

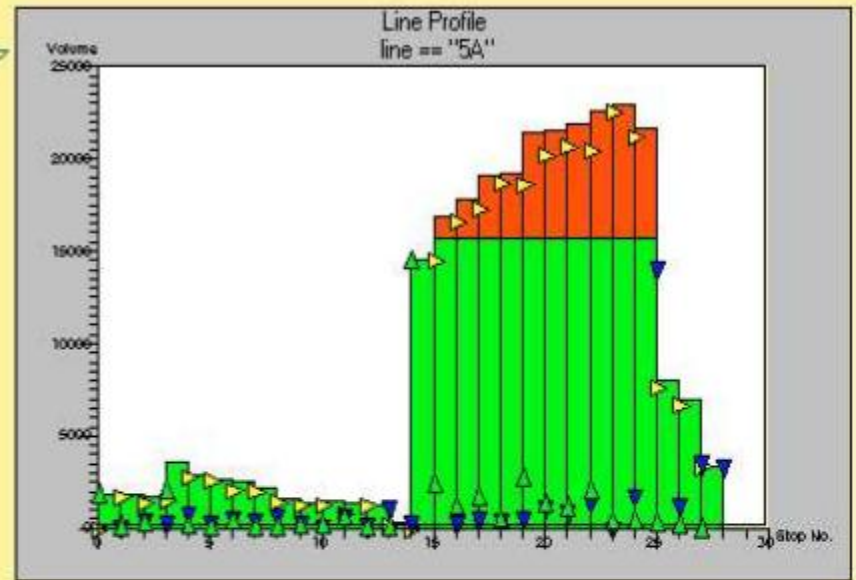
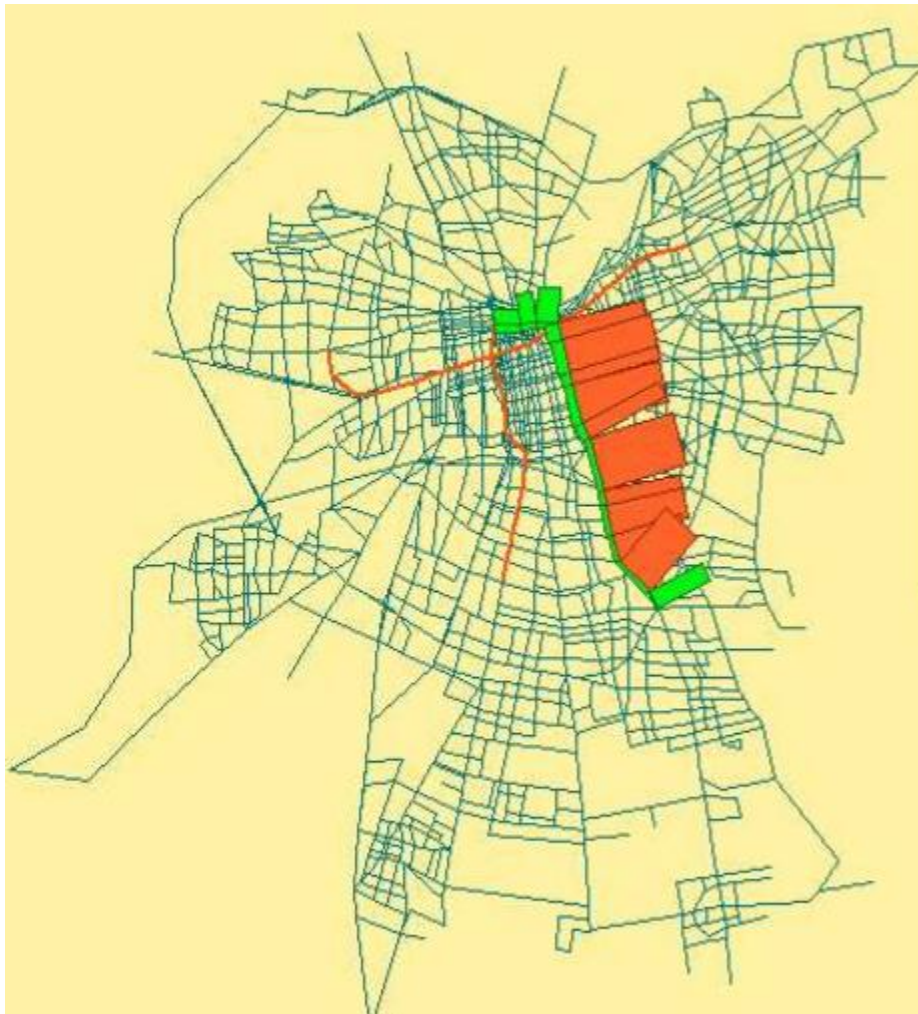


Emme Modeller

Congested and capacitated transit

Daniel Florian
dan@inrosoftware.com

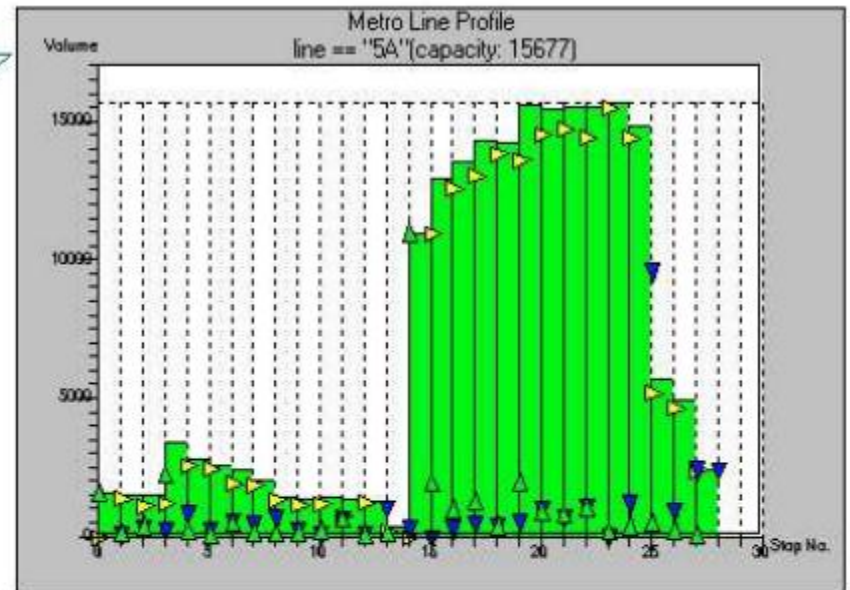
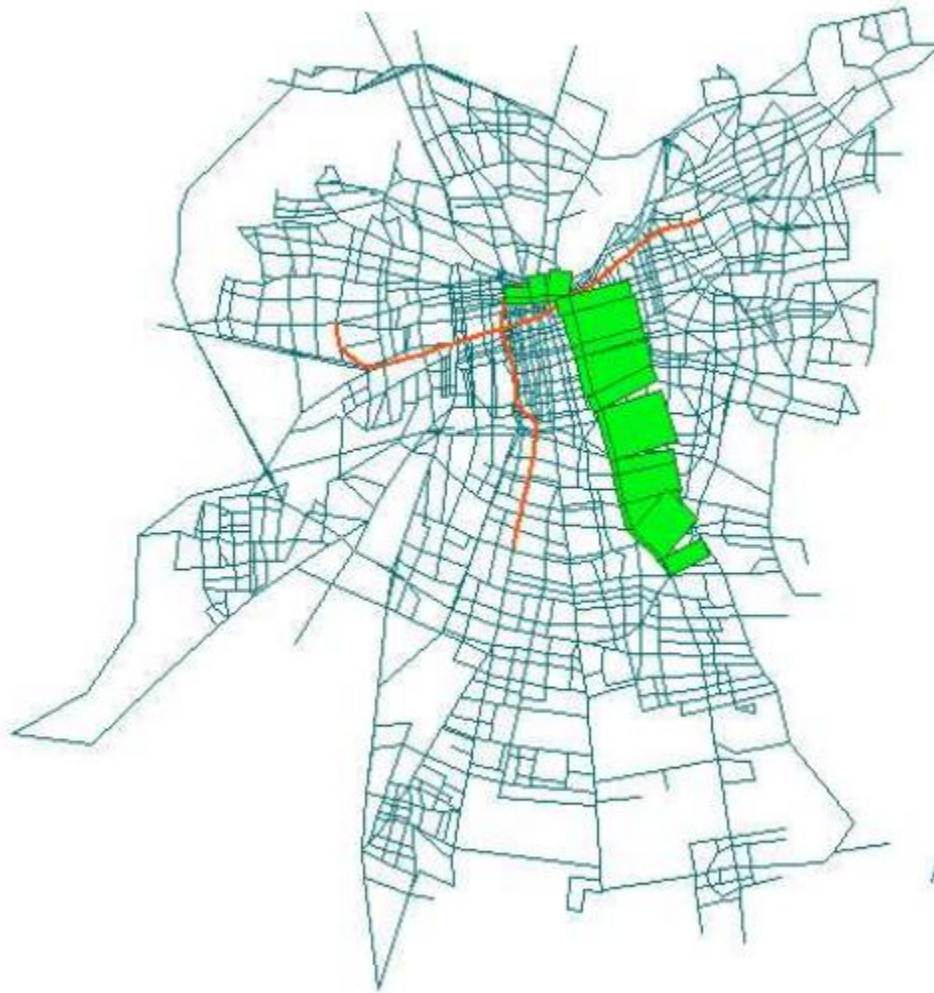
Transit model without congestion effect



*Metro Line 5A
(non-congested version)*

Plot generated by Enif 2002-02-12 16:50:30 at INRO

Transit model with congestion effect



Metro Line 5A
(congested version)

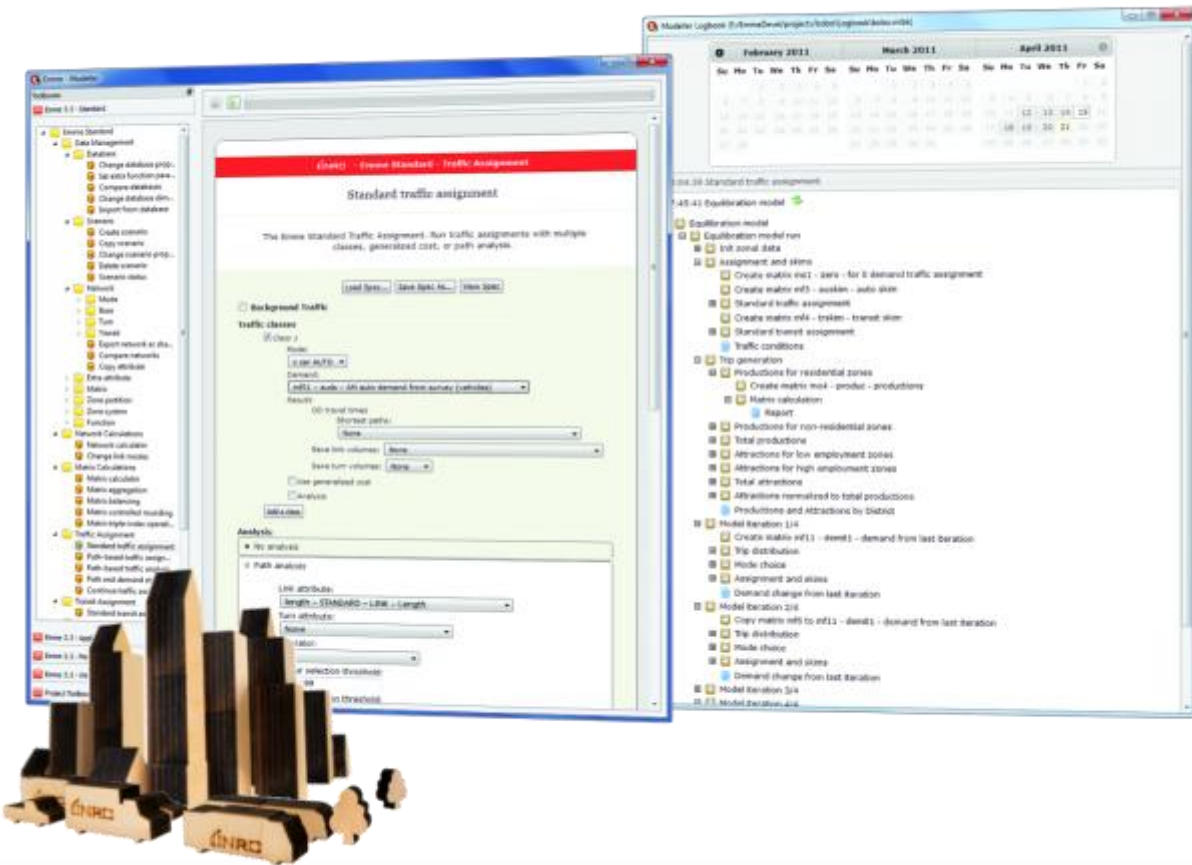
Plot generated by Enif 2002-02-12 15:09:32 at INRO





Emme Modeller

A better way to model.



A revolutionary new application development framework for travel demand forecasting, transportation planning and related applications.



-  **Modeller**
Easily prepare and run models
-  **API**
Quickly deploy complete travel demand models
-  **Logbook**
See models like never before
-  **Desktop**
Visualization, analysis, data management

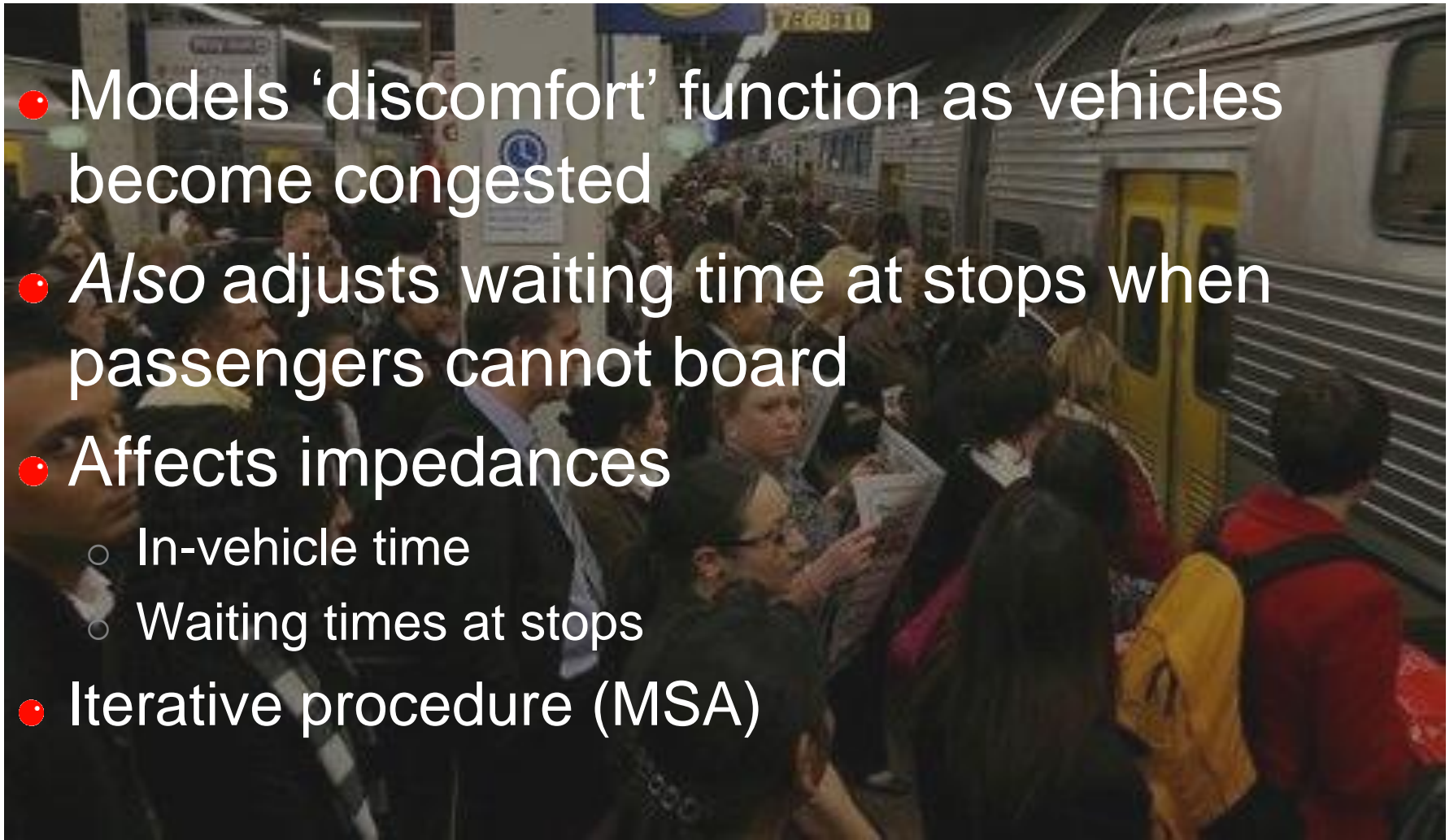


Congested Transit in Emme

- Models 'discomfort' function as vehicles become congested
- Increased perceived impedance through in-vehicle time
- Optimization model - unique solution

Capacitated Transit in Emme

- Models 'discomfort' function as vehicles become congested
- Also adjusts waiting time at stops when passengers cannot board
- Affects impedances
 - In-vehicle time
 - Waiting times at stops
- Iterative procedure (MSA)



Standard Transit Assignment

INRO - Emme Standard - Transit Assignment

Standard transit assignment

Runs transit assignments and performs transit strategy analysis.

Assign more demand on existing transit volumes

C:/Emme/Emme-Modeller/specifications/basic_spta.ems

Modes

E Express TRANSIT	<input type="checkbox"/>
b bus TRANSIT	<input type="checkbox"/>
a tr_access AUX_TRANSIT	<input type="checkbox"/>
p pedestrian AUX_TRANSIT	<input type="checkbox"/>
<i>Search</i>	<input type="text"/>

Demand

mf2 - trdA - AM transit demand A

Waiting time

Effective headways:
hdw - STANDARD - TRANSIT_LINE - Headway

Headway fraction:

Constant
0.5

At nodes:
None

Spread factor:
1

Perception factor:
2

Boarding time penalties

Constant
2.5

Attributes

At nodes:
None

On lines:
None

Perception factor:
2

Auxiliary transit time

Perception factor:
2

Save O-D results

Transit times:
mf5 - trtAb - transit impedances for trdA - base

Total waiting times:
None

First waiting times:
None

Boarding times:
None

By mode subset:

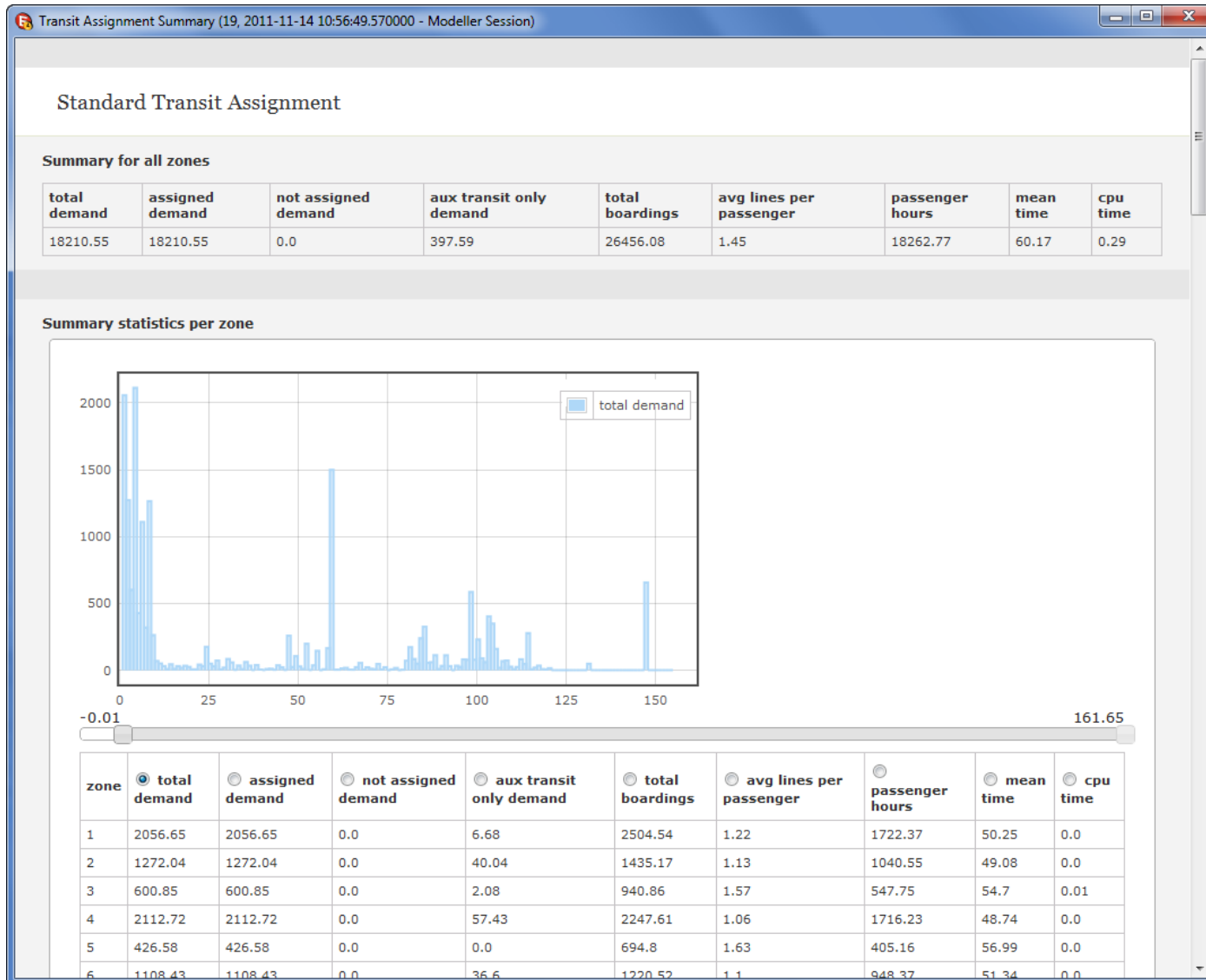
Strategy analysis

Recent history

Tool Context

Database Title: Emme Standard Demonstration and Course Database
Database Path: P:\EmmeProjects\Winter_2011_Demo\Database\emmebank
Current Scenario: 3002 - standard transit assignment

Standard Transit Assignment



Capacitated Transit Assignment

INRO - Emme Applications - Congested Transit

Capacitated transit assignment

Performs an equilibrium transit assignment considering capacity using increased waiting time at stops and in-vehicle congestion functions.

Transit demand matrix:

mf2 - trdA - AM transit demand A

Transit impedances matrix:

mf5 - trtAb - transit impedances for trdA - base

Type of segment congestion function:

BPR

Type of headway congestion function:

Effective headway

Maximum number of MSA iterations:

10

Maximum relative volume difference (%):

0.1

Maximum over capacity ratio:

0.1

Weight of the congestion term:

0.15

For BPR or Conical segment functions.

Exponent of the congestion term:

4

For BPR or Conical segment functions.

Exponent for the headway adjustment function:

0.02

Hours factor for the capacity:

1

Use current functions without modification

Transit time functions must include the congestion term as: $ft = ft^*(1+us1)$. If this option is not checked all the transit functions will be modified temporarily to include this term.

Base specification for the transit assignment:

C:/Emme/Emme-Modeller/specifications/basic_spta.ems [Load File...](#)

Used to specify source for effective headways, boarding time penalties, waiting time headway fraction and perception factors.

Show line profiles for congested lines

[▶ Start this tool](#)

▶ Recent history


Tool Context

Database Title: Emme Standard Demonstration and Course Database
Database Path: P:\EmmeProjects\Winter_2011_Demo\Database\demandmodel2\emmebank
Current Scenario: 3003 - congested transit assignment

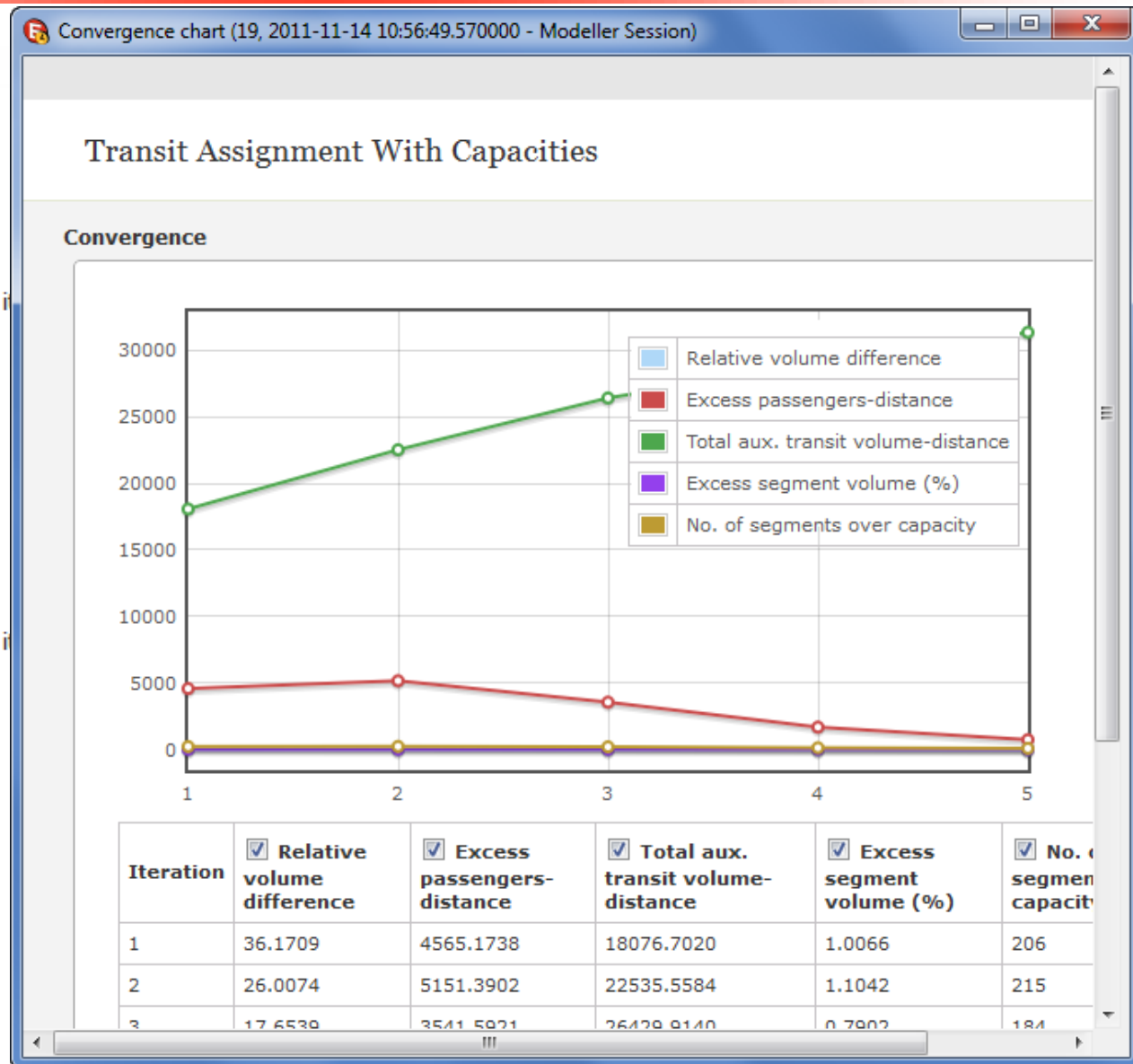


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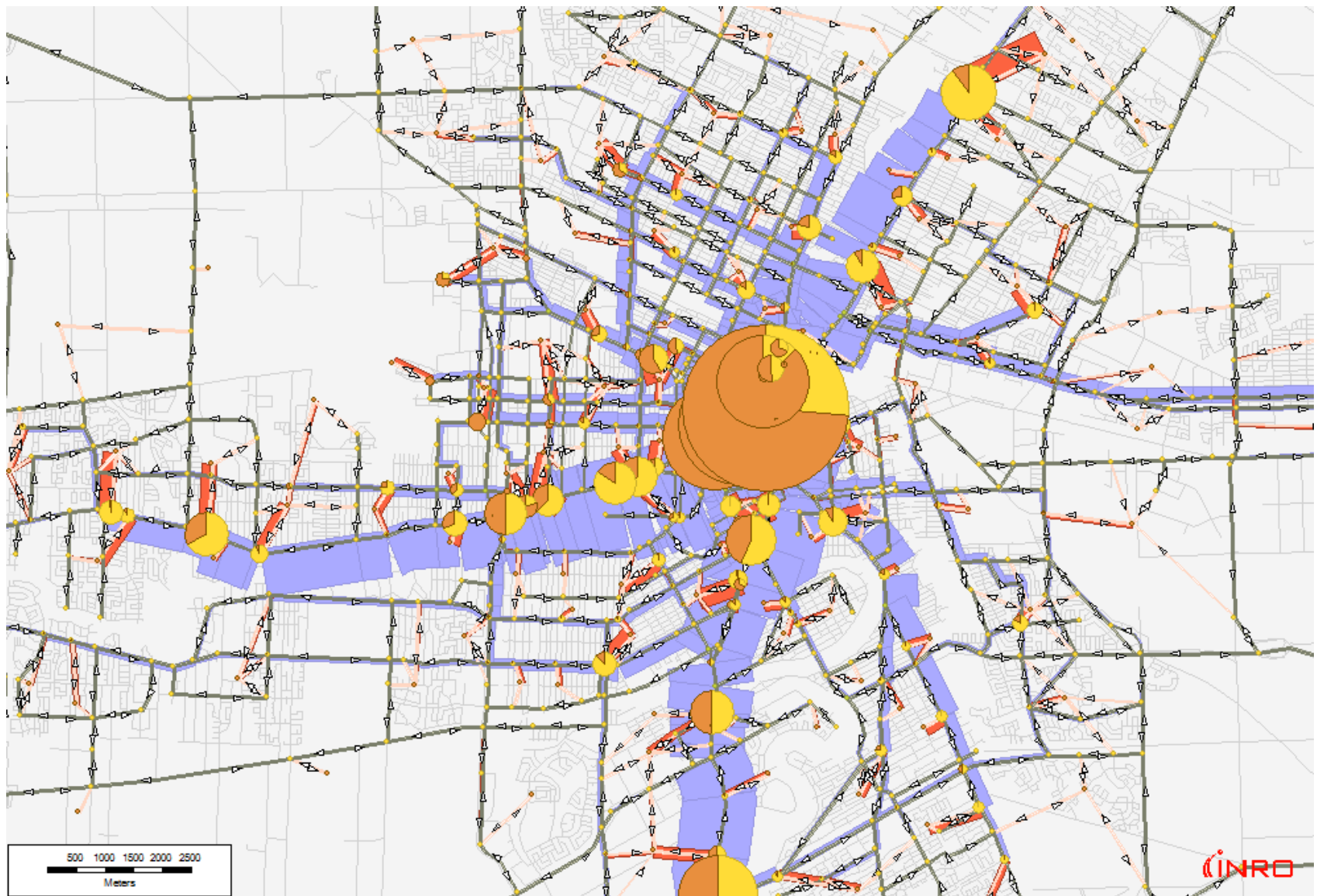
Capacitated Transit Assignment

10:56:49 Modeller Session 

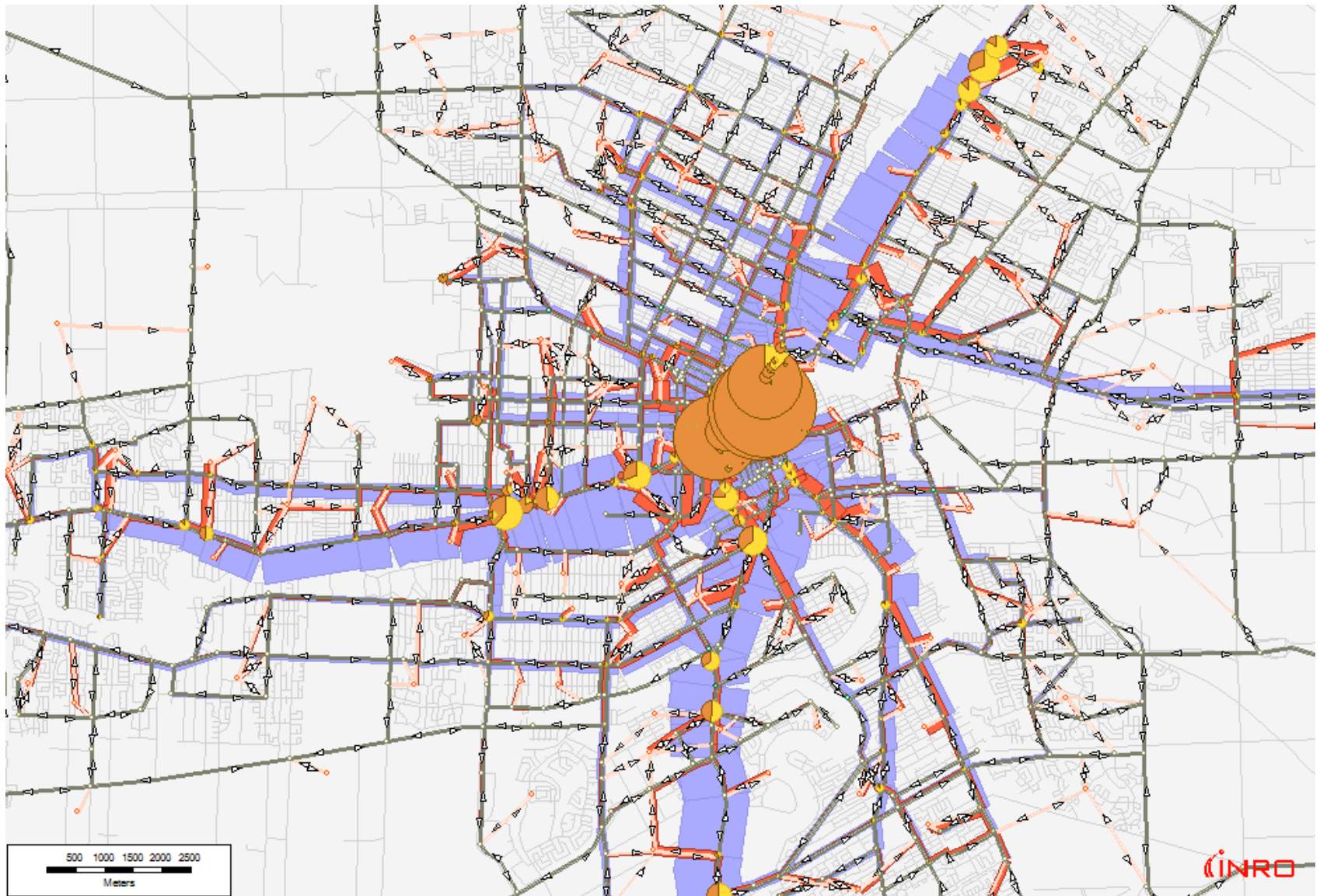
- [-] Modeller Session
 - [+] Standard transit assignment
 - [-] Transit assignment with capacities
 - [+] Matrix calculation
 - [-] Iteration 0
 - [+] Prepare transit assignment i
 - Congested line profiles
 - [+] Matrix calculation
 - Summary report (iter 0)
 - [+] Iteration 1
 - [+] Iteration 2
 - [+] Iteration 3
 - [+] Iteration 4
 - [-] Iteration 5
 - [+] Prepare transit assignment i
 - Congested line profiles**
 - [+] Matrix calculation
 - Summary report (iter 5)
 - Convergence chart



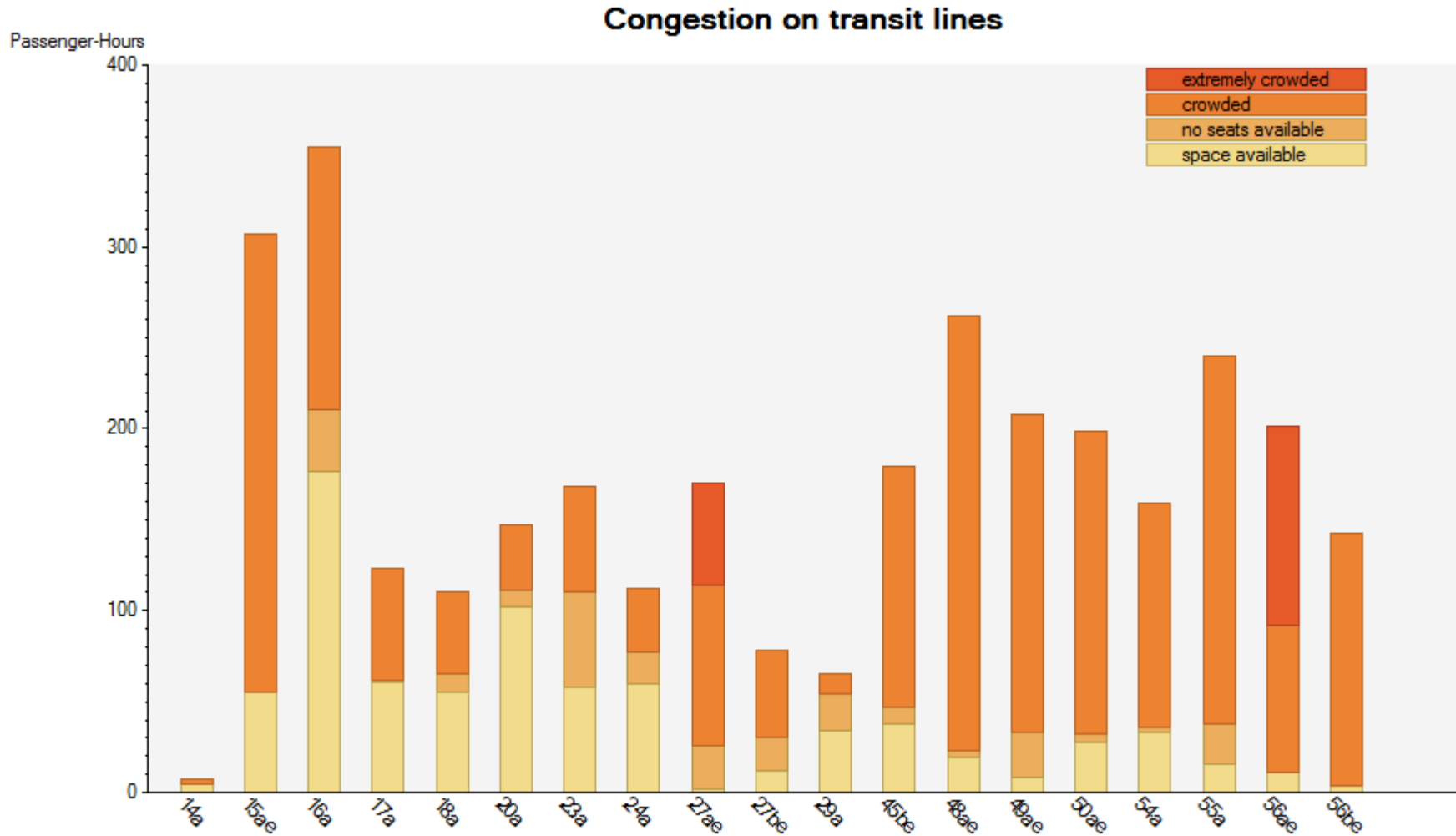
Transit activity (overcrowded)



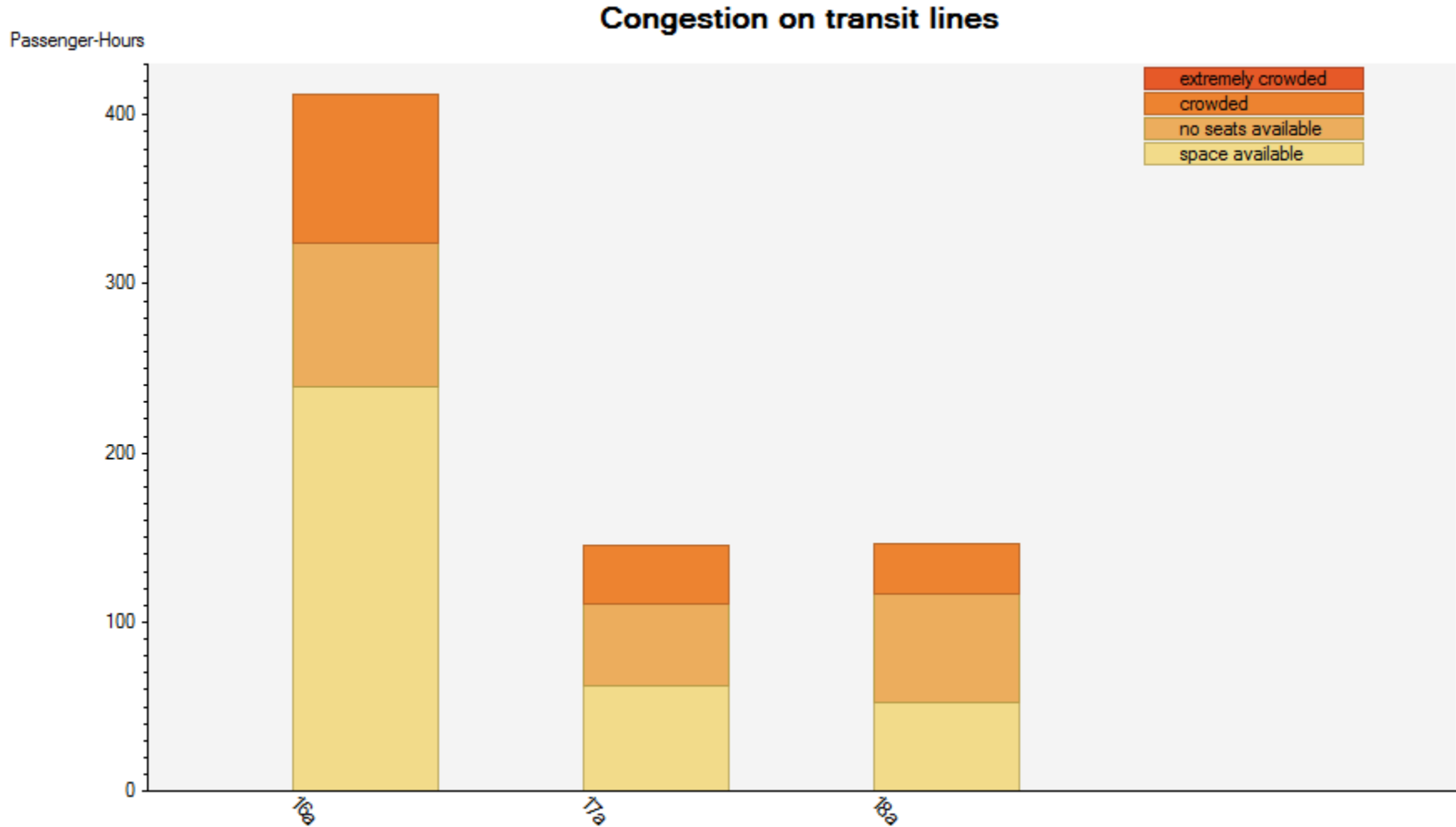
Transit activity (at capacity)



Overcrowded Transit



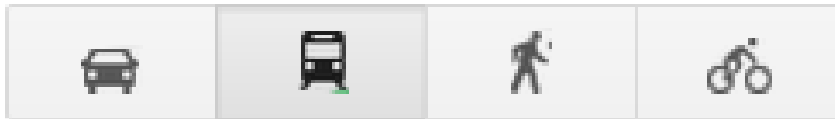
Capacity-constrained Transit



Integration with Travel Demand Model


- When equilibrating between supply and demand transit crowding drives multimodal impact

- Mode choice is affected



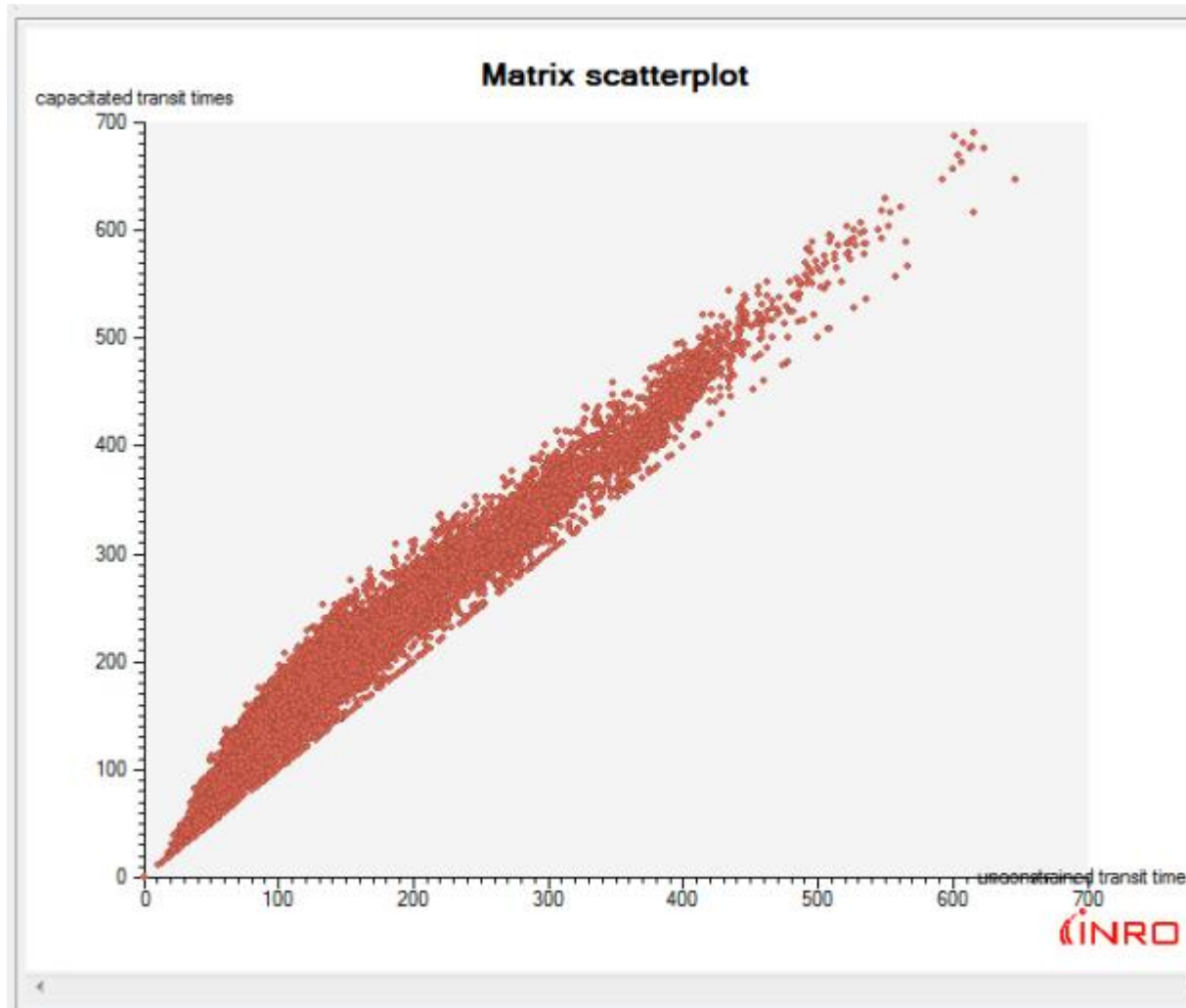
- Network flows of *competing* modes are also affected

Unconstrained vs Capacitated model

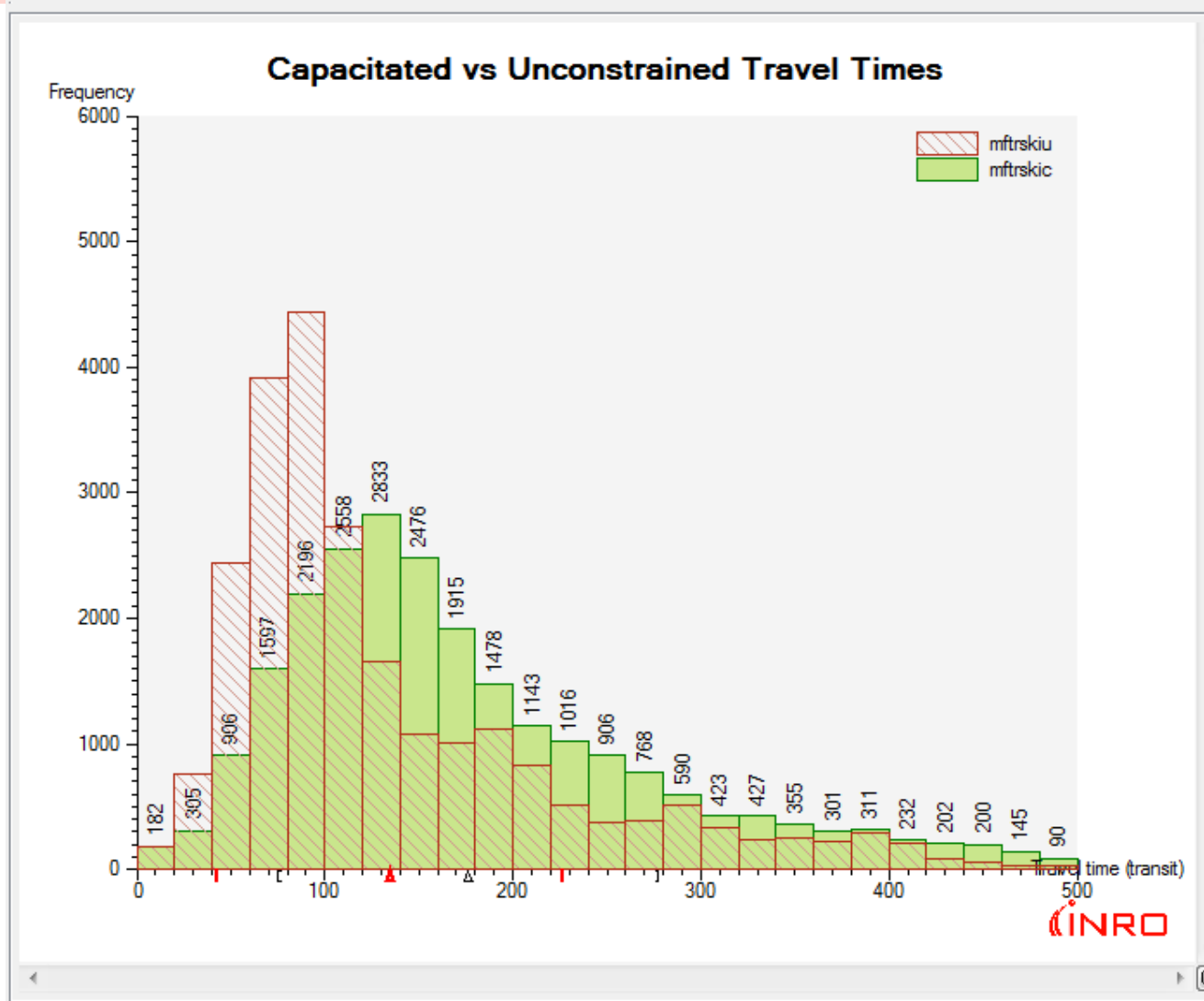
10:56:49 Modeller Session 

- [-] Modeller Session
 - [+] Standard transit assignment
 - [+] Transit assignment with capacities
 - [-] Equilibration model run
 - [-] Create matrix mf13 - survey - auto and transit survey demand
 - [+] Matrix calculation
 - [+] Init zonal data
 - [+] Assignment and skims
 - [+] Trip generation
 - [-] Create matrix mf16 - demit1 - demand from last iteration
 - [+] Model iteration 1/3
 - [+] Model iteration 2/3
 - [-] Model iteration 3/3
 - [-] Copy matrix mf18 to mf16 - demit1 - demand from last iteration
 - [+] Trip distribution
 - [+] Mode choice
 - [-] Assignment and skims
 - [+] Standard traffic assignment
 - [+] **Standard transit assignment**
 - [+] Traffic conditions
 - [+] Demand change from last iteration
- [-] Equilibration model run
 - [+] Init zonal data
 - [+] Assignment and skims
 - [+] Trip generation
 - [+] Model iteration 1/3
 - [+] Model iteration 2/3
 - [-] Model iteration 3/3
 - [-] Copy matrix mf18 to mf16 - demit1 - demand from last iteration
 - [+] Trip distribution
 - [+] Mode choice
 - [-] Assignment and skims
 - [+] Standard traffic assignment
 - [-] Transit assignment with capacities
 - [-] Transpose matrix mf20
 - [+] Matrix calculation
 - [+] Iteration 0
 - [+] Iteration 1
 - [+] Iteration 2
 - [+] Iteration 3
 - [+] Iteration 4
 - [+] Convergence chart
 - [+] Transpose matrix mf20
 - [+] Traffic conditions
 - [+] Demand change from last iteration

Transit travel times (Capacitated vs Unconstrained)




Distribution of travel times (Capacitated vs Unconstrained)



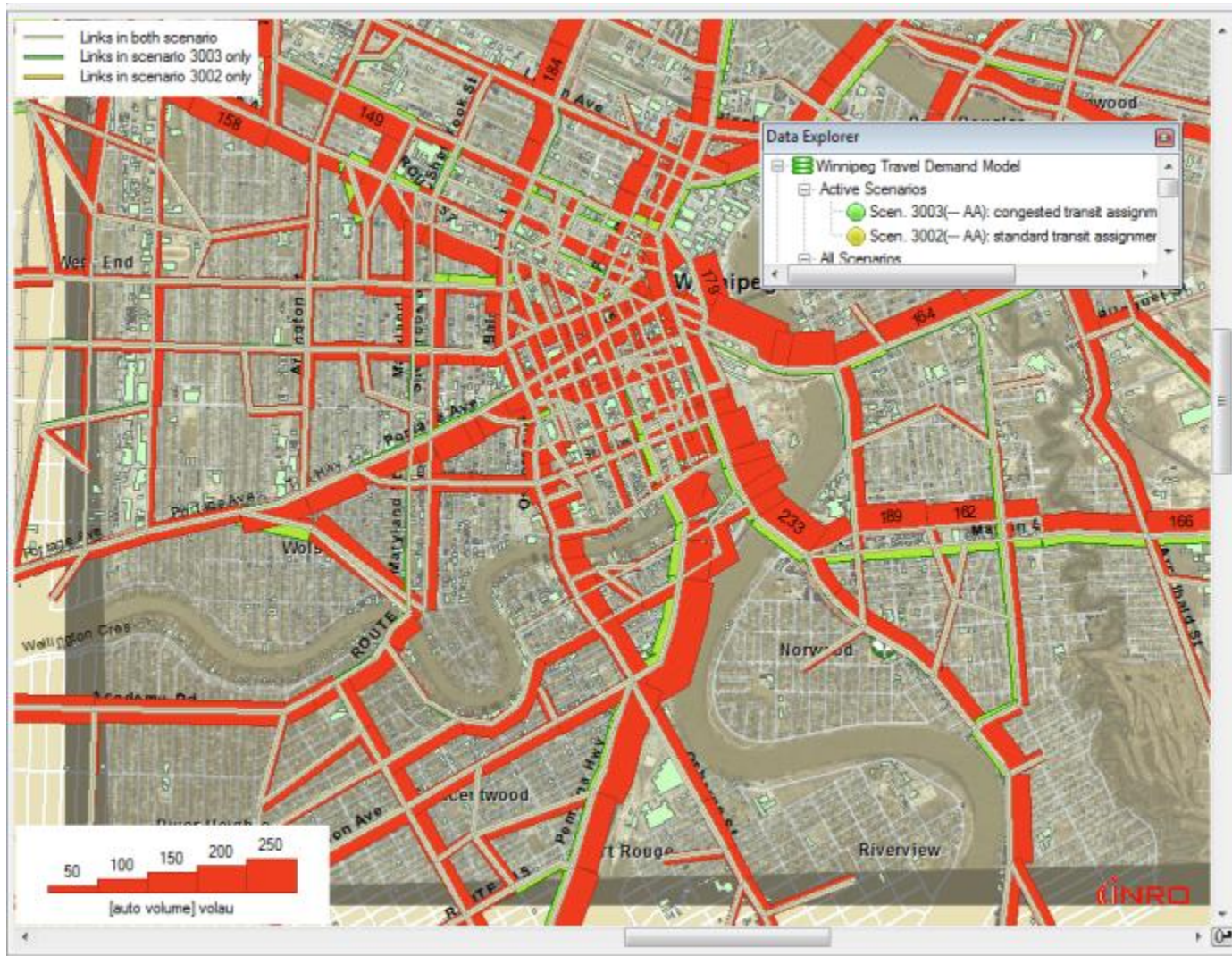
Unconstrained vs Constrained Model

CAR MODE SHARE

	Unconstrained Transit Assignment			Constrained Transit Assignment	
	Origin mode share	Destination mode share		Origin mode share	Destination mode share
Downtown					
Central	0.33	0.5		0.36	0.59
North West	0.61	0.84		0.67	0.88
North	0.8	0.85		0.86	0.9
North East	0.74	0.86		0.81	0.9
South East	0.75	0.87		0.82	0.91
South West	0.78	0.88		0.85	0.92
External zones	0.77	0.82		0.84	0.87
	0.93	0.97		0.96	0.98
Average	71%	82%		77%	87%

- Waiting, walking increase
- Transit mode shares drop
- *Flows of competing modes also change*

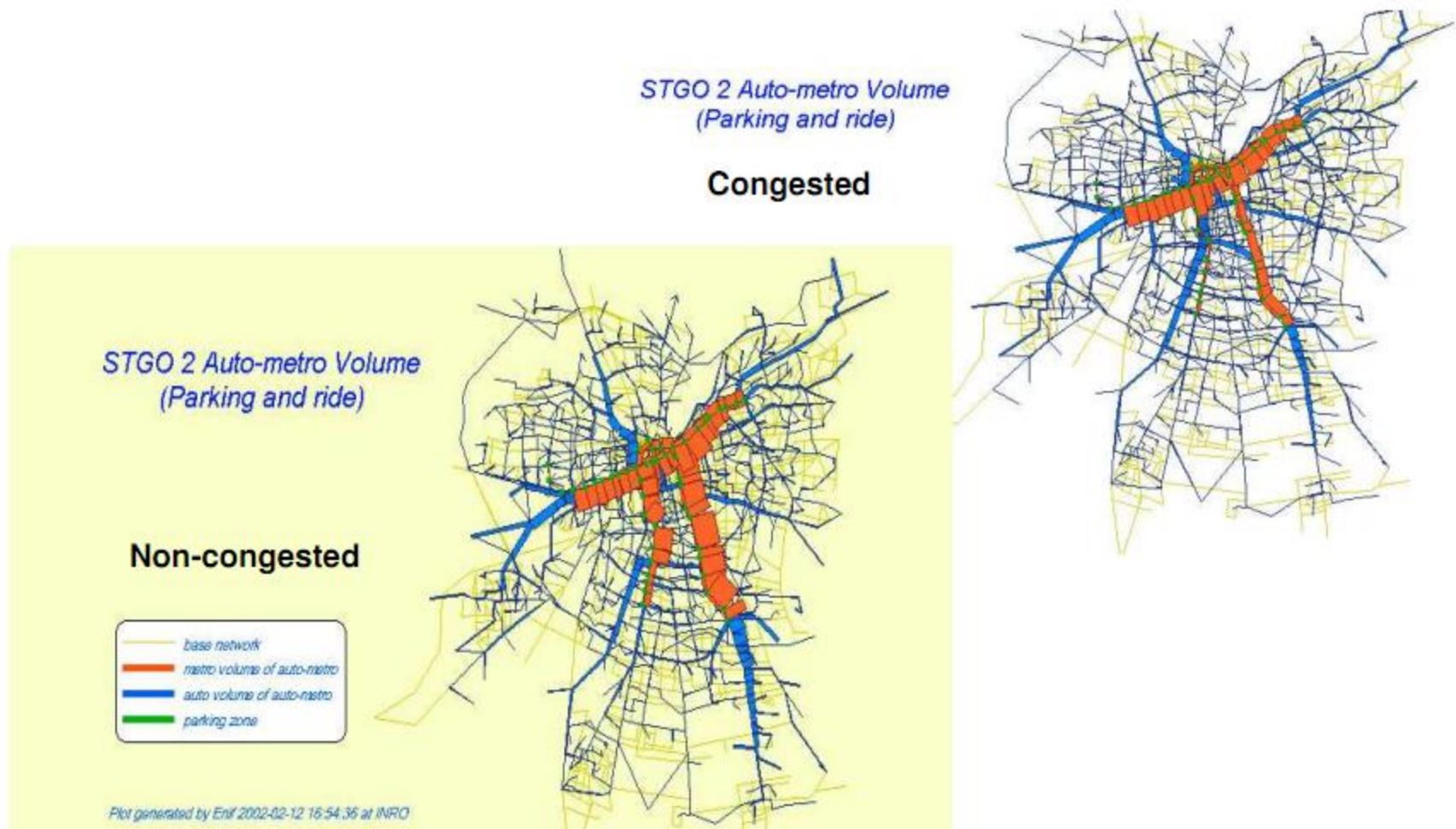
Car traffic increased



Transit flows diverted and decreased



Multimodal impacts of transit congestion



Congested Transit Applications



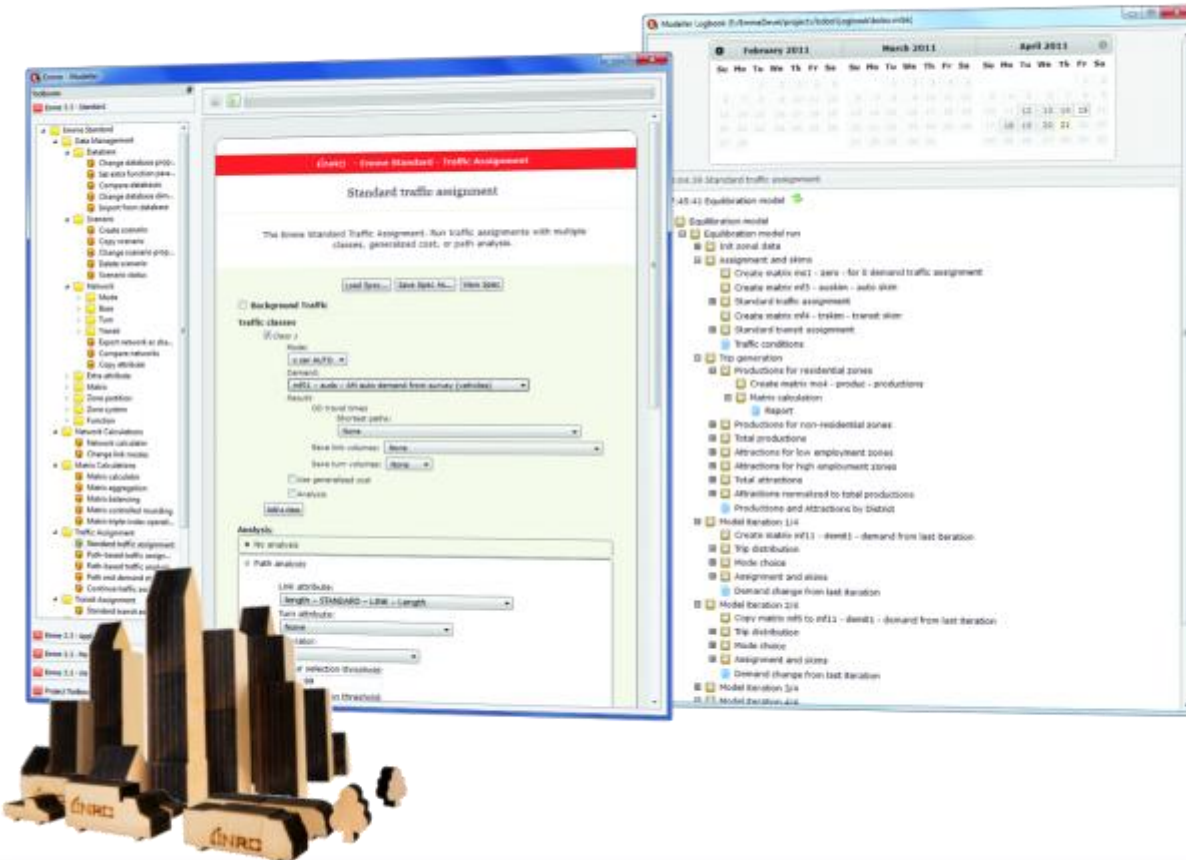
- London, UK
- Santiago, Chile
- Sao Paulo, Brazil
- Others...

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