IWEPS
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Internalisation of Freight Transport External Costs in the Paris-Amsterdam Corridor

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1. Context and overview of the study

Context

- New Eurovignette Directive:
  - Allows the Member States to include external costs in the charge levels (on top of infrastructure costs)
  - and to differentiate the charge levels according to the congestion level
- TEN-T Seine-Scheldt project (project nr 30),

Furthermore:

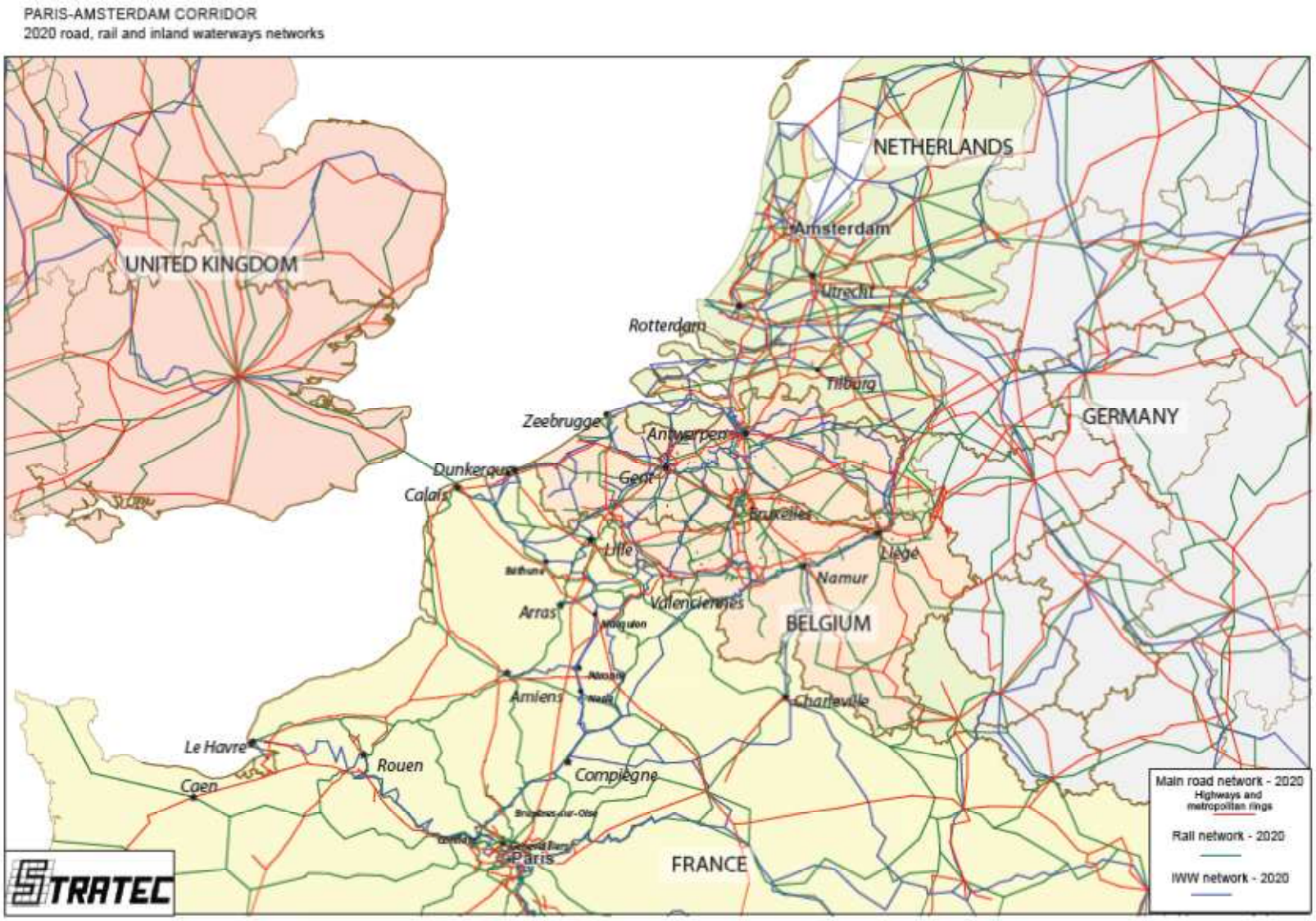
- High priority for decarbonising transport
- Objectives for reducing air pollution, noise and accidents
- Objectives for modal shift from road to IWW and rail

Study overview: aim and scope

- Aim:
  - Assess the impacts of transport pricing schemes based on social costs
  - Strategic EU freight corridor: Paris – Amsterdam (and related regions)

- Scope:
  - Road, rail and inland waterway transport
  - Interurban HLV traffic
  - France, Belgium and the Netherlands

The Paris-Amsterdam corridor – 2020 road, rail and IWW networks



The Seine-Scheldt project (TEN-T project 30)

Source: www.seine-scheldt.org

Study overview: funders, partners, timing

- Study co-funded by:
  - the European Commission (DG MOVE)
  - Voies Navigables de France, Réseau Ferré de France (France)
  - Service Public de Wallonie, Waterwegen en Zeekanaal (Belgium)
  - Ministry of Transport of The Netherlands

- Partners involved: two consortia of consultancies:
  - Environmental external costs :CE Delft, Alenium, Infras and Max Herry
  - Modelling: Stratec and Setec

  - plus a Scientific Committee

- Timing: September 2009 - December 2010

Study overview: overall approach

- Overall approach:
  - Overview of environmental and infrastructure costs
    - *Environmental costs considered are: climate, air pollution, noise, accidents, congestion and 'upstream'*
  - Overview of existing taxes, charges and subsidies (→ BAU scenario)
  - Development of a freight transport model, which includes:
    - *a mode choice model*
    - *an assignment model able to calculate multimode User Equilibrium as wel as System Optimal Equilibrium*
  - Definition of pricing scenarios
  - Scenario simulations and impact analysis

2. The pricing scenarios

- A set of 5 scenarios, including an optimal scenario, two realistic scenarios and an accentuated target-oriented scenario

Scenario overview

BAU
Business-as-usual

Scenario 1
Marginal Social Cost Pricing (MSCP)

Scenario 2
Eurovignette

Scenario 3
Eurovignette extended

Scenario 4
Target oriented

Scenario 5
Eurovignette extended – *Boiteux values*

Note: only the HGV's are charged, not the light vehicles (private cars and light freight)

Scenario overview: BAU and MSCP

- **BAU- Reference scenario (2020 and 2050)**:
  - Current taxes and charges
  - Needed to see the impacts of internalisation policies

- **Scenario 1 – MSCP (Marginal Social Cost Pricing)**:
  - Marginal Social Cost for all modes
  - Congestion charges based on model calculations: System Optimum Equilibrium
  - **Optimal pricing according to the economic theory (Pigou, Hotelling, ..)**

Scenario overview (cont.): Eurovignette

- **Scenario 2 – Eurovignette proposal**:
- Based on 2008 Commission proposal (at the time of the study) and in line with the Eurovignette Directive adopted in June-July 2011 (Parliament/Council)
- Focus on road: charging for total infrastructure cost plus air pollution and noise
- Congestion charges based on IMPACT values
- No charges for IWT and rail (BAU situation)
- **Realistic proposal for short term**

- **Scenario 3 - Eurovignette proposal – extended**:
- Same as scenario 2 with additional carbon tax on fuel for all modes
- Congestion charges based on model calculations (averages)
- Marginal infrastructure cost + air pollution and noise charges for rail and IWT (like for road – noise only for rail)
- **More collaborative and realistic for medium term**

Scenario overview (cont.): Target oriented

- **Scenario 4 - Target oriented**
  - Carbon tax of €40 (2020) and €85 (2050) per t CO_2; doubled for road
  - Km-charges for road: twice all infrastructure and external costs: air pollution, noise and accidents
  - Congestion charges for road based on congestion model output
  - Marginal infrastructure and external costs for IWT and rail
  - To test the **impact on modal shift of a maximum pricing of road according to the future IWW capacity**

- **Scenario 5 – Eurovignette proposal – Boiteux values**
  - Same as scenario 3, but with French default external cost values from Boiteux (while in scenario 3: external cost values from the IMPACT Handbook)

Methodology for the external costs

- External costs (CE Delft):
  - Climate, air pollution, noise, accidents, congestion and ‘upstream’
  - Unit cost values: corridor values in line with IMPACT handbook (2008)
  - Data on fuel consumption, emissions and load factors made consistent with the traffic model (improvements in 2020 and 2050)

3. The model

- A comprehensive model
- Able to calculate the optimal pricing scenario (Pigovian) against which other scenarios could be assessed

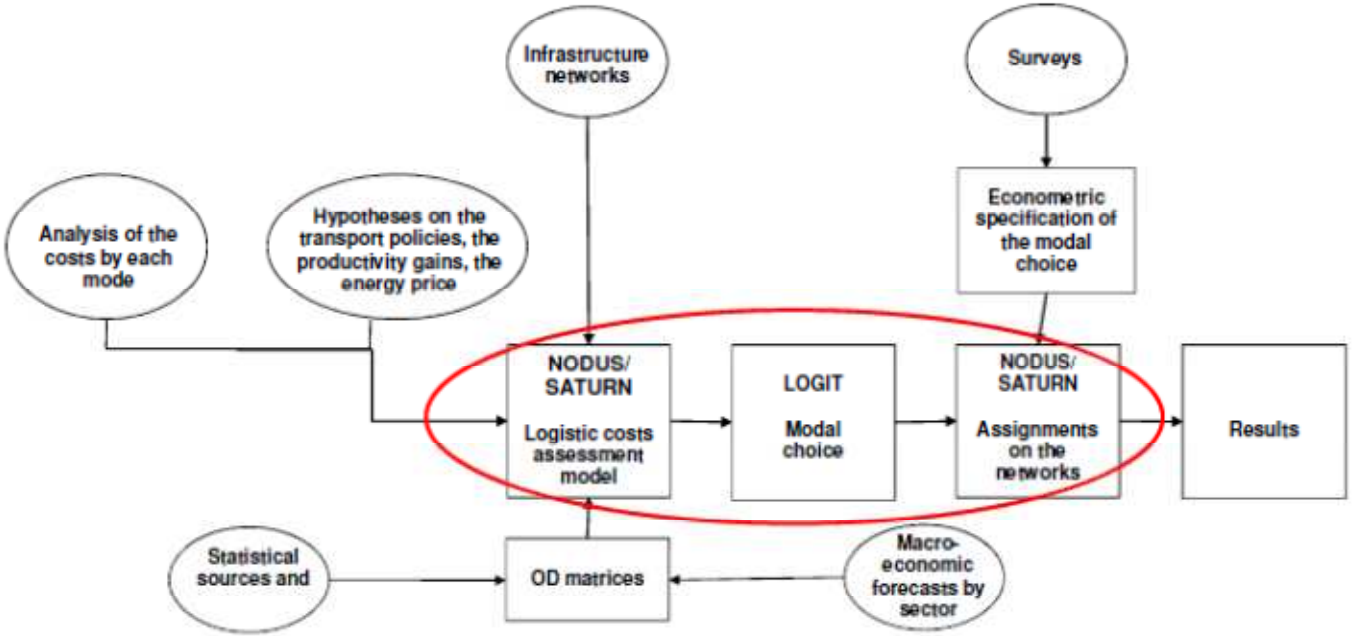
Model overview

- Mode choice model: multinomial logit model (road/rail/IWW) (*shippers behaviour*) – shipper utilities as a function of cost and time – estimated on SP and RP data

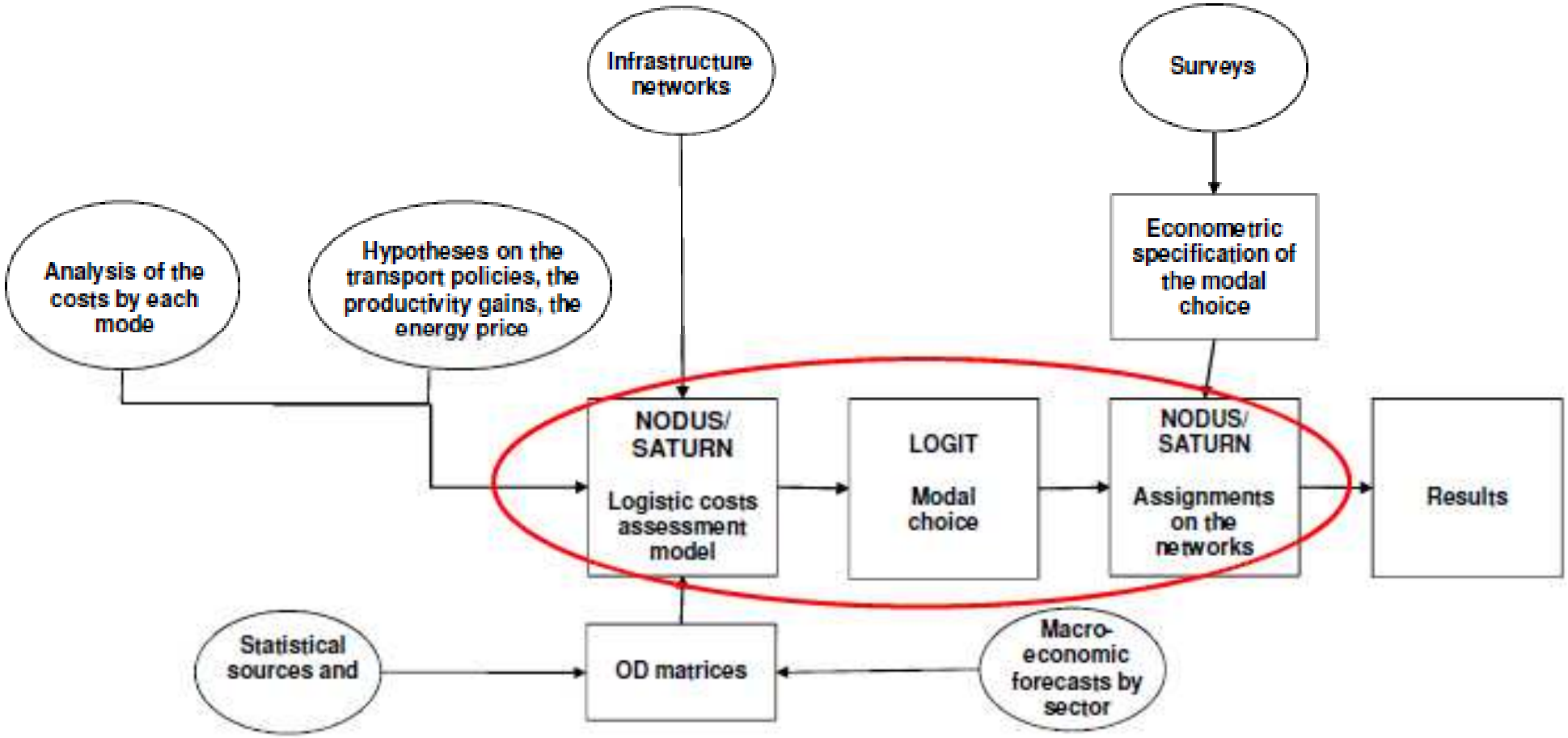
- Network models: NODUS (rail and IWW) and SATURN (road) softwares – path choice (*transport operators behaviour*) – transport cost functions depending on transport time and distance

- Demand segmentation in 14 good categories

- Congestion modelling in the Saturn traffic model



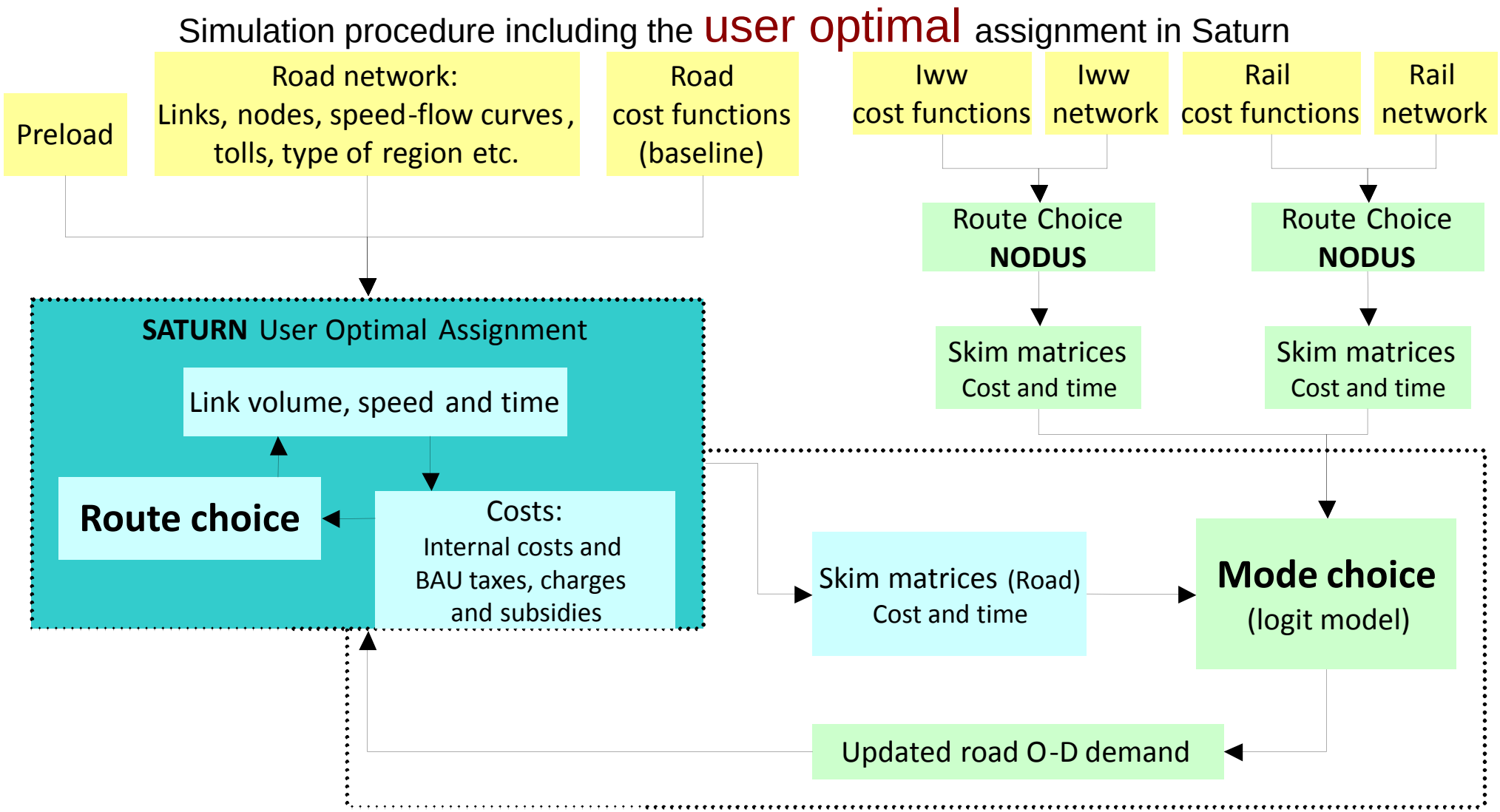
Model overview



Saturn road traffic model

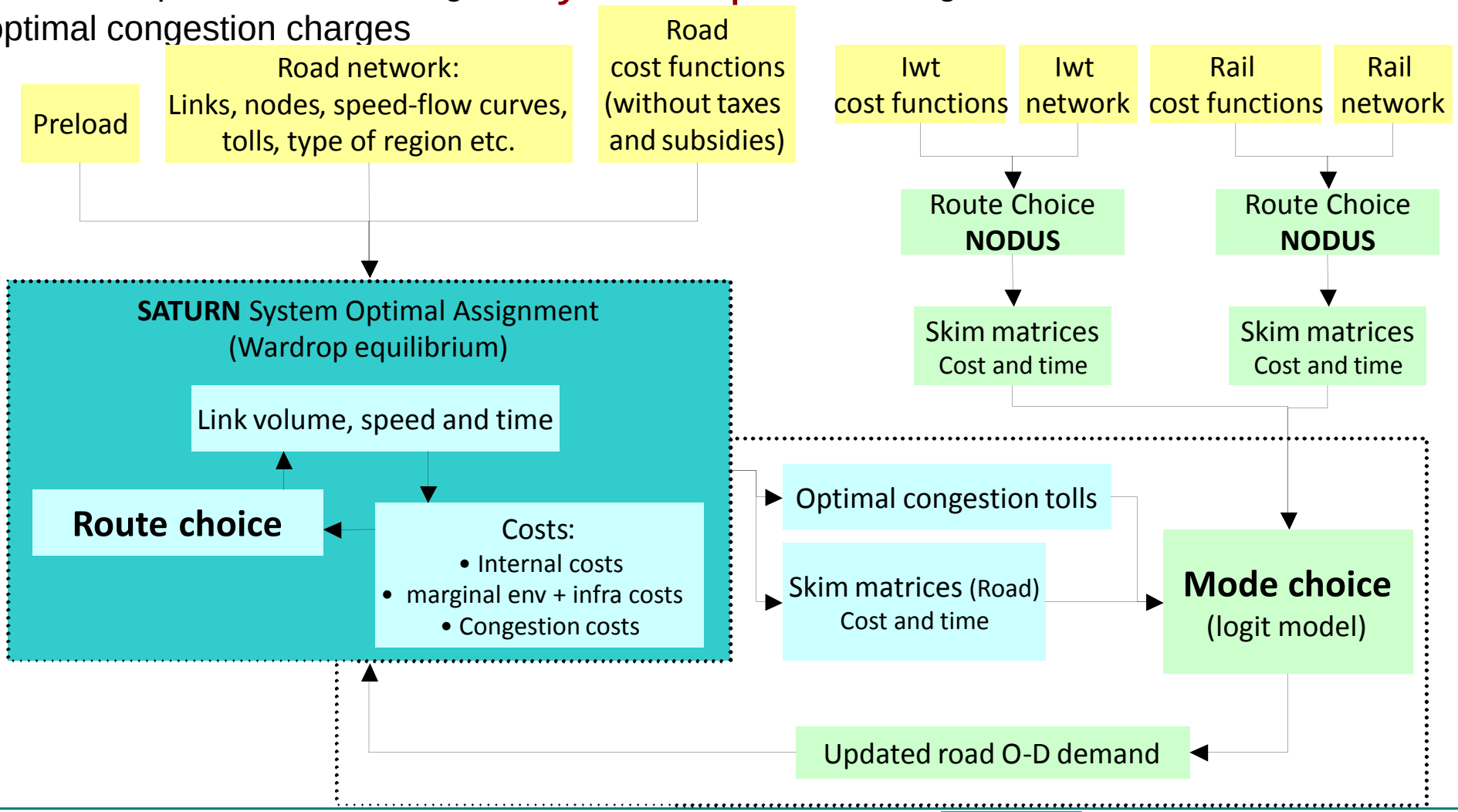
- Saturn assignment: equilibrium approach
- Two types of assignment:
  - **User Optimal Equilibrium**: reflects the actual behaviour of the user (each user tends to minimise his generalised transport cost)
  - **System Optimal Equilibrium**: reflects how it would be if each user is charged with his Marginal Social Cost, i.e. the value of the time losses that he causes to all other road users + other external costs

Mode choice and road congestion models



Mode choice and road congestion models

Simulation procedure including the system optimal assignment and the calculation of the optimal congestion charges



4.1 Simulation results: congestion cost

Summary

- The marginal congestion costs (MCC) are highly differentiated both **spatially** and **temporally**
- The MCC averaged on the whole network and the whole year (**peak hours and off-peak hours**) leads to a rather low value (≈ 3 Eurocents/HGV-km)
- But in **congested areas**, the MCC is the highest component of the external costs (MCC ≈ 65 Eurocents/HGV-km in the Brussels area)

4.1 Simulation results: MSCP scenario

MCC by road section in France - 2020

Motorways – peak hour

Marginal congestion cost (cents €2007/km) by HGV on the motorways in 2020 (peak hour)

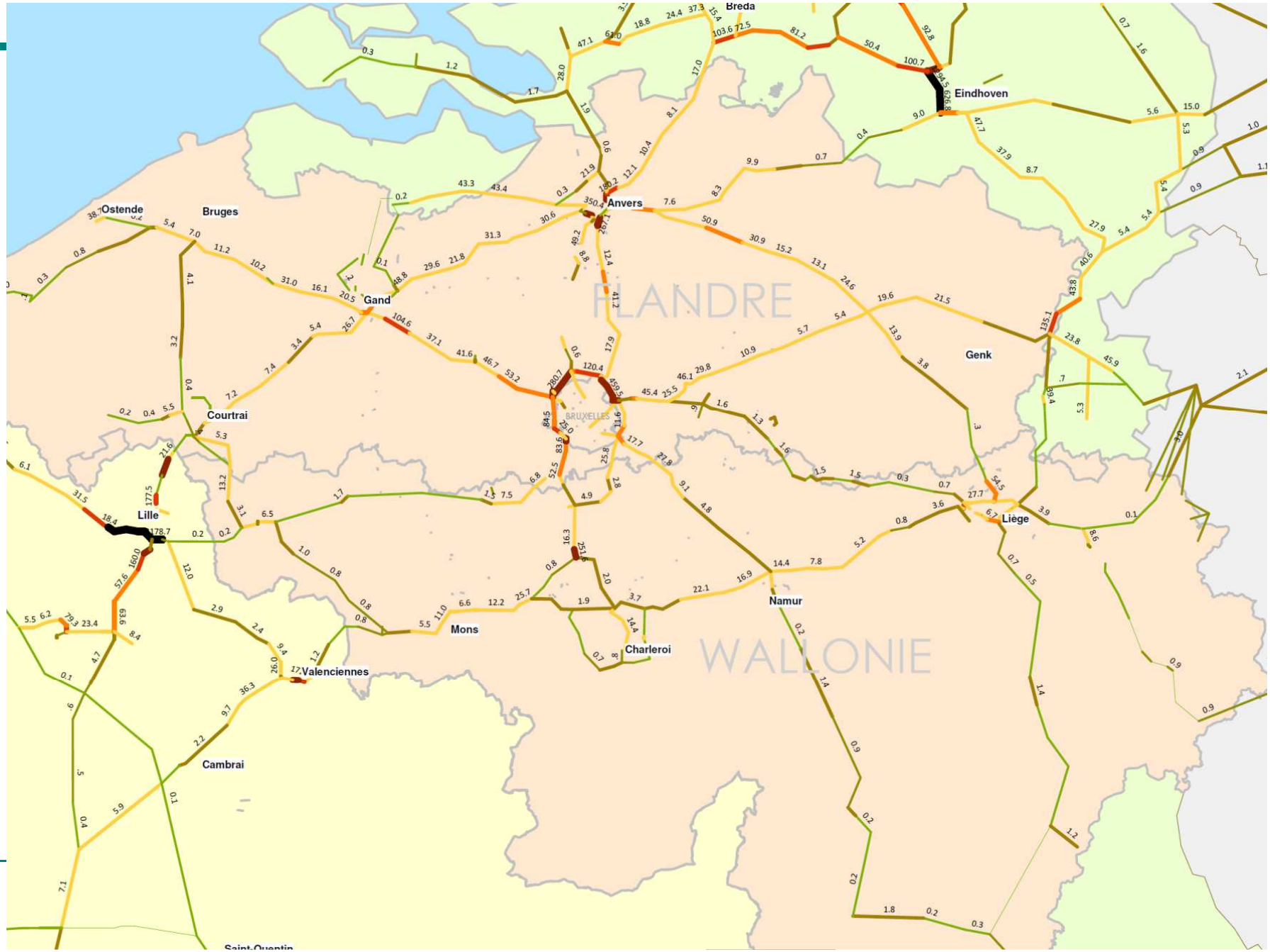
- 0 to 0.01
- 0.01 to 0.5
- 0.5 to 1
- 1 to 5
- 5 to 50
- 50 to 100
- 100 to 200
- 200 to 500
- More than 500

MCC by road section in Belgium - 2020

Motorways – peak hour

Marginal congestion cost (cents €2007/km) by HGV on the motorways in 2020 (peak hour)

- 0 to 0.01
- 0.01 to 0.5
- 0.5 to 1
- 1 to 5
- 5 to 50
- 50 to 100
- 100 to 200
- 200 to 500
- More than 500

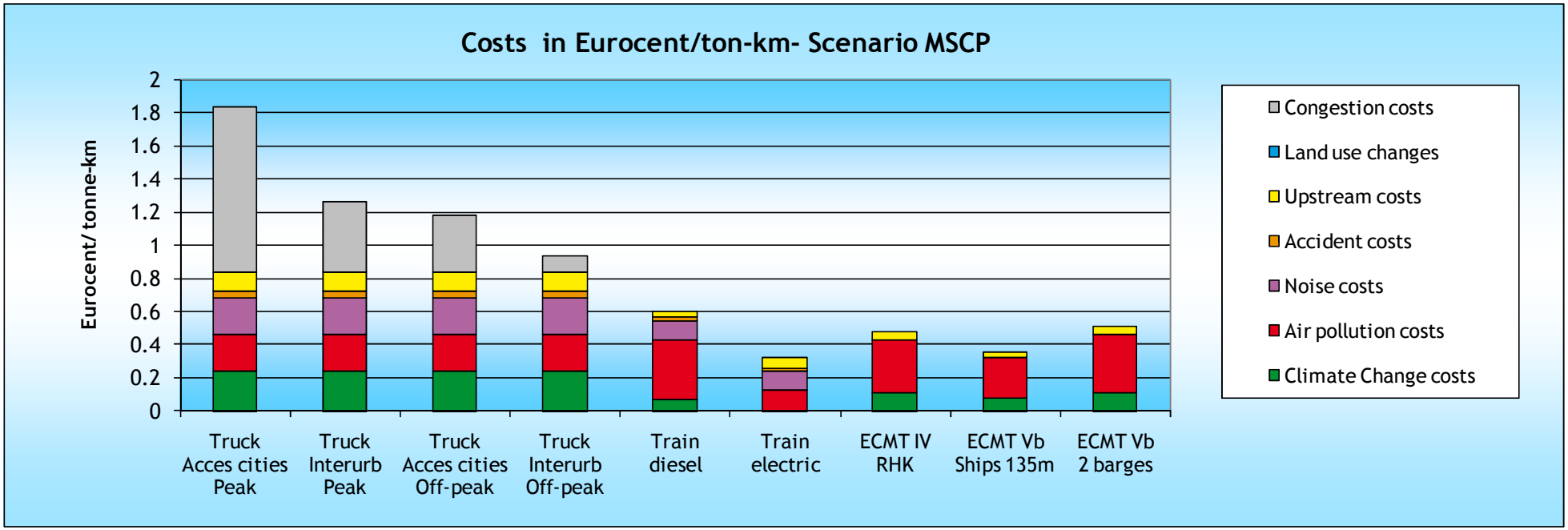


MCC by road section in The Netherlands - 2020

Motorways – peak hour

Congestion cost versus the other road external costs

- Marginal external cost in 2020 for bulk (source: CE Delft + Stratec for the congestion cost)



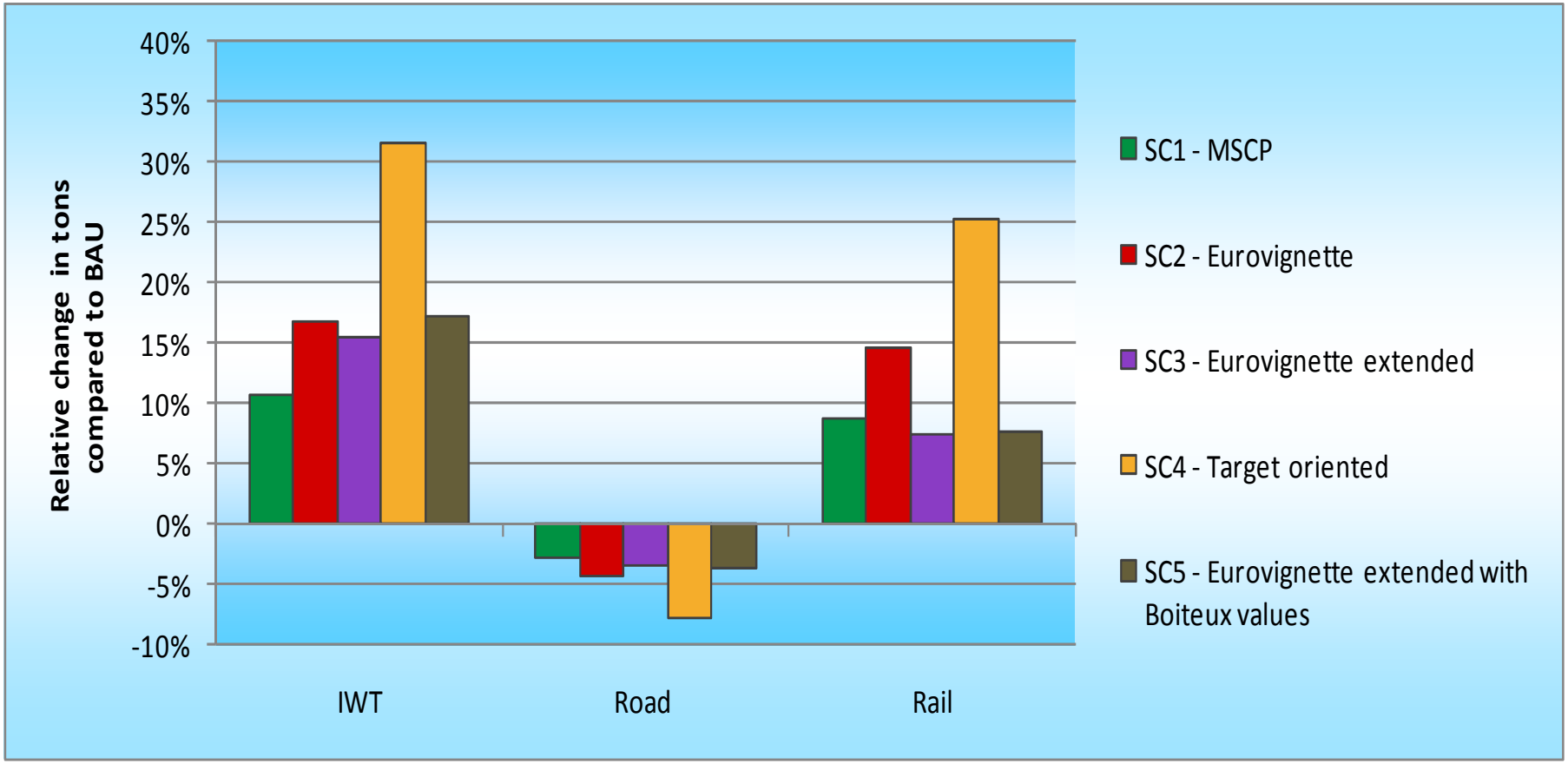
→ Conclusion : in (highly) congested areas, the congestion cost is by far the largest component of the road external cost

4.2 Simulation results: scenario impacts

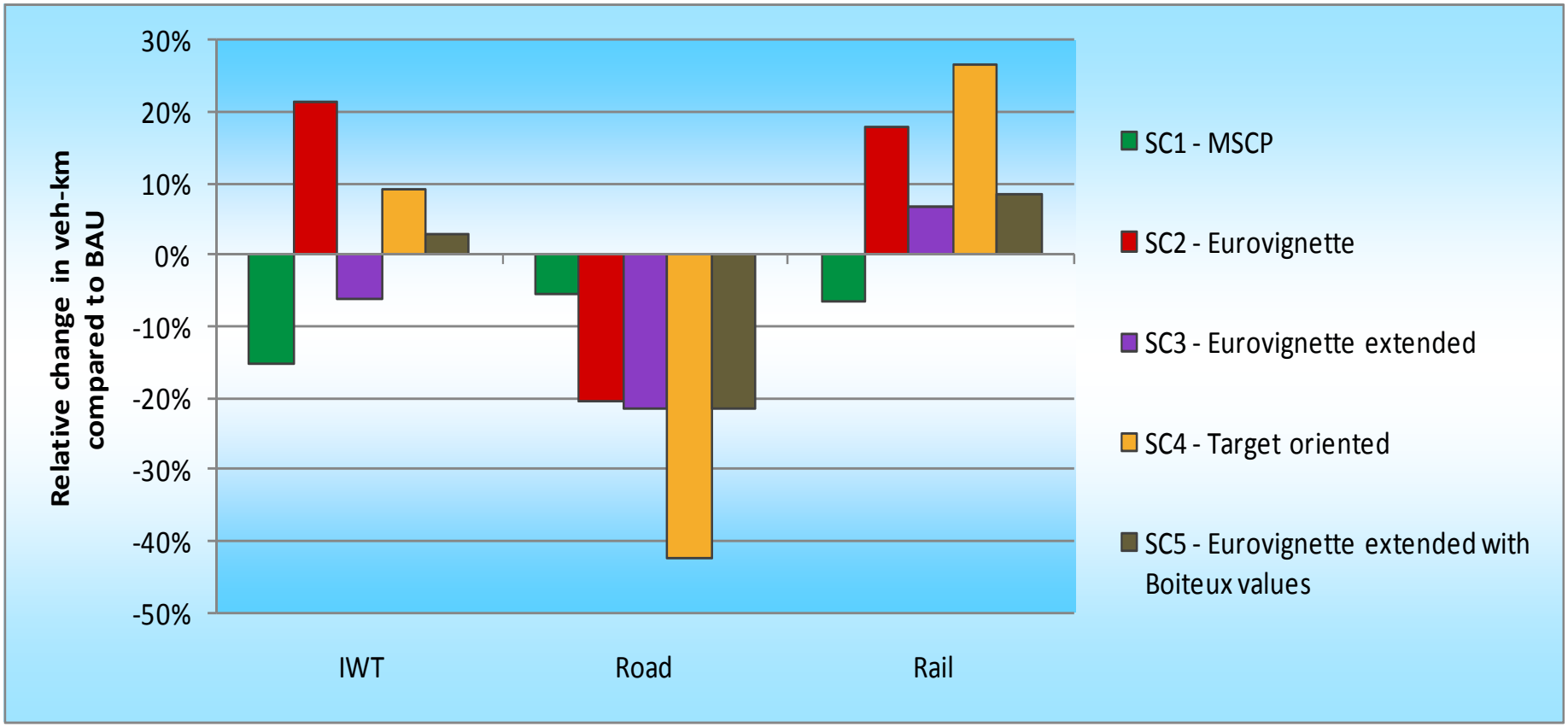
Summary

- Significant modal shift:
  - about 15 % increase in IWW and rail volumes (tons) in the Eurovignette scenario
  - up to +30% tons by IWW and 25% by rail in the target-oriented scenario
- Significant reduction in CO_2 emission:
  - about 20% in the Eurovignette scenarios
- Significant reduction of external costs:
  - up to 14% in the Eurovignette scenarios
- Higher revenues
  - twice BAU revenues in Eurovignette scenarios

Impacts on the modal repartition (tons) in the corridor in 2020

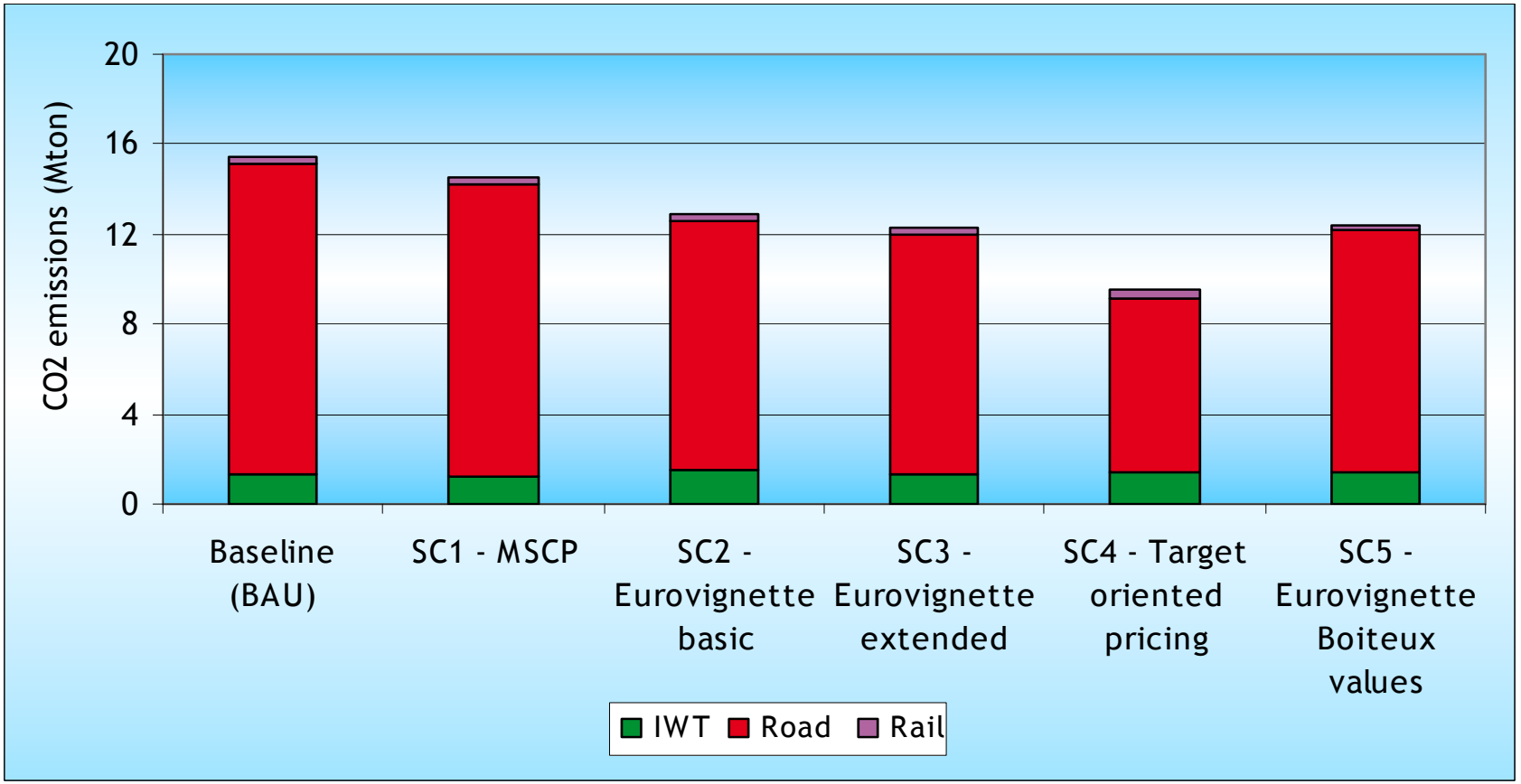


Impacts on traffic volumes (vehicle-km) by mode in the corridor in 2020



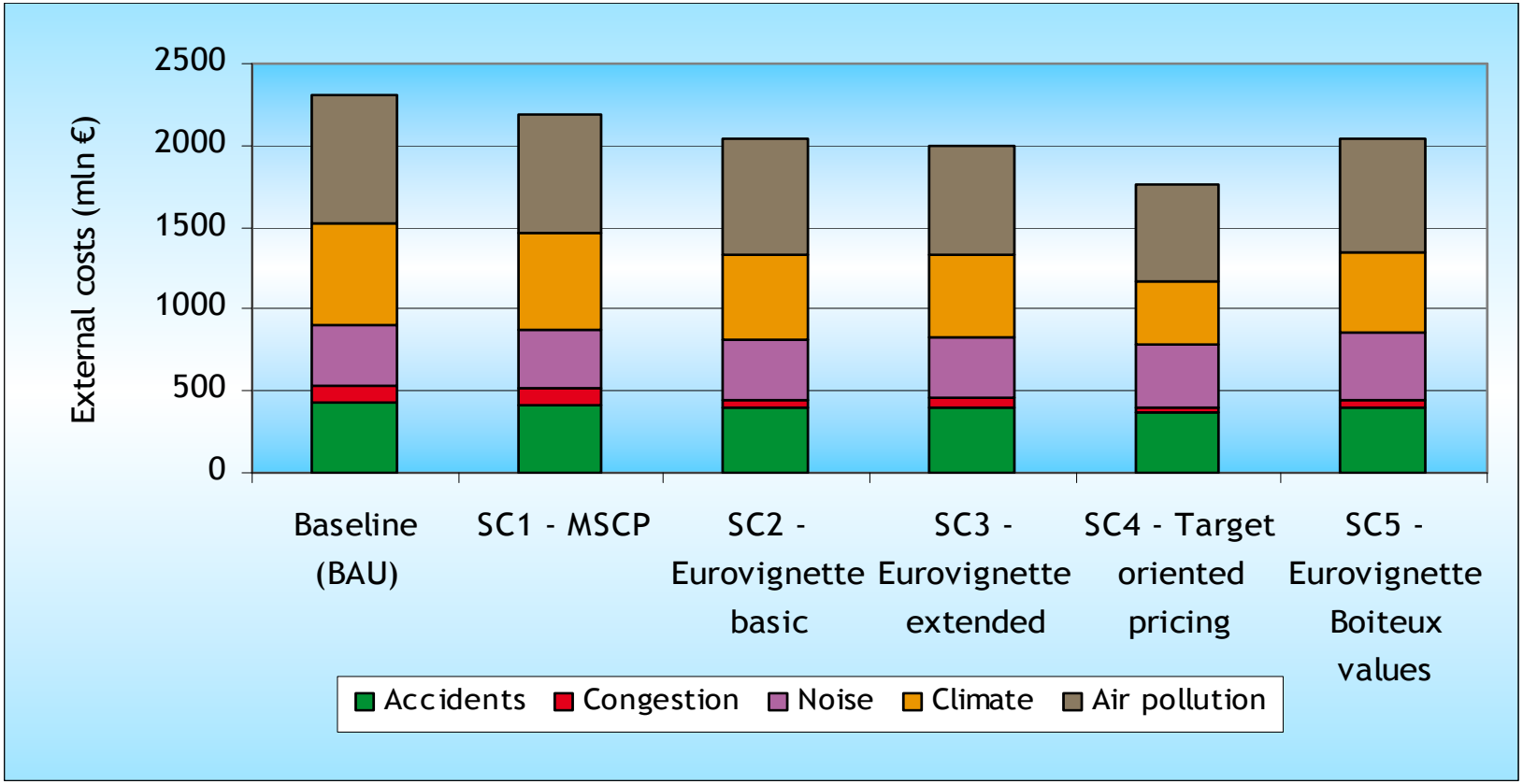
Impacts on CO_2 emissions in 2020

Reduction in CO2 emission (well-to-wheel) : -17% and -21 % in the Eurovignette scenarios, -39 % in the target-oriented scenario



Source : CE DElft

Impacts on external costs in 2020



Source : CE DElft

Conclusions

- About methods:
  - Availability of tools to simulate optimal pricing scenarios and then compare politically/technically feasible scenarios to the optimum

- About policies:
  - Pricing policy fits well in long term strategy for reducing environmental damages due to transport (among others, for decarbonizing transport) and other external costs