LOCOMOTION

Locomotion Network Solver

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Introduction to the System

The Locomotion Network Solver was developed by Locomotion Incorporated for Union Pacific's Operations and Network Planning department. This software can optimize networks, offer cost-saving capacity changes, and provide a wealth of information concerning the networks. The system also provides an interactive map to allow easy editing of any network.

Using the Manual

This manual explains how to use the Locomotion Network Solver to carry out the functions described above. The manual uses screenshots of the software to show how to use the system. The information in the manual can also be found by clicking on the Help tab in the application.

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Getting Started

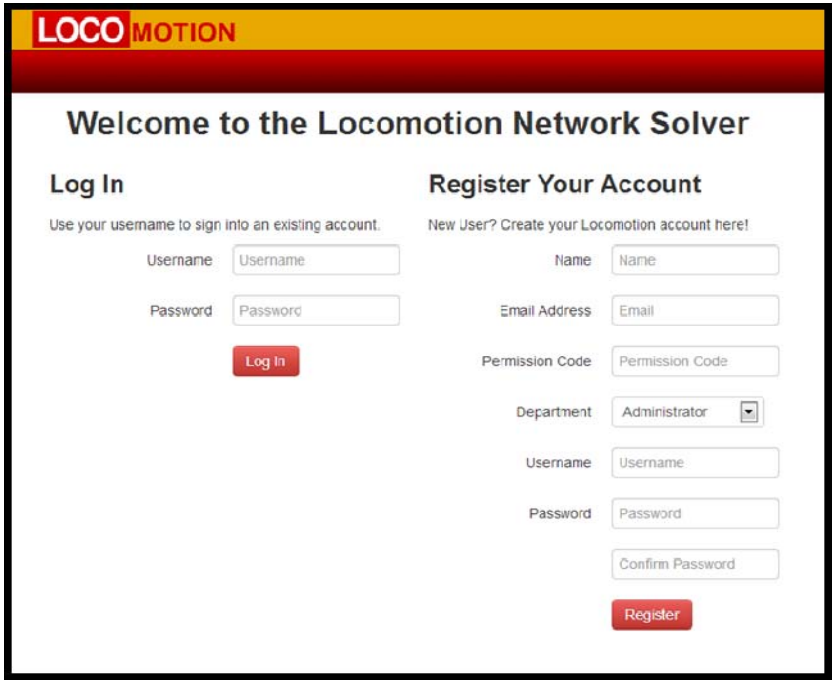
Typical use of the Locomotion Network Solver involves logging in, uploading a network, editing and optimizing the network, and generating a report on the network. This section is intended to guide you through this process and explain the sections of the interface.

Actions required to move on to the next step in the sequence are in bold. The non-bold text describes features that can be found on each step.

Login

To log in, first browse to the Locomotion Network Solver website. The website URL depends on your company's deployment of the system, and needs to be obtained internally.

The first screen is a login form.



Creating a New Account

If you are a new user, you must **create an account** to proceed. You can do this by filling out the user creation form. After completing registration by pressing the Register button, you are taken to the Home tab. For more information on creating new accounts, and a description of the user account departments, see the Accounts section on page 14.

Logging in to an Existing Account

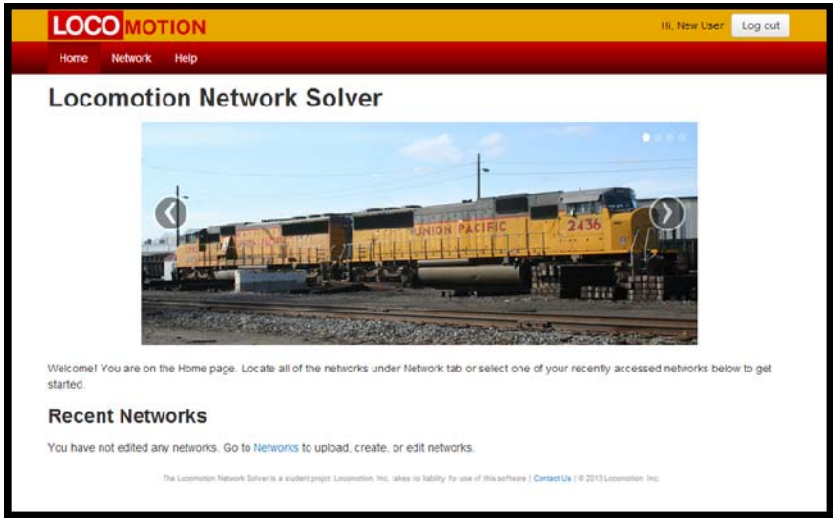
If you already have an account, you can **log in** to it using the same username and password you used to create it.

If you lose your credentials, speak to a system administrator for assistance.

For more information on the login process, see the Accounts section on page 14.

Home Tab

After you successfully log in, you are taken to the home tab. This tab shows networks you have recently edited, so you can quickly continue previous optimization sessions.



Three tabs are located on the navigation bar at the top of the screen: Home, Network, and Help. You can navigate between them at any time by clicking them. The tabs are the following:

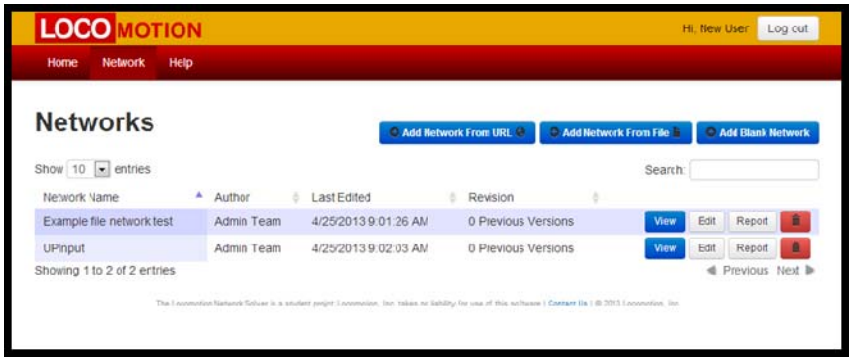
- **Home**: A central location to view recently-edited networks.
- **Network**: Where networks are uploaded, browsed, edited, and otherwise used.
- **Help**: A place to get tips and quick help about the Locomotion Network Solver.

On the right side of the navigation bar, there is a Log out button that returns you to the Login screen.

To add a new network, **click the Network button in the navigation bar** to move to the Network tab.

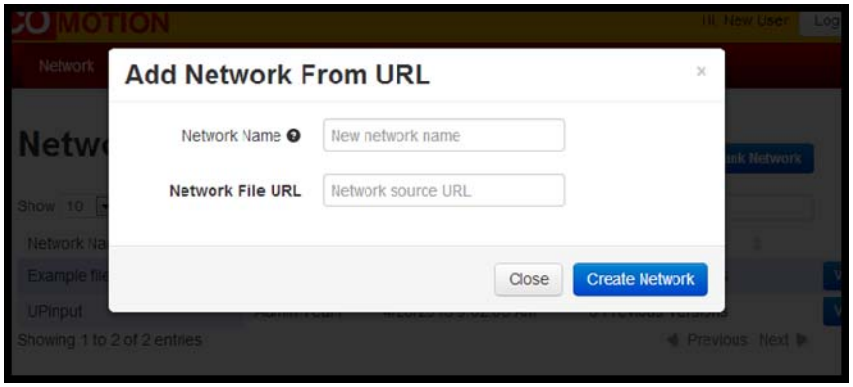
Network Tab

This tab allows you to browse all networks that have been uploaded to the Locomotion Network Solver. You can also create new networks here. For more information about networks, see the Networks section on page 17.



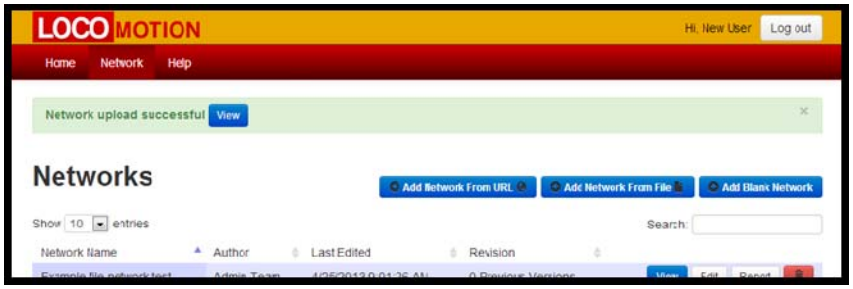
To begin uploading a new network, first identify your data source. Locomotion Network Solver can parse XML files uploaded from your hard drive, parse networks from a web address (URL), and create blank networks for experimentation.

Once you have determined which of these categories your network falls under, **click on the corresponding button**. A modal dialog will appear, similar to the following one.



Then, name the new network, fill out other necessary fields for your selection, and press the Create Network button. For more information on network creation, see the Adding a Network section on page 17.

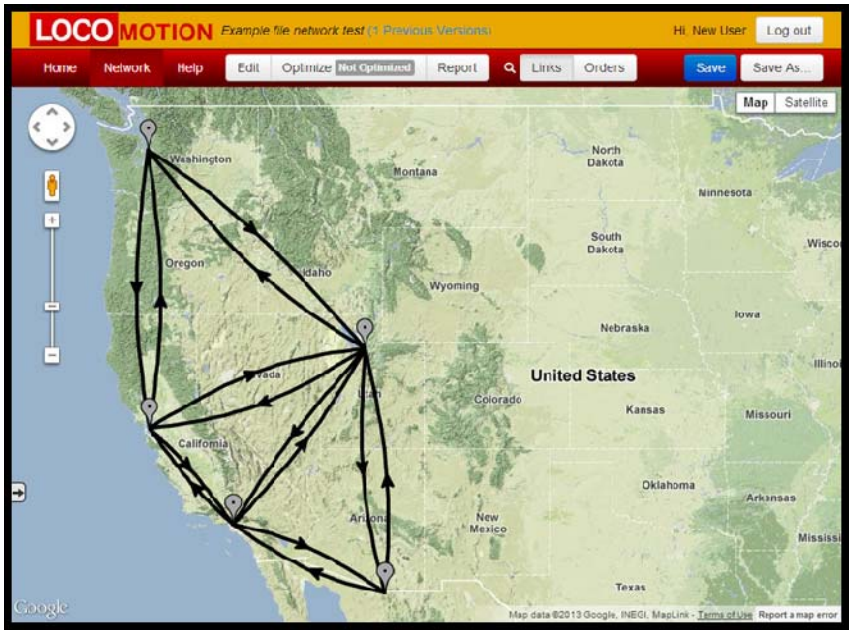
After creating a new network, a message appears near the top of the screen, indicating success or failure of network upload.



If network upload succeeded, you can **click the View button to quickly go to the network viewing page**.

Viewing a Network

In the network view page, you can look at and operate on any network that has been uploaded to the Locomotion Network Solver.



Five new buttons are located on the navigation bar on the top of the screen: Edit, Optimize, Report, Links, Orders, Save, and Save As.

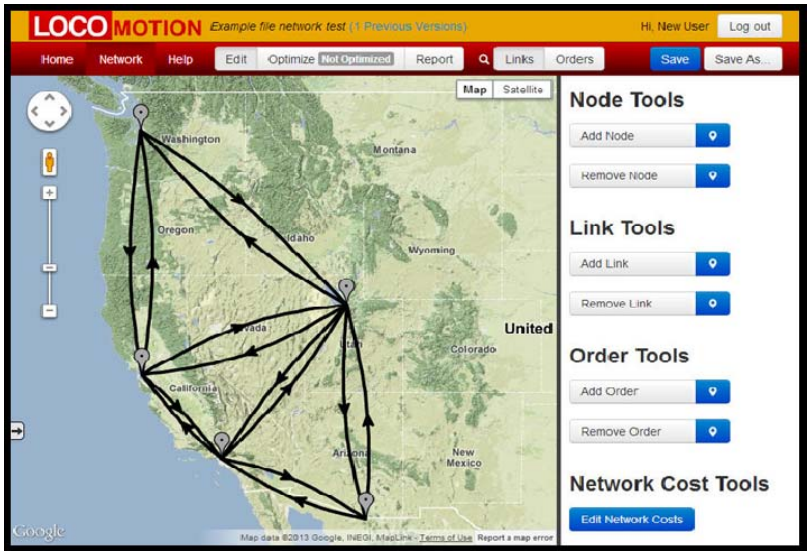
The first group of three buttons open sidebars that can be used to edit (Edit), optimize (Optimize), and view reports on the network (Report). Switch between sidebars by clicking on any of these three buttons at any time while viewing a network.

The Links and Orders buttons switch what is displayed on the screen. When the Links button is selected, the map shows links on the map. When the Orders button is selected, the map shows orders on the map.

The Save and Save As buttons work as they usually do for desktop applications. For more information about network saving and versioning, see the Saving Your Changes section on page 19.

Editing the Network

To start editing a network, click the Edit button to expand the edit sidebar.

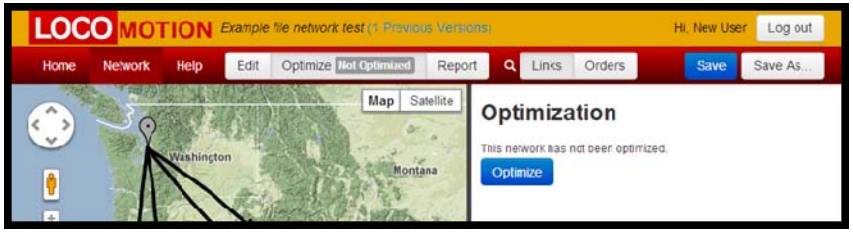


In the edit toolbar, the top two buttons allow you to add and remove nodes. The next two buttons can be used to add and remove links. The last two can be used to add and remove orders. The Edit Network Costs button allows you to edit network-wide information such as fuel cost and the maximum number of cars per train. The Links and Orders tabs allow you to view and edit links or orders when selected.

For more information on network editing, see the Networks section on page 17, the Nodes section on page 22, the Links section on page 24, and the Orders section on page 26.

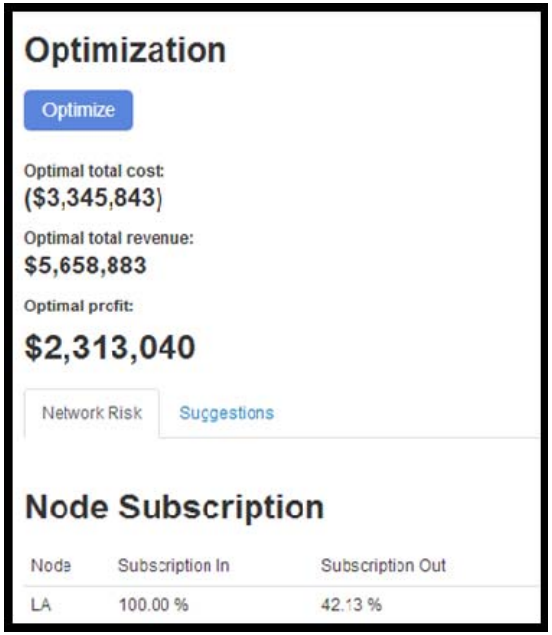
Optimizing the Network

To find the optimal routes that fulfill all orders on the current network, **open the Optimize sidebar by clicking the Optimize button in the navigation bar**.



If the network has not been optimized, **optimize it by clicking the blue Optimize button in the sidebar**.

After the network is optimized, the sidebar changes to display information that can be used to further improve the effectiveness of the network.



The total cost, total revenue, and profit of the optimal network solution are shown below the Optimize button. Below are two tabs to view further optimization information and

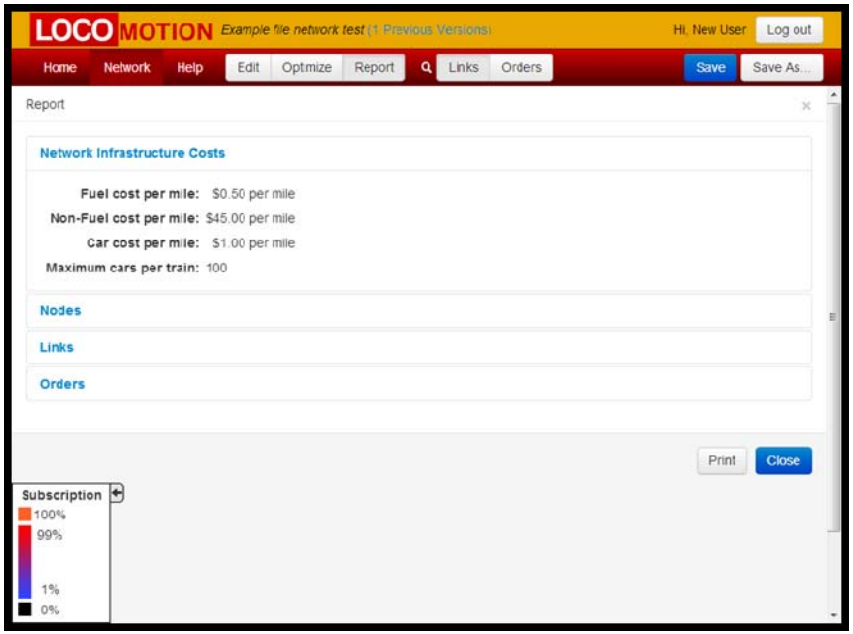
The Network Risk tab lists high-risk areas of the network for closer inspection.

The Suggestions tab contains the Locomotion Network Solver suggestion engine, which aids network operations engineers in deciding where infrastructure improvement investments would be the most effective.

For more information about the optimization sidebar, see the Network Optimization section on page 18.

Viewing a Report

To examine a comprehensive report on the network you are viewing, **click the Report button in the navigation bar**.



Report data is organized in collapsible sections. To open or close a section, click on the blue text that describes that section.

If you want to print the report, press the Print button at the bottom of the page to display all currently open sections in a printer-friendly format.

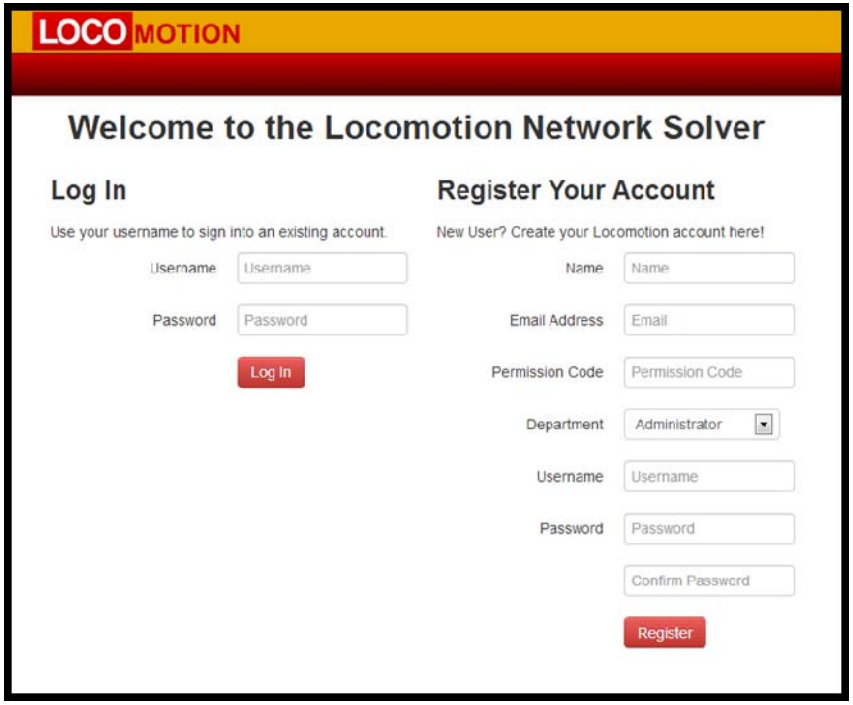
For more details on report information, see the Report section on page 27.

Accounts

The Locomotion Network Solver uses user accounts to track network authors and department permissions.

Registration

When you visit the Locomotion Network Solver, you are presented with a welcome page that has the options to log in or to create an account, as seen below:



To create a new account, you must complete the series of fields in the right column, then click the Register button.

- **Name** – Your full name, as you would like it to appear in the Locomotion Network Solver interface.
- **Email Address** – An email address that can be used to contact you.

- **Department** – Your department. This selection determines which set of actions you can perform on networks.
- **Permission Code** – A security code obtained from your network administrator, consisting of letters and numbers.
- **Username** – A memorable, unique name that will be used on subsequent logins.
- **Password** – A memorable sequence of printable or whitespace characters that is used to authenticate your identity on subsequent logins.

Default department permission settings are summarized here:

Department	Upload	View	Edit	Optimize	View Report
Operations	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Financials	**No**	**Yes**	**No**	**Yes**	**Yes**
Engineering	**No**	**Yes**	**No**	**No**	**Yes**

After registration, you will automatically be logged in and taken to the home page.

Login

To log in to an account you have already created, enter your credentials into the left column of the welcome page and click the Log In button. You will be taken to the home page after authentication.

If you lose your credentials, speak to a system administrator for assistance.

Your web browser may offer to store your password. This feature is compatible with Locomotion Network Solver, and may be used.

Network Ownership

When a network is uploaded, it refers to the user who performed the upload as its Author. After any change to a network, including

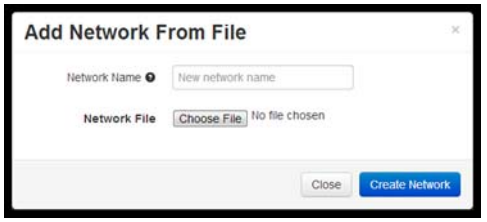
optimization, the user who performed the change is referred to as the Author of that network version.

You can view a list of previous Authors along with the previous network versions in the network version list. See the Network Versioning section on page 20 for more information.

Networks

The following functions are available under the Network tab.

Adding a Network



To add a new network, click the Add Network From File or Add Network From URL button. The dialog box below will appear.

The file must be an XML file with a specific format. For an example of this format please see the Appendix.

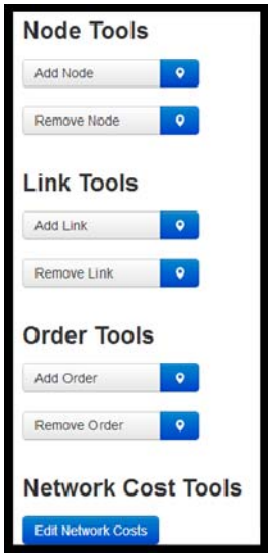
You also have the option to create a blank network to start from scratch.

Edit

To edit a network, click the Edit button.

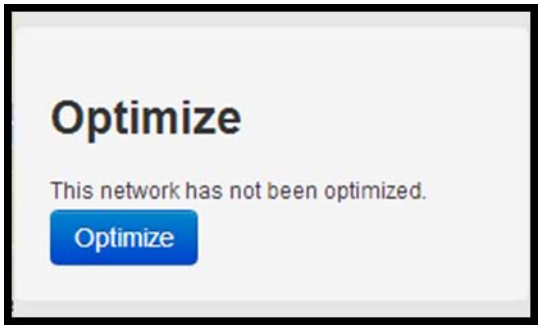
If you are not already in “View” mode you will be directed there. The toolbar shown below will appear on the right side of the screen.

For more information on editing nodes, links, and orders, please see the sections on nodes, links and orders respectively.



Optimize

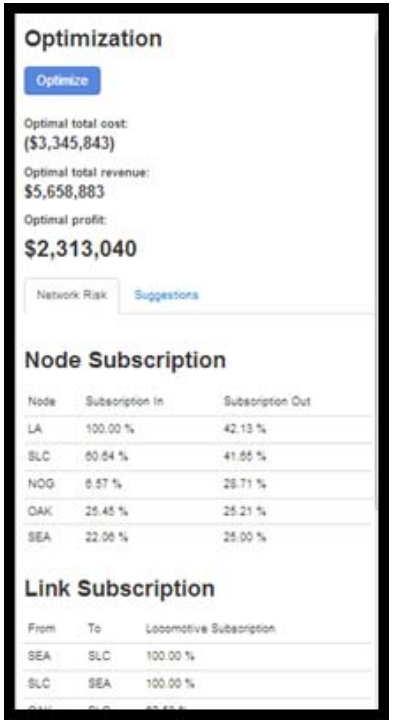
To optimize a network, click the Optimize button. If the network has not been optimized, the following message will appear on the right side of the screen.



After clicking "Optimize" information about the network optimization will appear on the side bar in a format shown below.

Network Risk & Suggestions

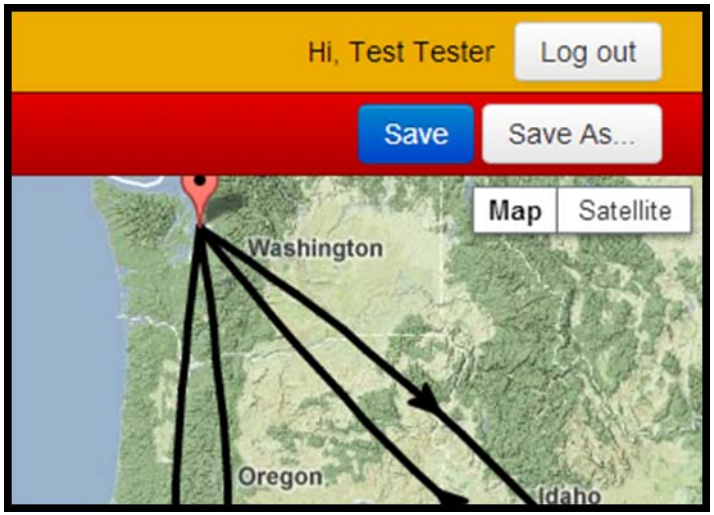
- The Network Risk tab lists high-risk areas of the network for closer inspection.
- The Suggestions tab contains the Locomotion Network Solver suggestion engine, which aids network operations engineers in deciding where infrastructure improvement investments would be the most effective.



Saving Your Changes

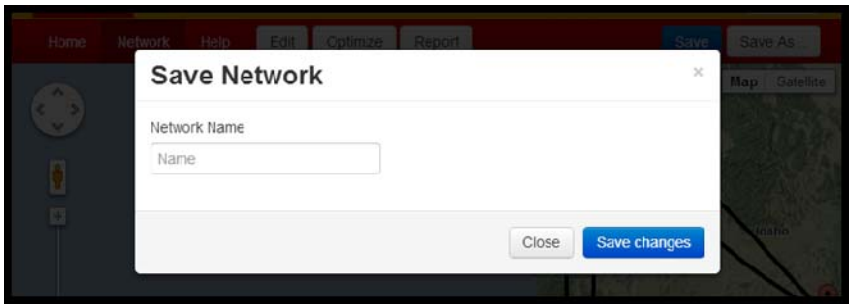
Saving networks in the Locomotion Network Solver is like using a word processor. You can Save your progress, or use Save As to create a copy with a new name.

The Save and Save As options are located while viewing a network at the top-right corner of the screen.



The Save button saves any changes you have made to the network without any further input.

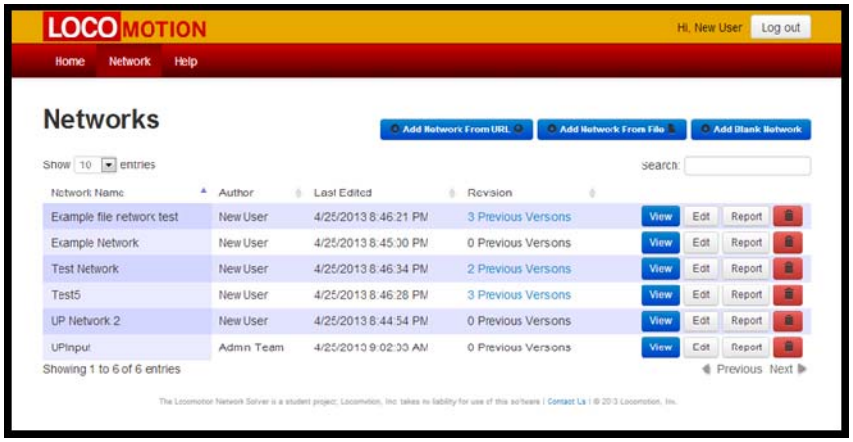
The Save As button opens a dialog box where you can input the new network name. After entering the new name, press Save Changes at the lower-right of the dialog.



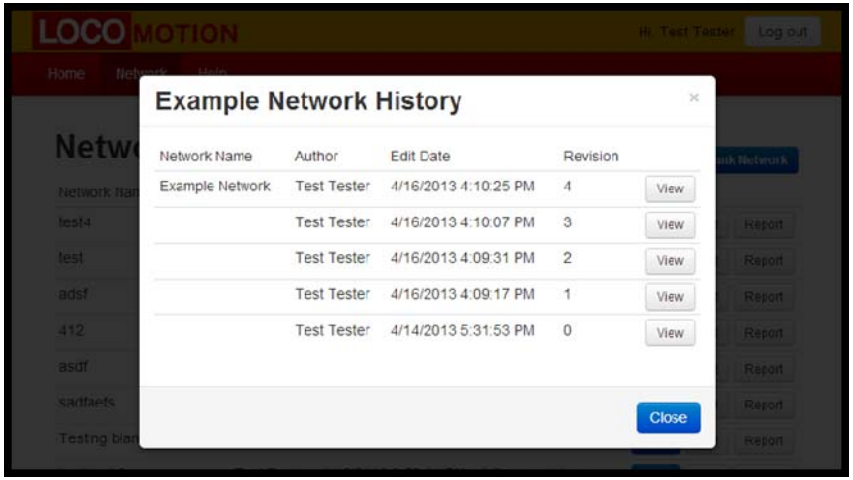
Network Versioning

The Locomotion Network Solver saves all versions of all uploaded networks, and provides easy access to all old versions.

To access the previous versions of a network, first locate the network on the Networks tab.



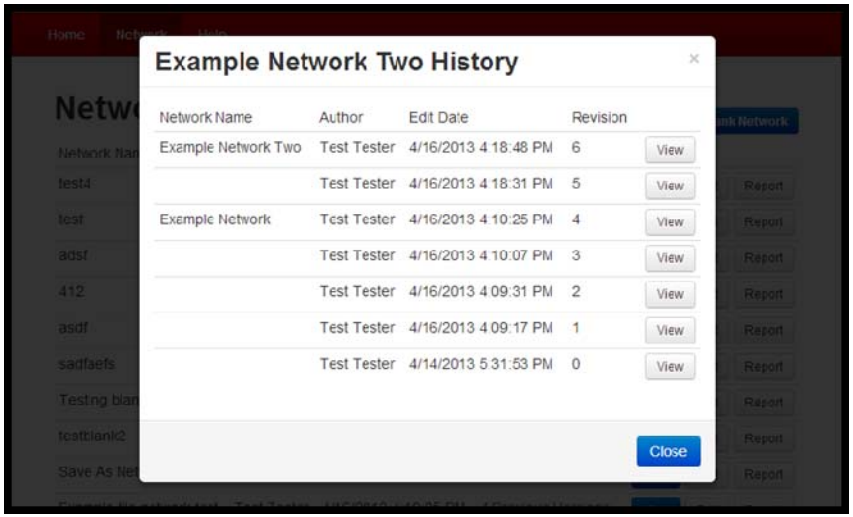
The Revision column shows how many previous versions of each network exist. Click on the blue text to open a dialog that shows detailed version information.



By clicking the View button to the right of any specific version, you can open that version.

The first column shows the name of each version of the network. If a network has had the same name since it was uploaded, this column will only show one name.

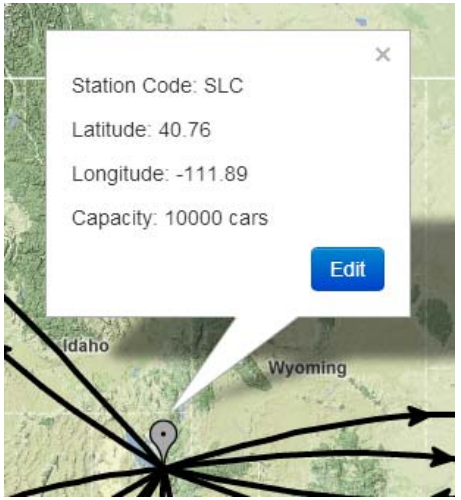
When Save As is used to create a network with a new name, the network history includes the originating network's history. In the following image, the Example Network from the previous image has been saved as Example Network Two.



With access to the complete lineage of a network, it is easy to track its origin and purpose without a complicated and long network name.

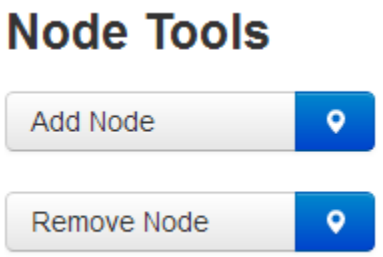
Nodes

A node is any single hub, or rail station, in the network. On the map, a node is represented by this symbol.



Right click on a node to display its information. This includes city, station code, geographic coordinates, and capacities. The image to the left shows a selected node with a box above it displaying the relevant information.

Add



To add a node, first enter “Edit” mode by clicking the Edit button. The toolbar to the right of the map will then display editing tools. If you would prefer to type out node information and coordinates and have the node automatically added to the map, click “Add Node.” Otherwise, to add a new node by clicking a map location, first click the button directly to the right of “Add Node.” This button displays a map pin.

Either option will require you to fill out a form with the remaining node information. The new node will appear on the map.

Remove

Removing a node is similar to adding one. You have the choice between adding a node via clicking the map and adding via entering known coordinates.

While in “Edit” mode, click on the button labeled with a map pin to enter node removal mode. Notice that the button remains depressed. From this point you can simply left click on a node to remove it. This will also bring up a confirmation box asking you to save the change. Now, you can continue to click on other nodes to remove them by the same process or click the map pin button again to turn off node removal mode.

A single node can also be removed by clicking the “Remove Node” button and typing in the node’s station code. Next, simply click “Save Changes” to complete the removal.

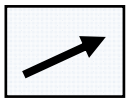
Edit

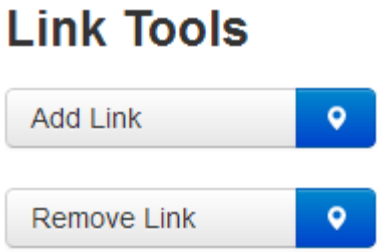
To edit the information of any node, right click on it to display the information box. Within the box there is a blue “Edit” button. Click this button to bring up a form. Make your necessary edits and then click “Save Changes.”

Links

A link is a rail path that exists between two stations (nodes).

A link is represented by a straight arrow as seen here. Links are shown on the map by default, but you can toggle between viewing links and orders. See the Orders section for more information.





Add

To add a link, enter “Edit” mode to display the toolbar on the right of the screen. To add a link between two nodes by interacting with the map, first click the map pin button then click on the origin node and finally click on the destination node. The link will be added and a box will pop up where you can fill in the remaining information for the link. To add a link by choosing the origin and destination node station codes, click on “Add Link” then fill out the necessary information in the popup box.

Remove

Removing a link can also be done in two ways. With “Edit” mode enabled, a link can be removed by map interaction or by typing in origin and destination node station codes. For map interaction link removal, first click the button just to the right of “Remove Link” that is labeled with a map pin. Then, individually click the two nodes that the link connects. Confirm this change in the pop up box that appears. If you know the origin and destination station codes of the link you wish to remove, simply click “Remove Link” and choose the station codes. Finally, click “Save Changes” to confirm the removal.

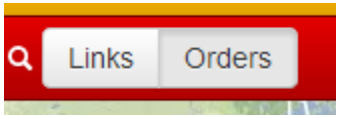
Edit

Link editing is done in the same way as node editing. First, you must click the link to view its information. Then, click the blue “Edit” button and make any necessary changes. See the Node editing section for more information.

Orders

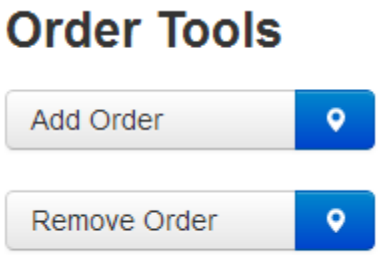
An order is a requirement that directs a certain number of trains from an origin node to a destination node.

Orders are represented on the map in the exact same way as links. To toggle between viewing links and orders, use the button pair labeled “Links” and “Orders” to switch between the two map views.



Add

Orders can be added in the same way as links. The button usage, however, some of the fields are different. Add an order by clicking the “Add Order” button to open a popup window. There you can fill out the information for the order and add it to the list of orders. The map pin button to the right allows you to interact with the map to add an order. See the Add Links section for more information.



Remove

Removing orders is done in the same way as link removal. Click “Remove Order,” or click the map pin button to the right of it if you would like to interact with the map. See Remove Link for more information.

Edit

Editing an order is done in the same way as editing a node or a link. While on the “Orders” tab, click on a particular order. Then, click the blue “Edit” button and make your necessary changes. For more information see the Node editing section.

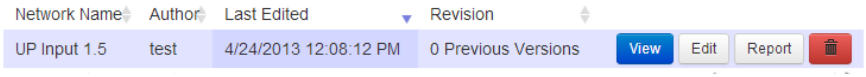
Report

The report contains information about an optimized network. This includes all the network information as well as generated information such as percent capacity for each node and link, and revenue.

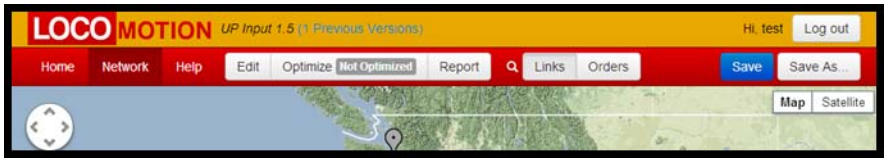
Viewing the Report

The report for a network can be viewed one of two ways.

1) When on the home or networks page, you can select the Report for a network to view the full report for the network.

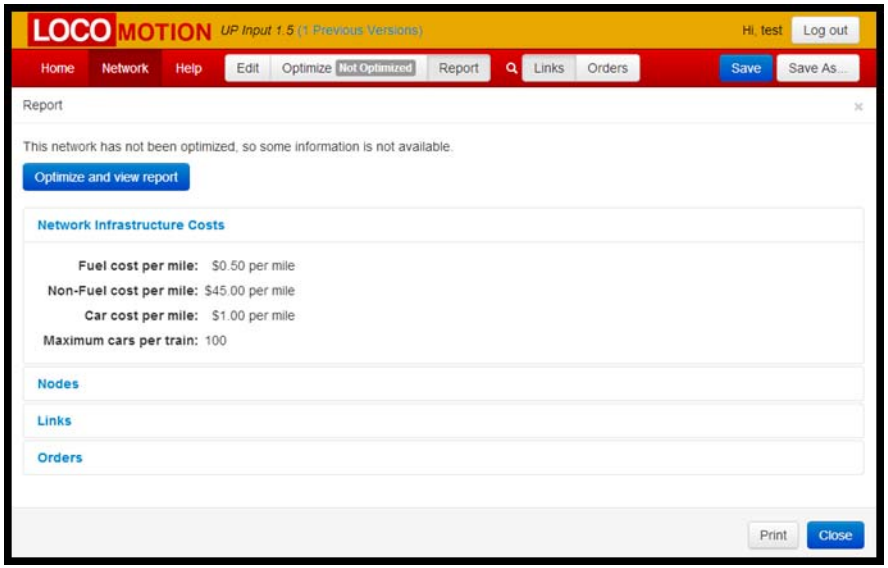


2) When viewing a specific network, you can press the Report button to view the report for the current network.



Optimizing the Network

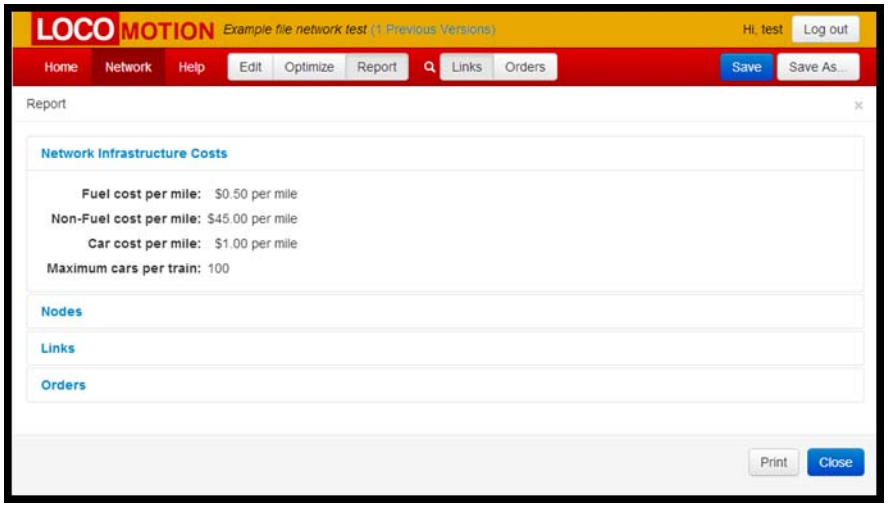
A report can only be displayed for an optimized network, so viewing the report for a network that is not optimized will show this screen.



Selecting the Optimize and view report button will optimize the network for you and display the full report.

Interpreting the Report

An example of the full report, after being optimized, can be seen below.



Selecting “Network Infrastructure Costs”, “Nodes”, “Links”, or “Orders” will toggle a dropdown section on or off.

Network Infrastructure Costs

The Infrastructure Costs section contains the following values:

- Fuel cost per mile (USD per mile)
- Non-Fuel cost per mile (USD per mile)
- Car cost per mile (USD per mile)
- Maximum cars per train (Cars)

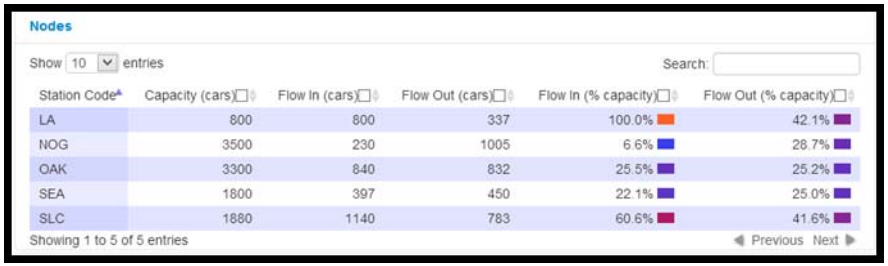
These statistics are constants that have been set for the network. An example is displayed below.

Nodes

The Nodes section of the report contains the following values:

- Capacity (Cars)
- Flow In (Cars)
- Flow Out (Cars)
- Flow In (% Capacity)
- Flow Out Percent (% Capacity)

These values are displayed for every Node in the network in tabular form. The table is dynamic, and can be sorted by any field by clicking the heading. The table can also be searched by entering a query into the search bar.



Links

The Links section of the report contains the following values:

- Distance (Miles)
- Locomotive Capacity (Locomotives)
- Active Locomotives (Locomotives)
- Locomotive Capacity Percent (% Capacity)
- Flow (Cars)
- Total Travel Cost (USD)
- Locomotive Cost (USD)
- Car Cost (USD)

These values are displayed for every Link in the network in tabular form. The table is dynamic, and can be sorted by any field by clicking the heading. The table can also be searched by entering a query into the search bar.

Links

Show 10 entries Search:

From	To	Distance (miles)	Locomotive Capacity	Active Locomotives	Locomotive Capacity (% capacity)	Flow (cars)	Total Travel Cost (USD)	Locomotive Cost (USD)	Car Cost (USD)
LA	SLC	688.45	12	0	0.0%	0	$0.00	$0.00	$0.00
LA	OAK	366.71	10	3	30.0%	297	$158,967.34	$50,055.46	$108,911.88
LA	NOG	500.33	16	1	6.3%	40	$42,778.53	$22,765.18	$20,013.35
NOG	LA	500.33	16	5	31.3%	500	$363,992.76	$113,825.91	$250,166.84
NOG	SLC	776.79	10	6	60.0%	505	$604,346.45	$212,065.01	$392,281.43
OAK	SEA	680.46	10	2	20.0%	197	$195,971.24	$61,921.47	$134,049.77
OAK	SLC	734.41	8	5	62.5%	435	$486,548.31	$167,078.85	$319,469.46
OAK	LA	366.71	10	2	20.0%	200	$106,711.64	$33,370.31	$73,341.33
SEA	OAK	680.46	10	3	30.0%	250	$262,996.13	$92,882.20	$170,113.93
SEA	SLC	841.33	2	2	100.0%	200	$244,826.16	$76,560.76	$168,265.40

Showing 1 to 10 of 14 entries Previous Next

Orders

The Orders section of the report contains the following values:

- Revenue (USD)
- Number of Cars (Cars)

These values are displayed for every Order in the network in tabular form. The table is dynamic, and can be sorted by any field by clicking the heading. The table can also be searched by entering a query into the search bar.

Orders

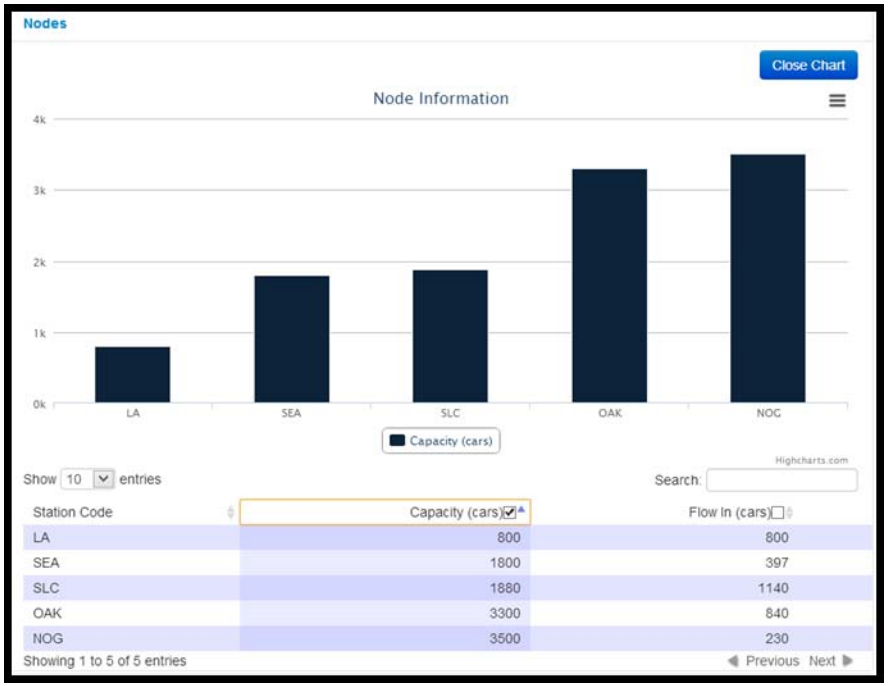
Show 10 entries Search:

From	To	Revenue (USD)	Number of Cars (cars)
NOG	SEA	$630.81	202
NOG	OAK	$57.05	298
NOG	LA	$183.38	203
NOG	SLC	$189.00	302
OAK	NOG	$3,468.00	105
OAK	LA	$1,468.00	40
OAK	SLC	$2,940.00	340
OAK	SEA	$3,405.00	105
SEA	NOG	$7,740.00	125
SEA	LA	$5,240.00	110

Showing 1 to 10 of 15 entries Previous Next

Viewing Graphical Information

To view any column of a table in graphical form, select the checkbox in the heading of the column. This will drop down a chart of the selected column. The chart can be closed by selecting the “Close Chart” button.



Combining Graphical Information

Selecting the checkbox of another heading of the table will add the column's data to the chart. This will only occur if the two columns have the same units.