rates directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon 🖫🖫 see section 2.4). This way, next time you need this data, you can simply read it using the "File Open" icon and 📁 ad the file you have saved.

We've already gone through the process to create the Demo's freight rate data file including customers, distribution centers, inbound sources, cross docks and several example freight rates. You can simply select **"How to Use Freight Rates" from the Projects list** and open the file from the File Dialog.
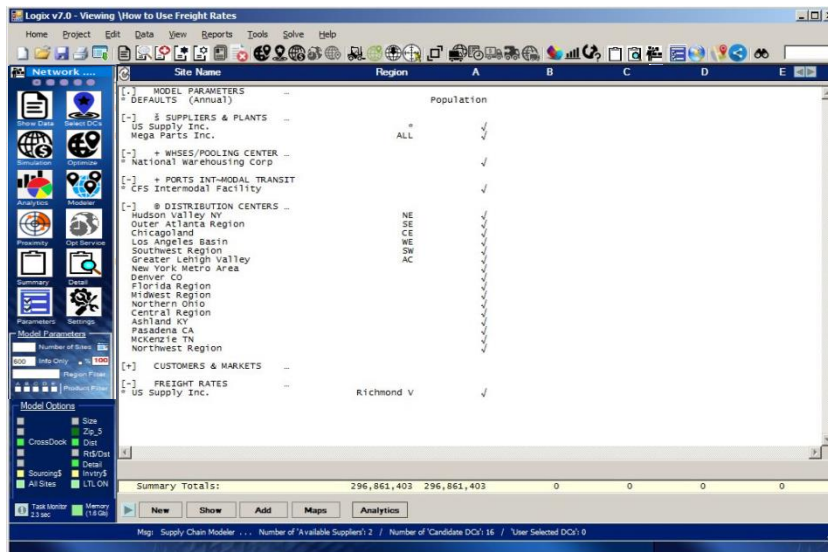
Figure A-15
"How to Use Freight Rates"

The data from the "How to Use Freight Rates" project list comes complete with:

- Default data with transportation rates, facility or warehouse rates/costs, and other default data.
- Customer/demand data from section A-2.
- Distribution Center data from section A-3.
- Supplier data from section A-4.
- Cross Dock and Intermodal facilities from the previous section.
- Freight Rate data from this example.

Now, Logix can **optimize the outbound supply chain** (i.e., number and location of distribution centers) **and the inbound supply chains** (i.e., suppliers and plants) **transiting through cross dock, warehouse and intermodal facilities** using point-to-point freight rates, actual distances and transit times from this example or you can add your own rates, suppliers, cross dock and distribution centers directly in Logix and optimize your own supply chain and more complex distribution options.

* Freight Rates don't need to be geocoded. You are limited to a total of 2000 Freight Rate records although you should limit the number of records using the "Internal Link" to a few hundred.

A.7 How to Add LTL/TL Freight Rates

Logix users can enter or import LTL and Truckload Freight Rates for even greater accuracy and efficiency in calculating transportation costs.   Logix includes an "LTL/TL Rates.csv" template in the Logix Excel Data Templates program as shown in Figure A-16 below.

Figure A-16
Excel LTL/TL Freight Rate Format

Logix allows you to enter up to ten (10) weight groups for each lane defined by a FROM Sitename, City and State, Zipcode or Region and a TO Sitename, City and State, Zipcode or Region and a freight classification or NMFC code. For each weight group you can enter an LTL rate as well as a cost per mile if applicable per ship unit as defined in the Default Record (i.e., per CWT hundred weight or per 40,000 lb. shipment). You can also enter a truckload rate (FTL) and a minimum fixed charge. For example, the weight groups could be 0-250 lbs, 251-500 lbs, 501-1000 lbs, 1001 to 5000 lbs and 5001 to 10,000 lbs. Over 10,000 lbs would be classified as full truckload in this case. The Mode is designated as LTL/TL.

Save the LTL/TL rate file as usual as a CSV file and import it using the Logix Data Import Wizard.

Next, you can simply **add to previously imported data** or data already entered in Logix by importing the file using the Data/Logix Data Import Wizard (do NOT press the New icon).

Or you can press the New icon and **import the new Freight Rate file into a blank data set** and add to this your customer, supplier and other data.

You can also "Upload" previously converted .XML Freight Files. Using the "Internal Link" option, the rate data will be incorporated and saved with your current data set.
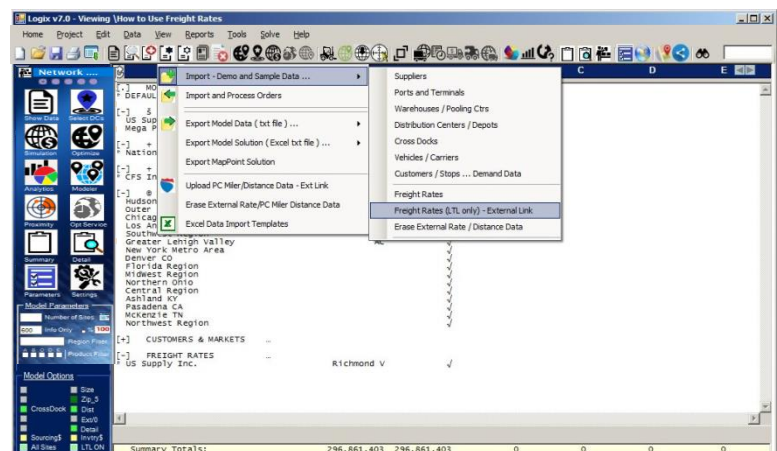

Figure A-17
Import LTL/TL Freight Rate Data

If you choose the "External Link" option, the rate data will not be visible to you and can not be saved with the current data set. The External Link option is useful when you have many freight records and will improve processing speed. In either case, the rate data will be active in the background rating each of the appropriate freight lanes and supply chain links.*

Once you have successfully imported the data*, you can add new rates, modify the data or delete rates directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon ⊞ (see section 2.4). This way, next time you need this data, you can simply read it using the "File Open" icon and 🗁 ad the file you have saved.

We've already gone through the process to create an example freight rate data file including several example freight rates. You can simply select **"How to Model LTL/TL Freight Rates"** from the Recent Projects list and open the file from the File Dialog.
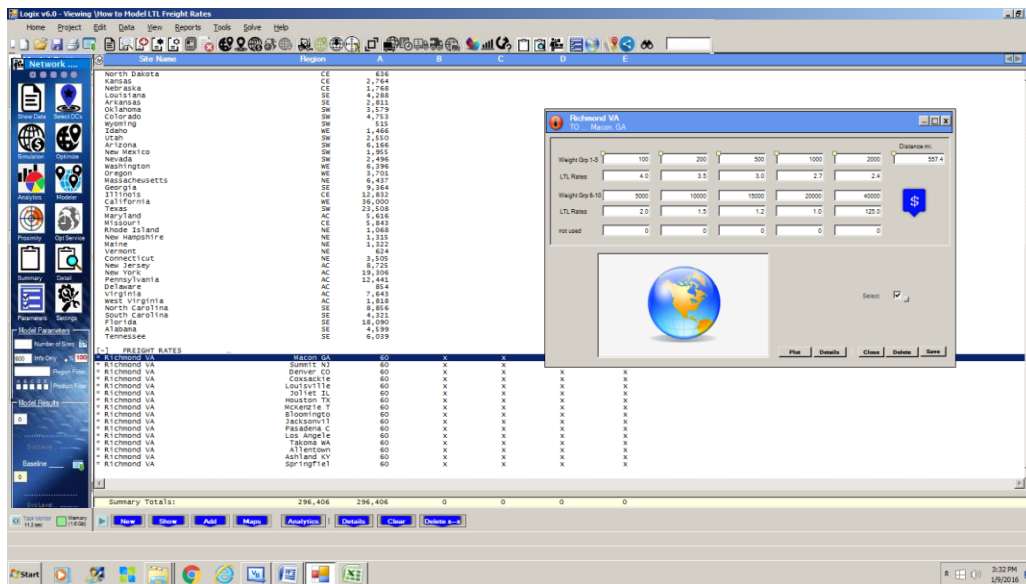

Figure A-18
"How to Model LTL/TL Freight Rates

* Freight Rates don't need to be geocoded. You are limited to a total of 2000 Freight Rate records although you should limit the number of records using the "Internal Link" to a few hundred for optimal performance.

A.8 How to Model Offshore Suppliers, Ports, In-Transit and Intermodal Terminals

Logix can optimize the entire supply chain from the point of origin at suppliers or plants overseas, through entry ports, intermodal facilities, distribution centers and finally to the destination customers or markets. Modeling "Offshoring" requires you to enter or import data for your sources, possible ports of entry and your domestic supply chain including warehouses, potential distribution centers and customers or simply customers if you are modeling a "Greenfield" scenario.

Logix includes a "Ports and Intermodal Terminals" template and data file included in the demo.

Figure A-19
Ports, In-Transit and Intermodal Terminals Format

You can follow the steps outlined above to modify, add to and convert this file which has already been created for you in Excel or create and convert your own "Ports and Intermodal Terminals" Excel data file.

Next, you can simply **add to previously imported data** or data already entered in Logix by importing the file using the Data/Logix Data Import Wizard (do NOT press the New icon).

Or you can press the New icon and **import the new Ports and/or Intermodal Terminals file into a blank data set** and add to this your customer, supplier and other data.

Logix will generally optimize which Port or Intermodal Terminal is selected based on least cost or best service if you leave the Region blank or enter "ALL" or "*". OR enter a Region that matches one or more of your Distribution Center Regions to ensure that a specific Port or Intermodal

Figure A-20
Terminal is selected.
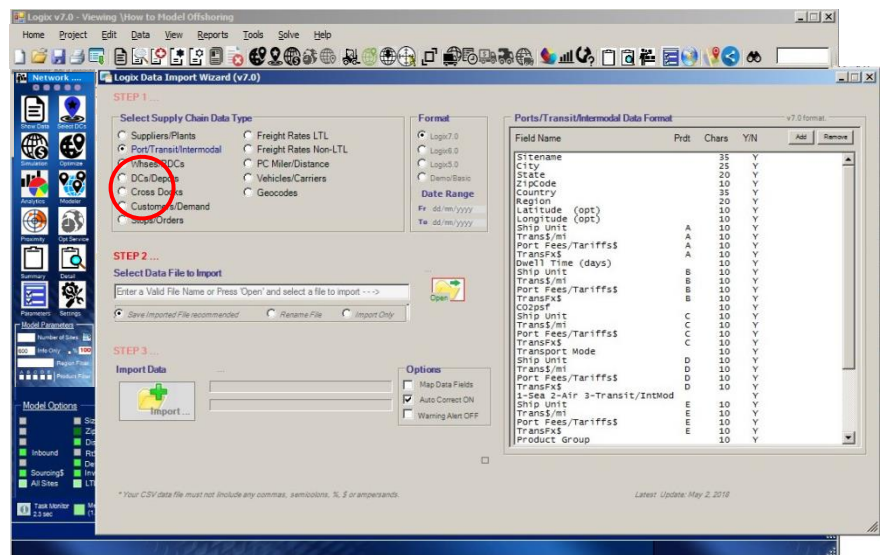
Import Ports, In-Transit and Intermodal Terminals Data

Once you have successfully imported the data, you may still need to geocode all of the customer sites. Use the "Geocode" icon   to automatically fill in latitude and longitude by City/State, 5-digit zip or 3-digit zip.

You can import or add overseas suppliers, shipping container freight rates, actual distance and transit time information, modify the data or delete records directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon .

Note: Modeling overseas supply chains virtually requires specific supplier-to-port freight rates with actual distances and transit times in order to obtain accurate results. Overseas sites may require manual entry of latitude and longitude information in decimal degrees.

We've already gone through the process to create the Demo's offshoring data file including customers, distribution centers, domestic and overseas suppliers, entry ports and freight rates. You can simply select **"How to Model Offshoring" from the Projects list** and open the file from the File Dialog.

The data from the "How to Model Offshoring" project list comes complete with:

- Default data with transportation rates, facility or warehouse rates/costs, and other default data.
- Customer/demand data from section A-2.
- Distribution Center data from section A-3.
- Supplier data from section A-4 and Overseas Supplier data from this example.
- Freight Rate and Entry Port data from this example.

Now, Logix can **optimize entire the supply chain including the outbound supply chain** (i.e., number and location of distribution centers) **and the inbound supply chains** (i.e., suppliers and plants) **transiting through entry ports** using point-to-point freight rates, actual distances and transit times from this example or you can import or add your own rates, suppliers, ports and distribution centers directly in Logix and optimize your own supply chain.

A.9 How to Optimize Transportation (Routing and Scheduling) in Logix

Logix can be used to produce accurate routes and schedules for your customers/stops using appropriately configured "Routes and Stops" data as well as your input of vehicles, distribution centers, cross docks and other parameters. The Routing and Scheduling application in Logix is an integral part of Logix, not a separate module or attachment.   You can optimize your distribution network including distribution site locations, capacities, product flows and sourcing while at the same time optimizing transportation costs using routes and delivery/pickup schedules for an accurate representation of true fleet operations and distribution.

You can import your stop information from Excel with only a few additional data items to the Customer data we have used for the distribution network design application. Logix includes a "Routes and Stops" template and data file which is very similar to the "Customer" data template.

Figure A-20
Routes and Stops Format

Logix can be used to automatically geocode your data up to 5-digit ZipCode accuracy.   You should enter your own geocode data for Latitude and Longitude from another source to obtain street-level accuracy. Logix provides an easy to use Excel template for extracting street level geocode data from MicroSoft's MapPoint mapping tool. See separate documentation for this template.

Additional Customer Data not previously described in the Customer Record

Quantity: Generally use a delivery or pickup quantity for a single day if you are using Routing and Scheduling.   Logix can approximate route delivery/pickup distribution using annual, semiannual, quarterly, monthly or weekly data but will be less accurate since the delivery/pickup quantity will be an average instead of a specific quantity.

Route-Stop: This is used for Route Simulation only and is the existing or current Route and Sequence separated by a dash. The Route designator must be unique and the Sequence must be sequential.

Size and/or Count: You can use any quantity measure such as square or cubic ft/meters, pallets, cases, linear feet/meters, etc. Count can also be number of shipments. These quantities will be displayed in the Manifest report.

Stop Type: Delivery, Pickup, CPU (Customer Pickup), Transfer, Dispatch, Backhaul or No Routes. Deliveries and Pickups can be mixed on a route. Backhauls are always last although you can have multiple backhauls on the same route. Not Routed indicates a stop is not to be placed on a route.

Vehicle Type: Vehicle Type restrictions group orders/customers with the same Vehicle Type or no Vehicle Type (blank) on the same route.

Comm Type: Commodity restrictions group orders/customers with the same Commodity Type or no Commodity Type (blank) on the same route.

Early Date: Earliest Delivery, Pickup or Backhaul date in the format (MMDDYYYY or DDMMYYYY).

Open Time: Beginning time of the Time Window for Delivery or Pickup (HH:MM AM or PM format or HH:MM 24-hour format). The latest allowable time is 23:59.

Close Time: End time of the Time Window for Delivery or Pickup (HH:MM AM or PM format or HH:MM 24-hour format). The latest allowable time is 23:59.

Late Date: Latest Delivery, Pickup or Backhaul date in the format (MMDDYYYY or DDMMYYYY).

You can follow the steps outlined above to modify, add to and convert this file which has already been created for you in Excel or create and convert your own "Routes and Stops" Excel data file.

Next, you can simply **add to previously imported data** or data already entered in Logix by importing the file using the Data/Logix Data Import Wizard (do NOT press the New icon).

You must select "Stops" as the Supply Chain category and Format 7.0 to import customer data in route/stop format.

Or you can press the New icon and **import the new Routes and Stops file into a blank data set** and add to this your distribution center, supplier and other data.
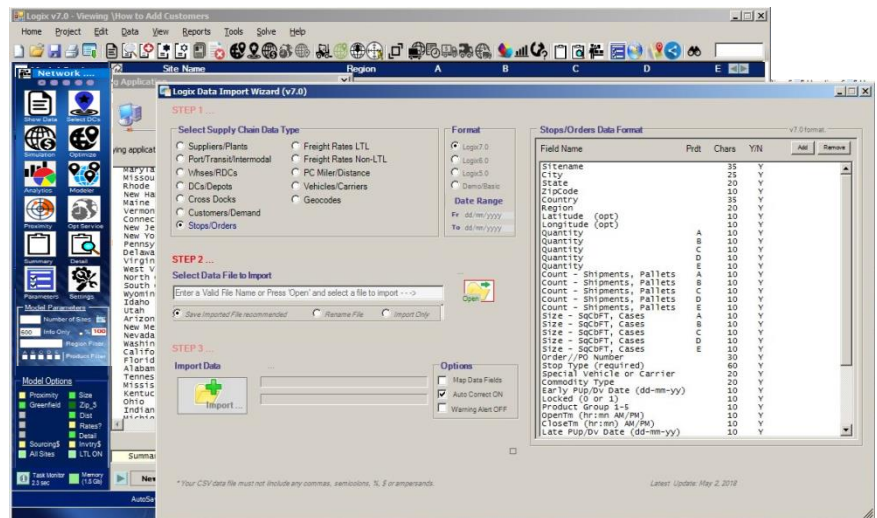
Figure A-21
Routes and Stops Data

Once you have successfully imported the data, you may still need to geocode all of the port sites. Use the "Geocode" icon automatically fill in latitude and longitude by City/State, 5-digit zip or 3-digit zip.

You can import or add distribution centers (depots), freight rates, actual distance and transit time information, modify the data or delete records directly from Logix' (see section 2.1). Then, don't forget to Save the data set you have created using the "Save" or "Save As" keys or the Save icon   .

Note: Modeling Routing and Scheduling in Logix requires routes and stops data, distribution center or depot data, vehicle data as well as your input of various routing parameters.

We've already gone through the process to create the Demo's Routing and Scheduling data file including customers, distribution centers and routing parameters. You can simply select **"How to Model Routing and Scheduling" from the Projects list** and open the file from the File Dialog.

Appendix B - Sourcing (Inbound) Optimization

Logix provides a number of optimization and simulation options for determining the supplier, product quantity, in-transit routing and all cost and service lead time considerations for each of the user-selected sourcing options. These options range from the very basic no inbound supply consideration at all (Distribution Network only Optimization) to full capacitated sourcing and product flow optimization (Sourcing/Supply Chain Network Optimization). This appendix describes each of these options, which option to use and when - and how they work.

Distribution Network only/Sourcing Optimization OFF: This basic option bypasses the Sourcing Optimization algorithms entirely and optimizes only the outbound portion of the supply chain even if the data includes ("unselected") source nodes and data.

Supply Chain Network/Sourcing Optimization OFF: This option optimizes the entire supply chain and includes inbound sources and quantities using the "Source%" percentages entered by the user for each source of supply. Sources <u>do not</u> need to be selected.

Distribution Network only/Sourcing Optimization ON: Both outbound and inbound supply chains are optimized based on source and distribution center capacities, all costs and service and the optimum inbound sourcing is applied as a final step. Suppliers are optimized based on production capacity and product costs as well as inbound transportation costs to each distribution facility. "Source %" percentages entered by the user are ignored.

Supply Chain Network/Sourcing Optimization ON: Both outbound and inbound supply chains are optimized as in the Supply Chain Network Optimization option above. HOWEVER, suppliers are optimized based on production capacity and product costs as well as inbound transportation costs to each distribution facility. "Source %" percentages entered by the user are ignored.

B.1 Distribution Network only /Sourcing Optimization OFF

This is the simplest option and allows optimization and display of the outbound network without any consideration of the inbound costs or product flows. Simply <u>do not</u> click on the Inbound Optimization icon, do not "select" any of the sources and click on Distribution Optimization only.

Alternatively, the Distribution Network only option will include any "selected" sources in the final solution using the "Source" percentages entered by the user – the outbound network will be optimized first and the inbound sourcing is applied as a final step only for "selected" sources.

B.2 Supply Chain Network/Sourcing Optimization OFF

If there are many sources of supply and inbound distribution is sent to many or all of the distribution facilities from each source or from sources by region or by product category, the user enters the region to which each source or supplier sends product and the percentage of each facility's demand that is fulfilled by each source. This can be illustrated in the following diagram:

Figure B.1
Supplier Data
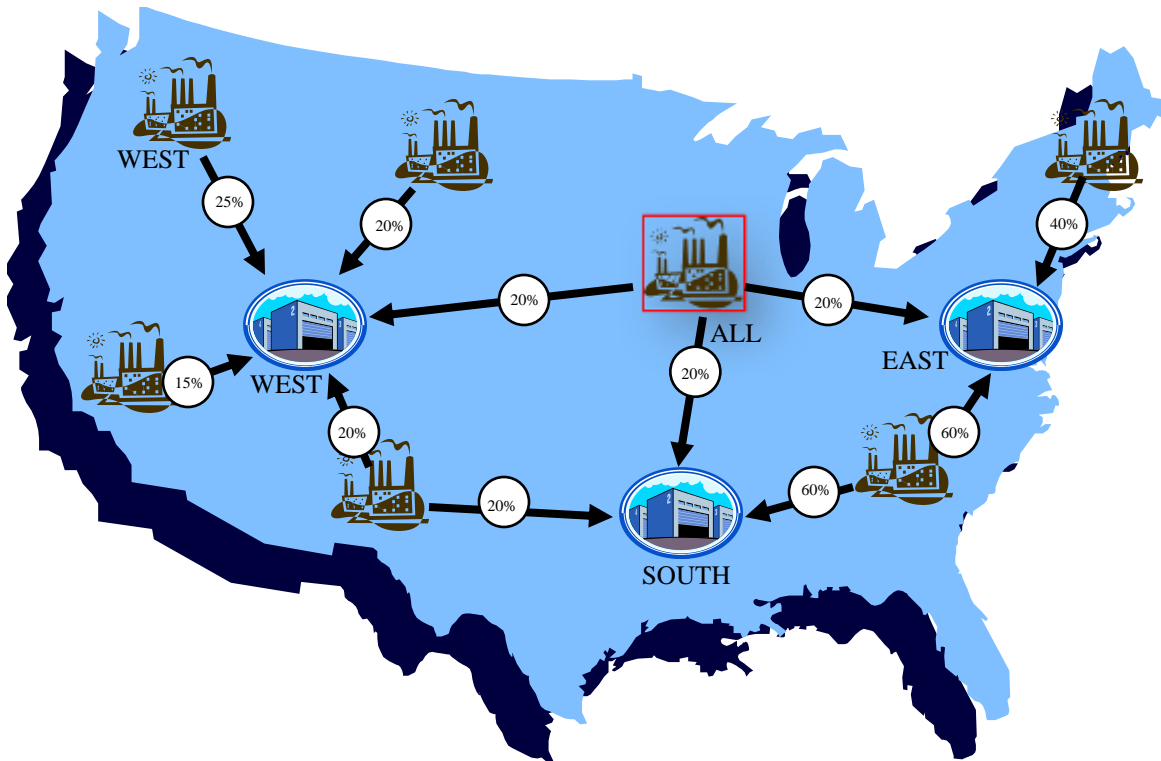

Figure B.2
Supplier Data Detail

In Figure B.1, the Mid-West Supply Company (highlighted in red) is a supplier to "ALL" distribution facilities for product A with 20% of Product A demand coming from this company. So if the distribution

facility designated by "SOUTH" were to distribute a total of 1,000,000 of product A to its distribution area, 20% or 200,000 would be supplied by Mid-West Supply.

In Figure B.2, the data would be entered in a "Supplier" record with Site Name, City, State, Zip Code and Mode data filled in as usual. The following data is particular to each supplier:

- The **"Region"** designator is matched to one or more distribution facilities to indicate the supplier is a source for these facilities.   In the illustration, "ALL" signifies that all distribution facilities receive product from this supplier in the same proportion (in this case, for the Mid-West Supply Company, 20%).   "ALL" can be replaced with an "*" <u>or the region can be left blank and the supplier can be "selected"</u> indicating that all facilities are sourced from this supplier. The region designator can also match any existing or candidate distribution facility region code indicating that the supplier is only a source for facilities with a matching region code. This can be a one-to-one, one-to-many, many-to-one or many-to-many relationship.

- The "**Source %**" field indicates the percentage of the <u>demand</u> that is fulfilled from this supplier.   This can be any number and may exceed the demand. In this case, the inbound quantity does not necessarily equal the outbound quantity. For example, 4 tires may be required for each automobile so that the Source % for a tire supplier may be 400% indicating a 4:1 ratio of supply to demand for this supplier and this product. <u>A blank Source % field defaults to 100% if the supplier region is set to "ALL" or "*" or if the supplier is "selected"</u>.

- **Maximum Quantity** indicates the maximum capacity for each supplier and specific product or product category.   The maximum quantity is only used with Inbound Optimization ON. Therefore, when user entered source percentages are used with Inbound Optimization OFF, the maximum capacity <u>must be a number greater than zero</u> but is, otherwise, not used.

- **Prdt ($/ea)** is price per unit of product.

- **Trans ($/mi)** is variable transportation cost per mile per ship unit.

- **Trans ($)** is fixed transportation cost per ship unit.

- **Mode and Ship Unit** must be entered for each supplier. Otherwise, the default ship unit in the Default record is used. If each product has a different ship unit, use a different supplier record for each product.

In our illustration, the supplier located approximately in Seattle WA would have a Region designator of "WEST" and a Source % of 25% indicating that it is a supplier for the distribution facility with a matching Region designator of "WEST" but not for any other distribution facility.

The Simulation option also works in much the same way with Inbound Optimization OFF allocating suppliers to designated distribution facilities according to user specified sourcing percentages.

B.3 Distribution Network only / Sourcing Optimization ON

Turning Inbound Optimization ON by clicking the icon triggers the Inbound ILP Optimization algorithm which takes into account the Maximum Capacity for each product as well as the Region designator and other supplier data as defined above.

Specifically, when a particular product is in short supply from one or more suppliers (whether by cost or service), Logix fills the product demand by apportioning available supply among the distribution facilities in the optimum solution using a cost-based integer programming optimization algorithm. The algorithm produces a total least cost sourcing solution from the various suppliers so that all supply is used up or all demand is fulfilled or both.   If the combined maximum capacity for all suppliers for any product does not meet the required demand, all supply for the one or more products and suppliers is used up and a warning message will appear indicating a supply/demand imbalance and, consequently, a partial optimum solution.

Of course, in this optimum solution, Logix determines the percentage of supply from each source that is shipped to each distribution facility – the user entered Source % does not apply. Logix will attempt to fill as much of the required demand for each product from the preferred supplier for each distribution facility. The optimization may, in reality, indicate that more than one supplier is required to source a particular product that is in particularly short supply from one or more preferred suppliers.

When optimizing Distribution Network only and Sourcing Optimization ON, Logix will first select the optimum outbound distribution network based on cost and then determine the optimum sourcing solution for this outbound solution. This option would be used when suppliers are constantly changing, when there are many suppliers and the distribution network should not be influenced by supplier locations, when sourcing transportation costs do not directly impact the distribution solution, or for any other reason for which the user only wants the outbound distribution solution to impact the optimum network.
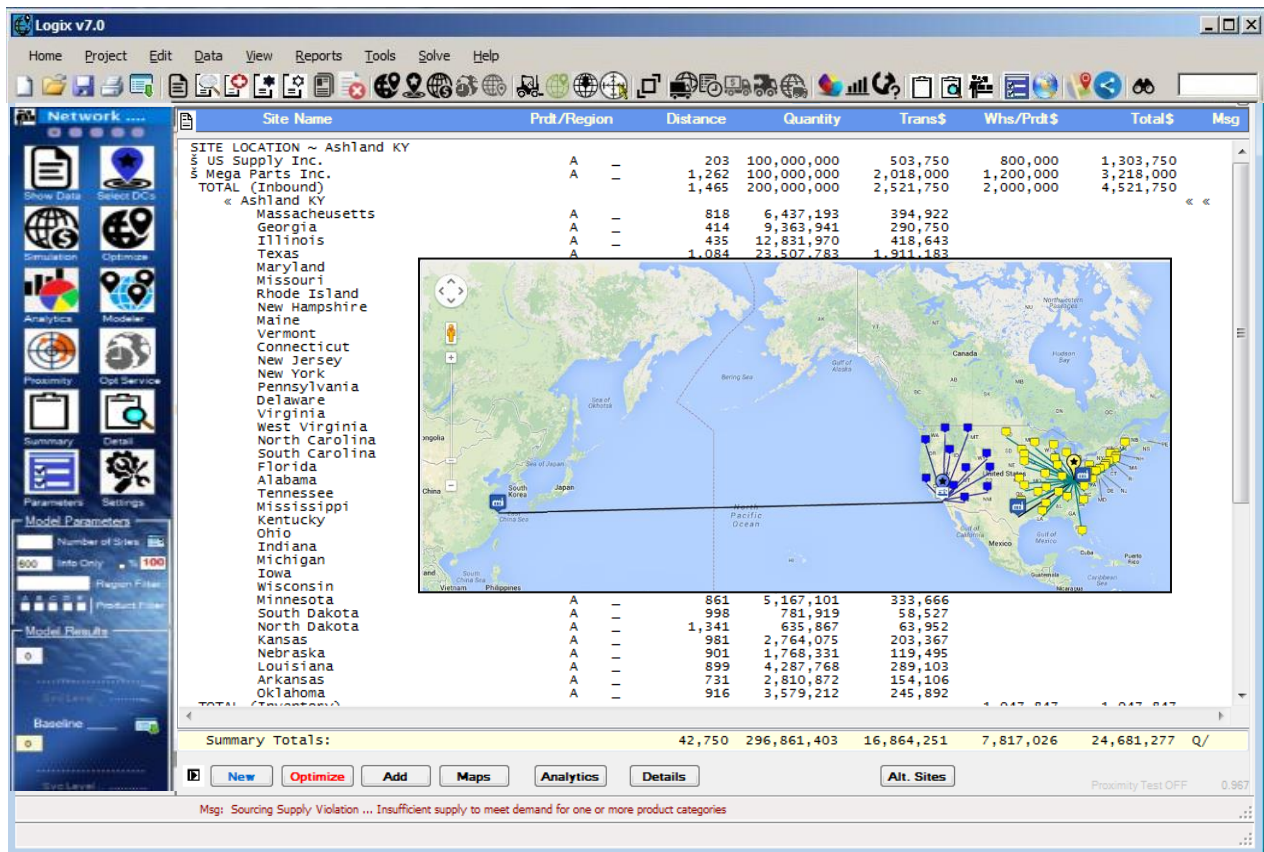

Figure B.3
Sourcing Solution

B.4 Supply Chain Network / Sourcing Optimization ON

As in the option above, turning Sourcing Optimization ON by clicking the icon triggers the Inbound ILP Optimization algorithm which takes into account the Maximum Capacity for each product as well as the Region designator and other supplier data as defined above. Then click on the Supply Chain Network optimization option. This option optimizes Sourcing for each iteration of the optimization process although it does not optimize both inbound and outbound flows simultaneously since the outbound flows must be determined first before the optimum sourcing can be applied.
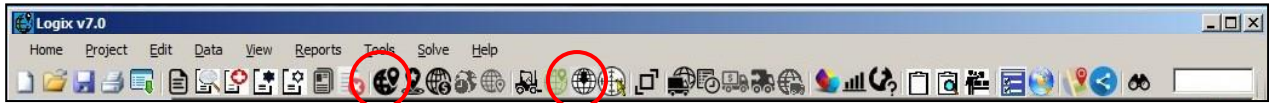
Logix, in this case will optimize both the inbound and the outbound distribution networks taking into account all capacity, cost and other constraints. This option may be used when there are only a few suppliers, when sourcing transportation costs directly impact the distribution solution, when attempting to locate distribution facilities closer to port-of-entry facilities or other in-transit or pool-point facilities or for any other reason for which the user wants the inbound distribution solution to have a greater impact on the optimum network.

B.5 Supply Chain Network / Simultaneously Optimize Inbound and Outbound

In Display Parameters/Network Optimization Network Options …. click on "Optimize Inbound and Outbound Simultaneously" and then select Supply Chain Optimization for any number or location of Distribution Centers.

Logix will display "Inb/Outb" in the Options grid.

Logix will simultaneously optimize both the inbound and outbound product flows and costs so that the resulting solution presents a balance between inbound and outbound costs in optimizing the location of distribution centers.

This is a very powerful algorithm and should be considered in many Supply Chain Optimization solutions unless you wish to optimize the outbound solution first and then apply an inbound optimized solution second to provide a greater weight to the outbound flow of products to customers.
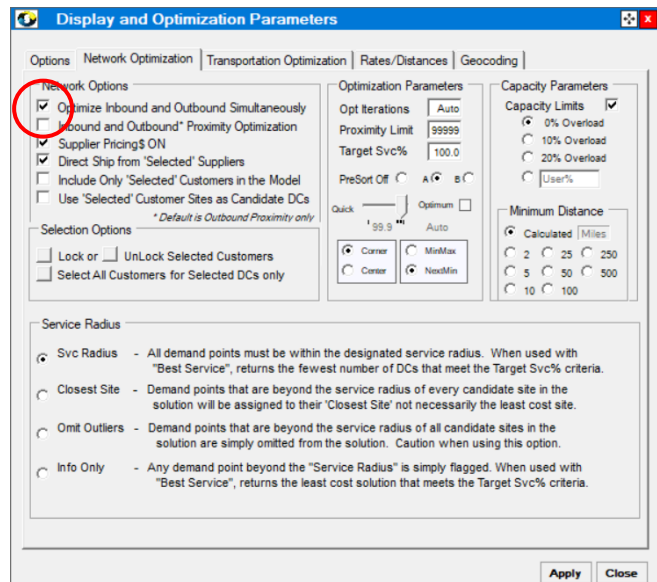
This option is NOT available in Simulation mode and is not supported together with Sourcing Optimization.

Appendix C – Task Monitor

The latest version of Logix8.0 includes a Task Monitor that provides constant feedback on the optimization process and allows you to "Pause" the optimization or "Stop" the optimization at any point.

Simply click on the Monitor button before optimizing. Once activated, the Task Monitor will stay activated until you turn it off and will start for any new optimization.

- When you start an optimization process, the Task Monitor will appear.

- Press the Start button to begin providing up to the minute updates on the current optimization iteration and approximate number of tasks completed and remaining.

- The Current Solution listing shows the last ten solutions in the optimization process.

- Press the Pause button to pause the optimization and continue or stop.

- Press Stop to stop the optimization at the current optimization iteration.

- When the optimization is completed, the solution is displayed and you can then "Close" the Task Monitor dialogue.

- The Task Monitor will stay active until you switch it off.
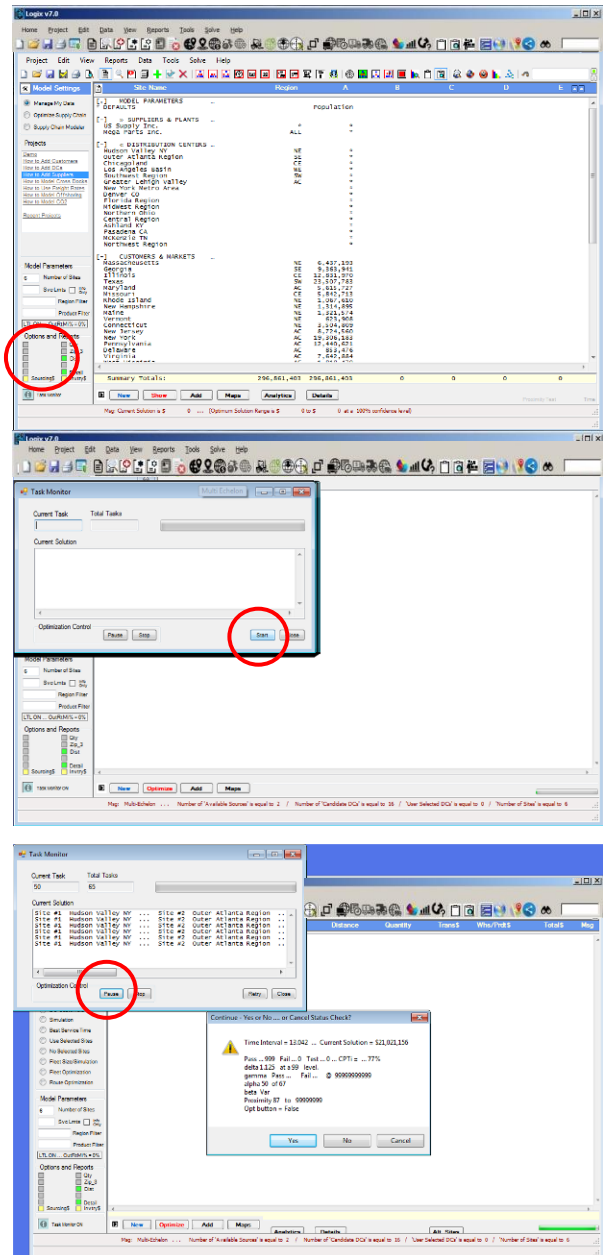
Appendix D – Display and Optimization Parameters

Logix 7.0 provides an easy to use display and modeling parameter screen that the user can access from Tools\Display Parameters or by pressing the Display Parameters icon from the menu.

The Display and Optimization Parameters screen has several tabs that allow the user to control the appearance and functionality of the Logix optimization, reporting and output display including:

- Options
- Network Optimization
- Transportation Optimization
- Rates and Distances
- Geocoding

D.1 Options

The Options screen allows the user to tailor Logix' map and reporting displays or use several Copy/Paste capabilities that make data editing in Logix much simpler.

Display Options – as shown.

ProLogix AI Filter – as shown.

Select Low, Average, Medium or High Impact to view (maps and reports) only those customers with lower, average or higher cost/service than the average. Zero in on those customers requiring attention.
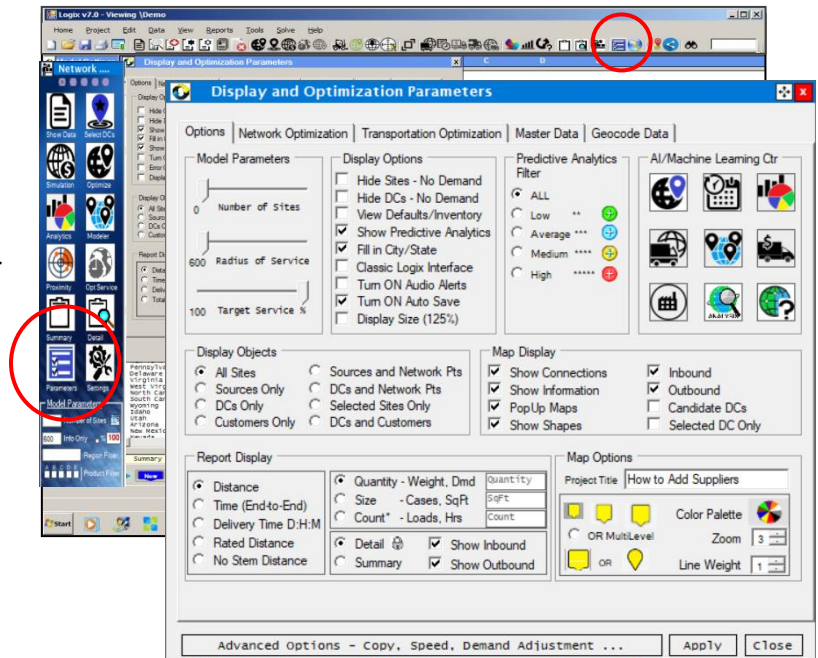
Copy/Paste Options (this has been moved to the Edit pull down menu from the Logix toolbar)

- Copy Region Code* – enter an appropriate "Region Code" and click button to copy the Region to all 'selected' or highlighted sites. (also in the What-If pop up screen).
- Copy Product/Trans Data* highlight any site and copy Product/Trans Data from that site to all "selected" sites.
- Copy Entire Site Record
- Copy Lat/Long Data

You first need to highlight the beginning and end of the range of records you wish to copy to or select them using the Select icon from the menu or select individual records.

Display Objects

Click on the appropriate display objects to show only those objects or records in the Site Listing as well as the corresponding map display.

Map Display and Map Options

Turn ON and OFF map connections, information captions, inbound or outbound map displays. Candidate DCs will show the candidates as well as the optimum DCs in a solution.
Select map icon size or choose Multi-Level to display map icons corresponding to the demand quantity.
Click on the color wheel to change map icon colors in the solution.

Report Display

Click on the appropriate report object to show a Detail or Summary report and various report column displays. You can also turn ON and OFF Inbound and/or Outbound display. The Summary report with Show Outbound turned ON shows a Summary Report with Product Category summary details. You can also rename the Size and Count designators on this screen. Logix displays your selection in the Model Parameters screen.

D.2 Rates and Distances

Freight Rate Parameters:

- All Levels (Most Accurate) searches until it finds the most specific rate (i.e., sitename to sitename) even if it first finds a Zip to Zip rate or a Region to Sitename rate for example.
- Zip Code Match (Faster) searches for the first correct Zip to Zip rate.
- Exact Match (Fastest) only searches for Sitename to Sitename matches.
- No Rates turns OFF Freight Rate matching and uses fixed and variable transportation rates from each distribution center, intermodal facility, supplier or cross dock record or the Default record.
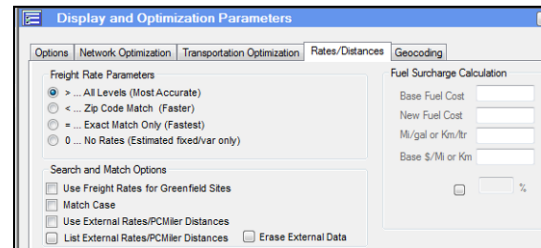
Search and Match Options:

- Use Freight Rates for Greenfield Sites. *This may result in much slower optimization speed.*
- Match Case – set to OFF by default.
- Use External Rates/Distances. Typically used to import PC Miler distances for greater accuracy.
- List External Rates/PC Miler Distances
- Erase External Data

D.3 Network Optimization

Network Options:

- Optimize Inbound AND Outbound Simultaneously
- Optimize Inbound AND Outbound Proximity
- Supplier Product Cost ON or OFF
- Direct Ship from 'Selected' Suppliers - set up selected suppliers as potential distribution sites.
- Include Only 'Selected' Customers in the Model.
- Use 'Selected' Customer Sites as Candidate DCs.

Selection Options: as shown

Service Radius: as shown.

Optimization Parameters:

- Opt Iterations – Used in optimization algorithm.
- Proximity Limit – maximum mi/km from Proximity Site. Used with Proximity Optimization.
- Target Svc% - Used in Best Service optimization. Do not enter % sign. (example, 95 for 95%)
- PreSort Off, A - Greenfield only, B - for large problems, presort all DCs for a 'best fit' solution.

Capacity Parameters (ON or OFF) and overload percentage.

Greenfield Distance - Minimum distance between Greenfield Distribution Centers (automatically calculated or override by clicking on a distance in miles or kilometers).
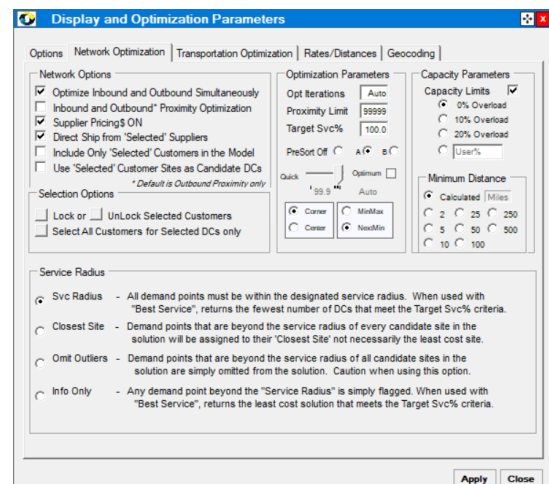
D.4 Transportation Optimization

The Transportation Optimization option in Logix supports a route estimate as well as a route optimization algorithm. You can control the optimization algorithm using these parameters. You can set the following parameters most of which have a context for both route estimation as well as route optimization unless noted.

Routing Options:

- **Optimize Depot and/or Mode**: This option is used in Route Optimization only. Selecting this option allows Logix to optimize the appropriate distribution center assignment and/or mode regardless of the assignment you designated using the DC and stop region codes.

- **Save Opt Rte-Seq/Depot Data**: By default, this option is turned ON so that the optimum Route designation and Sequence as well as Depot Assignment (if Optimize Depot Assignment is switched on) is stored in each Customer/Stop record AFTER route optimization. This allows you to modify any optimum route after optimization.   Logix will overwrite your entry of Route and Sequence and Route Simulation will return the optimum routes and schedules in this case. If you do not want to overwrite your Route and Sequence data entry or edit any optimized routes, SWITCH THIS OPTION OFF.

- **Mix Pickups and Deliveries**: Logix by default will not mix pickups and deliveries on the same route although backhauls can be optimized onto either pickup or delivery routes. Switching this option ON allows Logix to mix pickups and deliveries on the same route in the optimum sequence without violating vehicle load restrictions.

- **Insert Stops on Existing Routes**: Switch ON to use the Stop insertion algorithm.
- **Consolidate or Split Loads**: Split oversized Loads or consolidate loads prior to Route Optimization.
- **Ignore Time Violations**: Switch ON to ignore any Time Windows you have entered for each Stop.
- **Driver/Vehicle Schedule**: On by default, you can turn off the scheduling algorithm.
- **Commodity Restrictions**: Only the same Commodity Type (or blank) are allowed on the same route.
- **Vehicle Type Restrictions:** Only the same Vehicle Type (or blank) are allowed on the same route.
- **Fixed Ship/Due Dates:** Uses the Earliest Date as the Ship Date and the Latest Date as the Due Date.

Routing Constraints:

- **Max Wait Time/ Stop (mn):** Maximum wait time at any stop between arrival and open time of the stop.
- **Max Wait Time/ Rte (mn):** Maximum total wait time per route.
- **Max Layovers/Rte:** Maximum number of layovers per route. This is used for Single Drivers only.
- **Max mi/km between Stops:** Used to limit distance traveled between stops on a route.
- **Max Time per Route (Hrs):** Used to limit the number of total hours per route.
- **Hours of Service Regulations**
  - Max Work Time, Max Drive Time and Required Off-Duty Time in hours per DOT regulations.
  - Rest Break After in hours
  - Rest Break Time in minutes

Optimization Parameters:

- **Out of Route Mileage %:** Allows you to specify to Logix what additional distance the algorithm will alow to pickup or deliver a particular stop.   For example, in the Transport Optimization algorithm, an Out of Route Mileage % of 15% will not allow a route to go further than an additional 15% off route for any stop.   In the Fleet Deployment algorithm, this factor is used to estimate the reduction in distance from multi-stop routes so that the distance is reduced by one-half the Out of Route Mileage factor in combining any two points.

- **Adjusted Load Factor**: Adjust the load factor for the Transportation Optimization algorithm. The algorithm will adjust its costs and number of projected vehicles requirements based on this factor. The default is 100%. Do not enter a percentage symbol.
- **Min Time btwn Stops (mn)**: Enter a minimum drive time between stops in minutes or leave at 0.
- **Time Window Allowance**: Opens up the Earliest Pickup/Delivery time by the minutes entered.
- **Early Pickup/Delivery Days**: Opens up the Earliest Due Date by the number of days entered.
- **One Way Adjustment**: Used with the "One-Way" algorithm. Default is set at 5% (0.05).
- **Average Load Factor %:** Display only. Shows calculated vehicle utilization in weight/vehicle capacity from the "Route Optimization" process.

Routing Parameters

- **LTL (prorated).** Logix will prorate the computed transportation cost by the ratio of the Quantity to the Ship Unit for any calculation so that the cost will be Quantity/Ship Unit * rate. This is especially helpful if the quantity is an annual or summarized figure.
- **FTL (non-prorated).** Logix will not prorate the computed transportation cost and will assume that the transportation calculation is for a full truckload at this rate. Generally used for Route Optimization.
- **Consolidated LTL/FT**. Logix searches rates for the appropriate consolidated weight group.
- **Rnd Trip or One Way**: If the routes return to the depot (distribution center) click on Rnd Trip. If not, click on One Way.

Vehicle Parameters

- **Allow Overloads/Do Not Allow Overloads**
- **Vehicle Capacity**: Enter one of these factors only if you do not provide any Vehicle Records.

Display Options

- **Surrounding Stops**: Switch ON to show on the map other surrounding stops NOT on the route which you have selected for display.
- **Route Display ON**: Switch ON to display on the map ALL Routes or OFF to display only selected route.

Date Format: Either MM/DD/YYYY or DD/MM/YYYY

D.5 Geocoding

- Geocode Database (Region). Select
  - USA 3-Digit Zip/Global Cities (default)
  - USA 5-Digit Zip Codes
  - Any other displayed option
- Geocode Database (Search). Users can step through the active Geocode Database one entry at a time or search for a particular City, Postal Code or Country as well as plot the location on Google Maps.

D.6 Instantly Display Reports and Manifests

Logix 8.1 lets you instantly display any Simulation, Optimization or Transportation solution after you have run the appropriate model. These reports are available to you at any time until you run another Simulation or Optimization which will overwrite the previous report unless you have "saved" the report using your own naming convention to a folder you wish to use.

The reports are "Pop Up" displays in MicroSoft Notebook allowing you to display, modify and save any summary or detailed level results from Logix. You can also import any simulation, optimization or transportation solution directly into Excel using these "comma-delimited text" files which are automatically saved in the c:/LSTemp folder under the names "LS_SimDesign.txt" or "LS_OptDesign.txt" for the detailed simulation and optimization results, "LS_Simulation.txt" and "LS_Optimization.txt" for the summary level reports.

The reports are also available from the Transportation Optimization solution and are named LS_SimRoutes.txt, LS_OptRoutes.txt and LS_Maniftest.txt.

To instantly access the reports, just press the appropriate clipboard icon to show:

 Simulation or Optimization Summary Report

 Simulation or Optimization Detailed Report

 Detailed Truck Manifest Report

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- *Transportation Resource Scheduling and Execution*

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