

In the Works: Logit Choice of Transit Strategies

Contents

- **Motivation**
- Computing logit choice of strategies
- Conclusions

Strategy-based Transit Assignment

- The optimal strategy algorithm is well understood and field tested
- Extended successfully to congested transit assignment and capacitated transit assignment
- Further extensions can provide a richer set of transit modeling features

Deterministic vs Stochastic Strategies

- Currently in an optimal strategy

All the flow at a node either

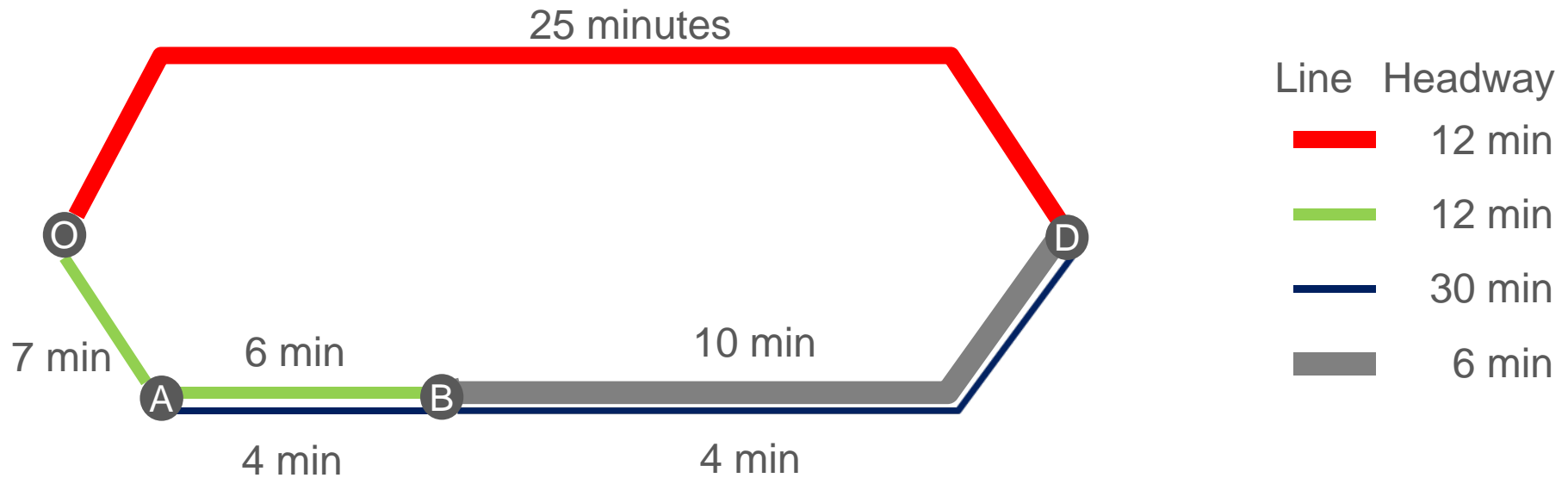
1. leaves by the best walk link, or
2. waits at the node for the first attractive line to be served

- Logit choice of strategies

A logit model can be used to distribute the flow at a node between *ride* and *walk* options:

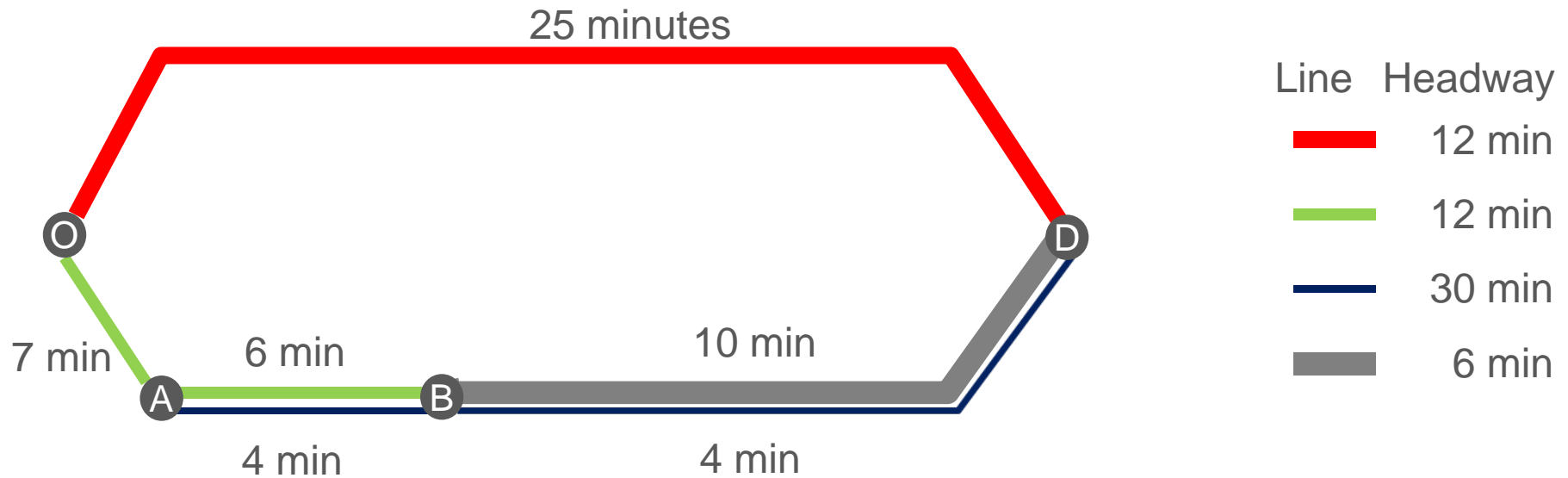
1. leaving by the best walk link or other “efficient” walk links
2. waiting at the node for the first “efficient” line to be served

Adding a Walk-to-line Option: a Small Example



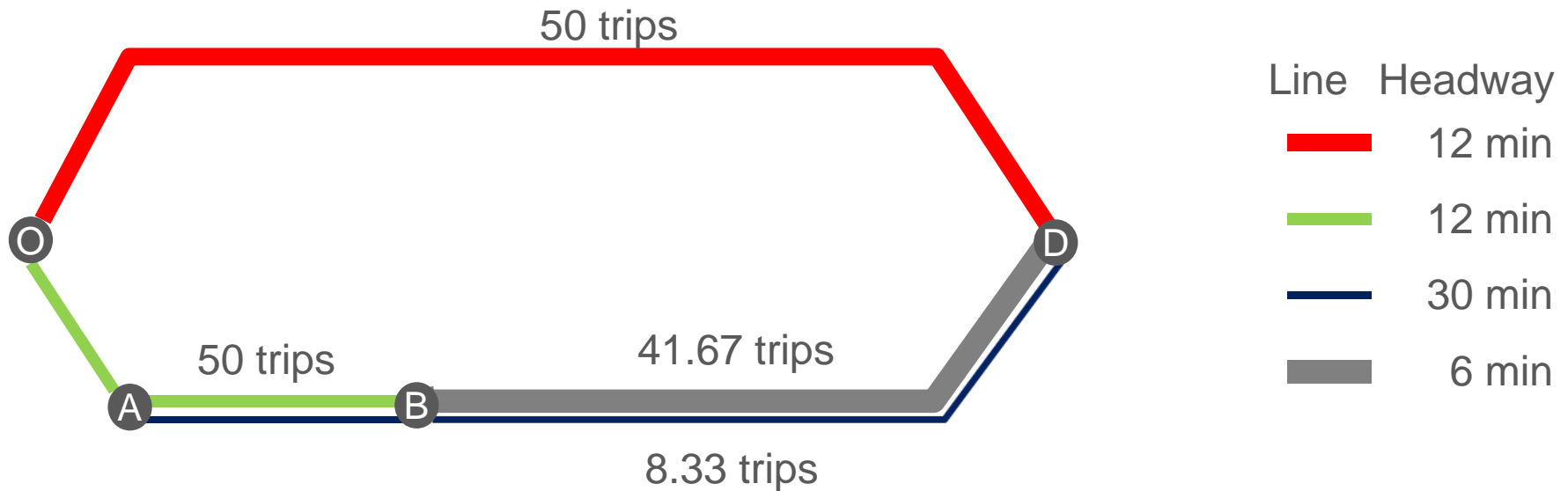
The demand from O to D is 100

Adding a Walk-to-line Option: a Small Example



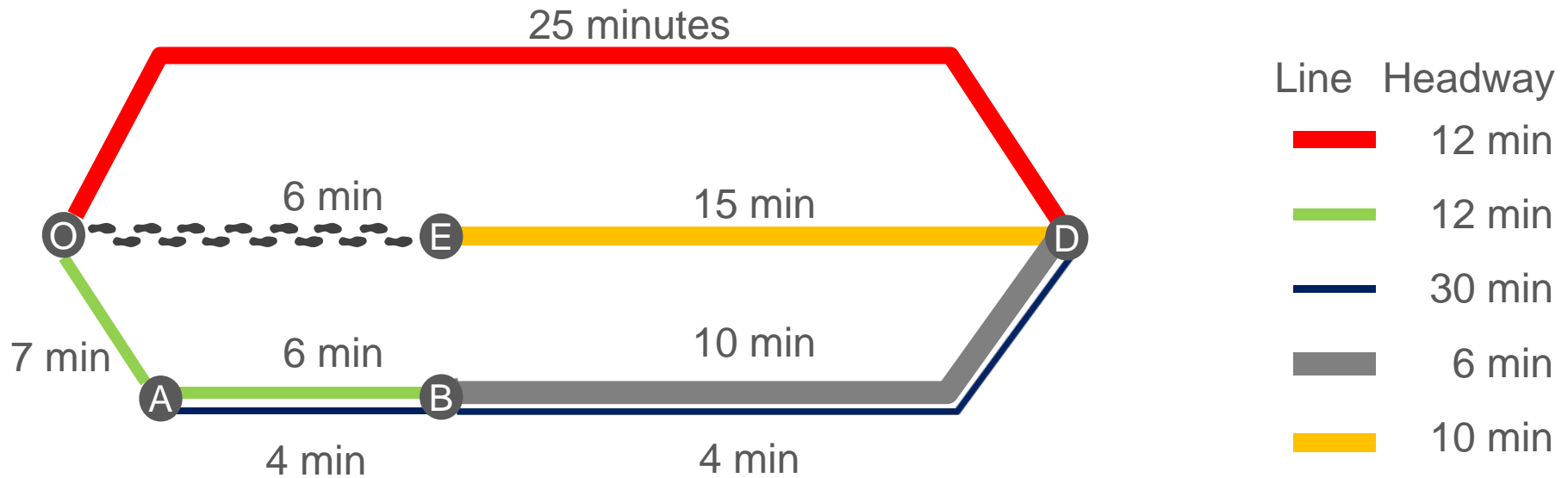
The demand from O to D is 100

The Optimal Strategy



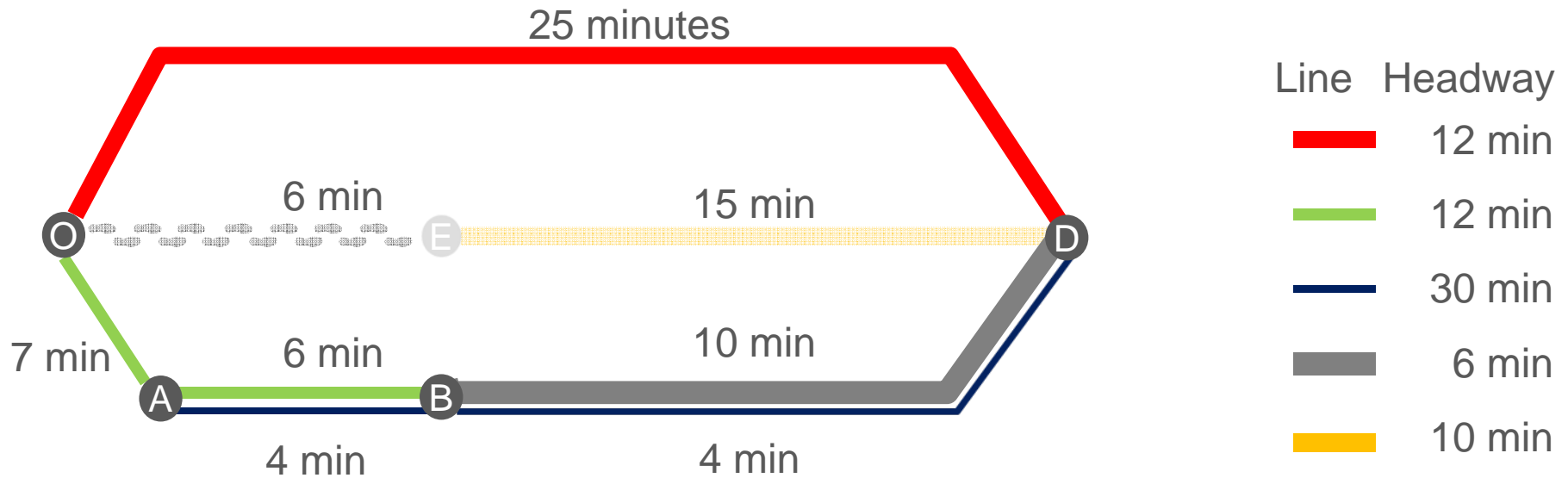
Expected travel time 27.75 min

Adding a Walk-to-transit Option



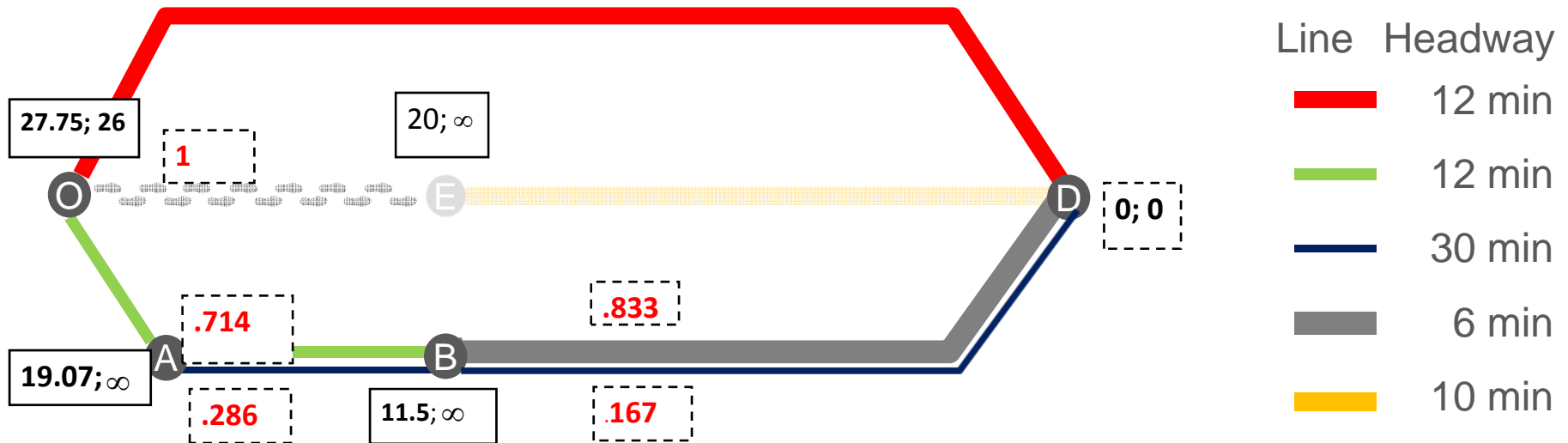
New walk to transit service

Adding a Walk-to-transit Option

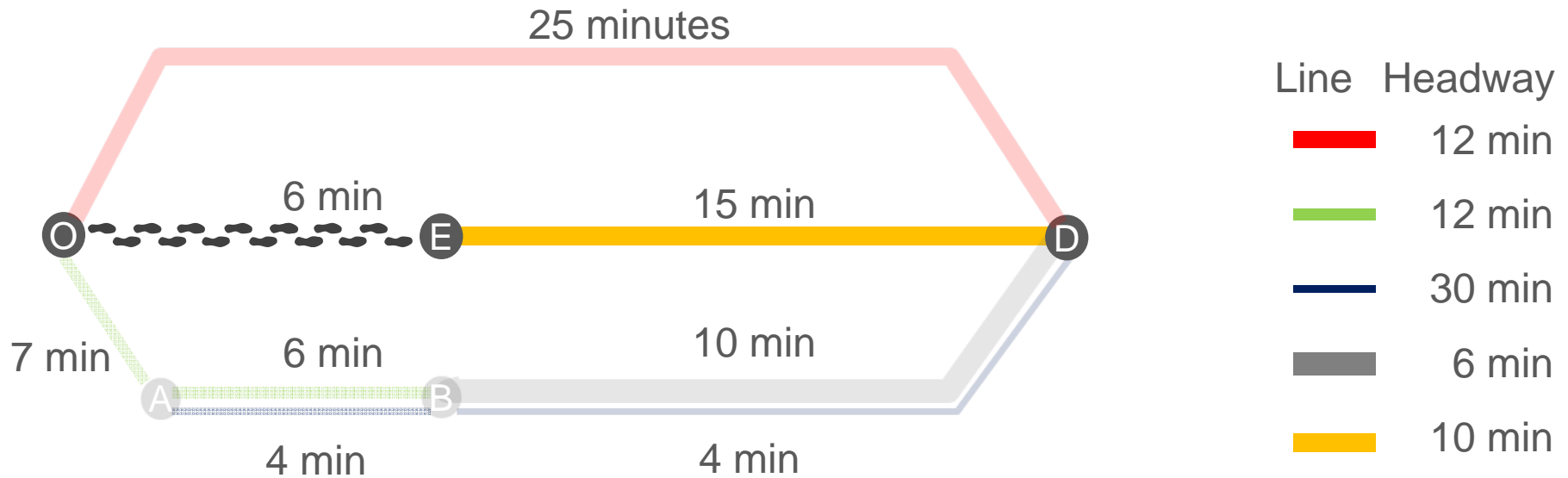


First strategy time is 27.75 min

Adding a Walk-to-transit Option

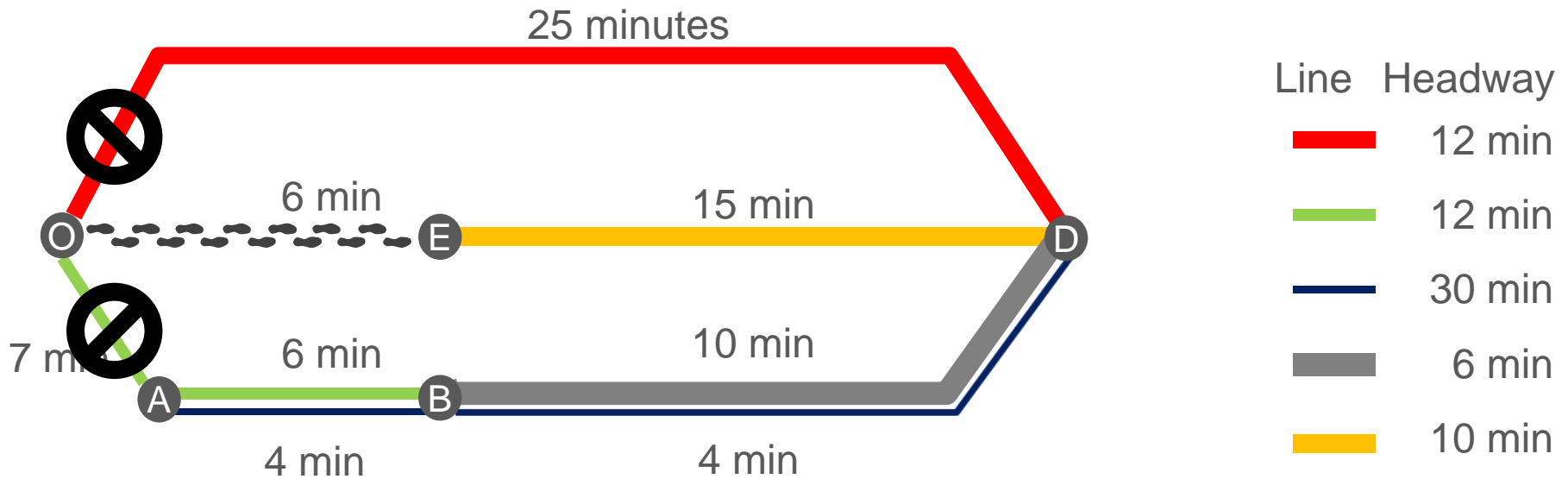


Adding a Walk-to-transit Option



Second strategy time is 26.00 min

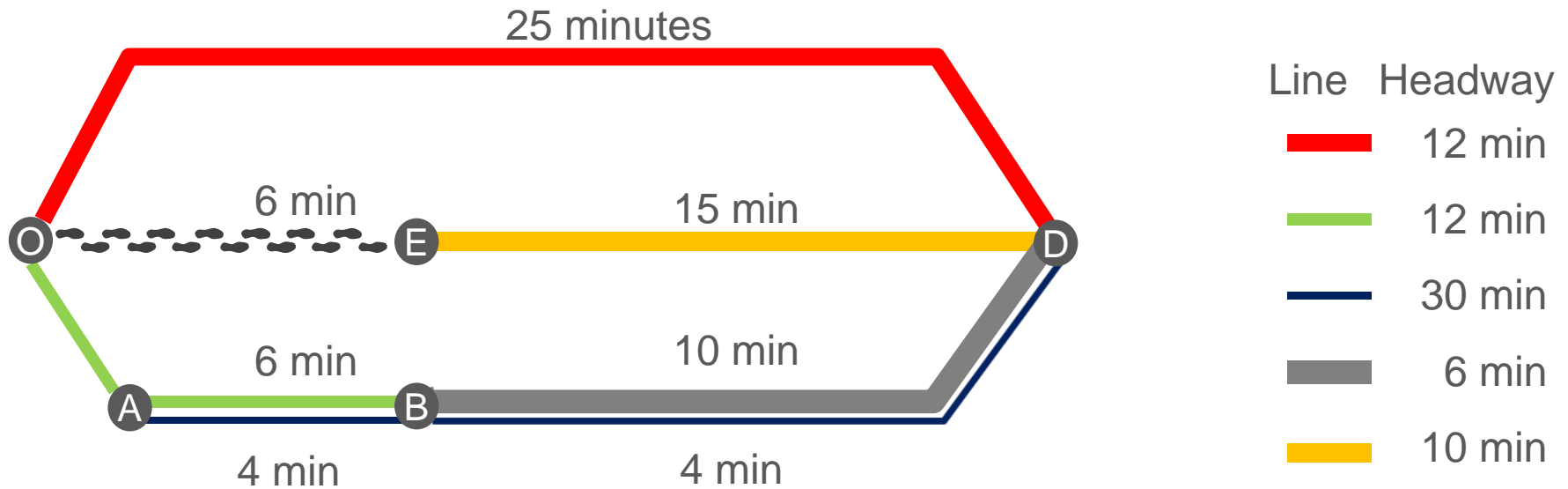
Adding a Walk-to-transit Option



New walk path is 26 min (vs 27.75 min)

Optimal strategy is to walk to the orange line

Logit Choice of Strategies



Logit choice of strategies (with scale = 0.1)

First strategy



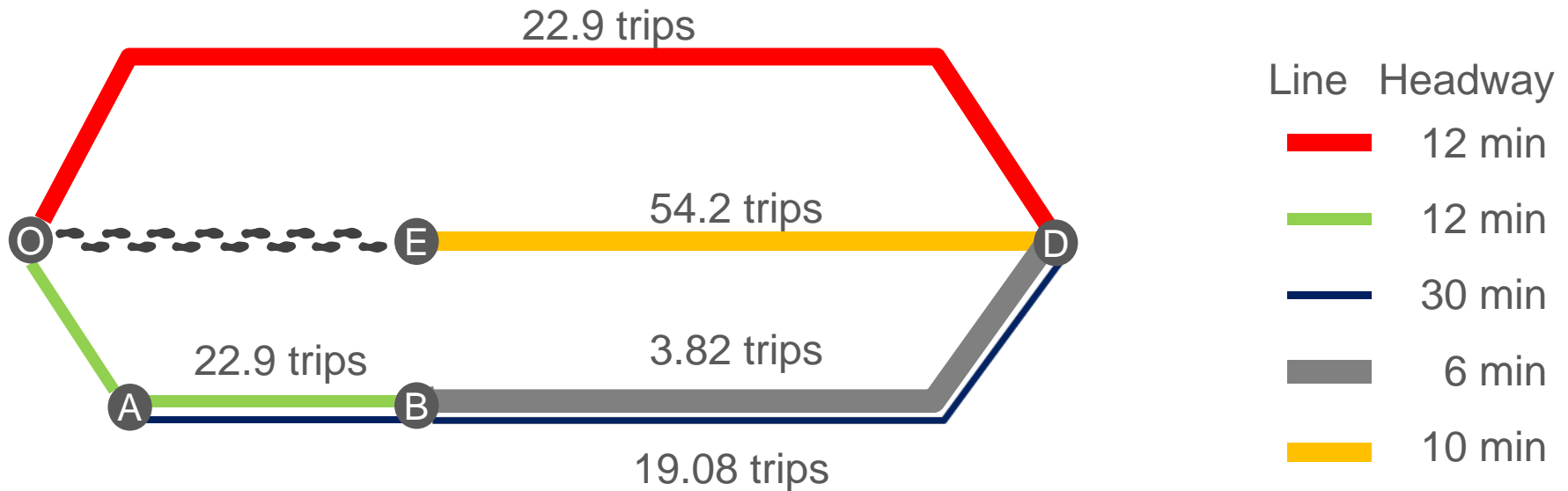
Second strategy



$$\frac{\exp(-0.1 \cdot 27.75)}{\exp(-0.1 \cdot 27.75) + \exp(-0.1 \cdot 26.0)}$$

$$\frac{\exp(-0.1 \cdot 26.0)}{\exp(-0.1 \cdot 27.75) + \exp(-0.1 \cdot 26.0)}$$

Logit Choice of Strategies



Logit choice of strategies (with scale = 0.1)

First strategy



45.8 trips

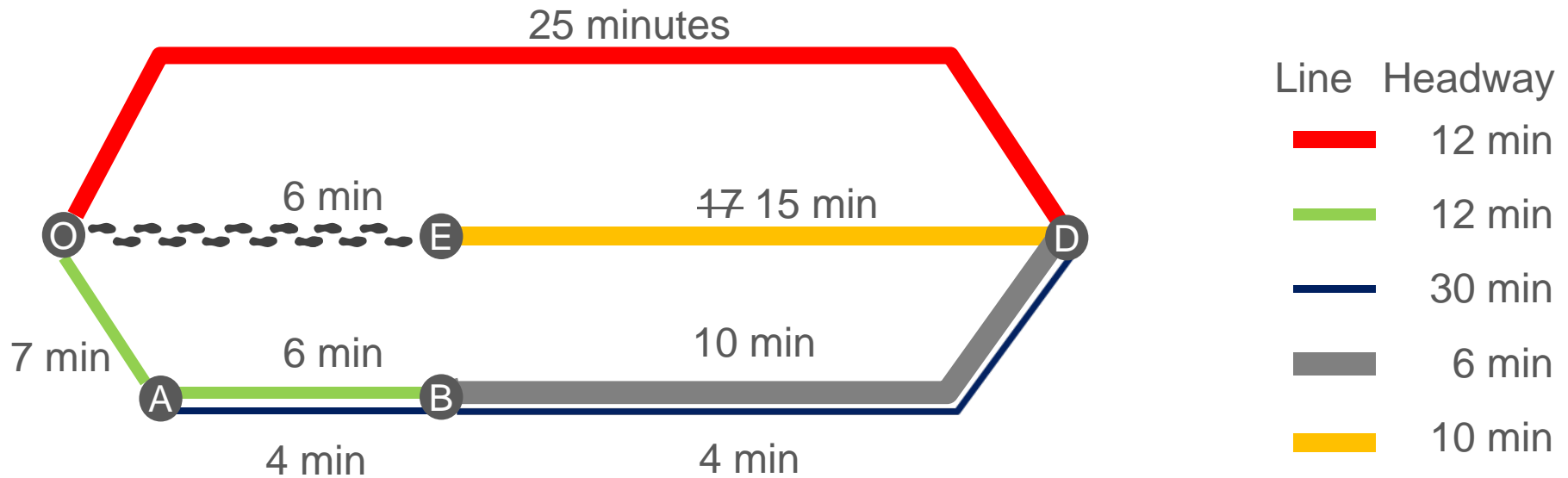
Second strategy



54.2 trips

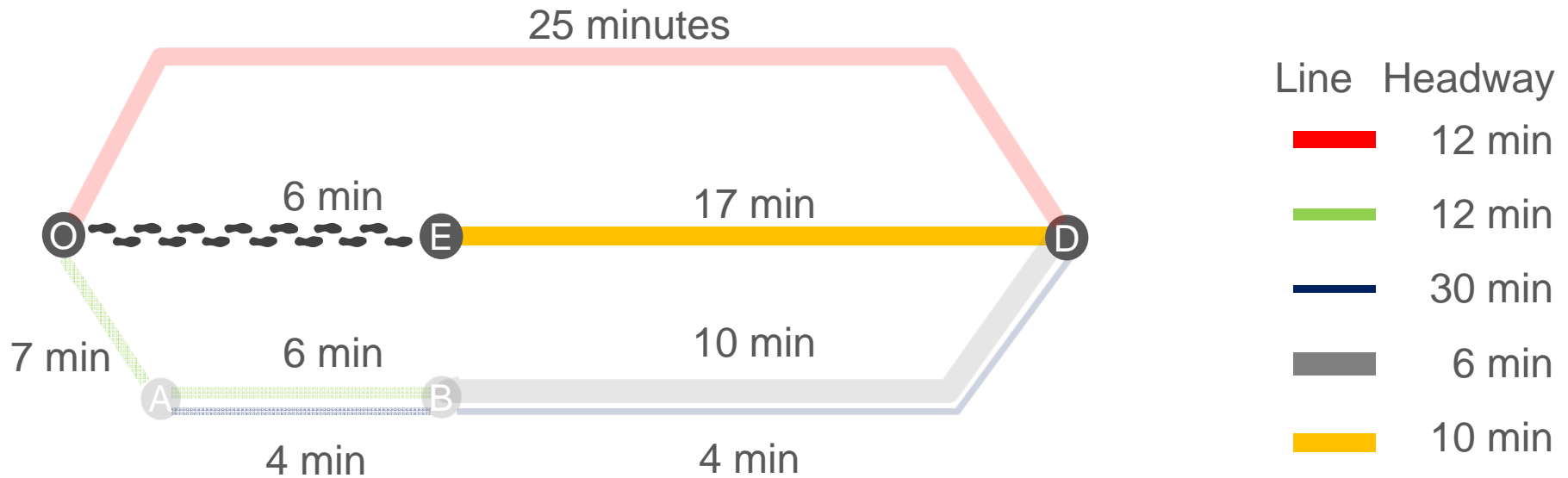
mean travel time 27.9 min

Adding a Walk-to-transit Option



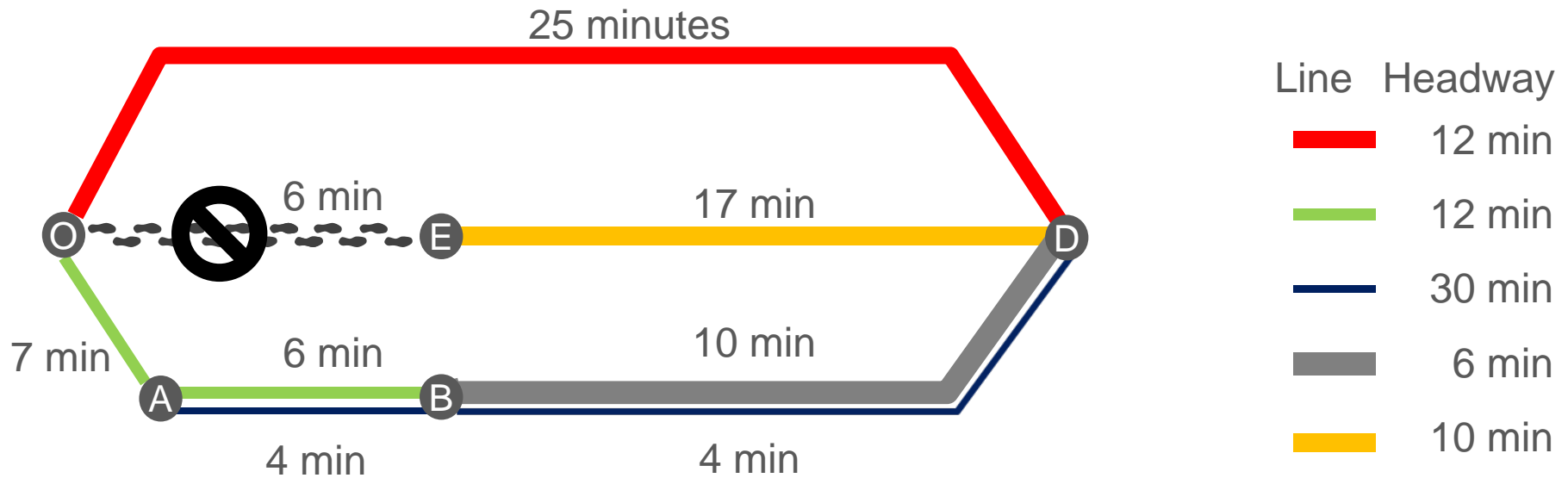
The travel time of the orange line is increased by 2 minutes to 17 minutes

Logit Choice of Strategies



Second strategy time is now 28.00 min

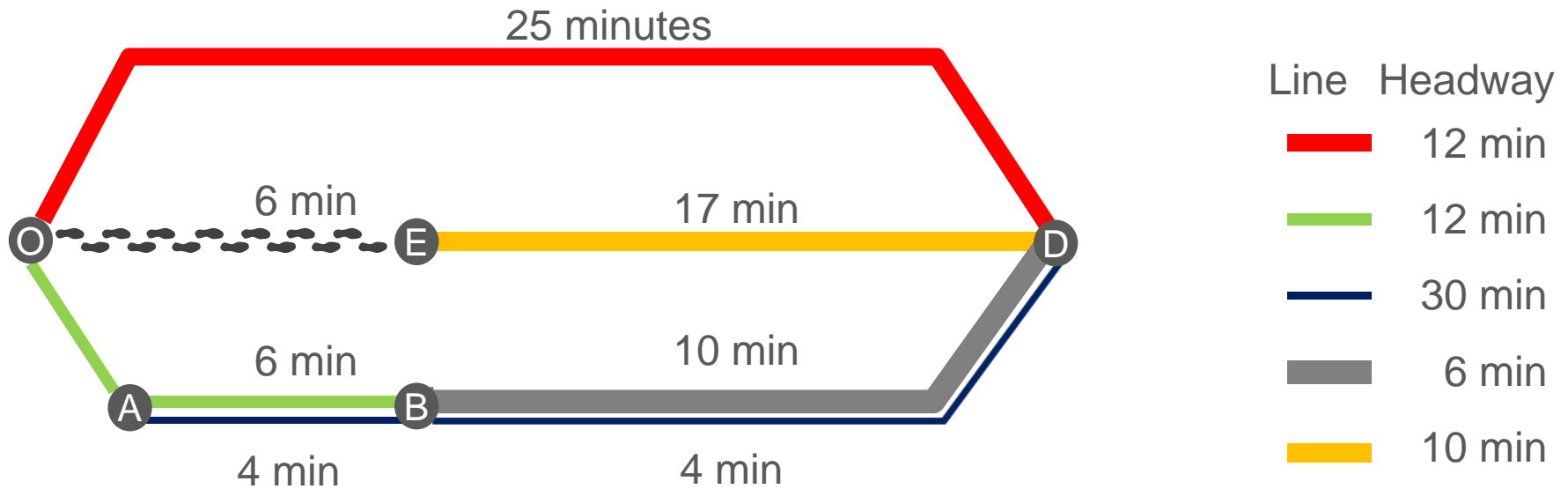
Adding a Walk-to-transit Option



New walk path is 28 min vs 27.75 min

Optimal strategy does not use the walk to the orange line

Logit Choice of Strategies



Logit choice of strategies (with scale = 0.1)

First strategy



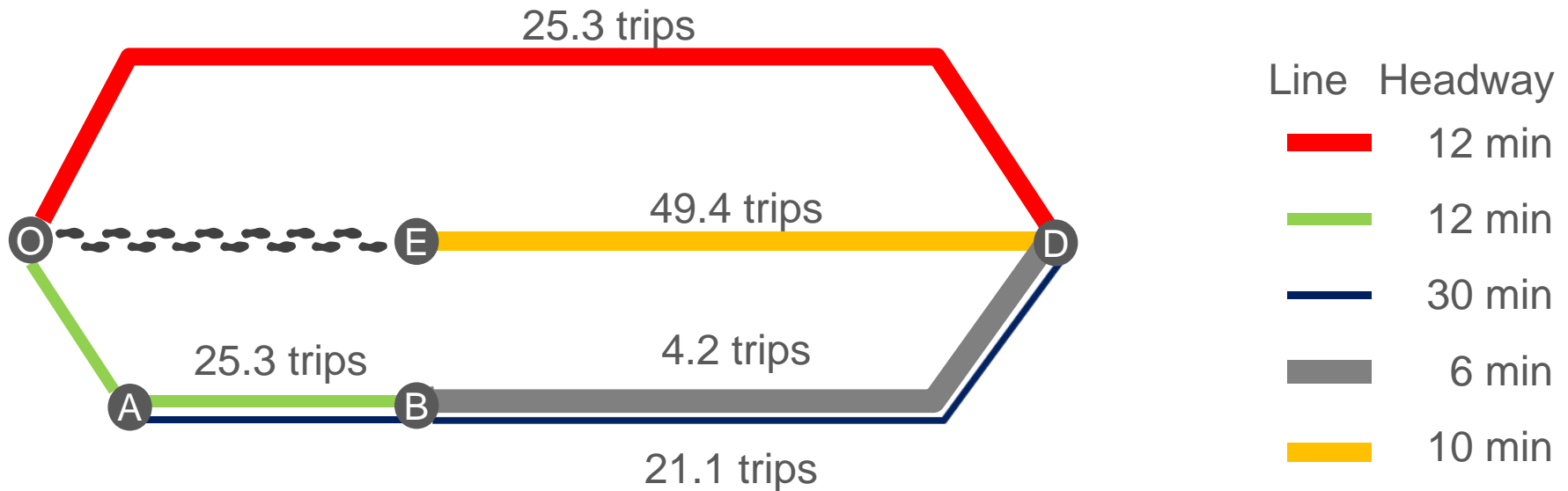
$$\frac{\exp(-0.1 \cdot 27.75)}{\exp(-0.1 \cdot 27.75) + \exp(-0.1 \cdot 28.0)}$$

Second strategy



$$\frac{\exp(-0.1 \cdot 28.0)}{\exp(-0.1 \cdot 27.75) + \exp(-0.1 \cdot 28.0)}$$

Logit Choice of Strategies



Logit choice of strategies (with scale = 0.1)

First strategy



45.8 50.6 trips

Second strategy



54.2 49.4 trips

mean travel time ~~27.9~~ 26.9 min 

Contents

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How Can One Enlarge the Choice Set?

Option 1

- Generate a set of paths by O-D pair prior to the execution of the route choice algorithm
- Drawbacks
 - the paths are generated by using heuristics, so the path choices are somewhat arbitrary
 - the paths are processed by O-D pair, so the computation time increases as the square of the number of zones

How Can One Enlarge the Choice Set?

Option 2

- Enlarge the set of walk links and transit line segments that are considered in the transit assignment by using a well defined criterion
- Advantage
 - This preserves the computations by destination, so the computation time increases only linearly with the number of zones
- This is the approach that we have chosen

Modified Strategy Computation

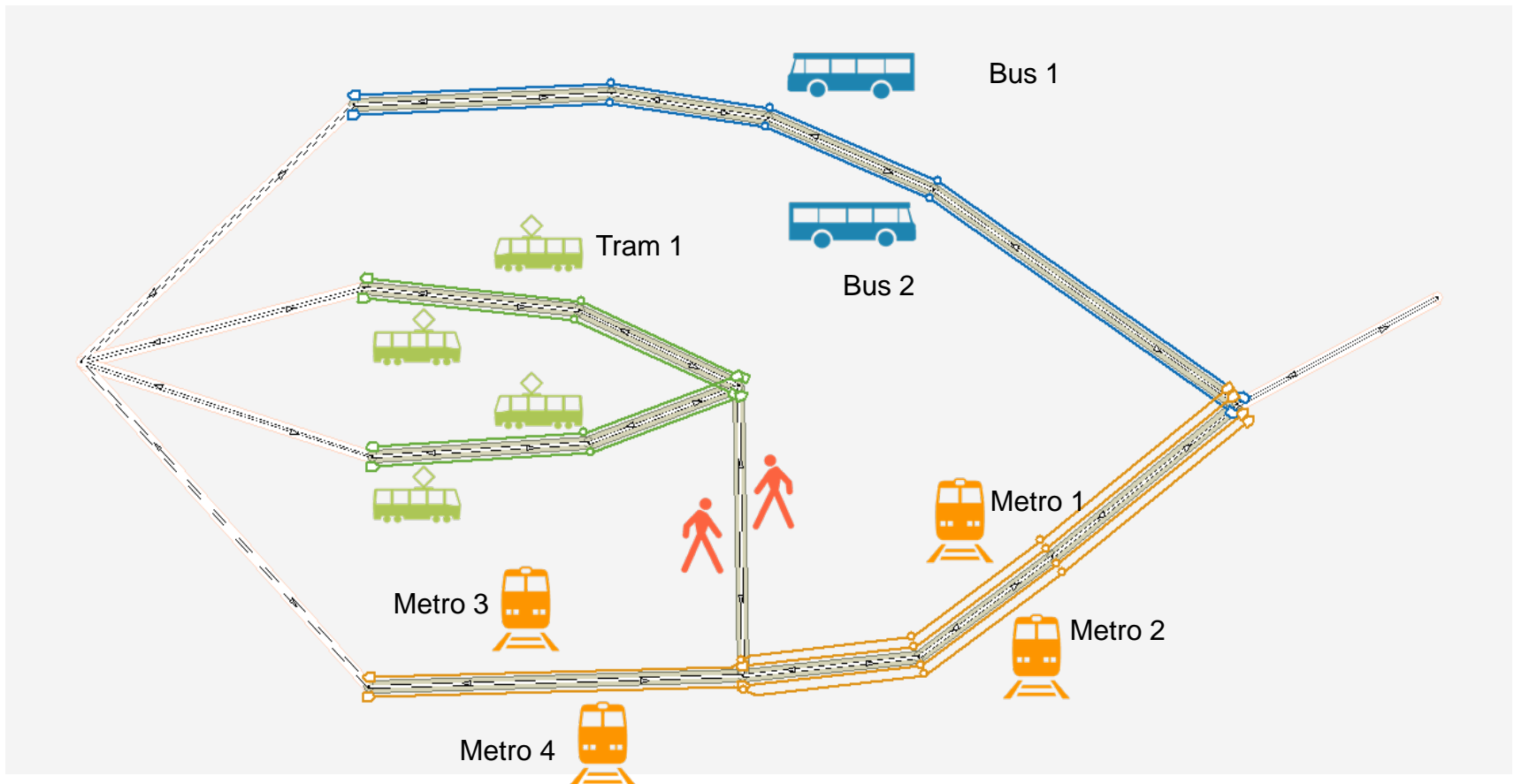
- The optimal strategy algorithm is first modified to compute simultaneously at each node two values:
The best expected travel and wait times from a node to the destination
 - by boarding a vehicle at the node, and
 - by walking to another node (stop) to board a vehicle.

Modified Strategy Computation

- Then, any “efficient arcs” or “efficient line segments” are included, in addition to those of the optimal strategy, by using the criteria:
 - a transit segment is efficient if, by boarding it, the best alighting stop is nearer to the destination
- Node likelihoods are computed recursively in order to obtain the probabilities (proportions) of all the strategies included

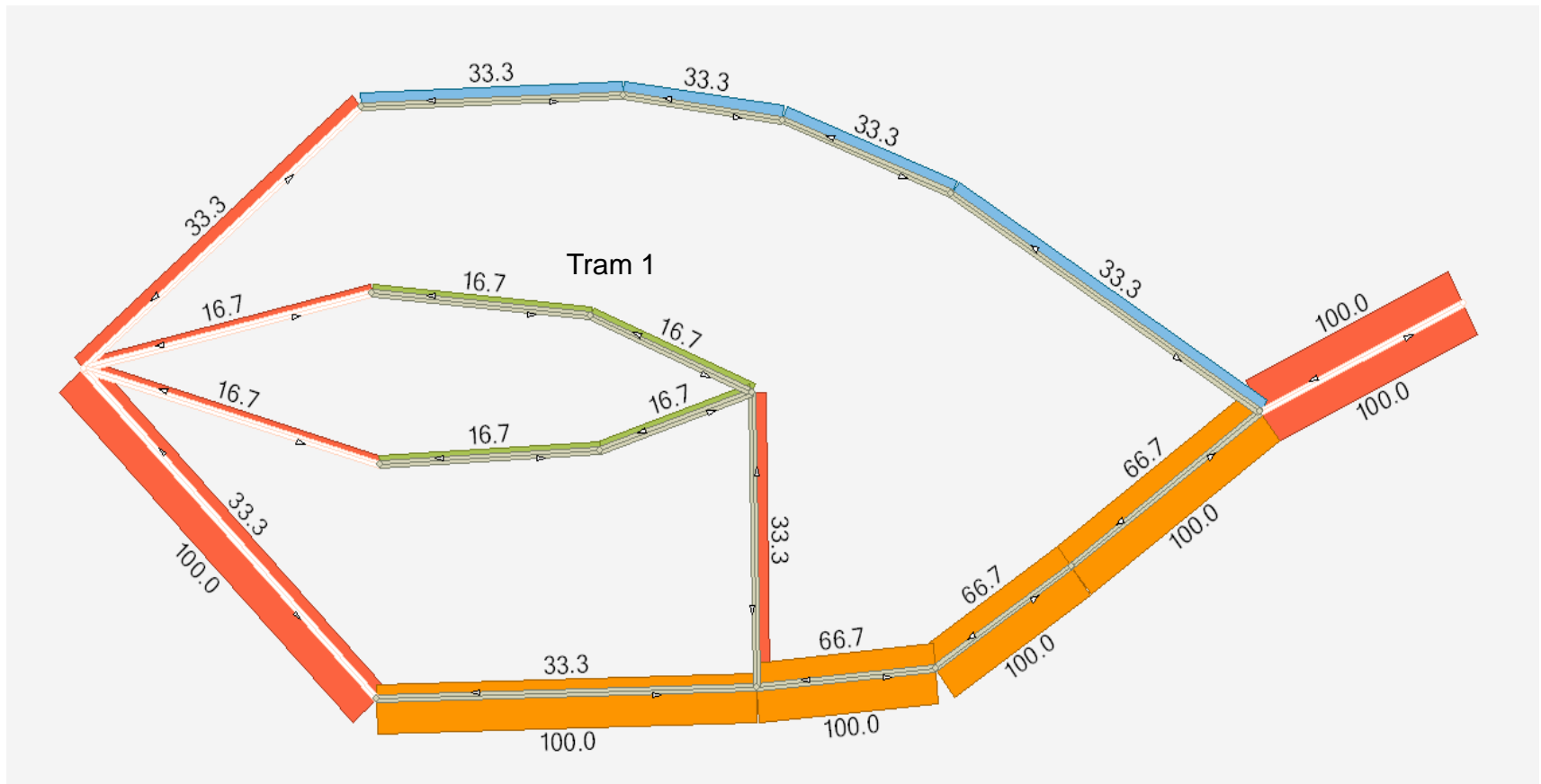
Another Example

The demand is 100 in each direction



Another Example: Optimal Strategy

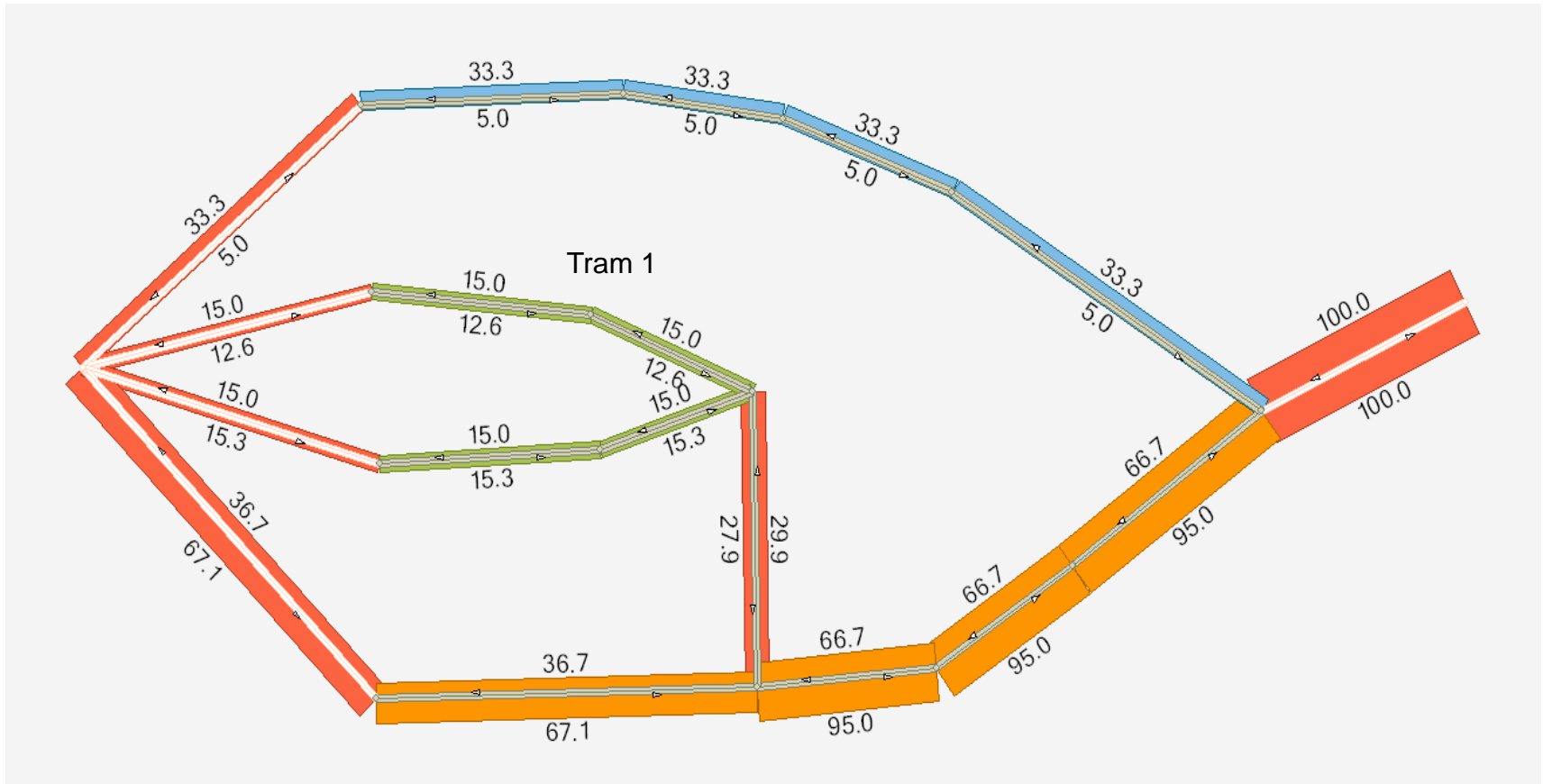
Tram 1 travel time : 4.5 minutes on each segment



Logit Choice of Strategies

Tram 1 travel time : 4.5 minutes on each segment

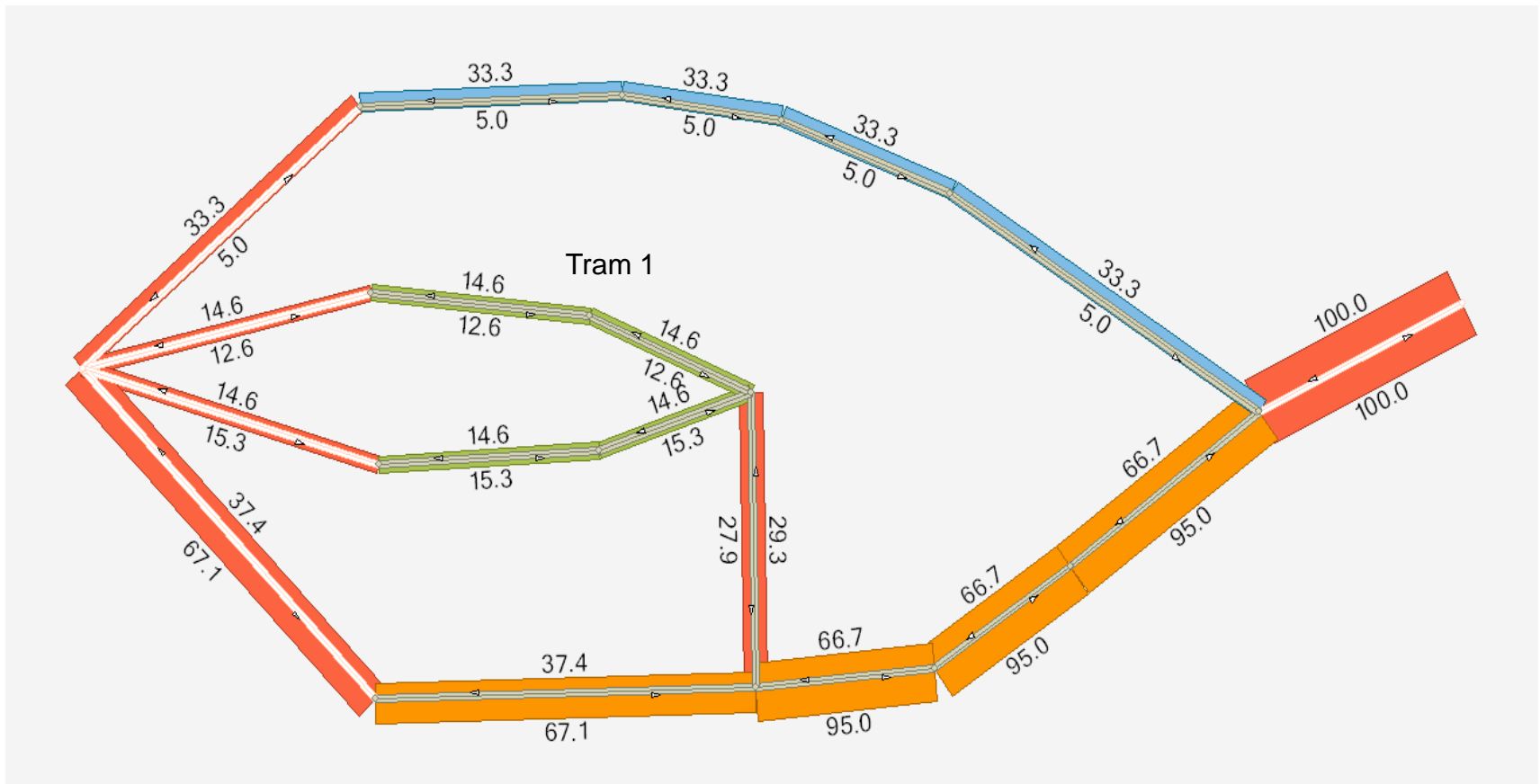
Scale: 0.2



Logit Choice of Strategies

Tram 1 travel time : 5.5 minutes on each segment

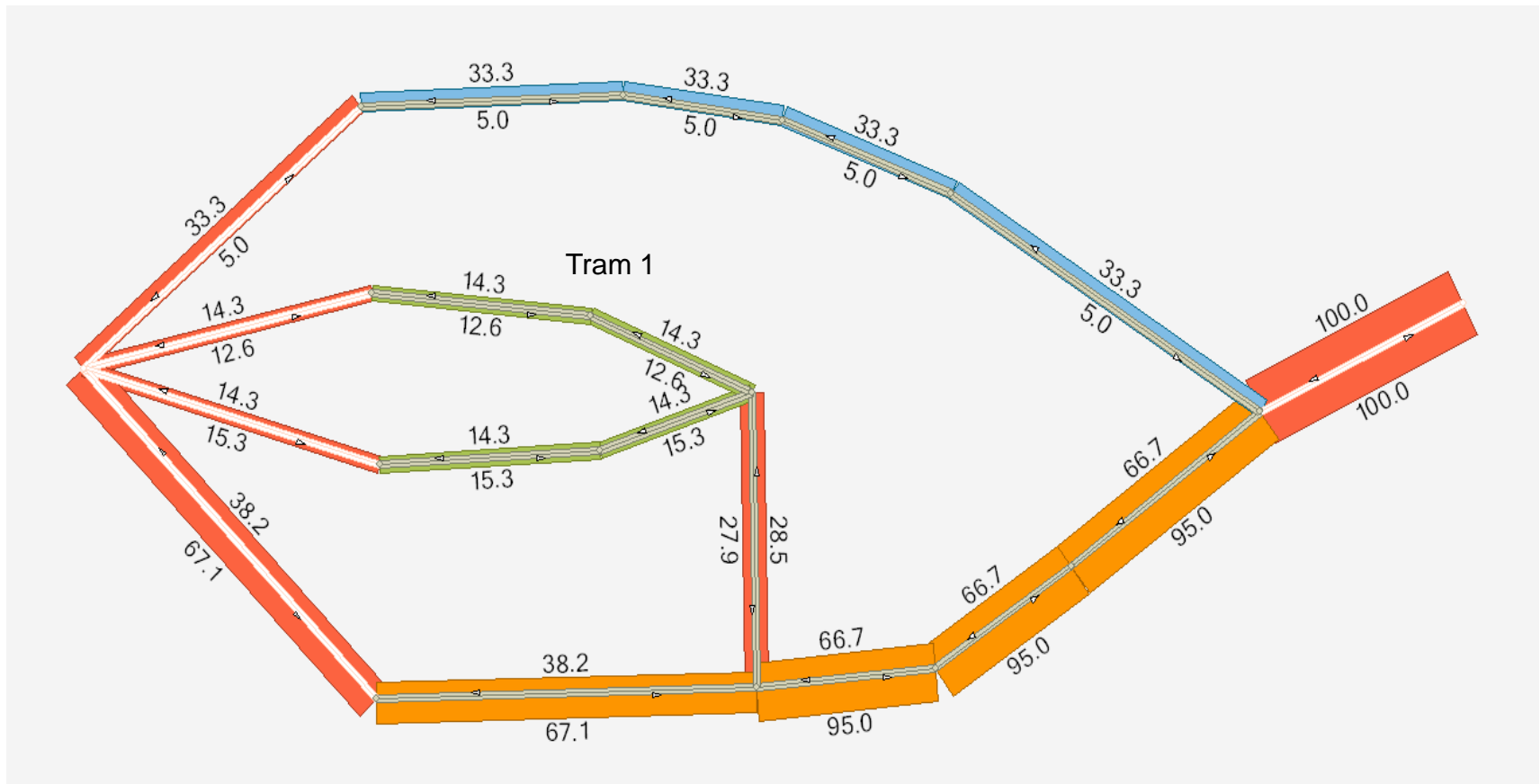
Scale: 0.2



Logit Choice of Strategies

Tram 1 travel time : 6.5 minutes on each segment

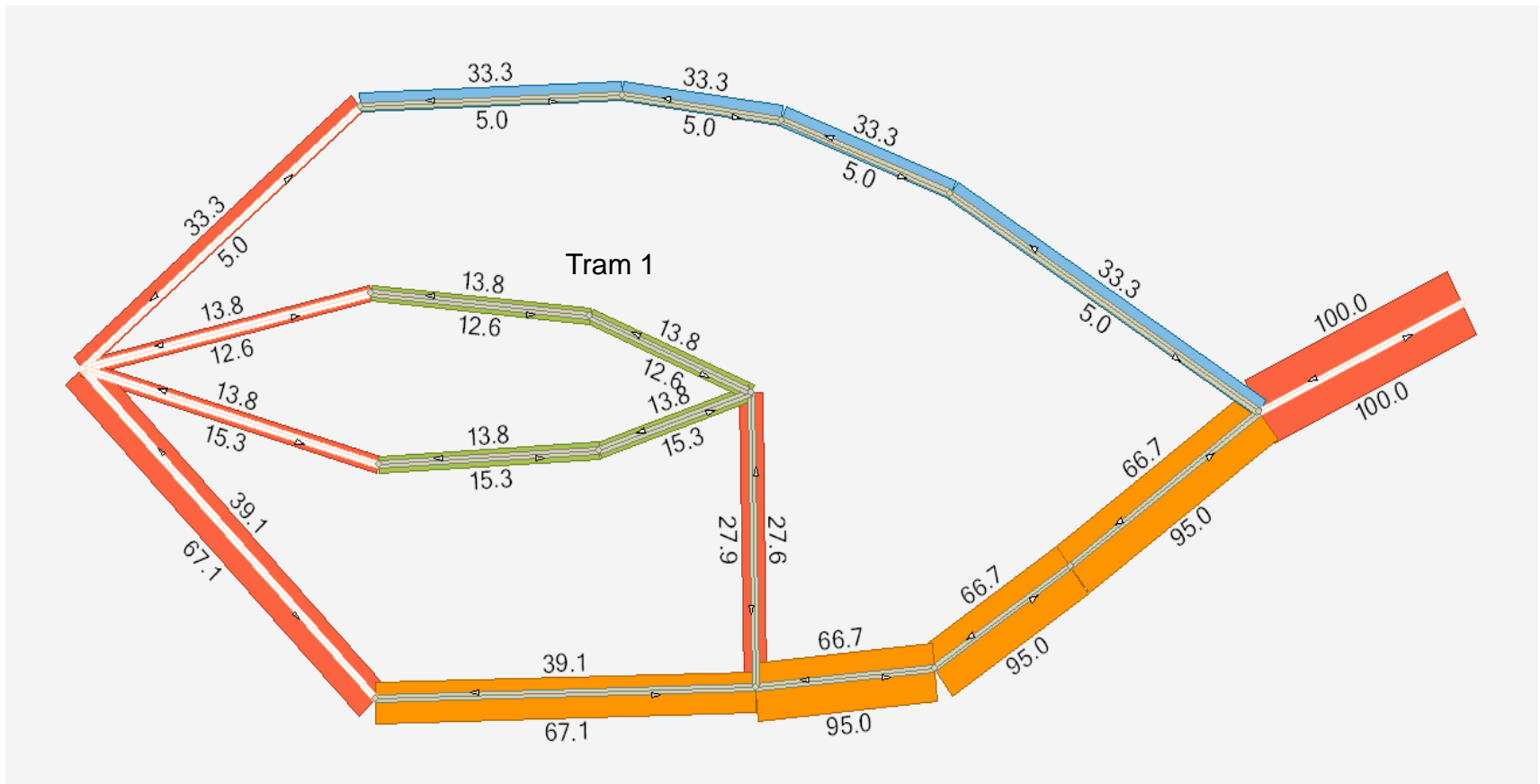
Scale: 0.2



Logit Choice of Strategies

Tram 1 travel time : 7.5 minutes on each segment

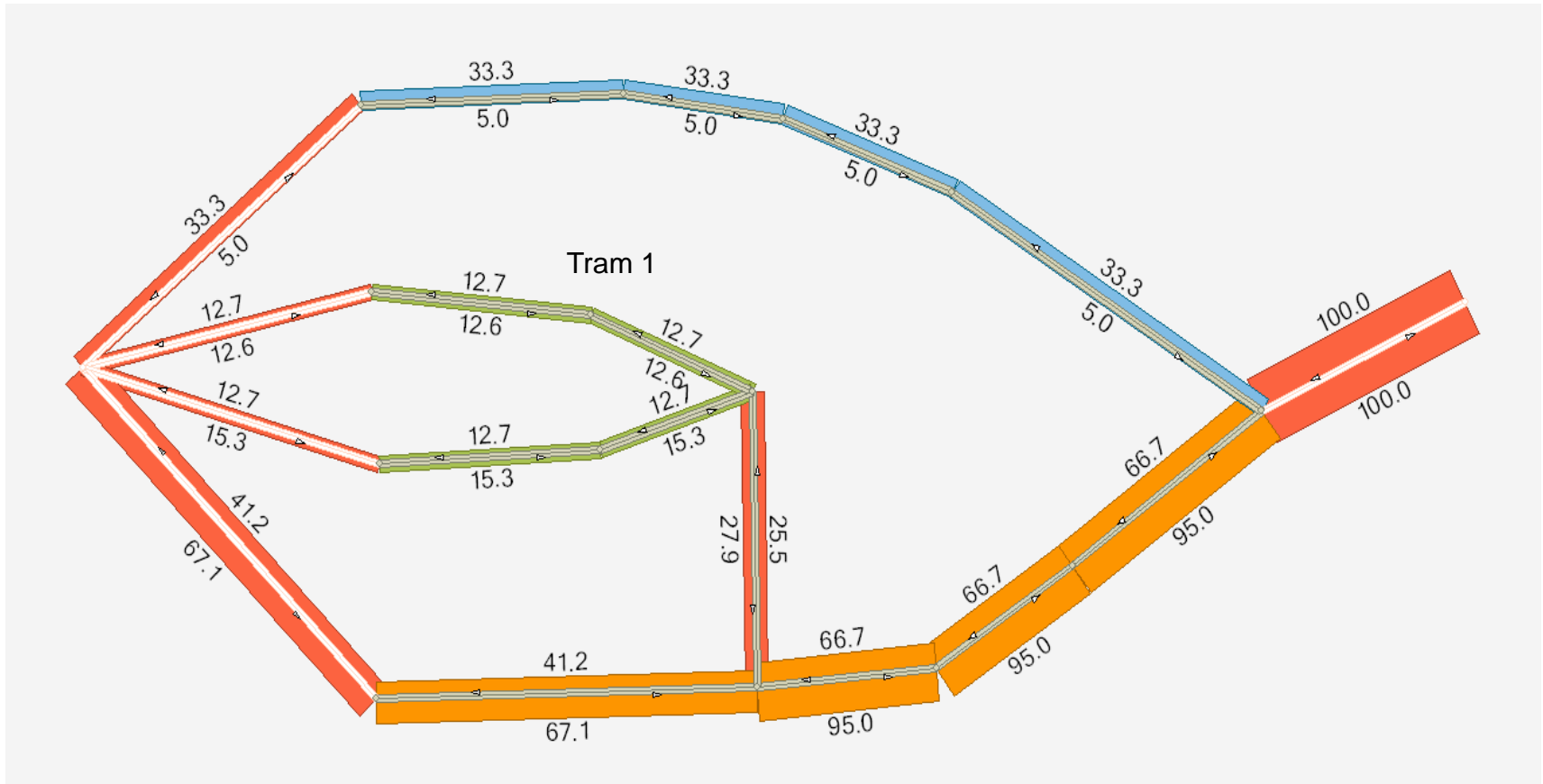
Scale: 0.2



Logit Choice of Strategies

Tram 1 travel time : 9.5 minutes on each segment

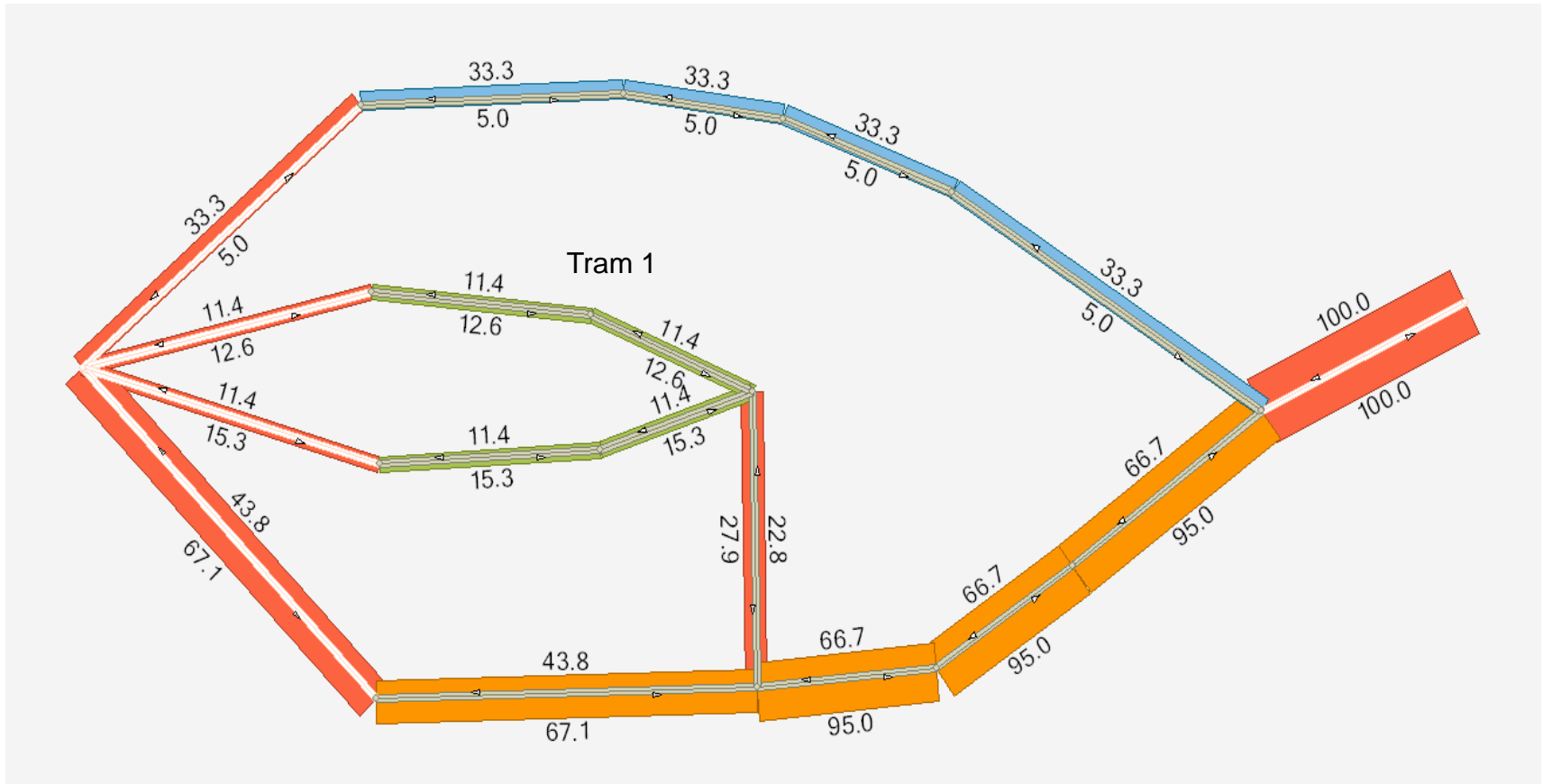
Scale: 0.2



Logit Choice of Strategies

Tram 1 travel time : 11.5 minutes on each segment

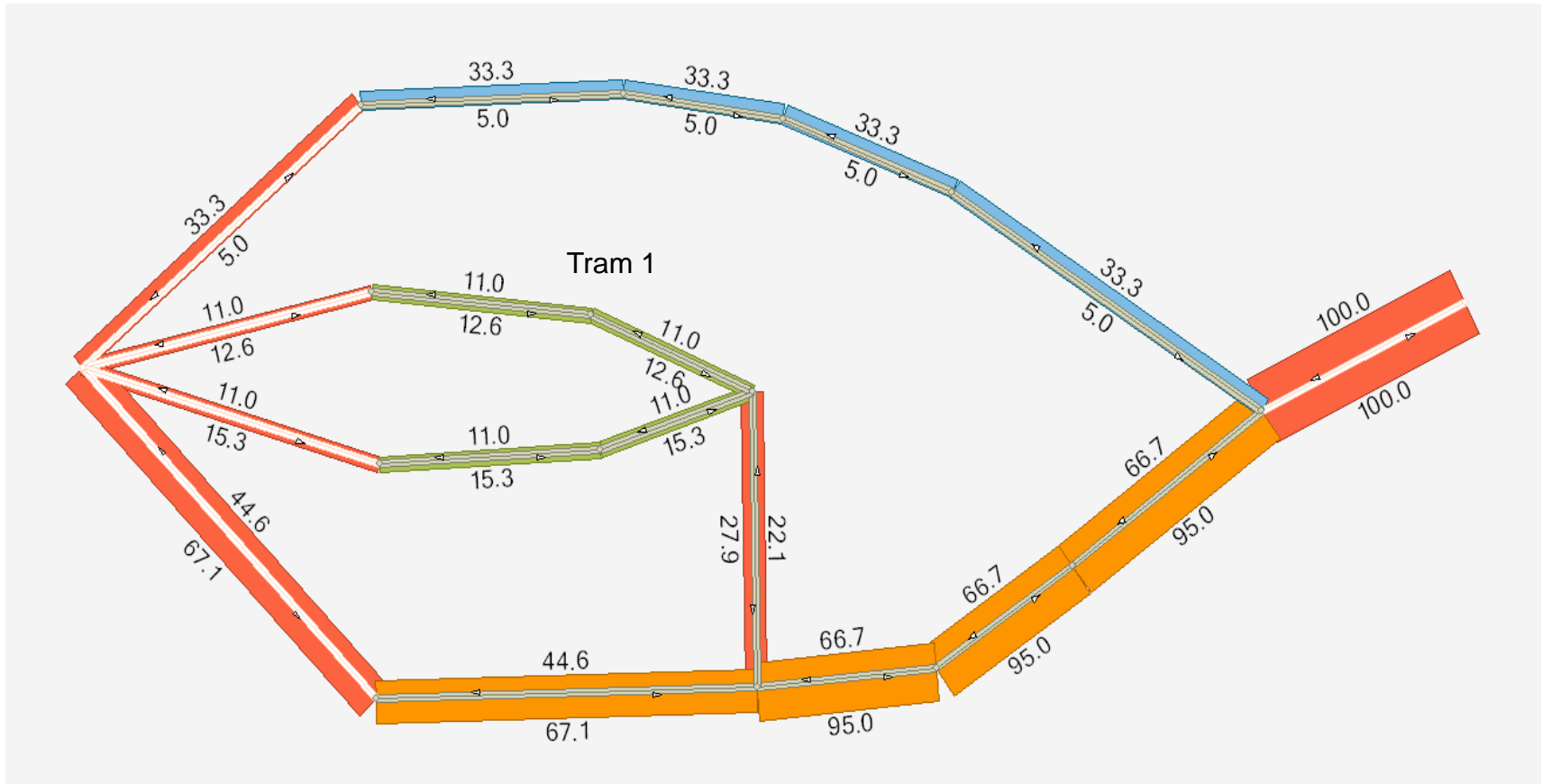
Scale: 0.2



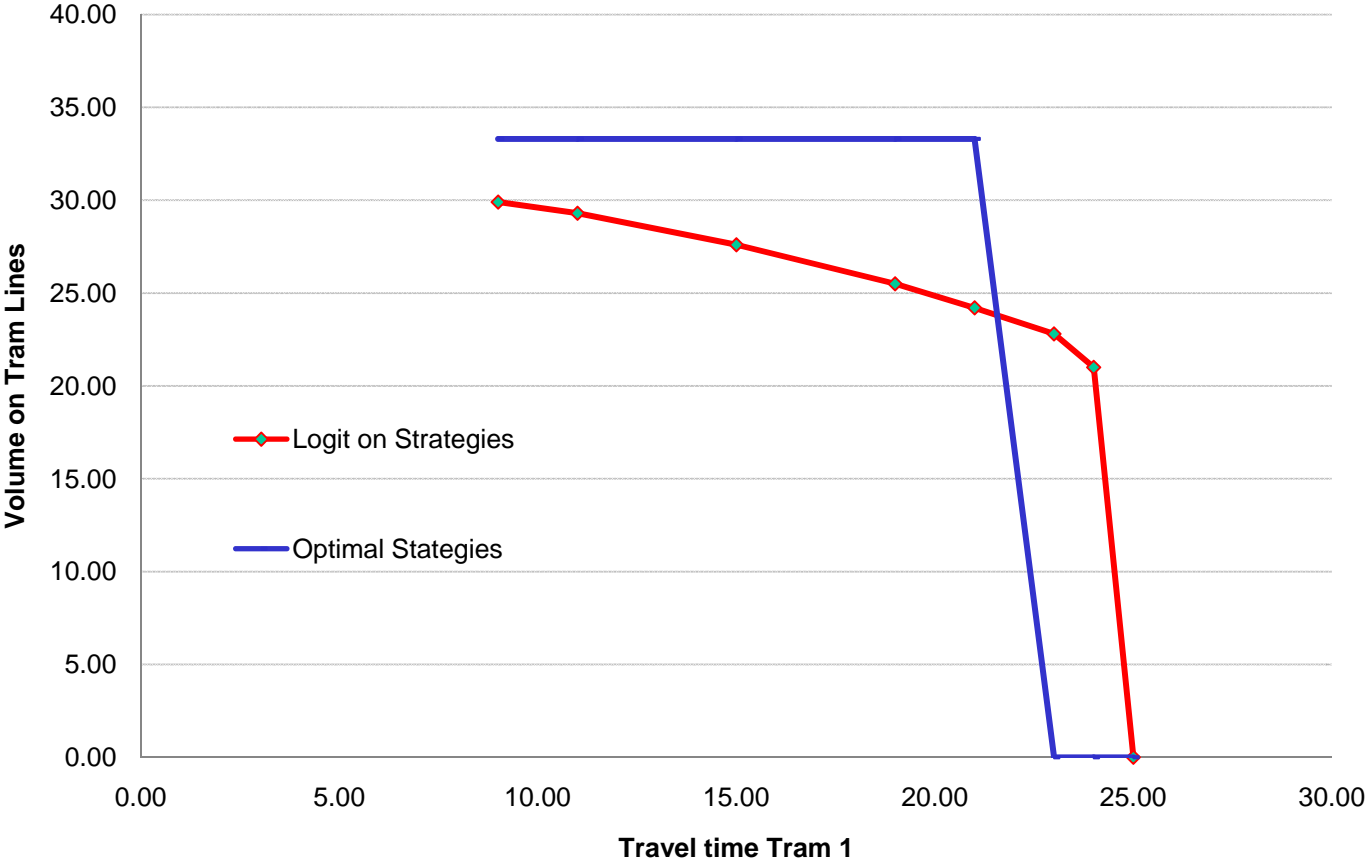
Logit Choice of Strategies

Tram 1 travel time : 12.0 minutes on each segment

Scale: 0.2



Use of Tram lines vs. Tram1 time



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Enhanced modeling possibilities

- The consideration of a richer set of strategies
- Inclusion of walk in “sub-optimal” strategies
- Evaluation measures based on log-sum computations
- No loss of computational efficiency
- ...



New Public Transport Modelling Methods

- Distribution of flow between connectors
- Distribution of flow between attractive lines
- In-vehicle generalized cost
- Post-assignment analysis of strategies
- Logit choice of strategies

Emme will deliver more power, flexibility, and ease of use to model public transport systems