

How can (micro) simulation be used for noise mapping and action planning?

Workshop on Road Traffic Modelling and the
European Environmental Noise Directive
Budapest, August 29, 2005



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Overview

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- Strengths: Micro-simulation seems perfect for noise mapping and planning
- Too good to be true?
...some weaknesses
- Case study intersections – some preliminary results



Micro-simulation

The logo for IMAGINE, featuring the word "imagine" in a lowercase, sans-serif font. The letters are white with a slight shadow, set against a background of overlapping, semi-transparent blue and green oval shapes. A small white star is positioned at the top right of the word.

- Individual vehicles are simulated:
for each time-step (typically 0,5s), position, speed and acceleration are calculated
- Simulation based on a number of algorithms:
 - vehicle generation ---> **stochastic process:** *time of entry, vehicle type, driver characteristics*
 - car-following
 - gap-acceptance
 - lane-changing
 - signal-behaviour



Micro-simulation (2)

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- Extreme level of detail:
 - network: #lanes, lane width, detailed intersection layout (incl. position of stop lines, flared approaches, ...), HOV lanes, ...
 - traffic signals: from fixed settings to vehicle actuated
 - vehicle characteristics: vehicle type, length, max. speed, max. acceleration/deceleration, mean age, ...
 - driver characteristics: behavioural parameters (reaction times, aggression level, gap acceptance, ...)



Dashboard View [X]

File View Tracers Help

01 Type 00:03:32 00:01:17 1 889.03 m

03 Age Time Taken Cost to Dest Distance To Go

06 Awareness

04 Aggression

01 Origin

01 Trip Origin

02 Trip Dest

02 Destination

01 Nextout

01 Nextout2

01 Exit Index

00 Lane Secs

01 Lane

01 NextLane

01 Table

00 Perturbation

00 ATT Type

03 ATT Trust

22 Patience

000 Link Stop Time

000 Trip Stop Time

01 User 1

01 User 2

01 User 3

01 Familiar

01 Restricted

01 Move R

01 Move L

01 Slip

01 New

01 Braking

01 Accelerating

01 Diverted

01 Rerouted

01 Delayed

01 Temp Dest

01 Incident

01 Next Set

01 Range Set

01 IRange Set

01 Let In

01 Stopped

01 Stop State

01 Slow Change

01 Congestion

01 Overtaking

1 0.97 s Tgt (Headway) Act 2.47 s 1

Max 77 Turn --

77 kph

1 700

mpss

-0.0

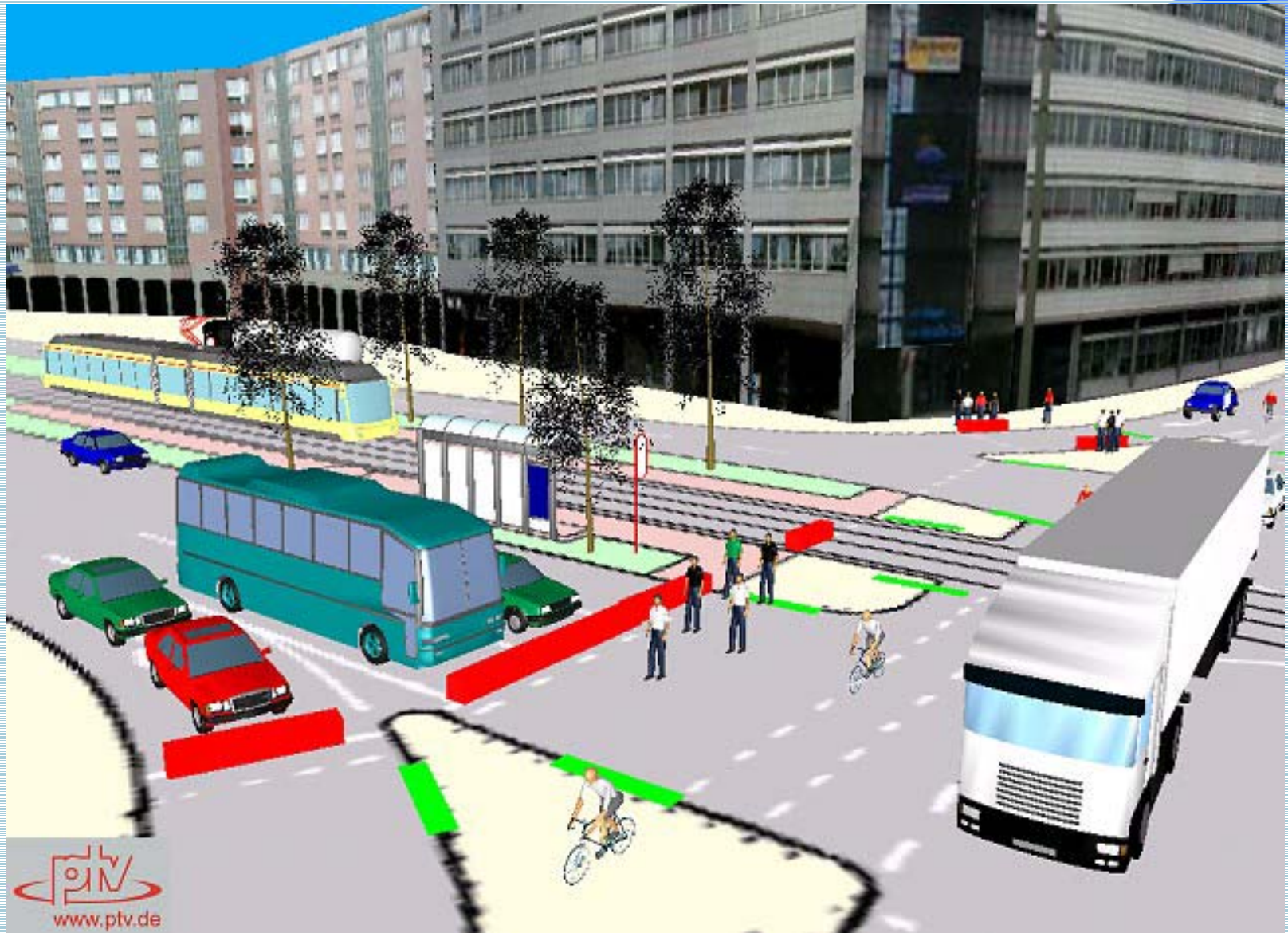
2 4 5

1 3 R

77 kph 77 kph 77 kph

Incident



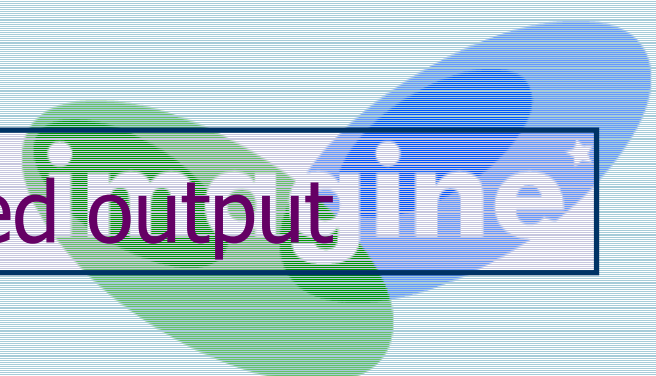


...as input for noise modelling engine

- speed and acceleration information, both spatially and temporally very detailed, per user class available
- Aggregation procedures
 - use instantaneous vehicle parameters to calculate emissions, then assign emissions to section of road
 - use aggregate vehicle parameters for a given road section/time period to produce noise emissions



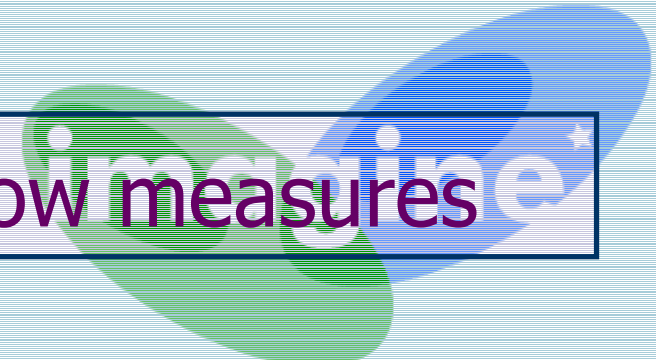
Suitability to produce detailed output



Traffic volumes	+/-
Speeds	++
Speed distribution	++
Acceleration	++
Traffic fleet influence	+

- ++ available and reliable
- + available; possibly not reliable
- not available

Capability to model traffic flow measures



Reducing traffic volumes	+/-
Changing traffic conditions	++
Changing traffic composition	+

- ++ available and reliable
- + available; possibly not reliable
- not available



Too good to be true?

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Some weaknesses:

1. Traffic demand required as input:

at least OD-matrix, often also routes required as input

→ Often: static model used to produce required input

If static model exists: Is there value in extra effort (see 2!) to produce micromodel?

2. Time- and data-intensive

Detailed level of simulation

= detailed level of input (network, traffic signals, vehicle & driver characteristics)

Particularly the calibration is time-consuming (cfr. typical study area!)



Some weaknesses (2)

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3. “fake” accuracy?

Large range of input parameters, stochastic nature:
Careful calibration can produce accurate simulation of current situation. However, simulation of (long-term) scenario's is a little more dubious.

→Risk of overconfidence in unreliable data
(impressive visualisation does not imply correct simulation)



Other things to keep in mind

Current practice: study area

Regional/ National	N
City	+
Local motorways	+
Local urban	++

++ available and reliable

+ available; possibly not reliable

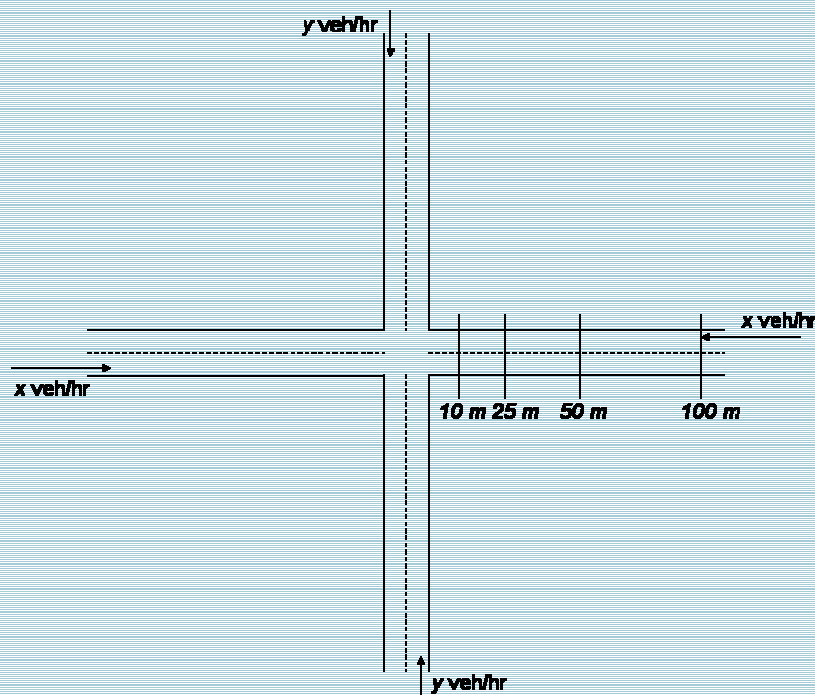
0 (neutral)

N not available / not common
practice

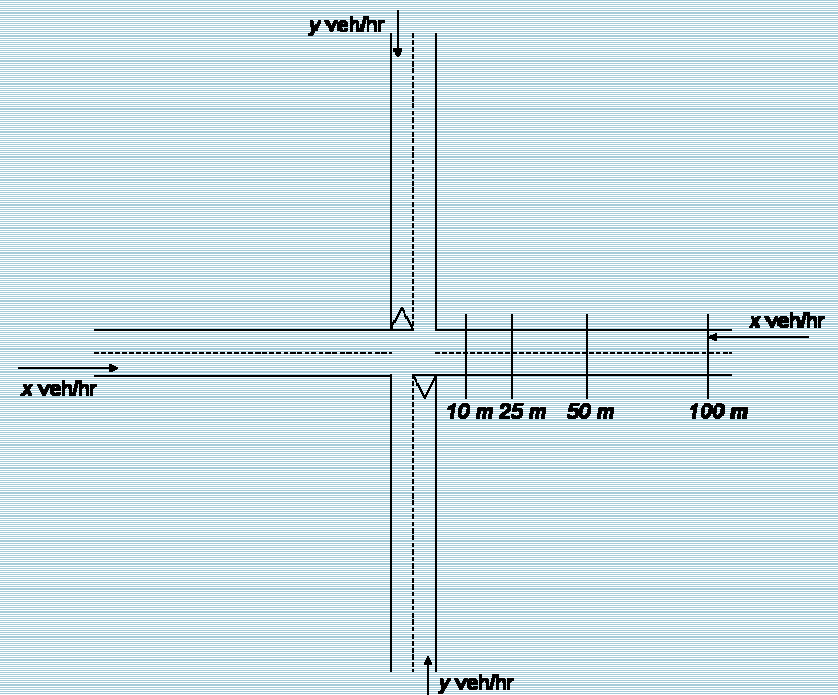
Case study: intersections

- Purpose: to determine correction factors for the influence of traffic dynamics of intersections on noise
- In function of:
 - type of junction
 - traffic demand
- case study: 4 prototype intersections, each for different flows on major and minor arms

4 prototype intersections (1)

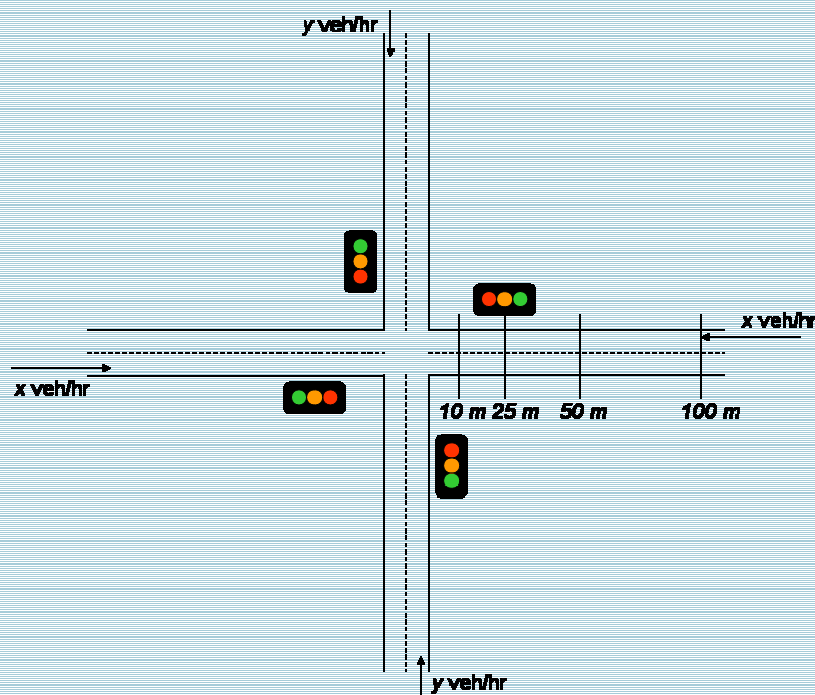


a) Priority-to-the-right

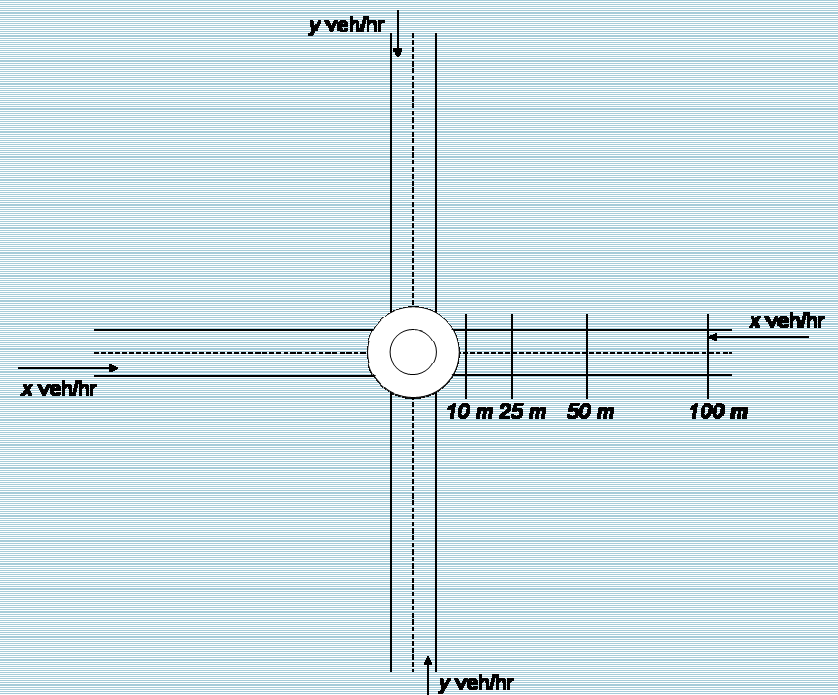


b) Priority

4 prototype intersections (2)



c) Traffic signals



d) Roundabout (12,5m)



Main assumptions (1)

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- 2 * 1-roads; lane width = 3,5m
- 70 km/u

- traffic demand: 36 combinations
 - 6 combinations major – minor
 - 2 different percentages of through traffic (80% and 60%)
 - trucks: 5%, 10% and 20%
- seed-values: 5 different runs
- 1 hour simulation



Main assumptions (2)

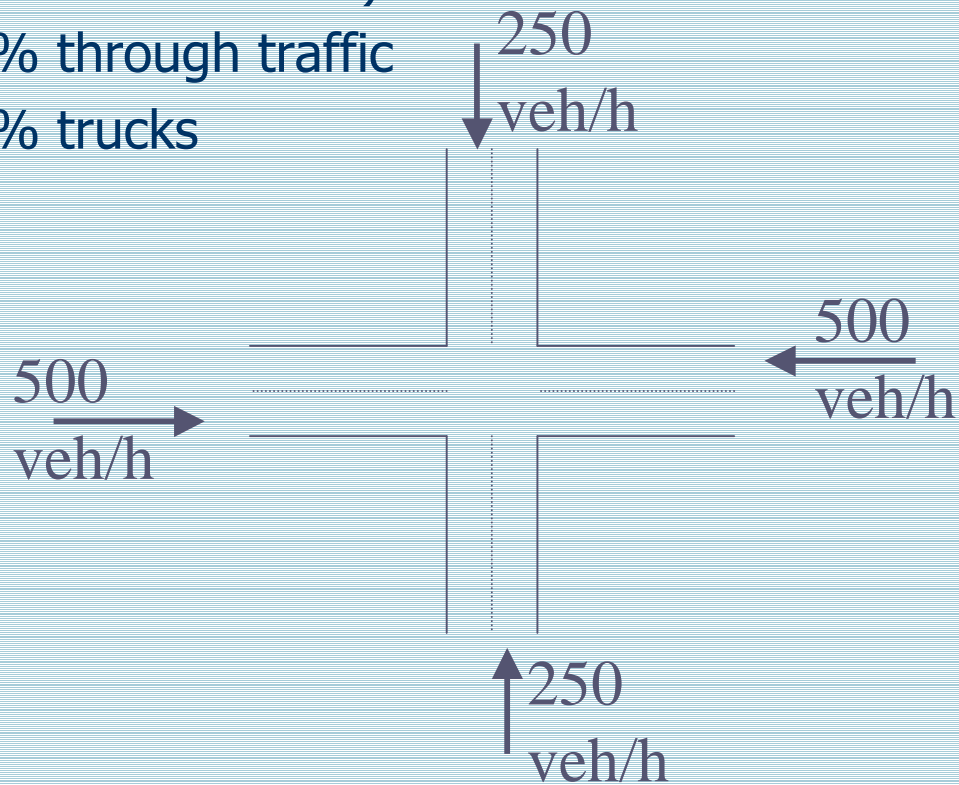
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- calculation of: 1hour noise level LAeq
- Parameters Harmonoise emission model:
 - Vehicle 1: default passenger car
 - Vehicle 2: class 3 truck, 5 axles
 - Road surface: default
(DAC, chipsize 11mm; age = 3 years; temp-coeff. = 20 degrees Celsius)
- No buildings
- Grid: 2m, area of 100m around intersection

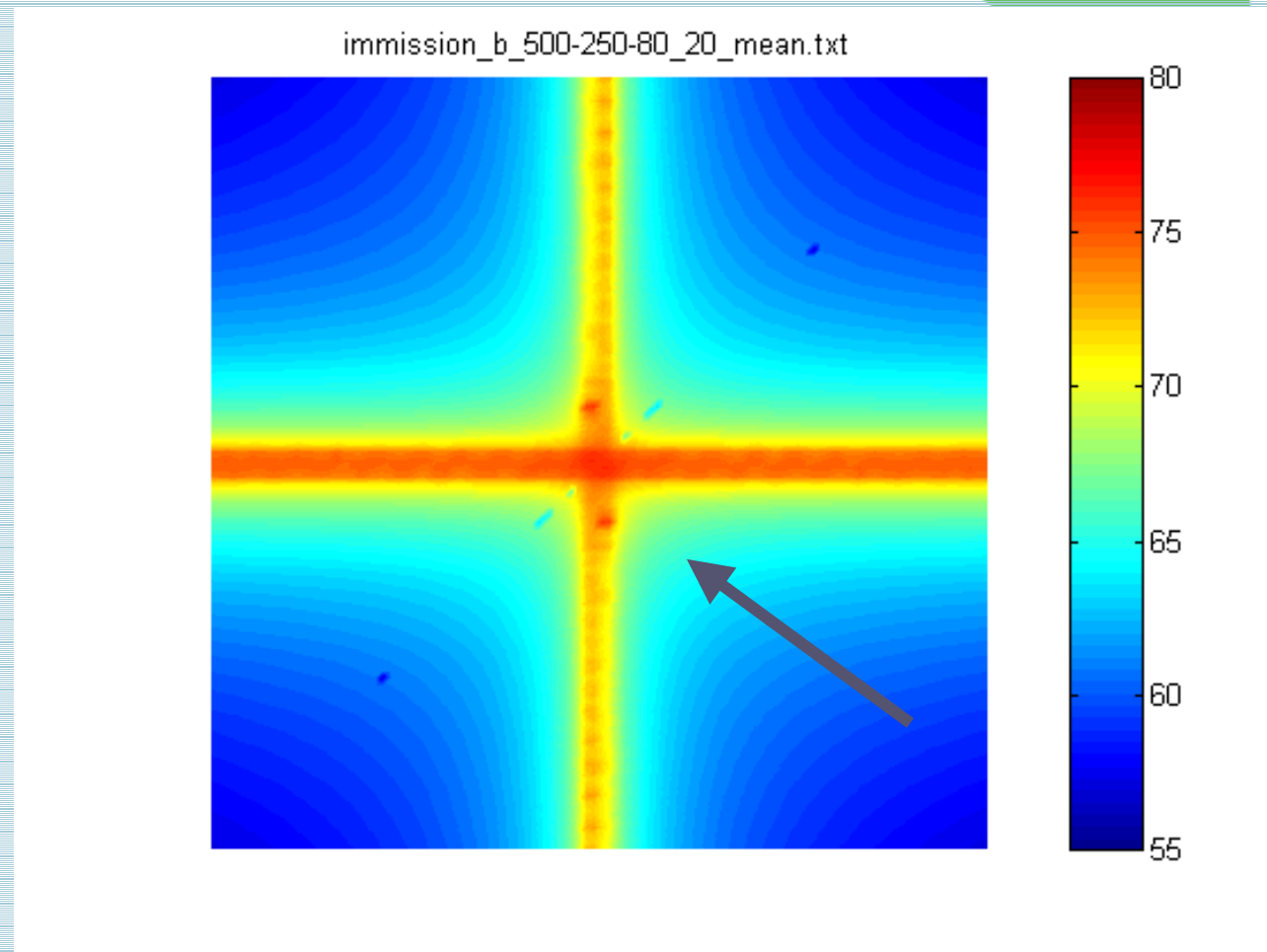


Some preliminary results...

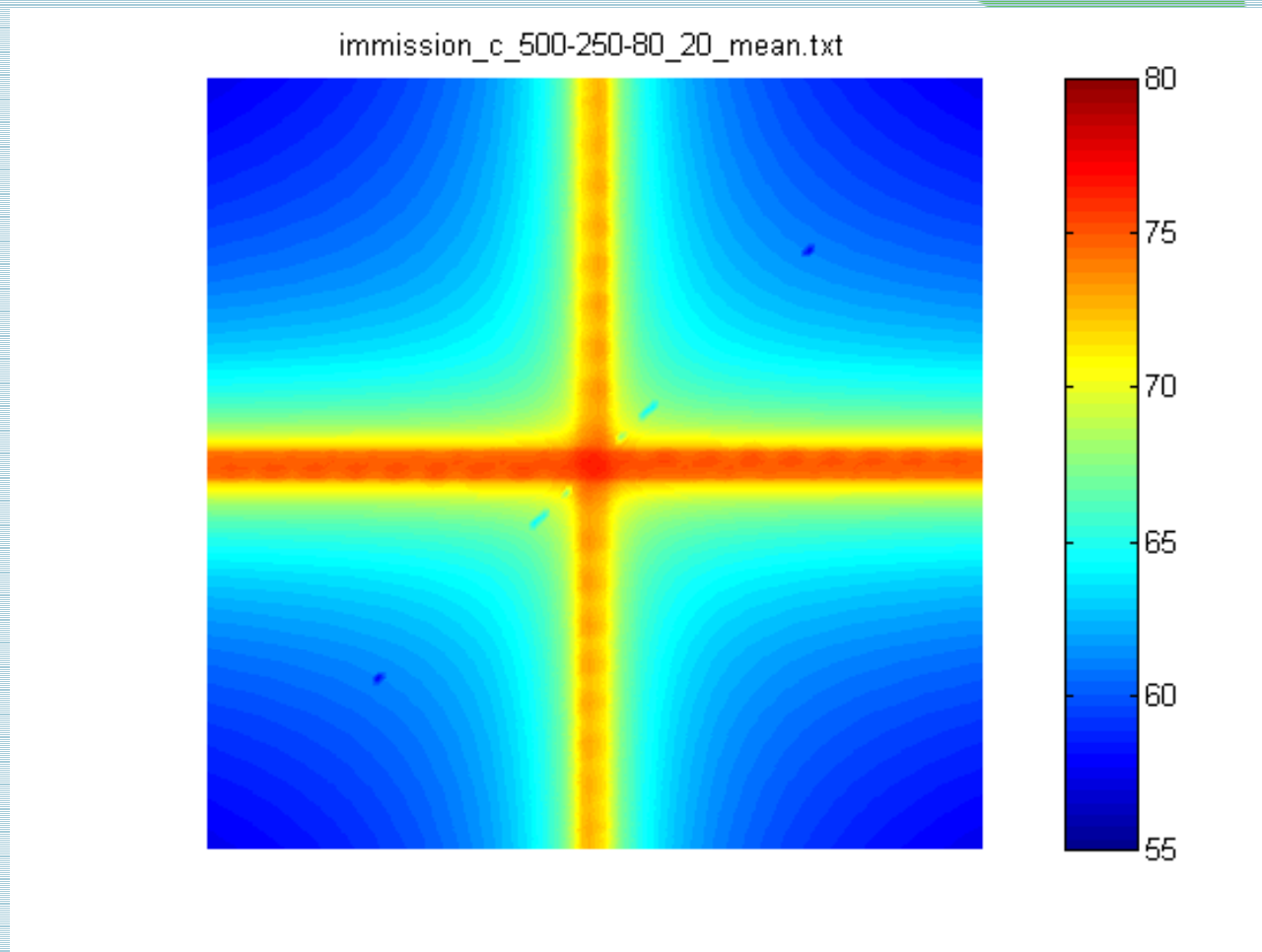
- Results for 1 combination:
 - Major road: 500 veh/h, Minor road: 250 veh/h (for each direction)
 - 80% through traffic
 - 20% trucks



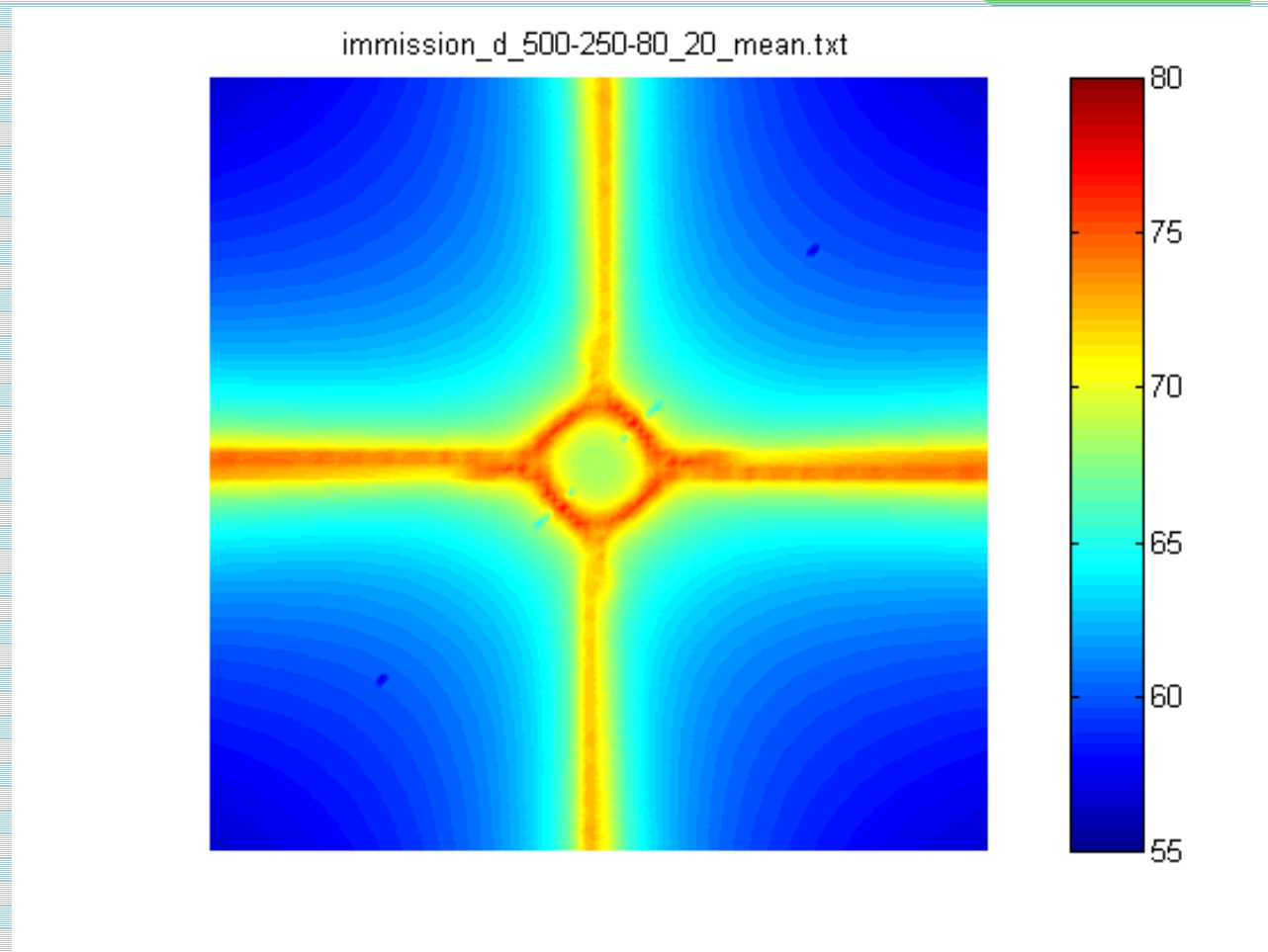
Priority junction: LAeq,1h (dB)



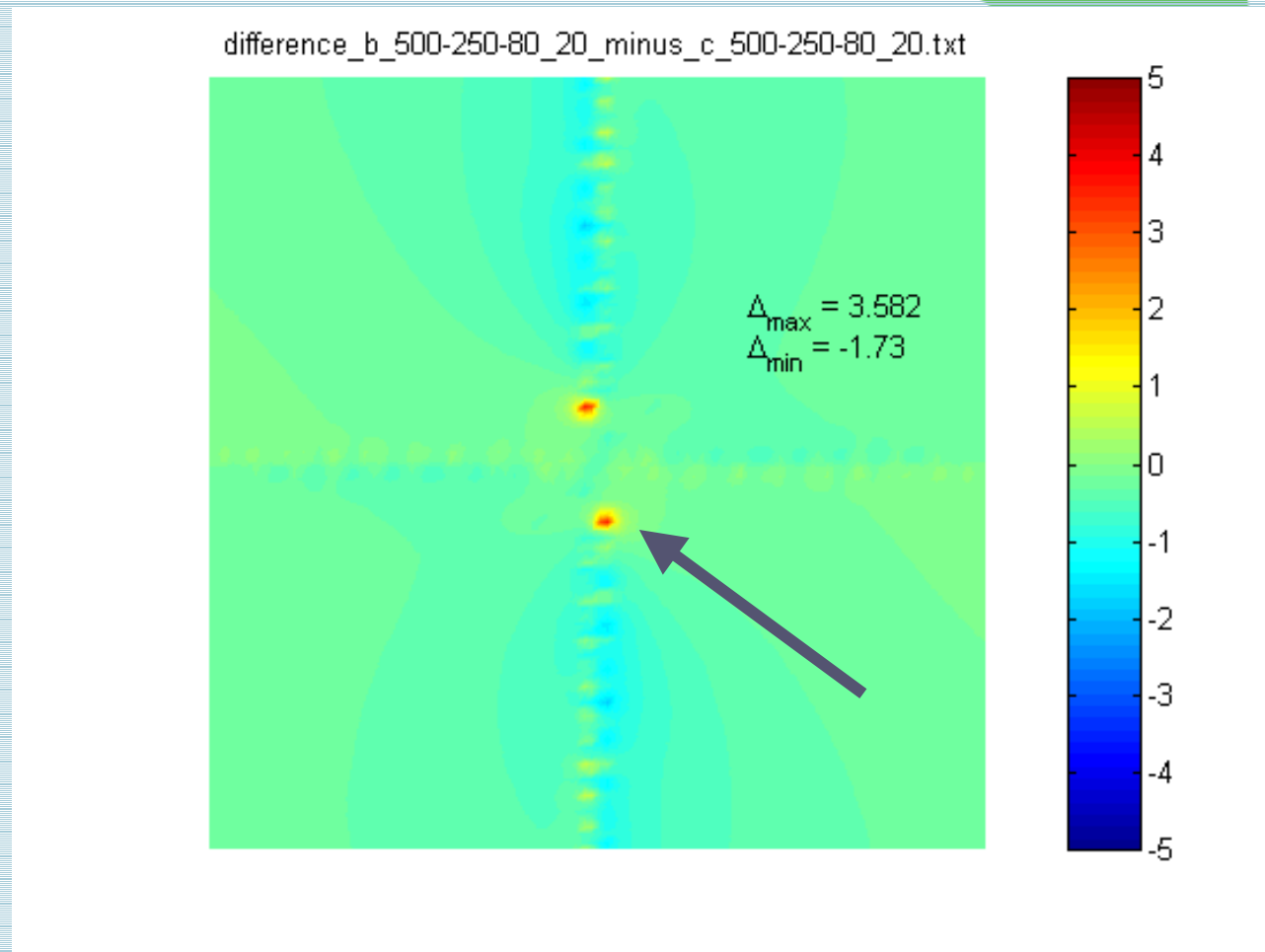
Traffic signals: LAeq,1h (dB)



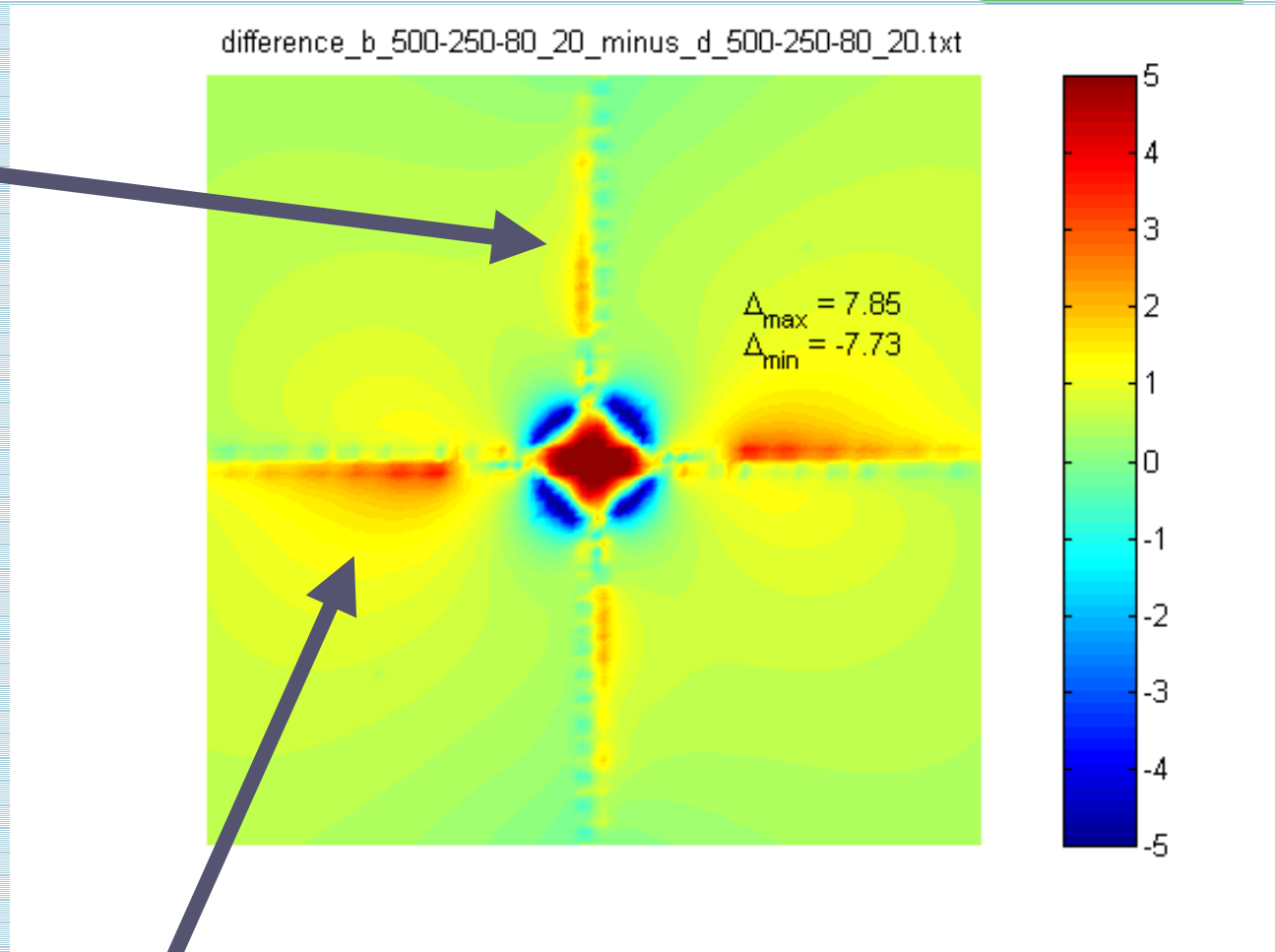
Roundabout: LAeq,1h (dB)



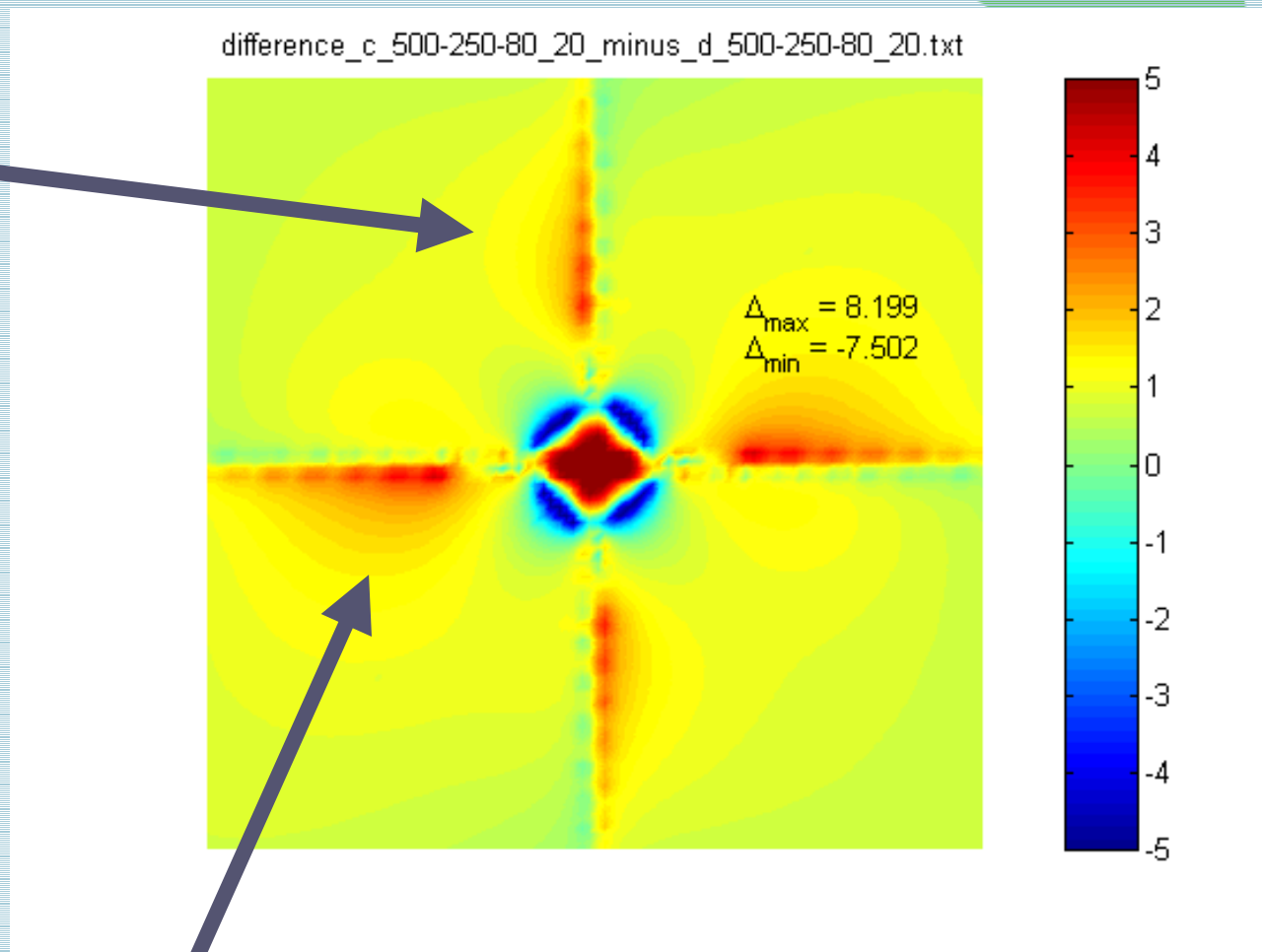
Diff: Priority – Traffic signals



Diff: Priority - Roundabout

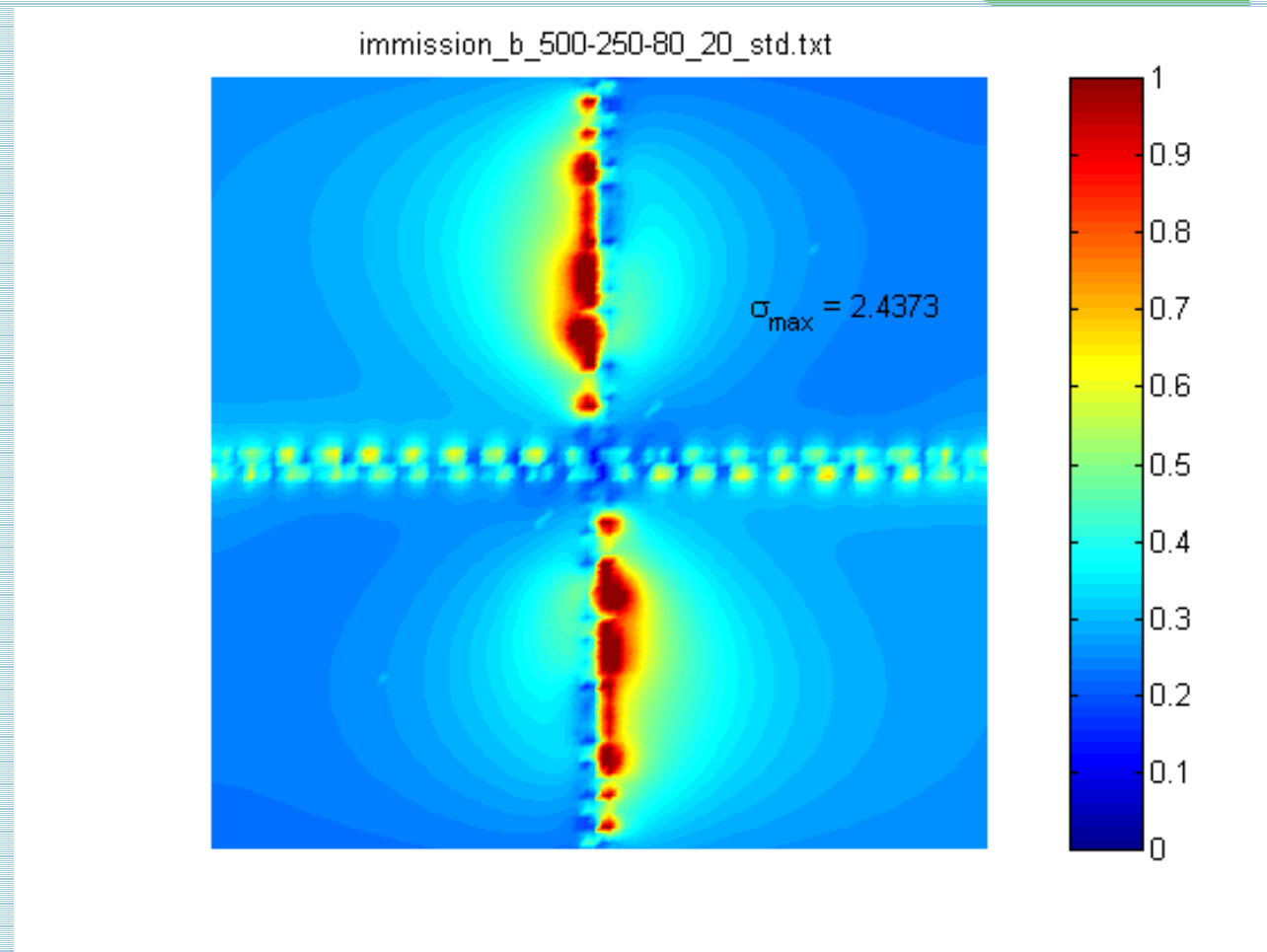


Diff: Traffic signals - Roundabout



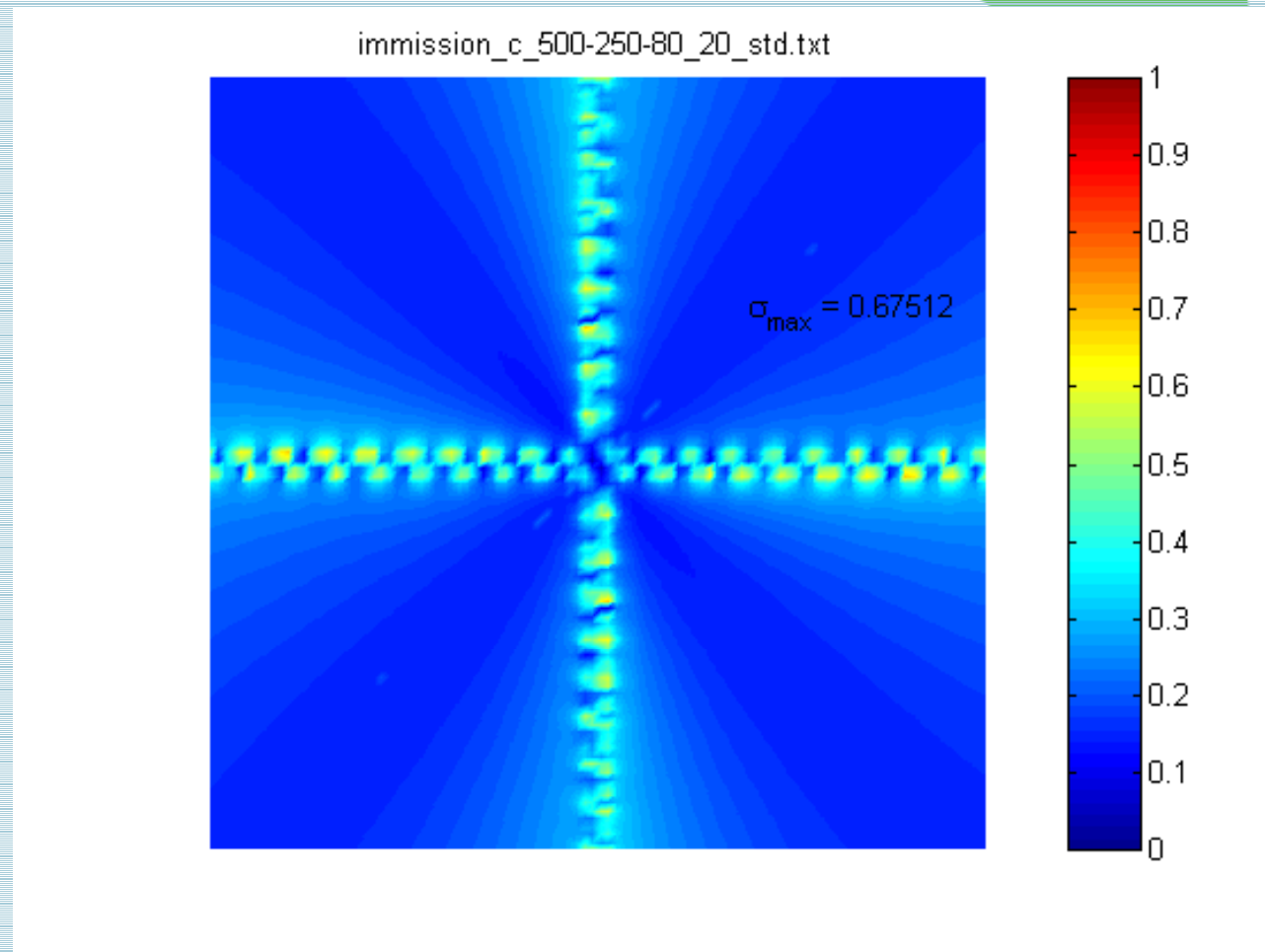
Priority junction: stdev

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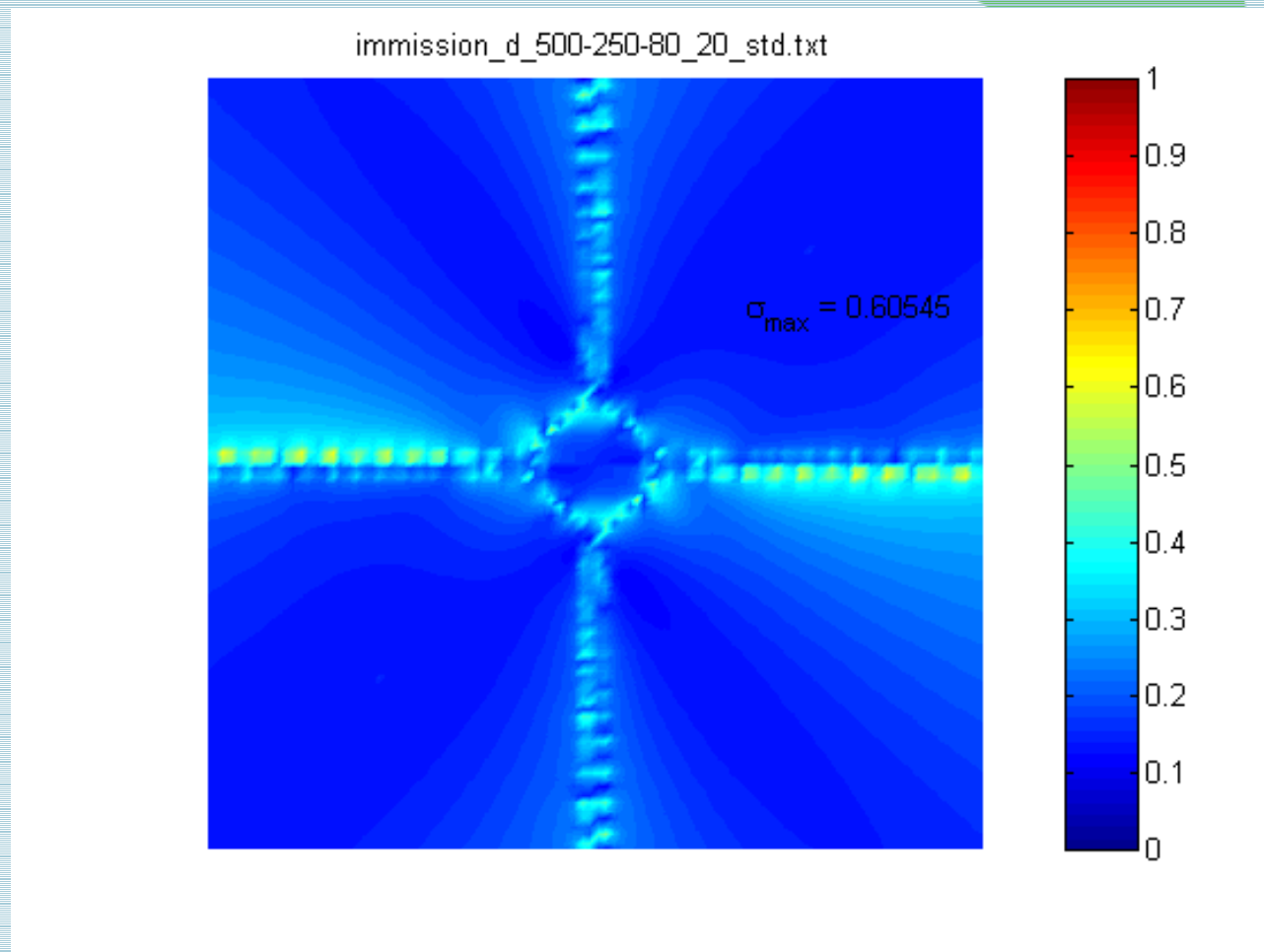


Traffic signals: stdev

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Roundabout: LAeq stdev (dB) **agine***



How to define the correction factors?

- Derive from case study
- What do YOU want?

