

Simulating Road Pricing / Tolls with MATSim

MATSim Workshop

Marcel Rieser · VSP TU Berlin · 11.12.2008

Agenda

What tolls can MATSim simulate?

Example of a toll simulation

How can one simulate tolls in MATSim?

How is the toll simulation realized within MATSim?

Road Pricing in MATSim

MATSim can simulate:

- distance-based toll
- cordon-based toll
- area-based toll

Remarks

- all tolls can be limited to specific links
- distance and cordon toll can have different toll costs depending on the time of day
- only one toll scheme (distance, area, cordon) per simulation
- toll costs are added to agents score
- router knows about tolls when searching for best path through network

Example of a toll simulation

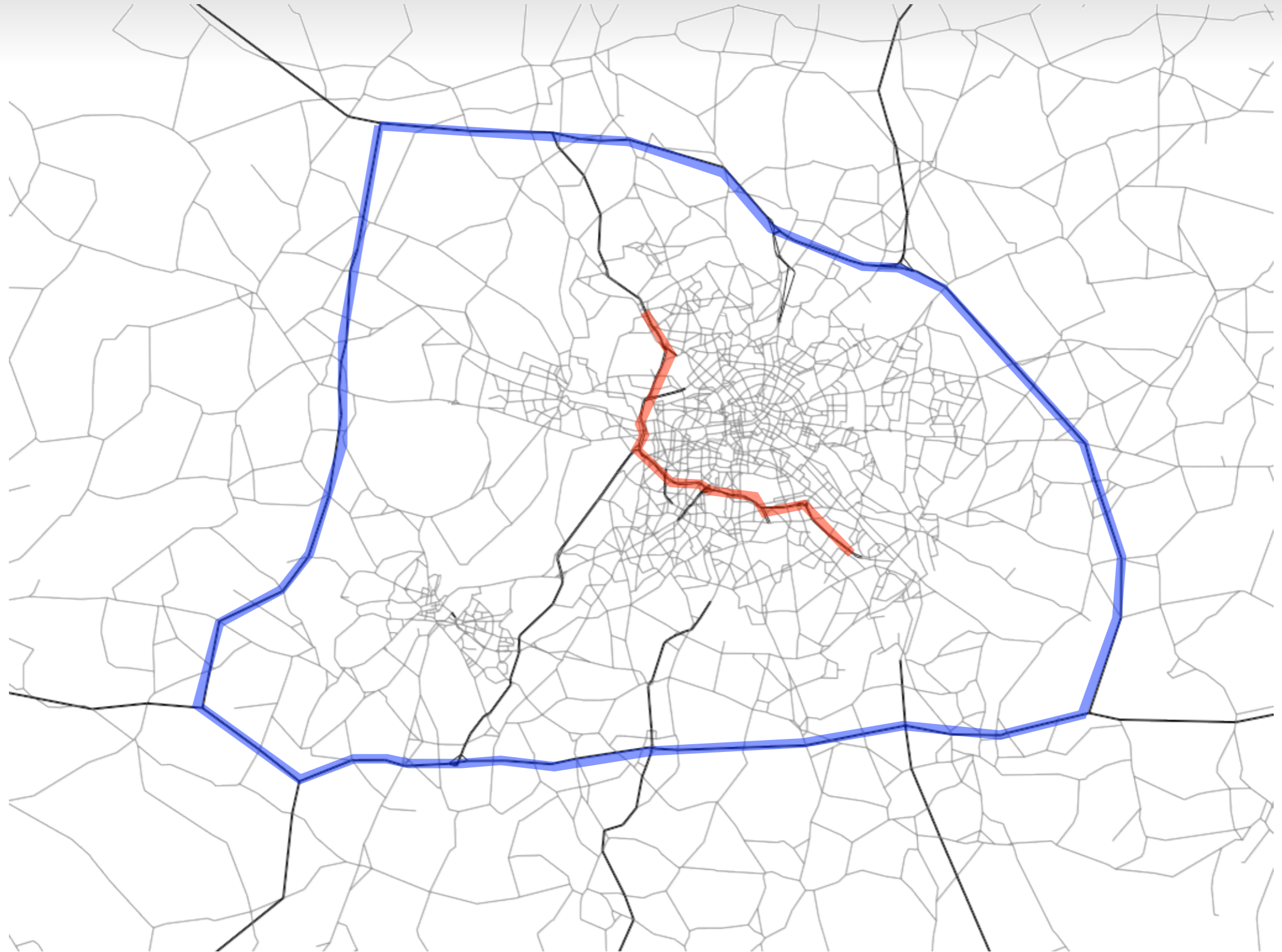
Berlin / Brandenburg

- car-commuters only, 10% sample, 160 171 agents
- network with 12k nodes, 28k links
- base case
- distance toll: all of Berlin, 2 scenarios: 10ct/km, 25ct/km
- area toll: only inner city of Berlin (“Hundekopf”), 2 scenarios: 30ct, 75ct
- realized within the project “Environmentally-oriented Road Pricing for Livable Cities” funded by the Volvo Research and Education Foundation
- project together with Workgroup for Infrastructure Policy (WIP) TU Berlin

Example of a toll simulation

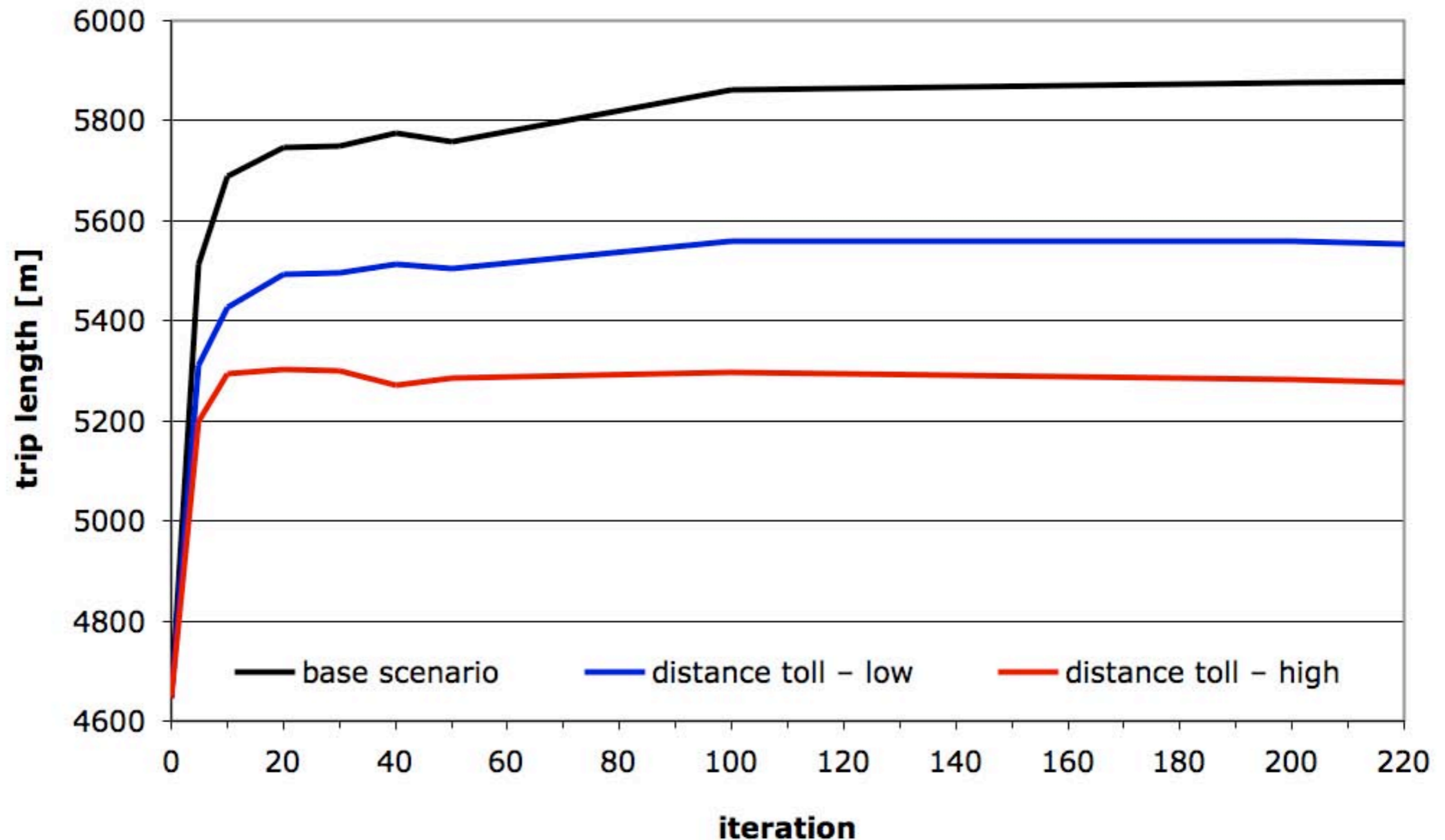


Example of a toll simulation



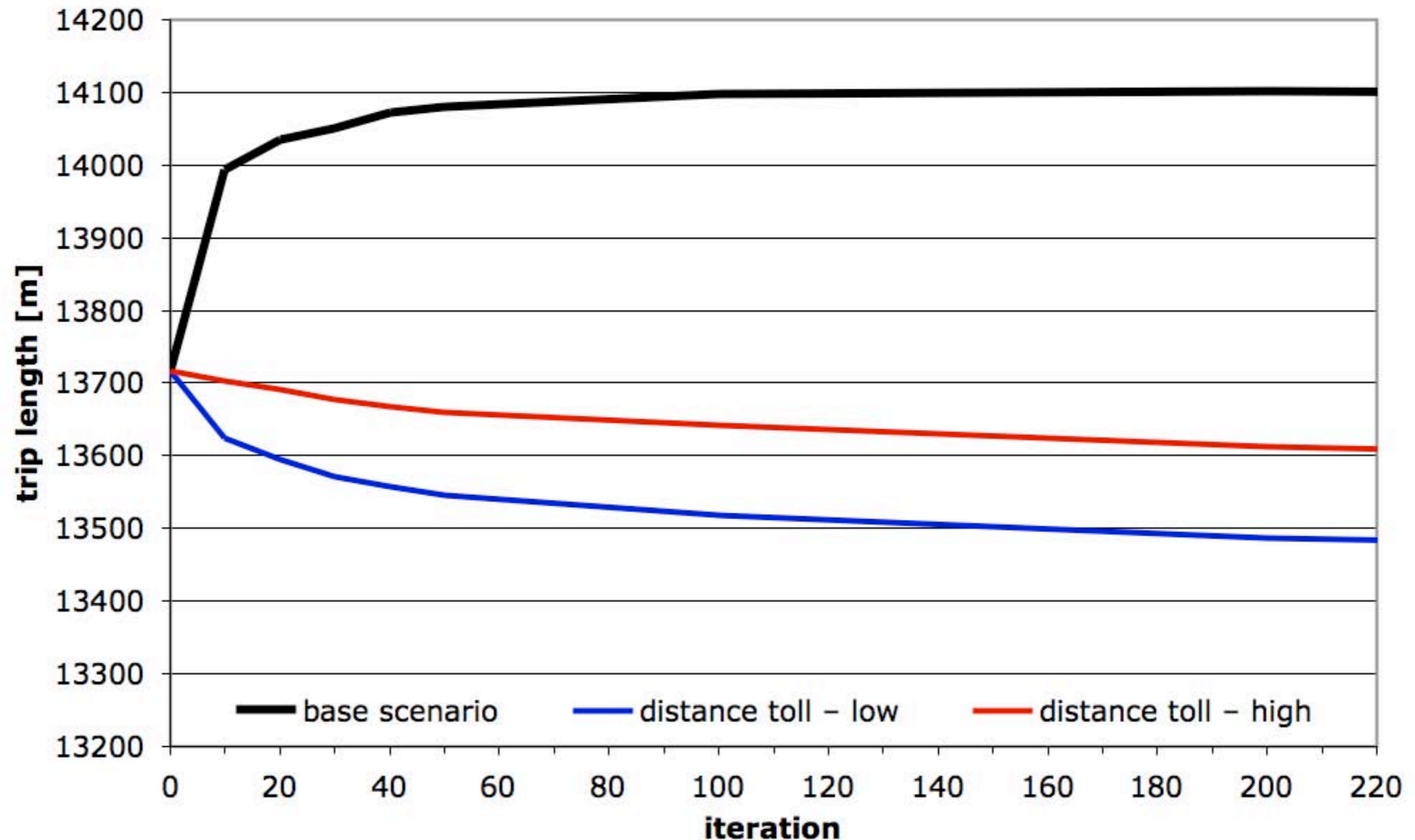
Results of example toll simulation

Trip length within toll area with distance toll



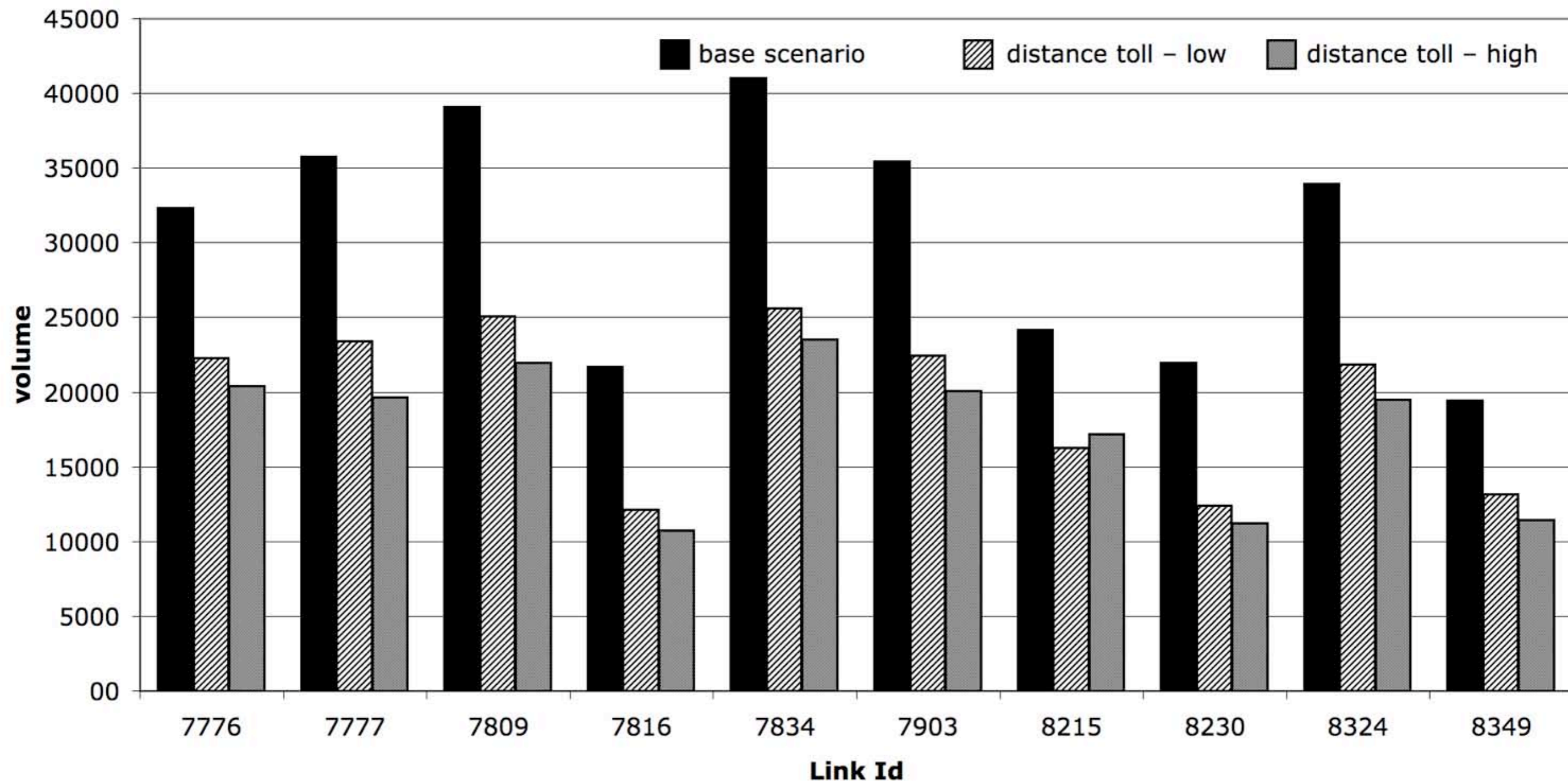
Results of example toll simulation

Total trip lengths with distance toll



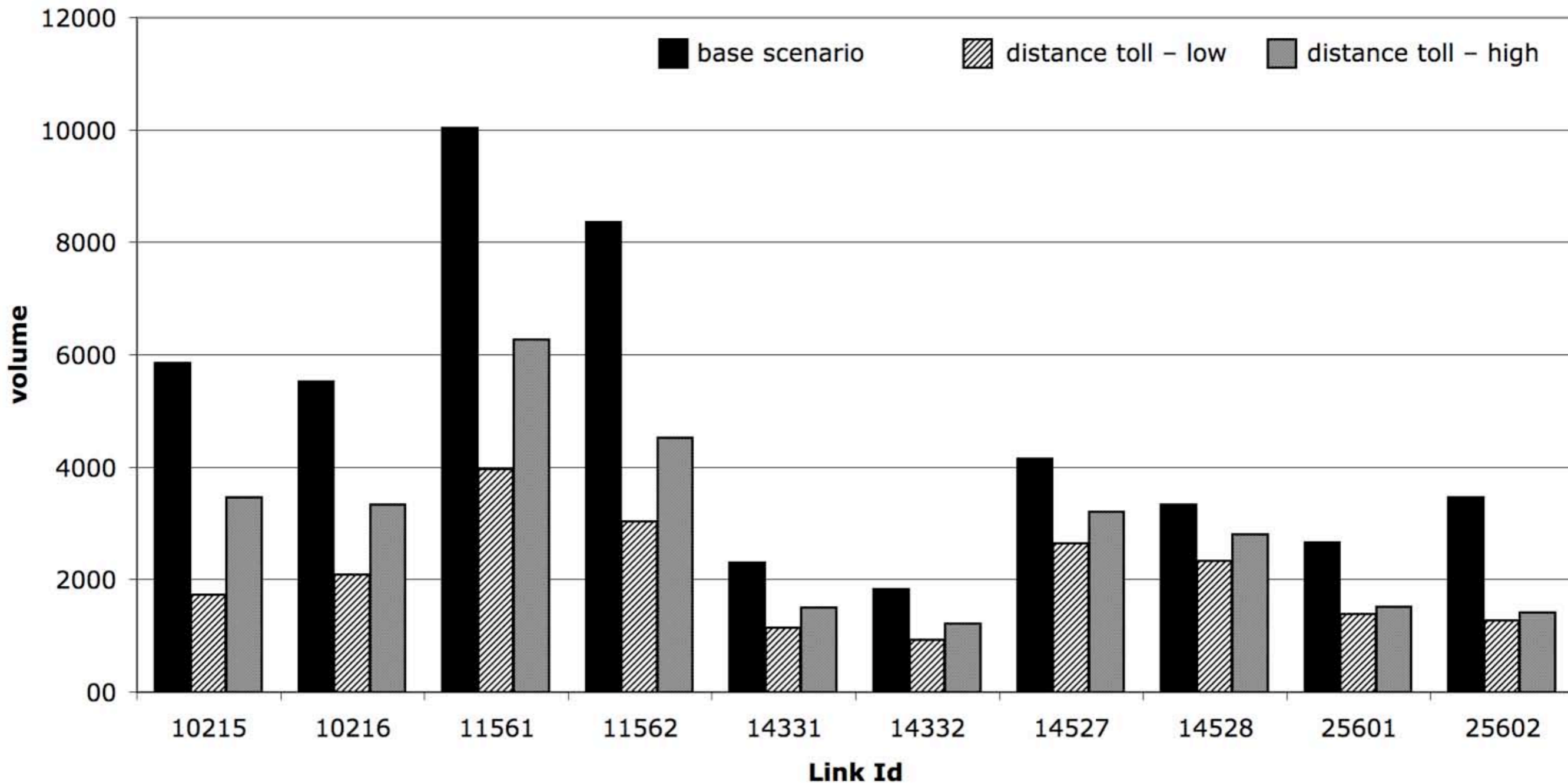
Results of example toll simulation

Traffic volumes on inner highway



Results of example toll simulation

Traffic volumes on outer highway



How to simulate tolls?

Simulating tolls in MATSim in three easy steps:

- prepare a file describing the toll to be simulated (XML, `roadpricing_v1.dtd`)
- change the configuration:
set in module “`global`” the parameter “`useRoadPricing`” to “`yes`”
- start the simulation as usual:
`java -classpath classes org.matsim.run.Controler config.xml`

Example of a toll-file

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE roadpricing SYSTEM "http://www.matsim.org/files/dtd/roadpricing_v1.dtd">

<roadpricing type="distance" name="Distanzmaut Testnet">

  <description>Eine distanzbasierte Maut für das einfache Test-Netzwerk.
</description>

  <links>
    <link id="1" />
    <link id="2" />
    <link id="3" />
  </links>

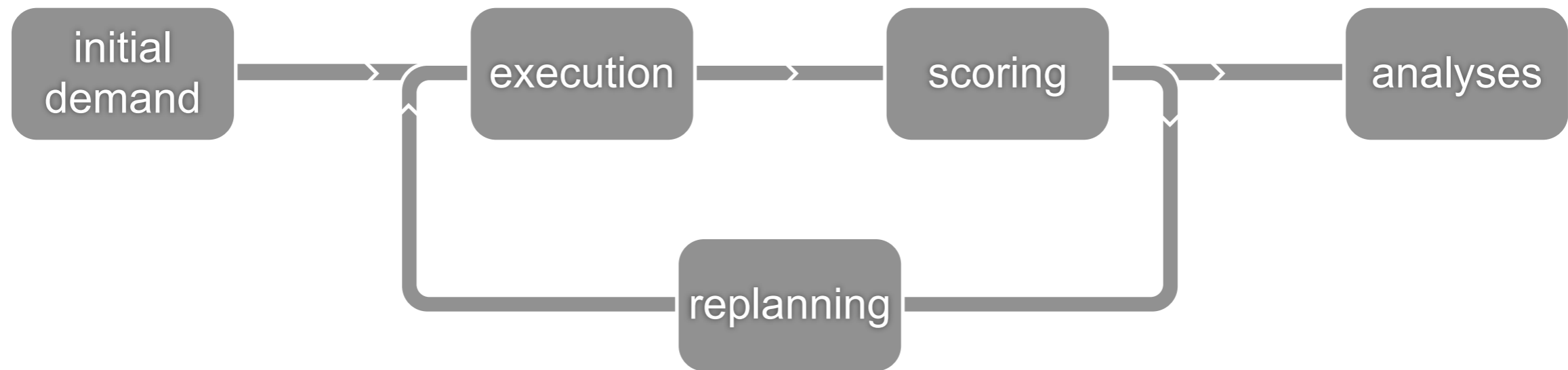
  <!-- amount: [monetary unit] / [link length unit] -->
  <cost start_time="06:00" end_time="10:00" amount="0.00020" />
  <cost start_time="10:00" end_time="15:00" amount="0.00010" />
  <cost start_time="15:00" end_time="19:00" amount="0.00020" />

</roadpricing>
```

see example files in **MATSimJ-Testing/testdata/tests/roadpricing**

How are tolls simulated?

Excursus: MATSim-Controller



Scoring and replanning currently only for Persons / Plans.

In future, scoring and replanning also for other elements in MATSim.

Scoring and replanning easily replaceable / extendable.

Tolls influence replanning (routes) and scoring (paid tolls)

How are tolls simulated?

All classes for simulating road pricing are in `org.matsim.demandmodeling.roadpricing`

Controler loads different classes when needed

Default Class	Road Pricing Class
BasicScoringFunction	RoadPricingScoringFunction
TravelTimeCostCalculator	TollTravelCostCalculator
PlansCalcRoute	PlansCalcAreaTollRoute

How are tolls simulated?

CalcPaidToll

- EventHandler
- checks on each EnterLinkEvent whether Agent has to pay the toll
- sums up all the paid tolls per agent

RoadPricingScoringFunction

- adds the toll costs (using CalcPaidToll) to the agents score when calculating the final score per agent

How are tolls simulated?

TollTravelCostCalculator

- checks for each link on route whether toll has to be paid
- adds the toll cost to the travel cost

PlansCalcAreaTollRoute

- extends PlansCalcRoute, no Landmarks (yet)
- only needed when simulating area tolls
- tries to find best routes for all trips of a agent in a plan
- figures out if an agent can gain in total when paying for the area toll (paying for only one route would be worse than driving around, but paying once and driving through toll area more than once is better)