Cost Modeling

WAE Design provides basic cost modeling of network plans. Costs are specified for nodes and circuits, and these can be used to approximate infrastructure costs for the network or parts of the network. This allows for quick assessments of the costs of various upgrade alternatives, as well as for greenfield build-outs.

The specified circuit costs can also be used to estimate demand and demand grouping costs. This is the cost of routing traffic between particular locations or sets of locations in the network, taking into account the amount and cost of the circuit infrastructure used. This can be used to assess the cost of a customer, a particular service, or any other defined traffic source on the network.

This section contains the following topics:

Infrastructure Costs

An Infrastructure Cost report can help you approximate the total monetary cost of a network design based on estimated costs assigned to nodes and circuits. These costs are calculated from initial costs and per-period costs, where per-period costs are amortized based on the specified number of periods and interest rates. The report gives an infrastructure cost based on sums of all node and circuit costs, as follows:

- Total initial cost—Sum of all initial costs for each object type.

- Total cost per period—Sum of all per-period costs for each object type before the amortization is applied.

- Total cost—Total initial cost + total cost per period after being amortized to a net present value.

- Total infrastructure cost—Sum of the total node and total circuit costs.

	Nodes	Circuits
Number	41	69
Total initial cost	211,603	73,148
Total cost per period	4,779	13,722
Number of periods	2	2
Interest rate (%)	3.75	3.75
Total cost	220,649	99,122

Total Infrastructure Cost 319,771

Cost Basis

Costs are based on any combination of Cost Initial and Cost Per Period properties that are assigned to nodes and circuits. A typical use case is to set nodes with an initial cost to identify the initial capital investment and to set circuit costs per period to analyze the operational cost of leasing circuits over time.

- Cost Initial—Static, one-time cost to which amortization and interest rates are not applied.

- Cost Per Period—Ongoing costs that are amortized based on the number of periods identified and on the interest rate specified when generating the Infrastructure Cost report.

You can set these properties manually. For circuits, you can also use the Cost Circuit Initializer, on page 3 to set the costs automatically based on circuit distance and capacity.

The total cost for each node and each circuit appears in its respective Cost Initial or Cost Per Period column in the Nodes table and Circuits table. The sum total of the node and circuit costs appears in the output of the Infrastructure Cost report and is used in its calculations.

An easy way to see totals—as well as average, minimum, and maximum costs—without running the report is to right-click the Cost Initial or Cost Per Period column heading.

Cost Per Period	
1244	Hide this Column
5000	Show/Hide Columns
1244	Adjust Width to Fit
5000	Save Columns settings
1244	76148 (Sum)
5000	1522.96 (Avg)
1244	0 (Min)
1244	5000 (Max)

Setting Cost Properties

You can set these properties manually, as follows.

Cost (initial):   5000

Cost (per period):

Step 1   Choose one or more nodes or one or more circuits. Right-click one of these objects and choose **Properties**, or double-click one of these objects.

Step 2   Click the appropriate tab:

- Nodes—Click the **Inventory** tab.

- Circuits—Click the **Advanced** tab.

Step 3   Enter values in the **Cost (initial)** field, **Cost (per period)** field, or both, and click **OK**.

Cost Circuit Initializer

The Cost Circuit initializer offers an automated way of setting circuit costs. For example, it lets you set realistic per-period circuit costs based on distance, capacity, or both.

The total cost for each circuit is the sum of the fixed cost plus the variable cost, where the variable cost is the result of multiplying the per-unit cost times the units selected (distance or capacity).

Set costs on (69/69) selected circuits
- ○ Set initial cost
- ● Set per period cost

Fixed ——→ Fixed cost: 200.00

       ——→ Cost varies by:
                ☐ Unit distance
Variable —— ☑ Unit capacity
       ——→ Per-unit cost: 10.25

To access this initializer, choose **Initializers > Circuit Cost**. Options are as follows:

- Set cost—Set initial or per-period cost. The options that follow are applied to the choice selected here. Because initial and per-period costs are different values that do not overwrite each other, you can set one and then run the initializer again to set the other.

- Fixed cost—A static cost that is most often used when setting initial costs.

- Variable cost—A cost based on a circuit's distance, capacity, or both. Whichever unit is selected (one or both), the value is multiplied by the "Per-unit cost" value.

    - Per-unit cost—Per-unit monetary cost.

• Unit distance—Distance Sim value of the circuit.

Example: If only "Unit Distance" is selected, if the Distance Sim is 700, and if the "Per-unit cost" is 0.50, the variable value for this circuit is 700 x 0.50 = 350.00.

• Unit capacity—Capacity Sim value of the circuit.

Example: If only "Unit Capacity" is selected, if the Capacity Sim is 400, and if the "Per-unit cost" is 0.25, the variable value for this circuit is 400 x 0.25 = 100.00.

Example: This example sets a per-period cost for a circuit that has a fixed cost of 250, a per-unit cost of 2, circuit distance of 850, and a capacity of 1000. Including all of these options in the calculation, the cost of this circuit is:

Fixed + (Per-unit Cost x Distance Sim x Capacity Sim)

250 + (2 x 850 x 1000) = 250 + 1,700,250 = 1,700,250

Set costs on (1/69) selected circuits
  ○ Set initial cost
  ● Set per period cost

Fixed cost: 250.00

Cost varies by:
  ☑ Unit distance
  ☑ Unit capacity

Per-unit cost: 2.00

Capacity Sim	Distance Sim	Cost Per Period
1000.00	850.00	1700250.00

Infrastructure Cost Report

To create an infrastructure cost report, follow these steps.

Nodes: | All
```
Amortization
    Number of periods:  2
    Interest rate (%):   3.75
```

Circuits: | All
```
Amortization
    Number of periods:  2
    Interest rate (%):   3.75
```

380850

Step 1   For any node or circuits you want included in the report, set their initial or per-period costs. For more information, see Setting Cost Properties, on page 2.

Step 2   If creating a report for selected nodes or circuits, select them before opening the report dialog box.

Step 3   Choose **Tools > Reports > Cost Analysis**.

Step 4   Nodes:

    a)   Select whether to include all nodes, selected nodes, or specifically tagged nodes.

    b)   If you are calculating per-period costs, set the number of periods and the interest rate.

        Using tags is a convenient way to determine costs for a specific region of the network or for specific customers.

Step 5   Circuits:

    a)   Select whether to include all circuits, selected circuits, or specifically tagged circuits.

    b)   If you are calculating per-period costs, set the number of periods and the interest rate.

Step 6   Click **OK**.

Example Infrastructure Cost Workflow

This example shows the generation of an Infrastructure Cost report based on a specific set of nodes and circuits, both tagged as the East Region. It sets initial costs on the nodes and per-period costs on the circuits based on their distance. The report is for 4 periods, and the interest rate is 5%.

Step 1   Set initial node costs in the node Properties dialog box.

    a)   Filter to the nodes containing the East Region tag.

    b)   In this example, there are 20 nodes with this tag. Set the 10 core nodes to an initial cost of 2000 each and the 10 edge nodes to an initial cost of 1000 each.

The Nodes table lists these costs in the Cost Initial column. Right-click this column heading to see the total Cost Initial for all of these nodes (here, 30,000). Because we are only interested in initial node costs, this is the same value that the Infrastructure Cost report shows for total initial node cost.

Node Properties

Cost (initial):	2000
Cost (per period):	0

Cost (initial):	1000
Cost (per period):	0

Step 2   Run the Latency and Distance initializer to set Distance Sim values on the circuits (**Initializers > Latency and Distance**).

Set costs on (32/50) selected circuits
◯ Set initial cost
◉ Set per period cost

Fixed cost: 0.00
Cost varies by:
☑ Unit distance
☐ Unit capacity
Per-unit cost: 2.00

Step 3   Set per-period circuit costs using the Circuit Cost initializer on circuits tagged with East Region.

a) Filter to the circuits containing the East Region tag, and select these circuits.

b) Run the Circuit Cost initializer (**Initializers > Circuit Cost**). For this example, there are no fixed costs, a per-unit cost of 2, and the initializer is only using Distance Sim.

The Circuits table lists these costs in the Cost Per Period column. Right-click this column heading to see the total Cost Per Period for all of these circuits. Here, it is 35,063.46, and this is the number that is amortized in the Infrastructure Cost report based on 4 periods with a 5% interest rate.

Nodes: Tag: East Region (20/33) ▼

Amortization

Number of periods: 1

Interest rate (%): 0

Circuits: Tag: East Region (32/50) ▼

Amortization

Number of periods: 4

Interest rate (%): 5

Step 4 Now that costs are set up for the region, generate the Infrastructure Cost report.

a) Choose **Tools > Reports > Cost Analysis**.

b) Select the East Region nodes and circuits.

c) Because there are no per-period costs for nodes, no further node options are set.

Set the circuits "Number of periods" to 4, and the "Interest rate (%)" to 5.

What to do next

The resulting report performs these calculations:

• Sums the total initial costs for all nodes tagged with East Region to determine the total node cost.

• Sums the per-period costs for all circuits tagged with East Region to determine the total per-period circuit cost.

• Amortizes the per-period circuit costs across 4 periods using a 5% interest rate to determine the total circuit cost.

• Adds the total node cost to the total circuit cost to determine the total infrastructure cost.

	Nodes	Circuits
Number	20	32
Total initial cost	30,000	0
Total cost per period	0	35,063
Number of periods	na	4
Interest rate (%)	na	5
Total cost	30,000	124,333

Total Infrastructure Cost 154,333

Demand and Demand Grouping Costs

Two estimates of the monetary costs of demands are automatically derived when you set per-period costs for circuits, as follows. These appear as the following column headings in the Demands table:

- Cost by Capacity—Total of the Cost Per Period for the circuits using the demand as routed, scaled by proportion of demand traffic to the total interface capacity.

It is divided by two to share the circuit cost between the costs of traffic in two directions.

(Sum Cost Per Period of All Circuits Using the Demand) x (Demand Utilization on the Interface / 2)

Where demand utilization on the interface = (Interface Utilization / Capacity)

- Cost by Util—Total of the Cost Per Period for the circuits using the demand as routed, scaled by proportion of demand traffic to the total traffic through the circuit.

(Sum Cost Per Period of All Circuits Using the Demand) x (Demand Utilization on the Interface) / (Sum of the Utilizations on the Two Interfaces)

Where demand utilization on the interface = (Interface Utilization / Capacity)

If there is only one demand through the circuit, the full cost of that circuit is allocated to that demand.

Demand grouping costs are calculated when you run the Demand Grouping report (**Tools > Reports > Demand Groupings**). The Cost by Capacity and Cost by Util are the sum total of the costs of the demands within the demand grouping.
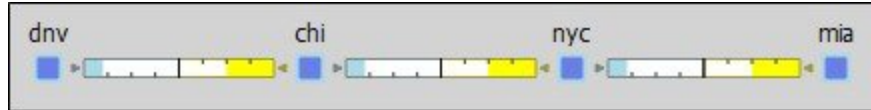
Example

This example shows four nodes connected by three circuits.

- Each circuit has 10,000 Mbps capacity.

- Each circuit has a Cost Per Period of 100.

- There are two demands:

dnv-mia has 2000 Mbps of traffic.

mia-dnv has 5000 Mbps of traffic.

• These two demands are in one demand grouping named Acme_region.

dnv	chi	nyc	mia

Circuits

Node A	Node B	Capacity Sim	Capacity	Cost Per Period
dnv	chi	10000.00	10000.00	100.00
chi	nyc	10000.00	10000.00	100.00
nyc	mia	10000.00	10000.00	100.00

Demands

Source	Destinatio	Traffic	Cost by Capacity	Cost by Util
mia	dnv	5000.00	75.00	214.29
dnv	mia	2000.00	30.00	85.71

Reports

▲ Demand Groupings

　　Demand Groupings (1)

　　Dema

Name	Traffic	Number of Demands	Cost by Capacity	Cost by Util
Acme_Region	7000....	2	105.00	300.00

The Cost by Capacity calculation is as follows:

• dnv-mia demand: $(100 + 100 + 100) \times ((2000/10{,}000)/2) = 30$

• mia-dnv demand: $(100 + 100 + 100) \times ((5000/10{,}000)/2) = 75$

• Acme_region demand grouping: $30 + 75 = 105$

The Cost by Util calculation is as follows:

• dnv-mia demand: $(100 + 100 + 100) \times 2000/(2000 + 5000) = 85.71$

• mia-dnv demand: $(100 + 100 + 100) \times 5000/(2000 + 5000) = 214.29$

• Acme_region demand grouping: $85.71 + 214.29 = 300$

Example