Space-Time Traffic Assignment

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DTA Applications in the GTHA

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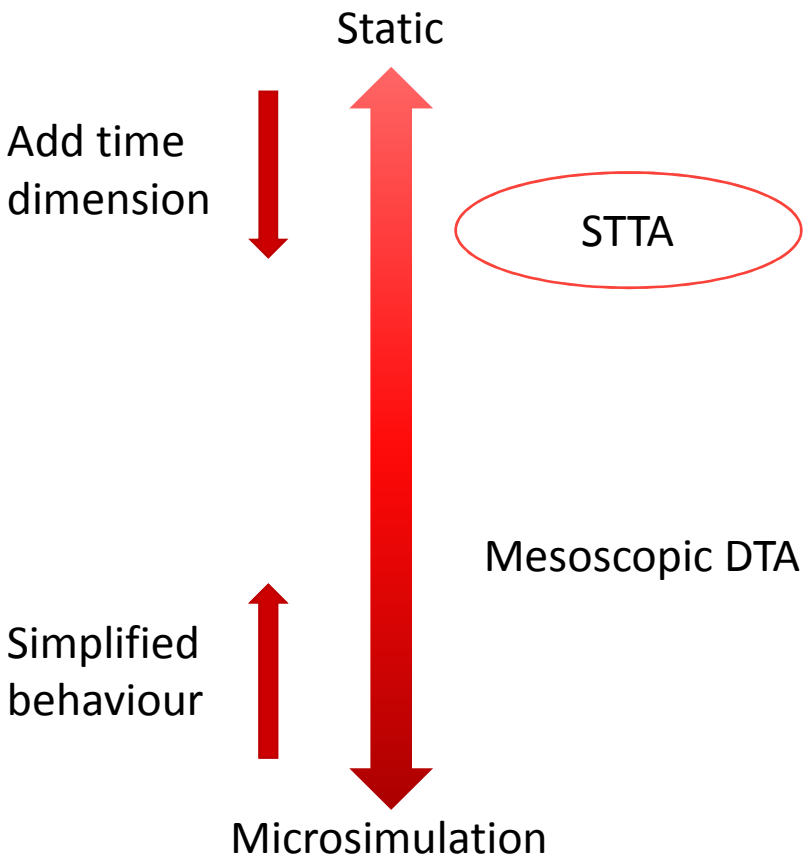
STTA in Context



Mathematical representation of congestion effects

More stable than microsimulation, often includes route choice

Very detailed behaviour. Usually for corridors or smaller subareas

Static Assignment Review

- Primary Simplifications
  - Vehicle interactions not considered, mathematical representation of delay
  - All trips span from origin to destination
- Advantages
  - Well studied, stable results, relatively easy to calibrate
- Drawbacks
  - Cannot profile start times in the assignment
  - Trips span from origin to destination (examples):
    - 1-hour assignment: Trip from Hamilton to Oshawa
    - 3-hour assignment: short trips always on the network

STTA: What, and why?

What:

- Divides the time period and demand into intervals.
- Link flows/analysis results have discrete time component

Why:

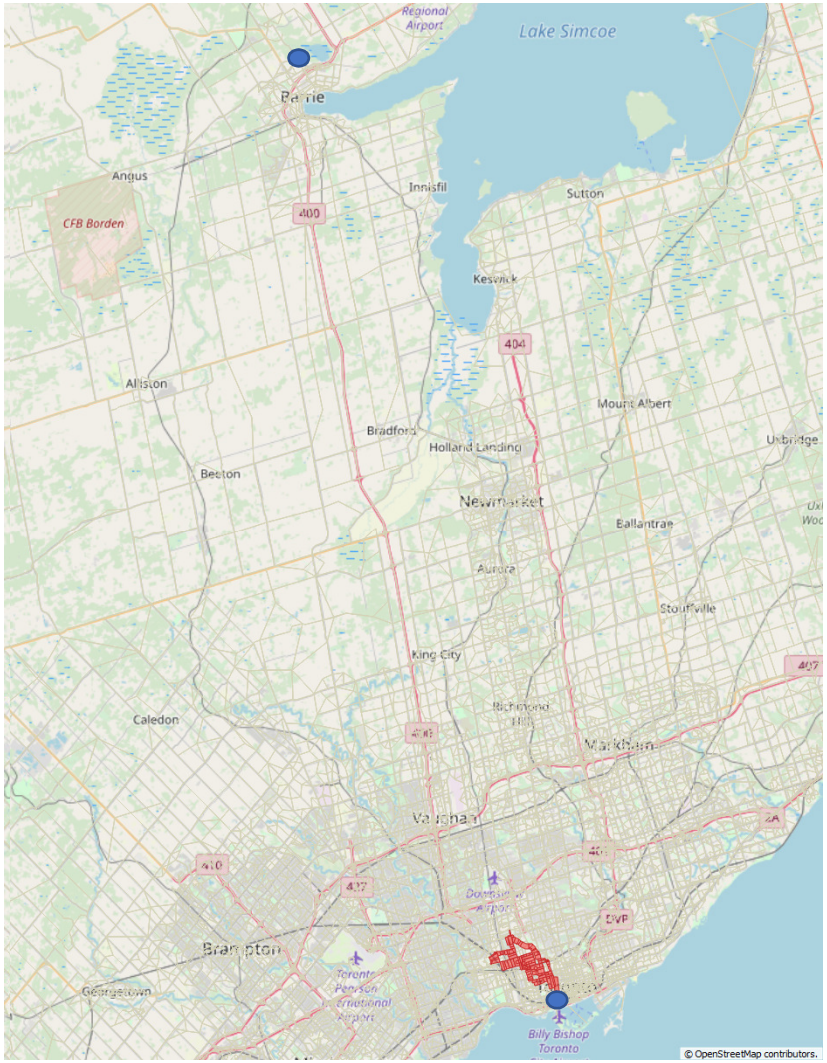
- Large study areas (regional, provincial, national)
  - Long trips are present
  - Trips profiled (segmented) into time periods
- Very useful to produce time-profiled subareas

Uses same network, volume delay functions, etc. as other Emme traffic assignments!

Example

Barrie to University of Toronto

SOTA with ½ hour intervals



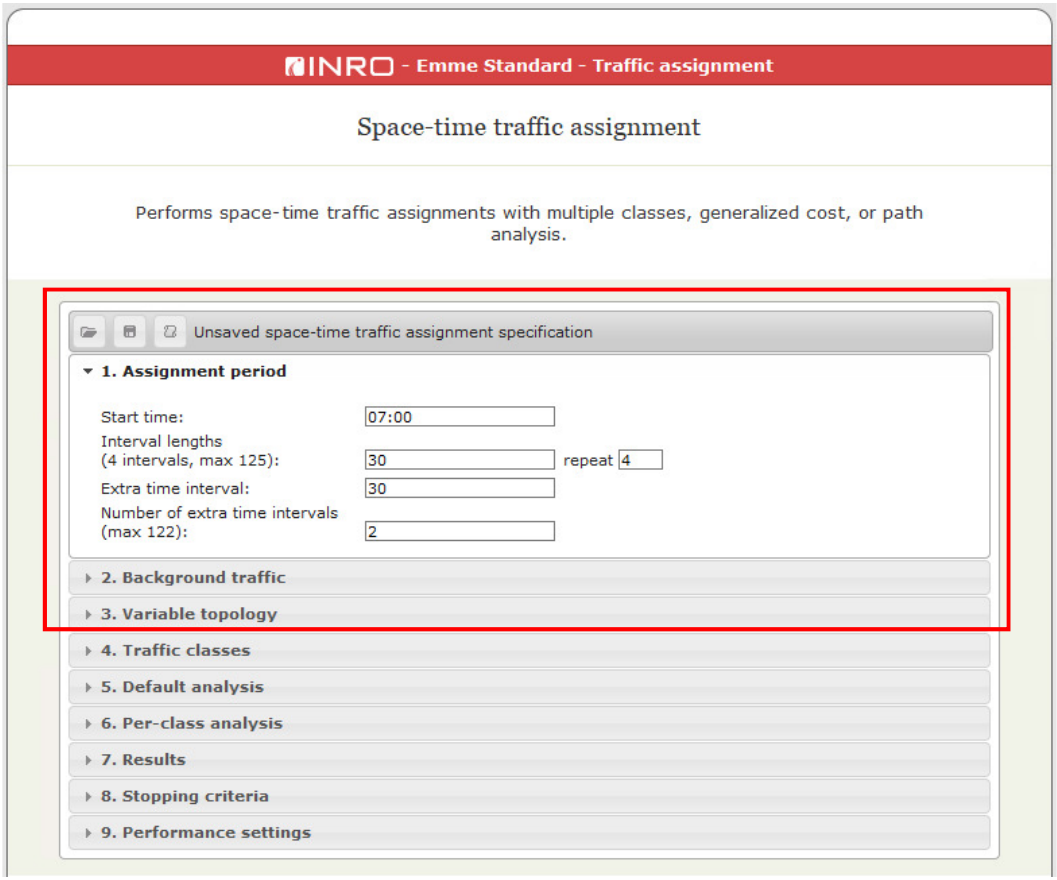
Two-Level Algorithm

- Internally duplicates network for each time interval
- Two-level problem:
  1. Outer loop
     - Defines subnetwork for each path (determines where paths switch between time intervals)
  2. Inner loop
     - Converges subnetwork using SOLA algorithm

Setting up an STTA Run

Define time periods

- *Start time* is just for reporting
- Can have unequal time periods
- Extra periods to clear the network
- Optional variable background traffic and network topology

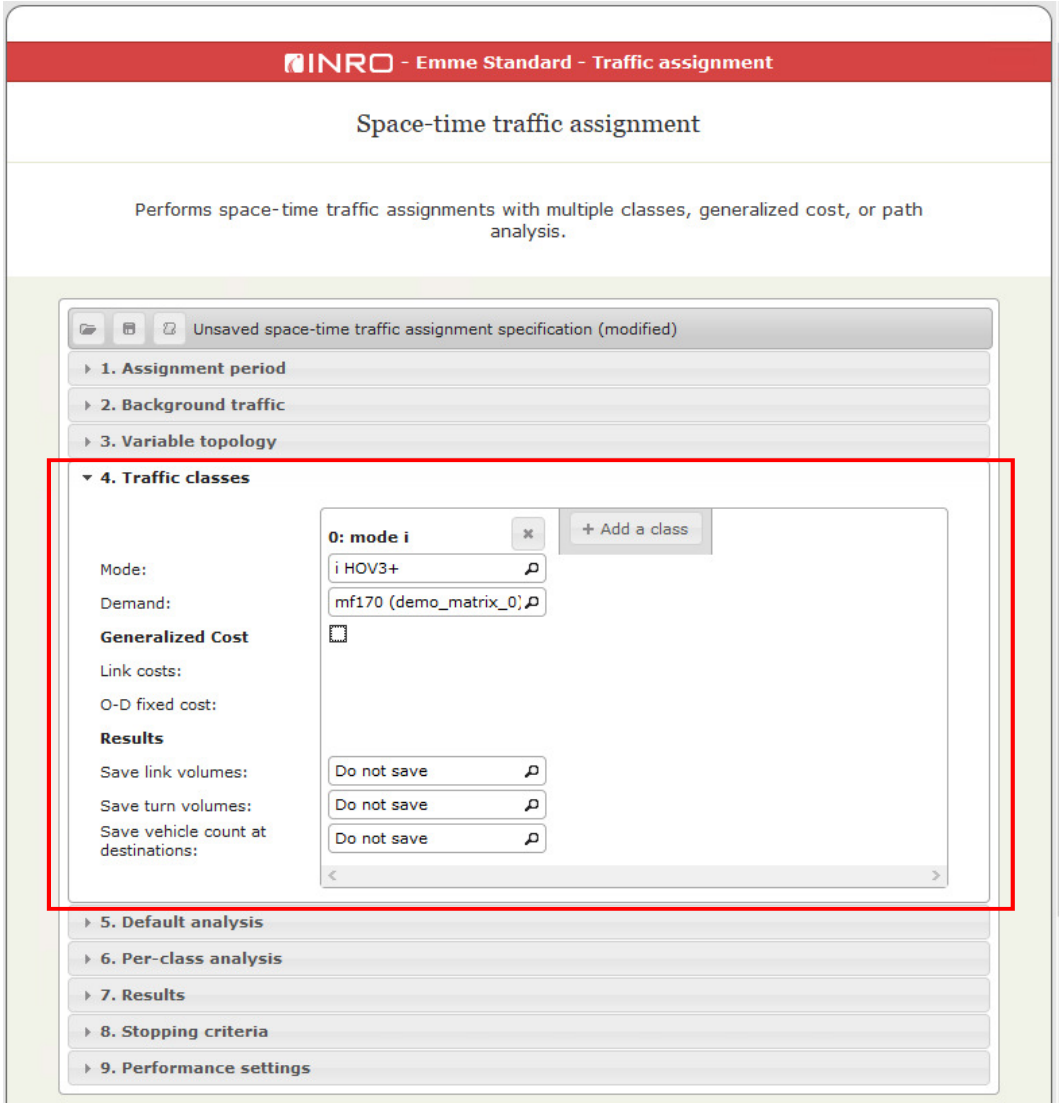


Time varying attributes / matrices

- STTA still uses EMME database structure
- Inputs/outputs use *time varying attributes*
  - *Example: 1 class, 3 intervals*
    - *Input demand matrix: mf10*
      - *Interval 1: mf10*
      - *Interval 2: mf11*
      - *Interval 3: mf12*
    - *Input link volumes: @volau_1*
      - *Interval 1: @volau_1*
      - *Interval 2: @volau_2*
      - *Interval 3: @volau_3*

Traffic Classes

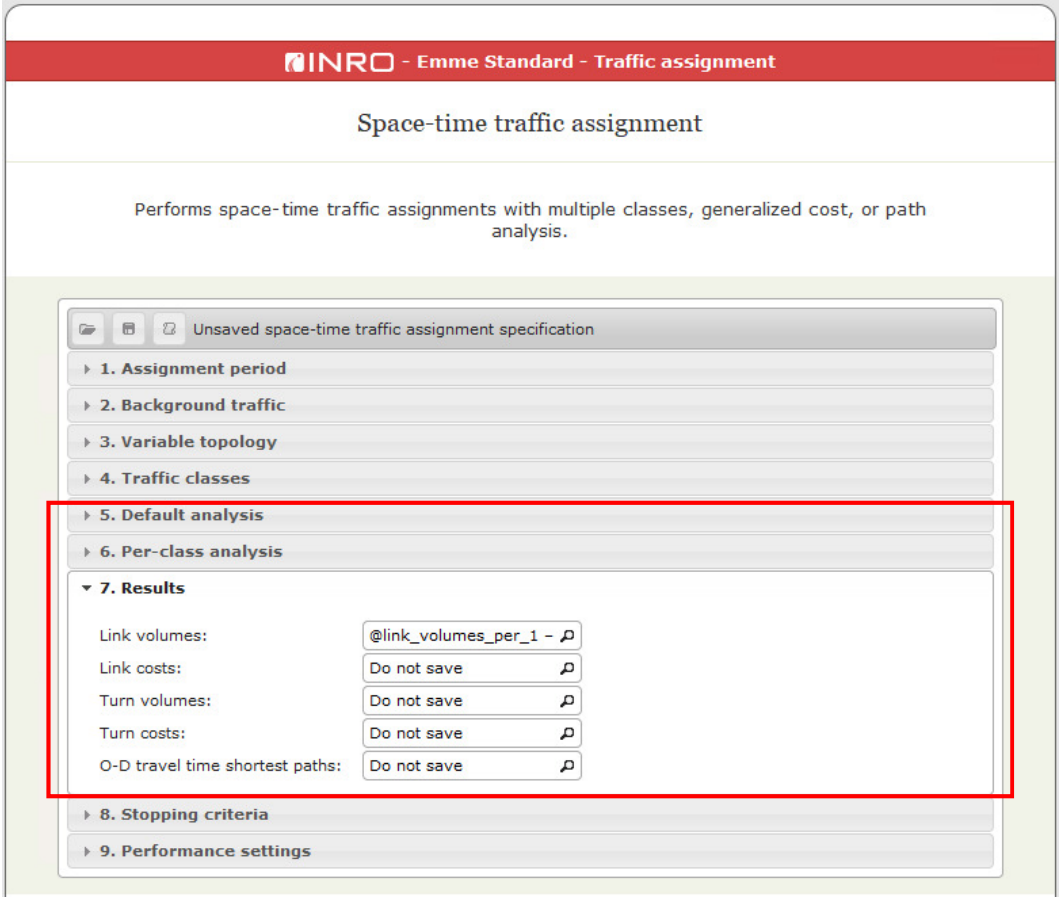
- Similar to other Emme traffic assignments
- Time varying attributes/matrices
  - Demand
  - Generalized costs
  - Results
- Demand defined as flow rate (veh/hr)[1]



1. Or time unit in your vdfs.

Results

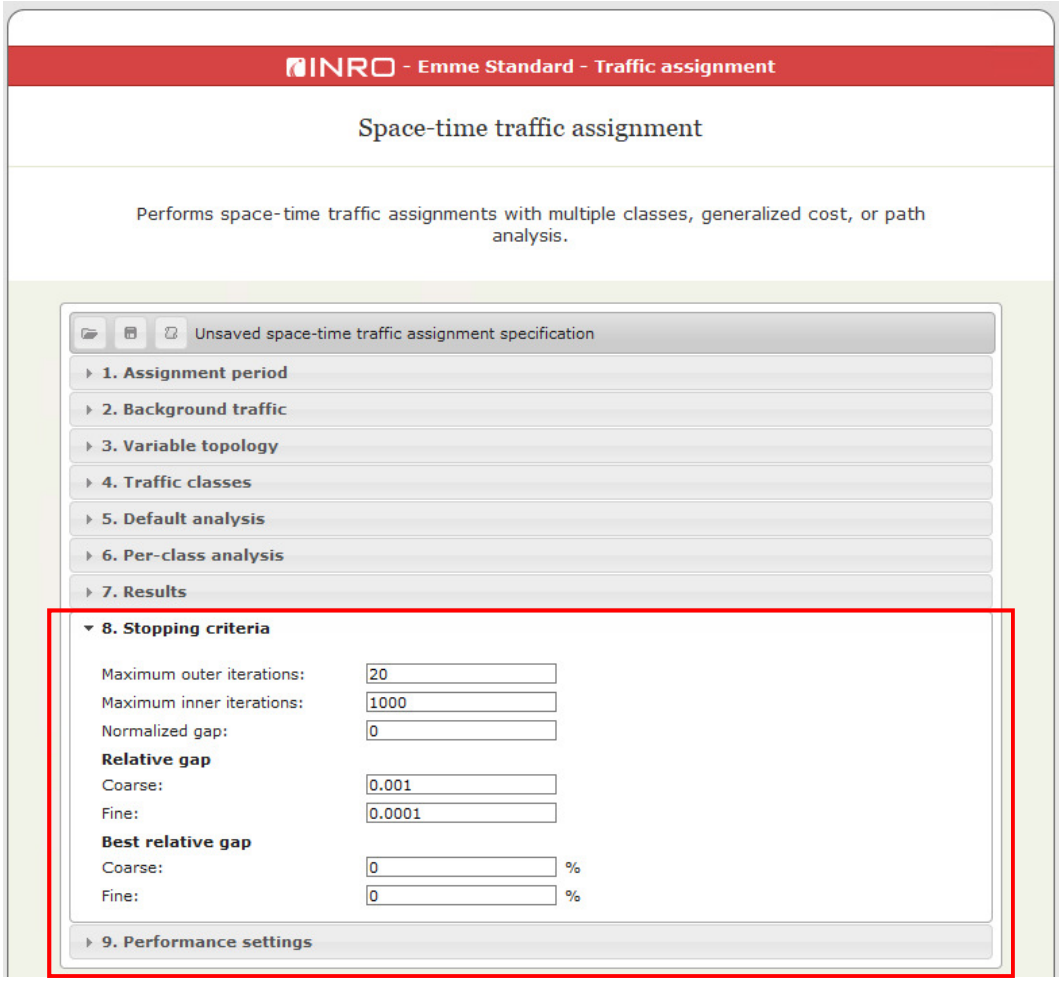
- Link/turn volumes (**flow rates in veh/hr**)[1]
- OD travel times
- Analyses … *:*
  - Select link
  - Distance
  - Traversal



1. Or time unit in your vdfs.

Stopping Criteria

- Two-level problem
- Outer problem
  - Number of iterations
  - 20 is a reasonable default but experimentation required
- Inner problem
  - Same as other traffic assignments
  - Shouldn't stop on number of inner iterations criteria.
- Can be parallelized to improve run times.



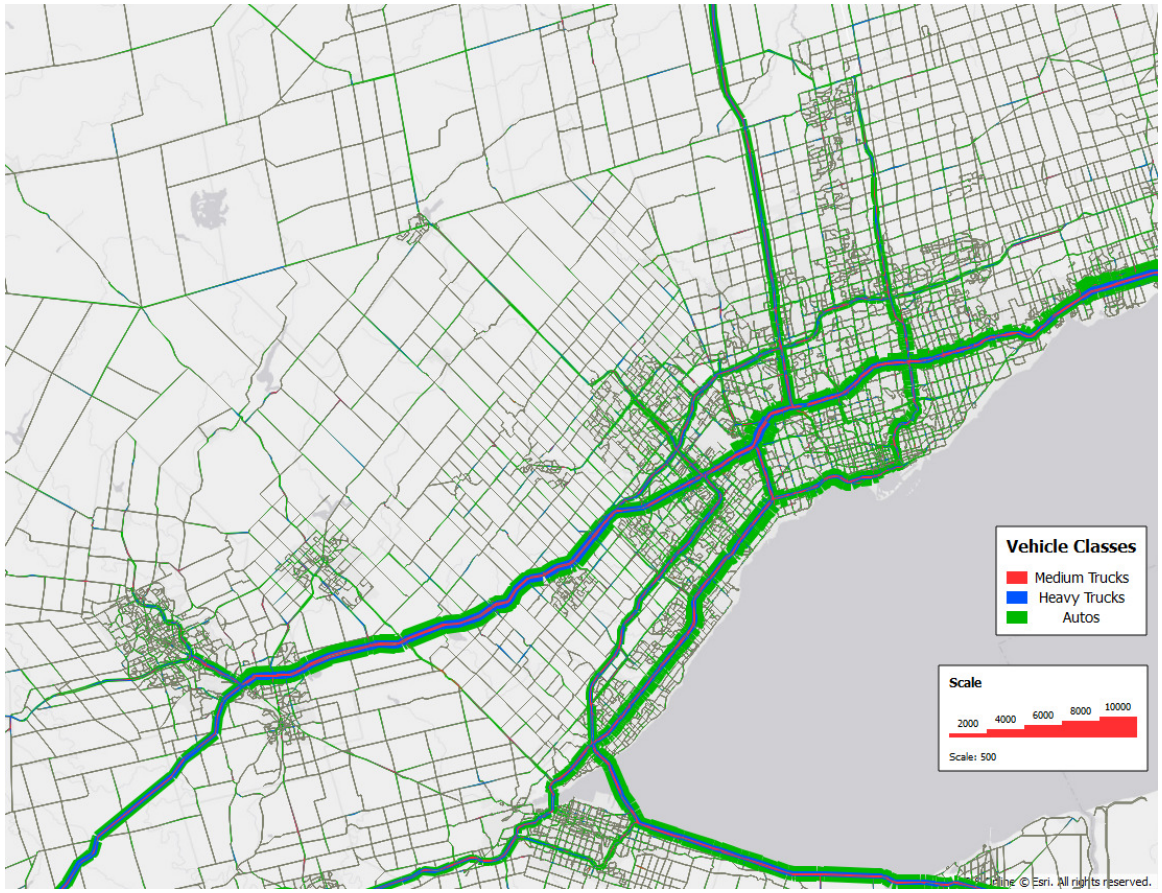
Gotchas

- Blackholes
  - All traffic must be able to exit a link during a time interval – otherwise trapped
  - Check link lengths
  - Can adjust VDFs
  - Verify using c*ost* result attributes
- Tolling
  - **Be careful** – response to generalized costs not the same as other traffic assignments
  - INRO says that this should be improved in Emme 4.4

TRESO Example project

07:00 – 08:59

- Provincial multimodal model, passenger and freight for MTO
- Network spans continental North America
- 6,638 zones
- 160,000 road links
- 9 traffic classes
- 10 time intervals



Recap

- STTA is an extension of ‘traditional’ Emme traffic assignments that adds a time component
- Allows:
  - Time profiled start times
  - Long trips to be broken up into different periods
  - Short trips only present during single period
- Expands network (internally) across time periods
- Time-varying inputs and outputs for time profiles

STTA vs. DTA

- STTA is still based on a ‘macro model’ philosophy
  - Individual vehicles not modelled
  - Delays based on mathematical formulations
  - Simplified (Emme-based) network compared to DTA
- STTA is particularly suited to modelling large areas
- Also very useful to produce time-profiles demand for more detailed DTA analyses.

Questions?