THE *CONDUITS* EUROPEAN PROJECT AND ITS DECISION SUPPORT TOOL WITH KEY PERFORMANCE INDICATORS FOR ITS IN URBAN ENVIRONMENT

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SEVENTH FRAMEWORK PROGRAMME

Cities needs for the best ITS choice

- **Neutral assessment of ITS in urban environment**
  - Ratio cost/benefit of an ITS investment
  - Assess the usefulness of an ITS as a whole
  - Identify the limits of an ITS
- **Decision Support Tool (DST) for traffic managers and decision makers**
- **Allow comparison between different ITS solutions**
- **Control/assessment of a ITS implementation**
- **Possibility of sharing results between cities**

Solution: KPIs with specific requirements

- **Key Performance Indicators *(KPIs)* easy to use and communicate to decision makers and public**
  - No or light extra work for the users
  - Clarity for the political decision makers and the public
- **Adapted to cities individuality**
  - Geographical scale :
    - sections, roads, zones, network, …
  - Adaptability :
    - Ability to use all kind of urban data that are relevant to quantify a performance
    - Weighting possibilities

CONDUITS goal and objectives

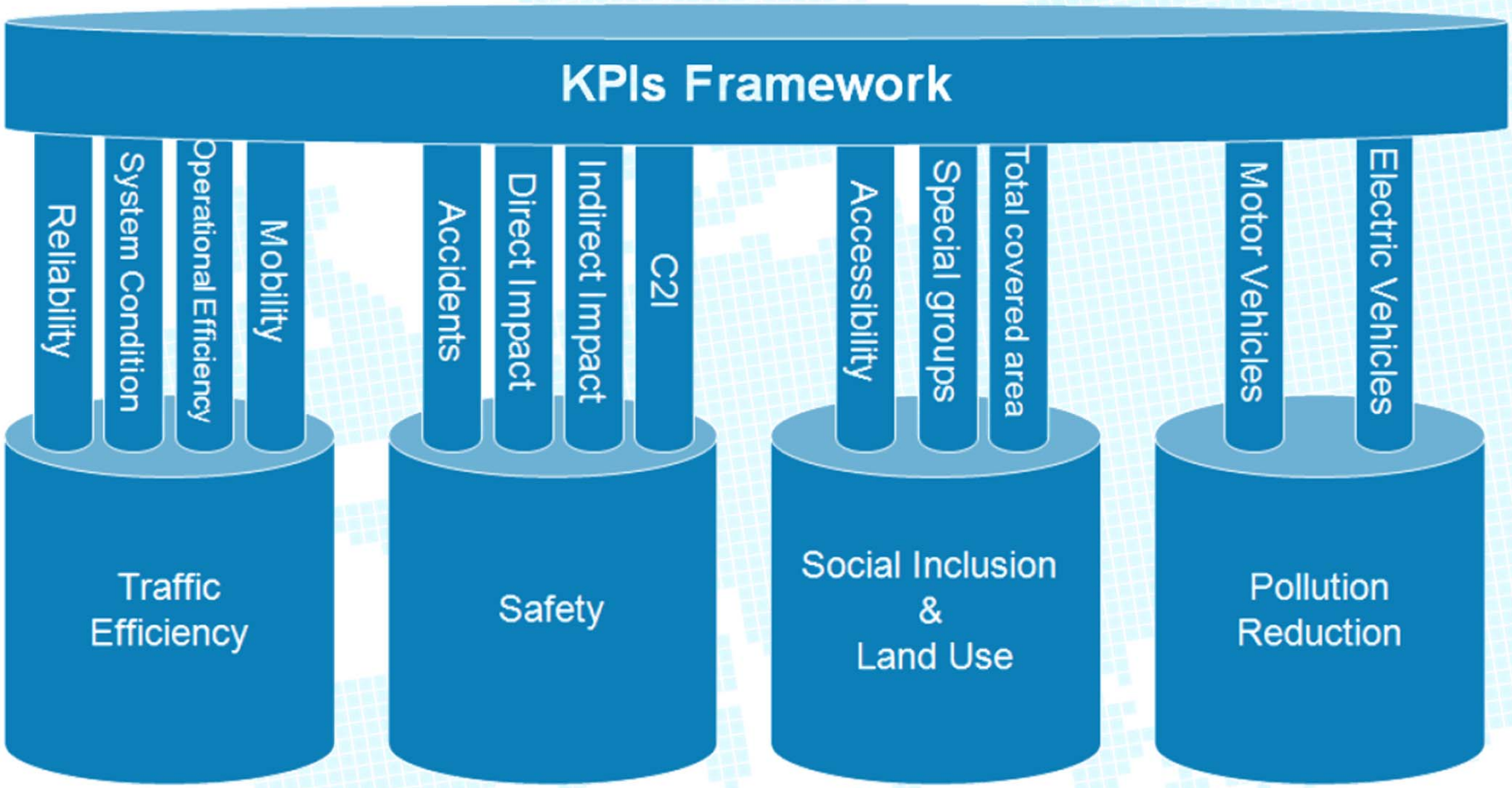
Goal of the CONDUITS project

- To establish a coherent set of **K**ey **P**erformance **I**ndicators *(KPIs)* for ITS used for urban traffic management

Main objectives

- To define a set of Key Performance Indicators for identifying best practices and best technologies
- To test these KPIs through real applications in Paris, Rome, Tel-Aviv, Munich and Ingolstadt

The CONDUITS Indicators



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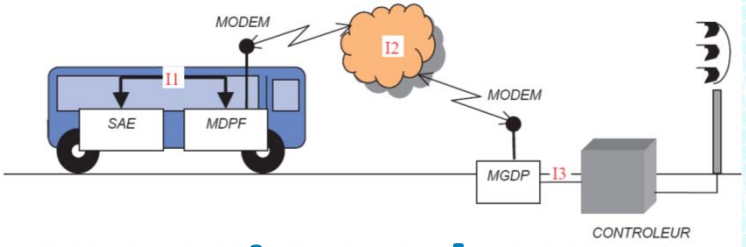
Test in Paris – Bus priority (1)

- Priority on lines 26, 91, 96
- Implementation in 2006
- Anticipated average travel time savings about 30s per trip, allowing 1 bus less for each line



Test in Paris – Bus priority (2)

Traffic efficiency: Mobility index

$$I_{MOB} = w_{PV} \cdot \frac{1}{|R_{PV}|} \sum_{r \in R_{PV}}^{|R_{PV}|} \frac{ATT_{PV}^{r}}{D_r} + w_{PT} \cdot \frac{1}{|R_{PT}|} \sum_{r \in R_{PT}}^{|R_{PT}|} \frac{ATT_{PT}^{r}}{D_r}$$

- minutes/km, weighted for public and private transport

Traffic safety: Accidents index

$$I_{ACD-L} = \sum_{l \in L}^{|L|} \left\{ w_l \cdot \sum_{se \in SE}^{|SE|} \left[w_{se} \cdot \sum_{m \in M}^{|M|} \left(w_m \cdot \frac{ACD_{l,se,m}}{DTV_l} \right) \right] \right\}$$

- casualties per million vehicles, severity weighted

Test in Paris – Bus priority (3)

Traffic efficiency: Mobility index

- **Separately for public and private transport**

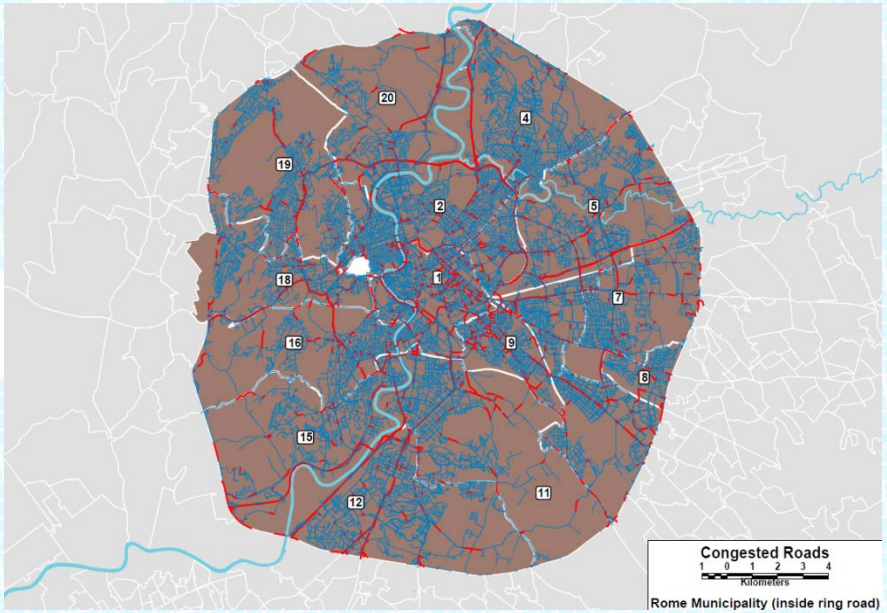
min/km	Public transport mobility		Private transport mobility	
	Before	**After**	**Before**	**After**
Line 26	4.46	4.25	4.46	4.65
Line 91	4.63	4.33	5.25	5.05
Line 96	5.03	4.67	2.71	3.02
TOTAL	**4.71**	**4.42**	**4.21**	**4.26**

- **Combined, with $w_{PT} = 0.7$ and $w_{PV} = 0.3$**

min/km	I_{MOB}	
	Before	**After**
Line 26	4.46	4.37
Line 91	4.82	4.54
Line 96	4.33	4.17
TOTAL	**4.56**	**4.37**

Test in Rome - General assessment

Several techniques and technologies, including ITS, are used for traffic management in the entire Greater Rome area

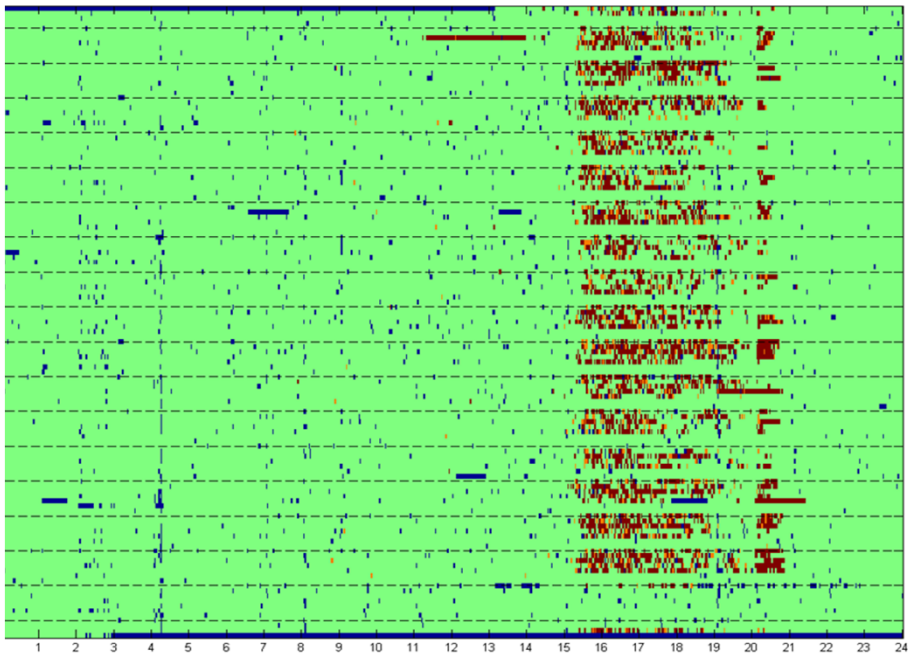


- **Supplied data:**
  - Travel times for public transport and private cars between all zones of the city and lengths of these routes
  - Occurrences of congestions and their average duration on certain key routes of the urban road network during one year

Test Tel-Aviv – New signal strategies

Recurrent Congestion during the Afternoon / Evening peak hours (~ 45 h/link/month)

- Deployment of new traffic management strategies



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Test in Munich – Safety assessment

- Installation of two feedback signs during a test period
- Measuring speeds at two urban streets (speed limit 50 and 30km/h) in both driving directions
- Flashing messages:
  - Slow down!
  - Thank you!

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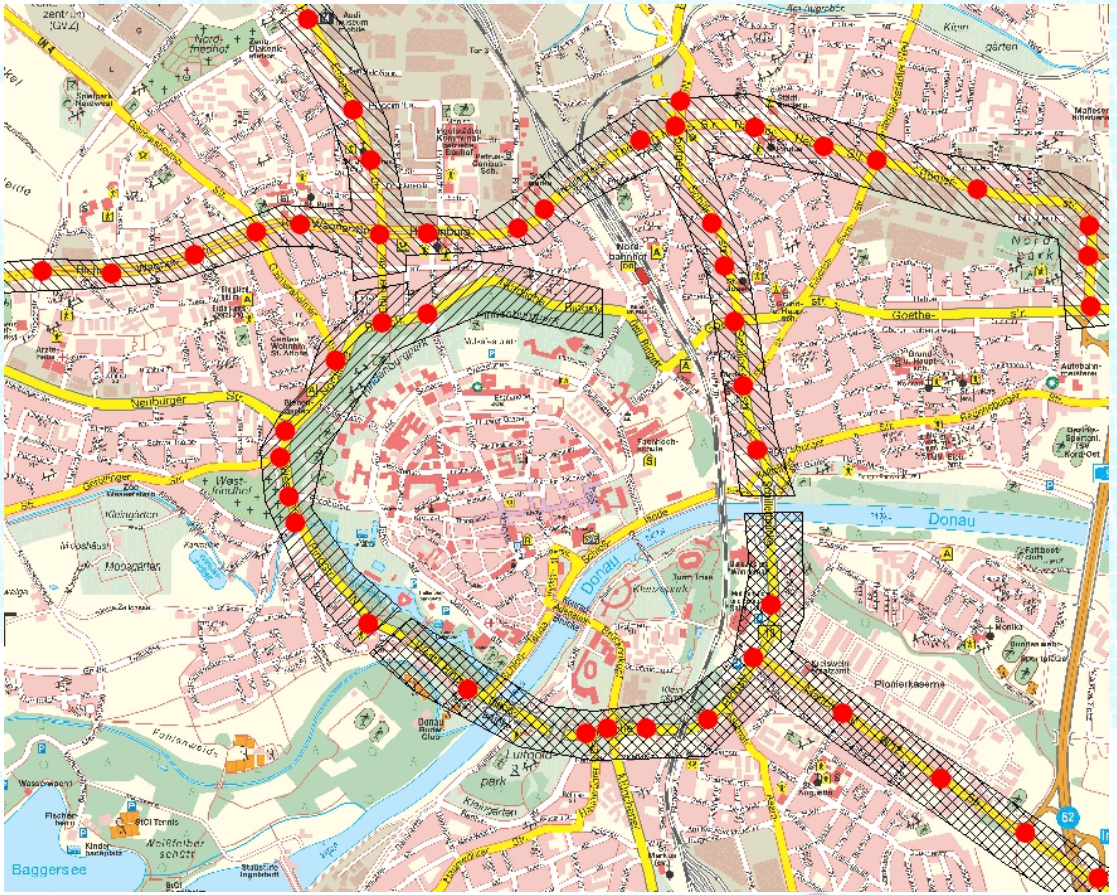
Test in Ingolstadt – Safety assessment

Congestion of the main axes during peak hours with traffic management by static green waves

- New adaptive green waves management
- Test of 2 kinds of algorithms for optimising green waves :
  - Hillclimbing algorithm
  - Genetic algorithm



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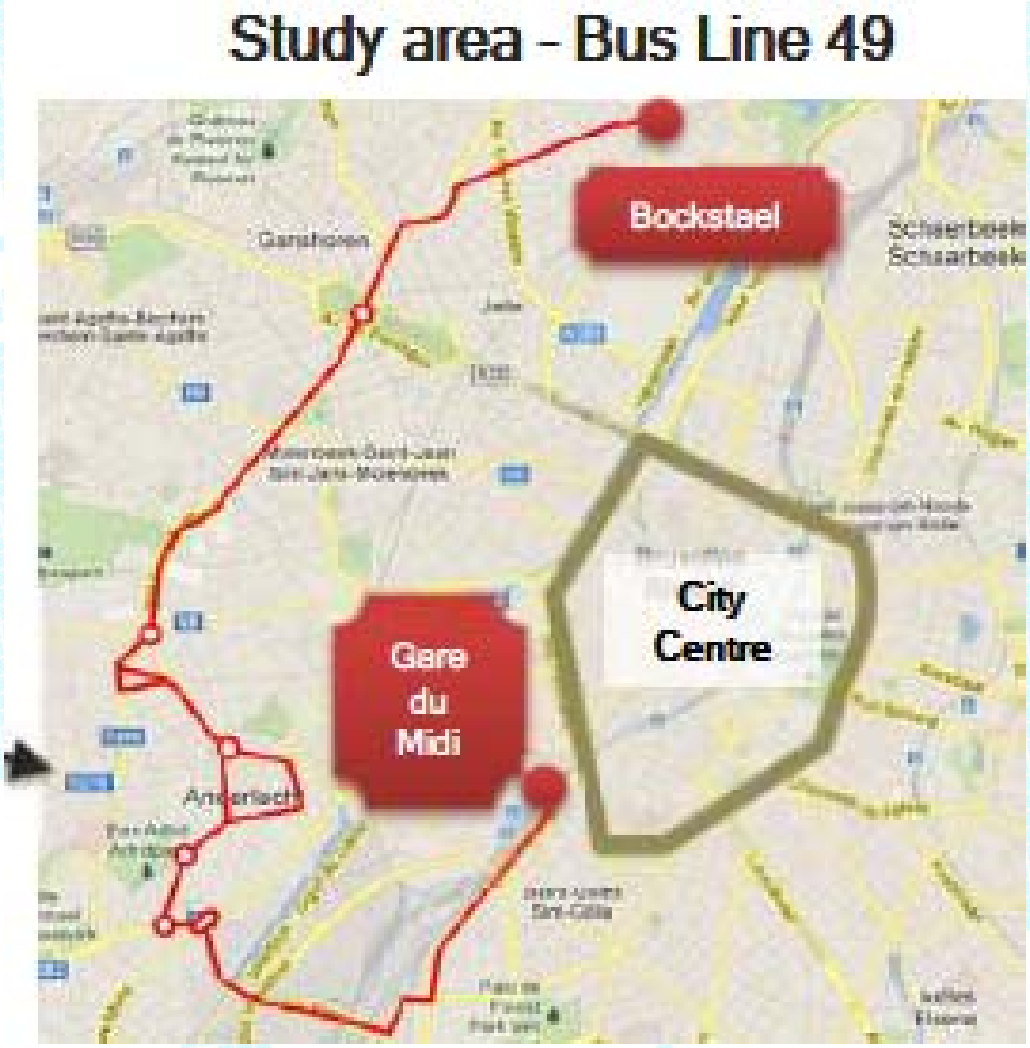
Continuation of the CONDUITS project

- End of the CONDUITS project in May 2011
- Kapsch financial support for the design of a “friendly” DST using some CONDUITS KPIs
- Choice of the Pollution KPI
- Brussels proposal : design of a pollution KPI calculation module using files generated in a traditional way by VISSIM simulations
- Case study : effect on pollution of real simulations done for a bus line priority system recently implemented

Brussels case study

- **Priority bus line 49**
  - Many intersections with traffic lights
- **4 VISSIM simulations**
  - Morning and evening peak hours
  - Situation before and after implementation



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Expected results of the bus priority

Short-term

- Increase average speed of the buses
- Increase average speed of the private vehicles displacement parallel to the line
- Reduction average speed of vehicles crossing the line

Medium-term

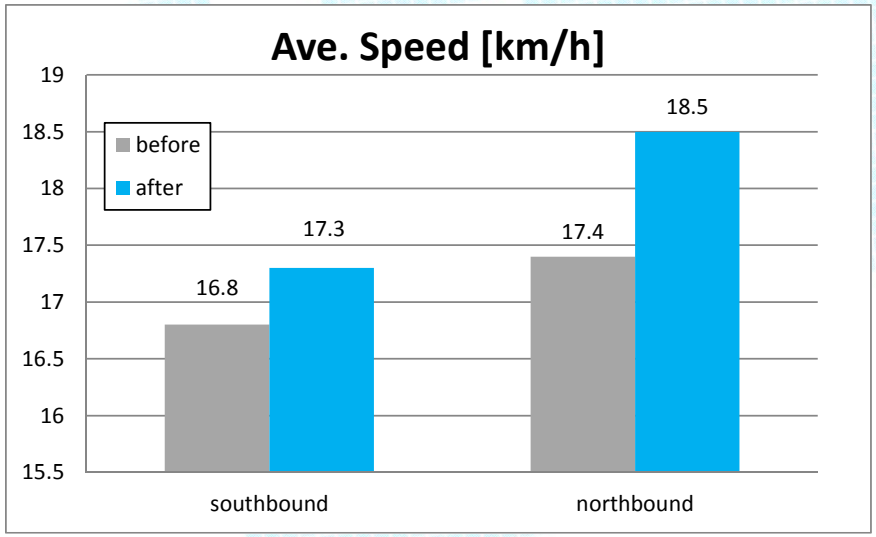
- Change of route choices for private car drivers
- Reduction of time losses in the implementation area

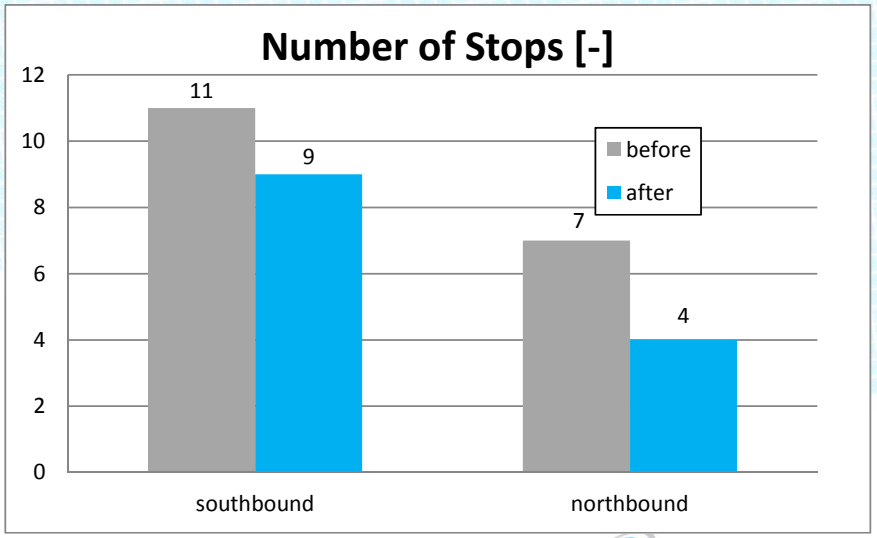
Long-term

- Demand shift towards public transport reduces private car rides

First results of the case study (1)

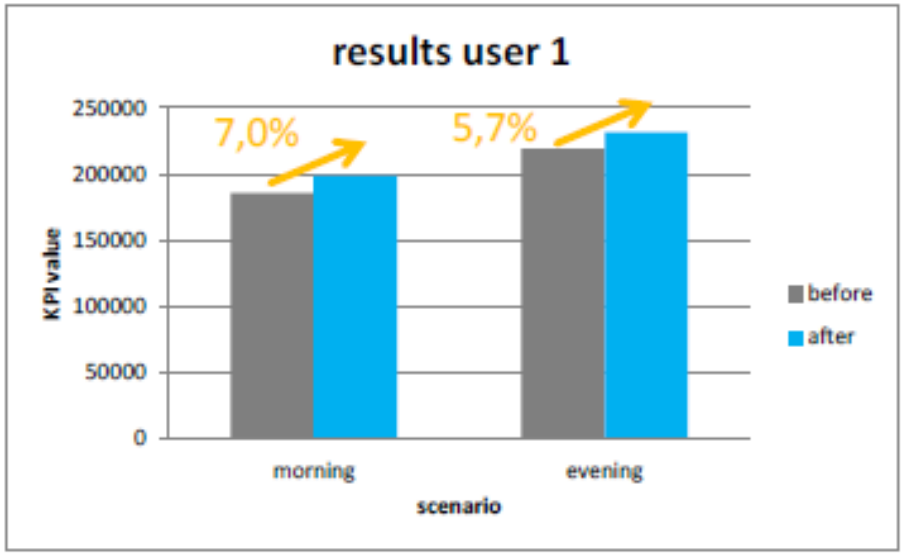
- **The first results reflect the expected short term effects**
  - Improvement of the public transport quality:
    - increase average speed of the buses
    - reduction of the stops at intersections

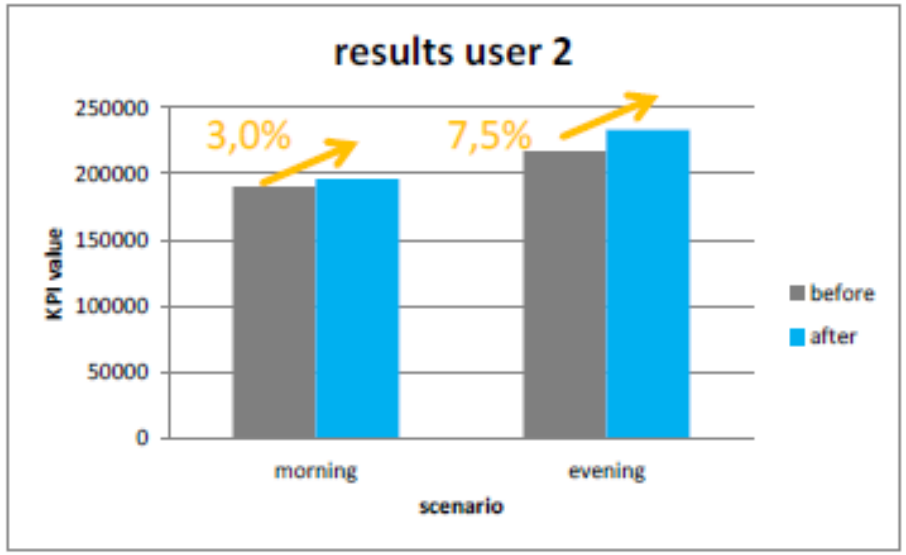




First results of the case study (2)

- but… increase in pollution





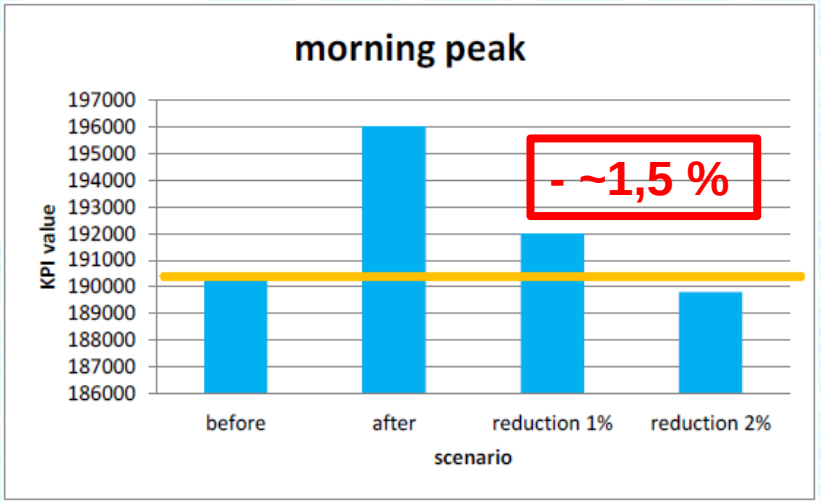
… what is (hopefully) normal !

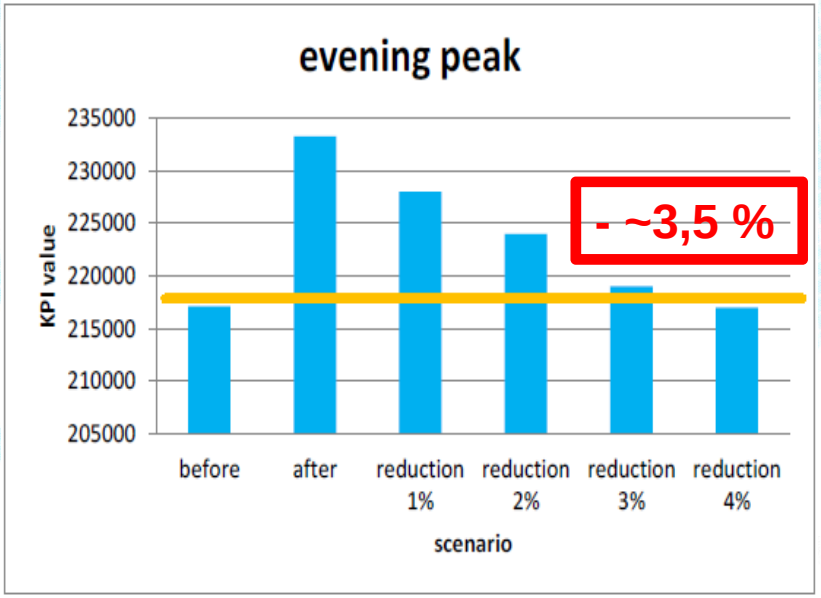
First results of the case study (3)

Sensitivity analysis with a pragmatic methodology

The given demand levels of the relevant flows are progressively reduced in increments of 1%

and the KPI values are recalculated for each scenario.





Sensitivity analysis of the single pollutants

Pollutant	Morning	Evening
CO_2	1,5%	4,0%
NOx	3,5%	6,0%
PM_{10}	0,5%	3,0%
KPI	1,5%	3,5%

Advantages of these Indicators

- Same methodology for all the indicators
- Calculation running with all kinds of data
- Easy weighting of the parameters
- Automatic calculation before, during and after the implementation of an ITS by using the VISSIM files as they are provided
- Allow sharing results got in other cities for similar ITS and the possibility to create a common DB with real measurements

Actual limits of these Indicators

- It will be necessary to wait a few years before having “before and after” data based on real measurements
- Require a cost/benefit analysis to complete the set of KPIs needed to cover the overall sustainability assessment of an ITS
- KPIs comparison between cities still needs an agreement on common weighting

Future developments !

- Pollution module assessment in other interested cities : Zurich, Stuttgart, Perugia,…
- New Kapsch sponsoring : Traffic efficiency module to be applied to the same VISSIM files and to be tested in Brussels
- Further step : Road safety prediction module
- Proposal for the design of an integrated sustainability module using CONDUITS KPIs for multimodal trips with VISUM macrosimulation tool in a new European FP7 project

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Thank you for your attention!

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