Improving convergence of quasi dynamic assignment models - poster

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Publication date
2016

Citation (APA)
Brederode, L., Pel, A., Wismans, L. J. J., & de Romph, E. (2016). *Improving convergence of quasi dynamic assignment models - poster*. Poster session presented at 6th International Symposium on Dynamic Traffic Assignment, Sydney, Australia.

Improving convergence of quasi dynamic assignment models

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Research objective

For application in a strategic context, assignment models need to converge to a stable state. Besides poor convergence, dynamic models lack the tractability, scalability and low input and computational requirements that are needed in this context. Therefore, in this research we use the quasi dynamic assignment model STAQ, that combines tractability, scalability and low input and computational requirements of static with the realism of dynamic models and try to improve its rate of convergence.

Methods used

Network Loading Model: **STAQ**

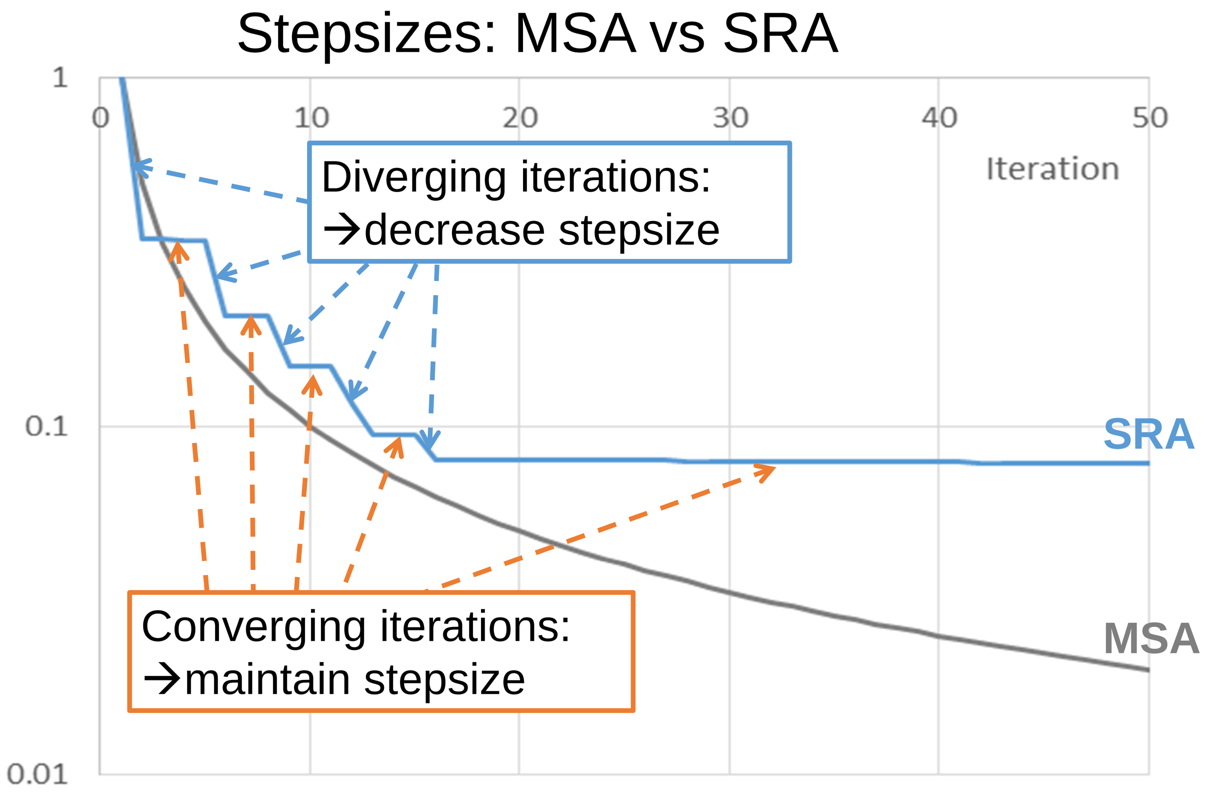
	Static	STAQ	1st order DTA
Link model:	Travel time function	Fundamental diagram	
Node model:	None	Explicit node model	
Demand:	Stationary		Time varying
Time periods:	Single		Multiple

Route Choice Model: **Multinomial Logit**

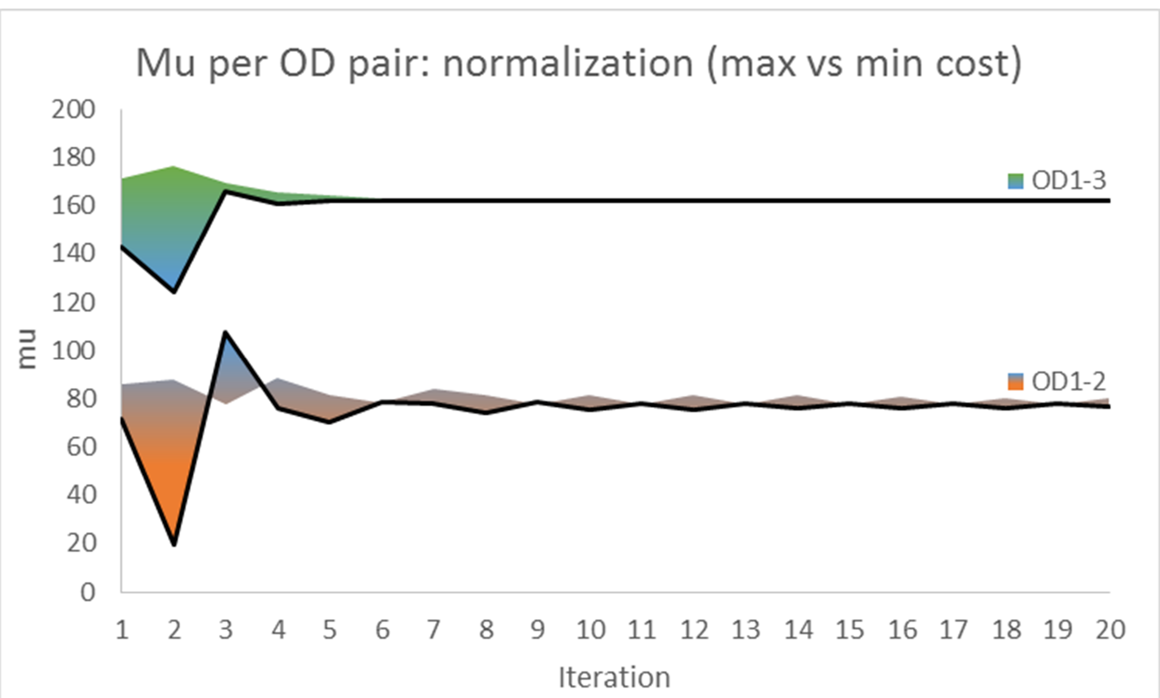
Convergence Metric: **Stochastic Duality Gap**
Straightforward extension of deterministic duality gap, but will go to 0 when using MNL route choice model

Tested averaging schemes:
MSA: method of successive averages (1/i)
SRA: Self regulating average (Liu et al 2009)

Stepsizes: MSA vs SRA

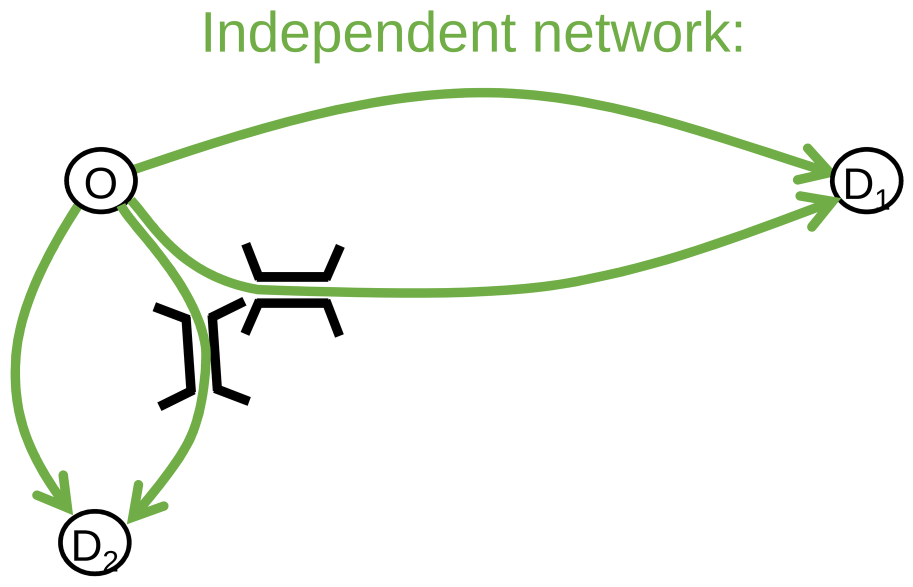


Proposed enhancements:
SRA **od specific**
SRA **normalize mu** based on maxcost:

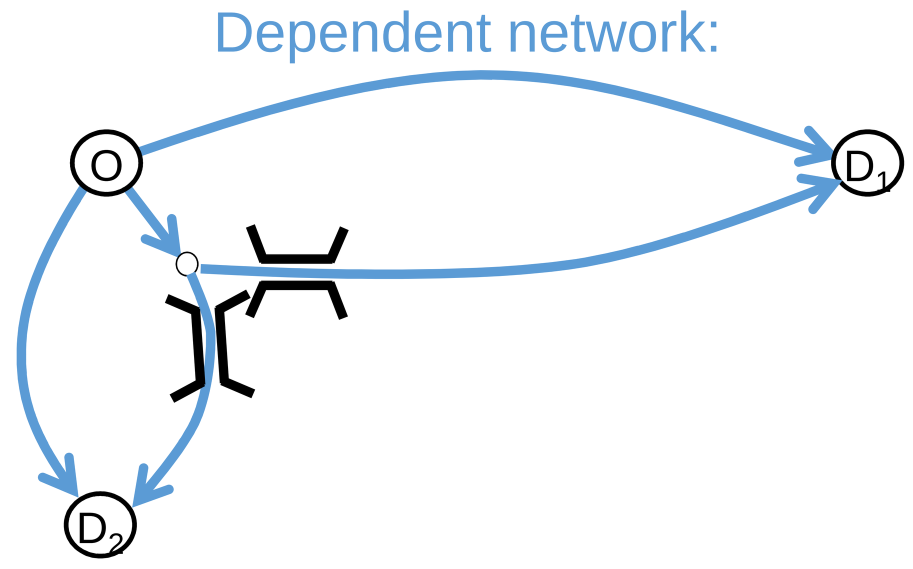


Results

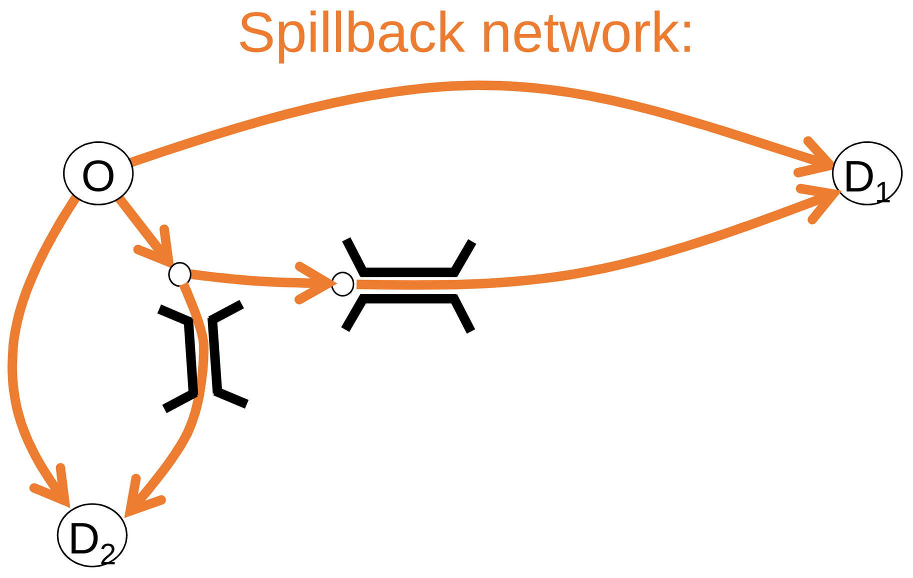
Test networks:
Independent network:



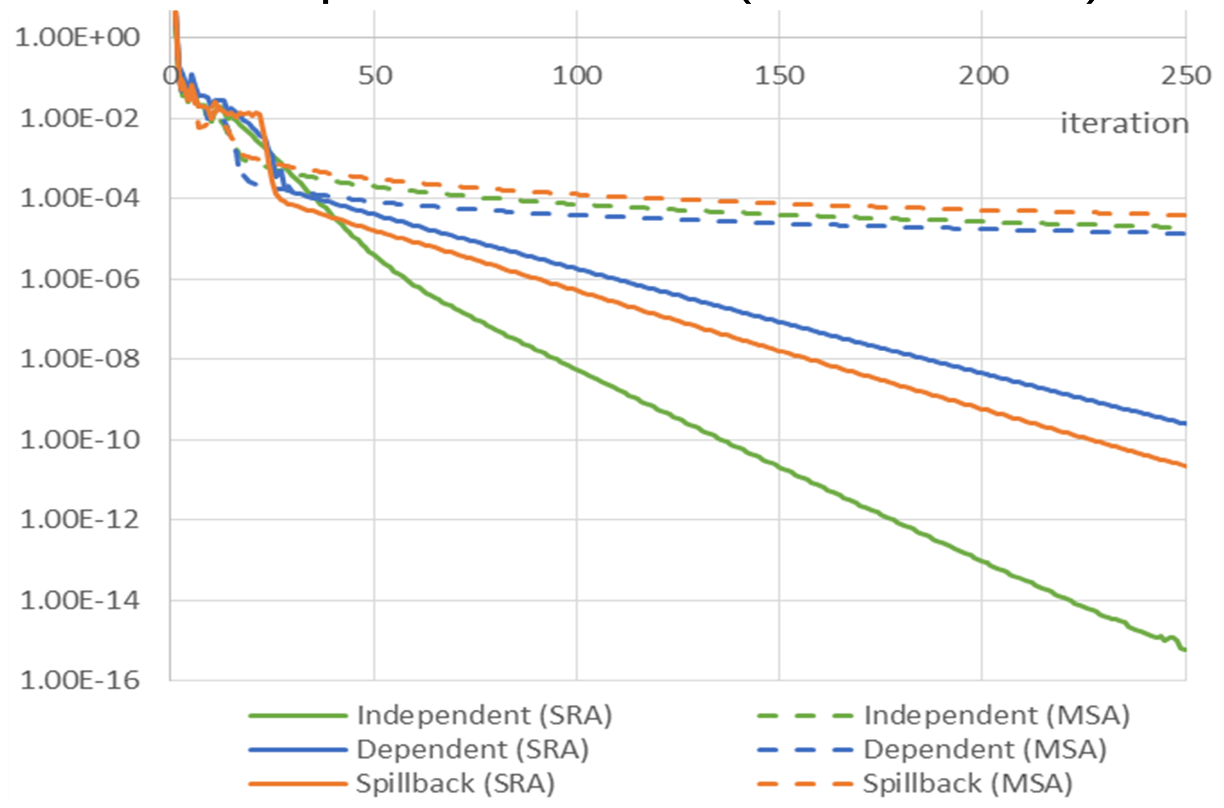
Dependent network:



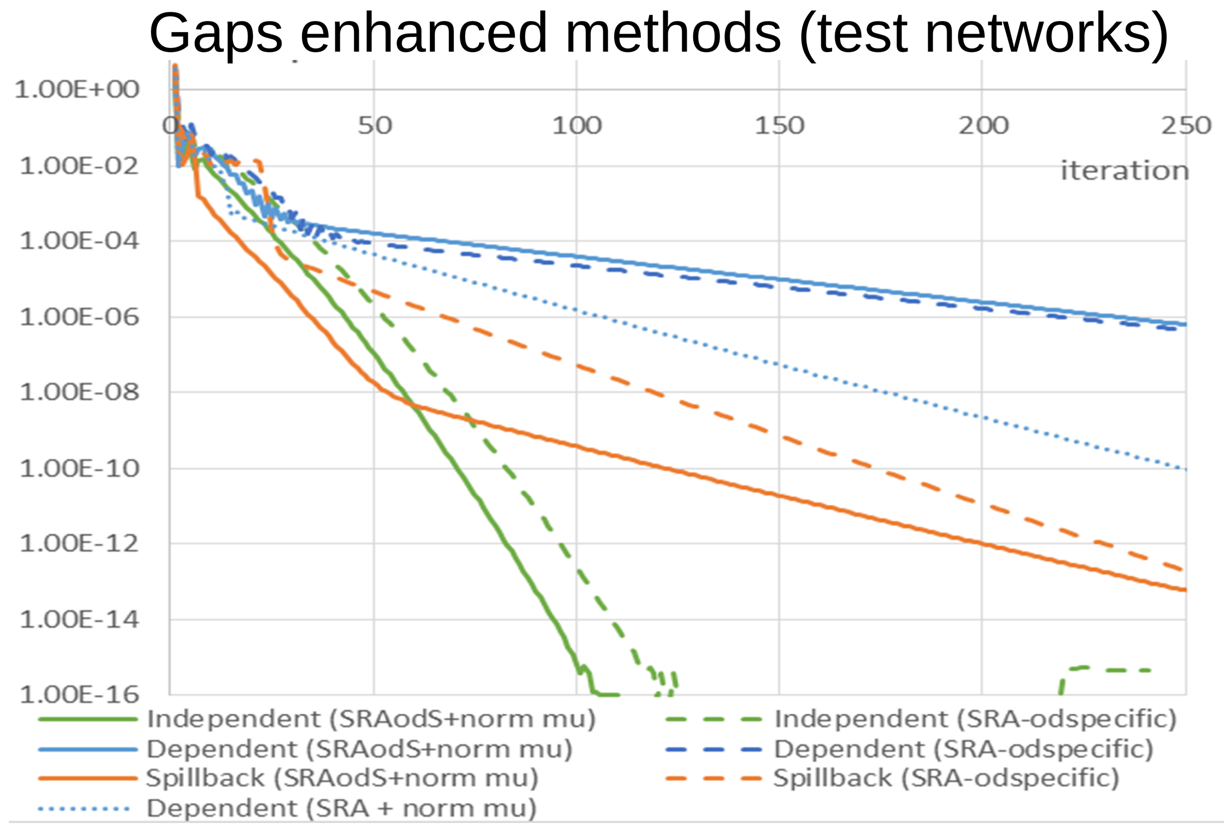
Spillback network:



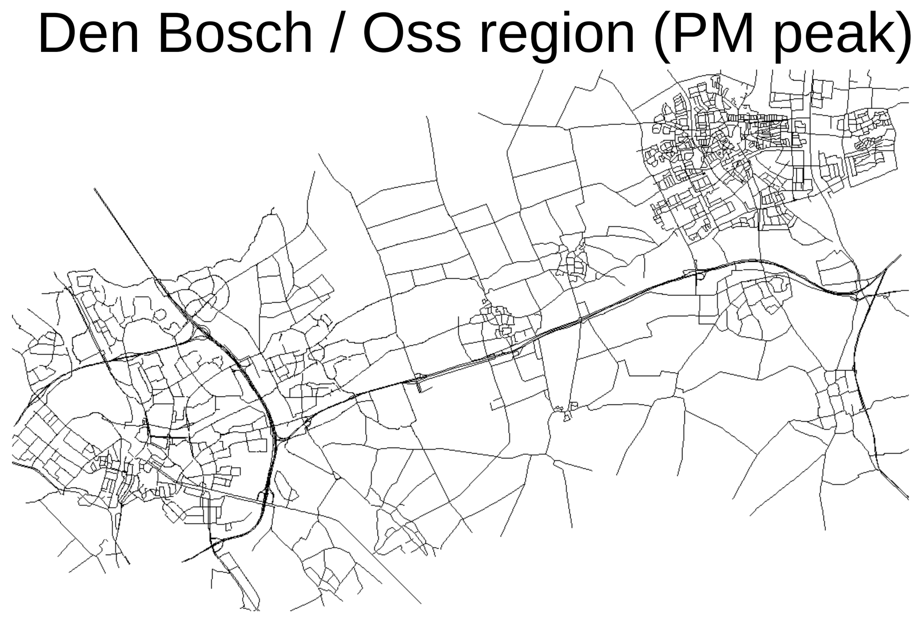
Convergence:
Gaps MSA vs SRA (test networks)



Gaps enhanced methods (test networks)

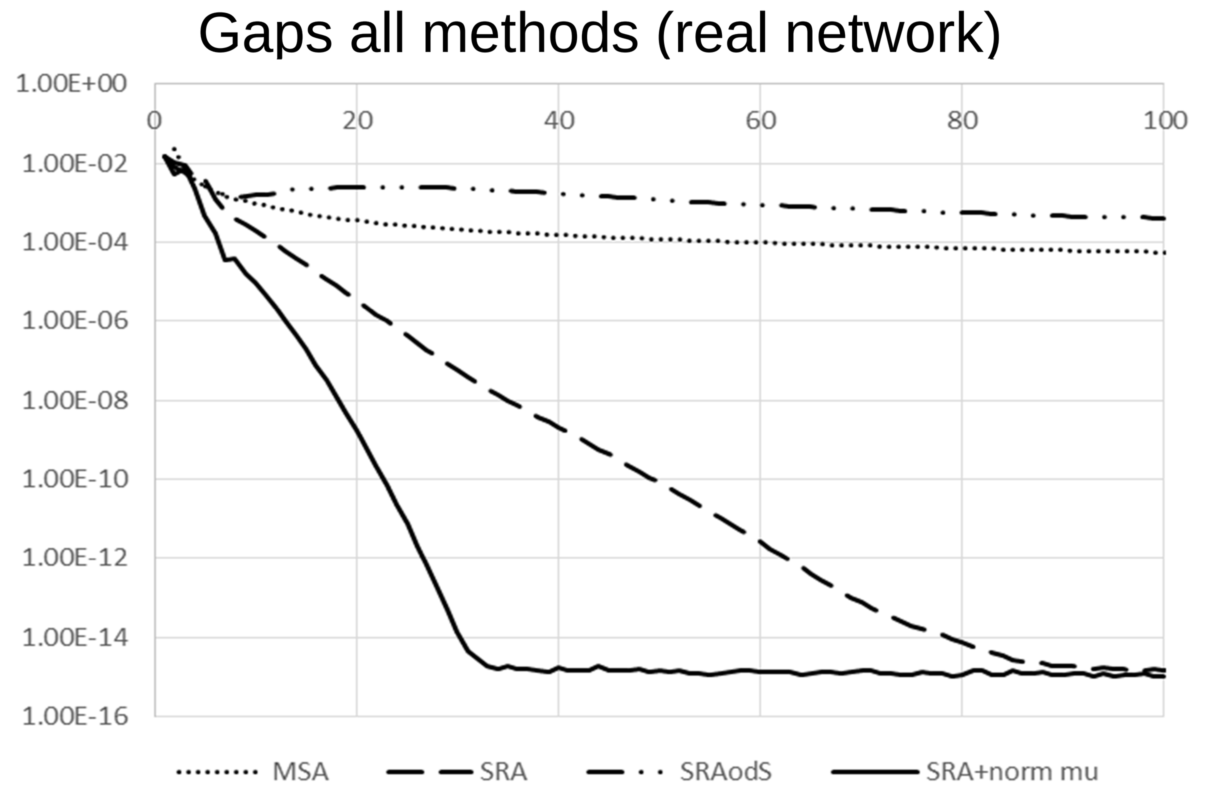


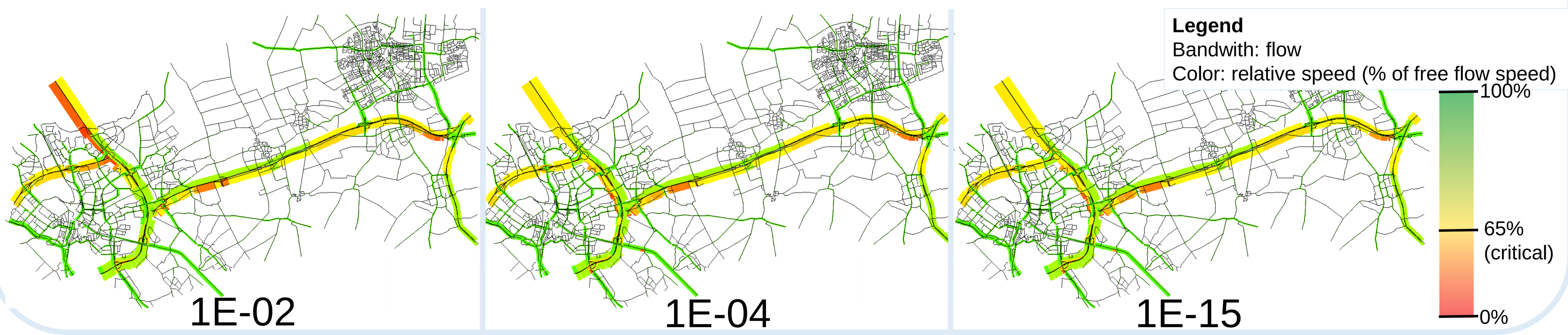
Realistic Network:
Den Bosch / Oss region (PM peak)



148 zones, 7005 nodes, 15200 links, 25000 routes

Gaps all methods (real network)





Conclusions

Capacity and storage constraints may cause route cost functions to become:

1. over-sensitive causing an ‘instable phase’ during the first iterations;
2. strongly inseparable when sharing (spillback from) a bottleneck.

Both properties are also existent in pure DTA models and lead to poor convergence.
Ad 1: SRA outperforms MSA, but only when higher precision user equilibrium is needed. For lower precision the ‘instable phase’ needs to be shortened, which can be done by normalizing the scale factor of the route choice model to the largest routecost.
Ad 2: SRA-ODspecific outperforms SRA, but only when inseparability of routes is taken into account: OD pairs should be clustered based on level of inseparability.
High precision (DG<1E-05) is not needed for strategic application (finding is in line with literature on static traffic assignment models, i.e.: Boyce, Ralevic and Bar Gera 2004).

Presented at the 6[th] international symposium on dynamic traffic assignment – Sydney, Australia