Light rail transit systems

61 lessons in sustainable urban development

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International light rail transit developments subcommittee AP075(03)

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@Niels_van_Oort


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ELEKTRISCHE BUS
5600
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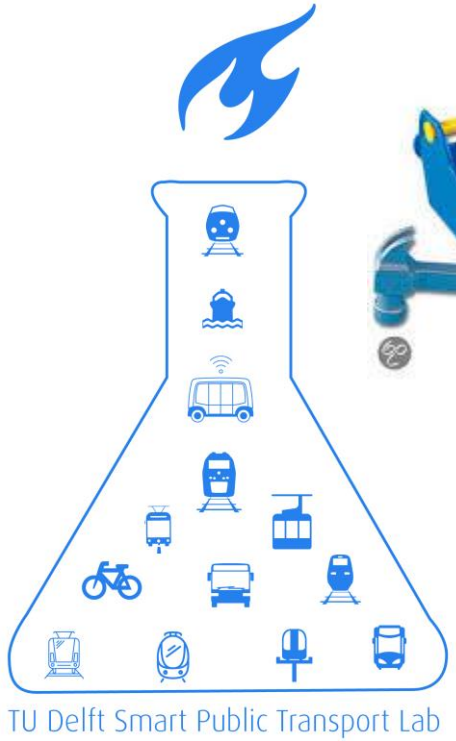
5039


GVB
2131


HYPER

Optimal mix of modes

- System choice: (Heavy/light) rail, metro, bus, ferry,…
- All needed, depending on context
- Integrated network
- Much debate:
  - BRT: Bus Rapid Transit
  - LRT: Light Rail Transit
  - MRT: Mass/Metro Rapid Transit



What do you think the future will be?

Mentimeter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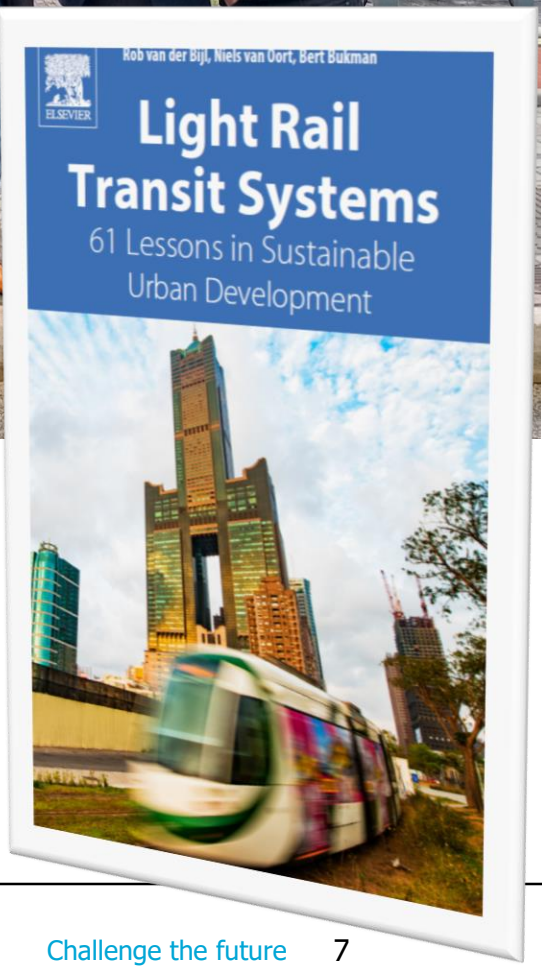
INCREASE REVENUE
Big data supports light rail in Utrecht
Written by Niels van Oort
Transport planners are starting to consider how "big data" retrieved from pas
computers and mobile phones could improve the design of urban rail networ


Light Rail Explained
Better public transport
& More than public transport
EMTA


Rob van der Bijl, Niels van Oort, Bert Bukman
ELSEVIER
Light Rail
Transit Systems
61 Lessons in Sustainable
Urban Development

Lessons learned: 61 cases

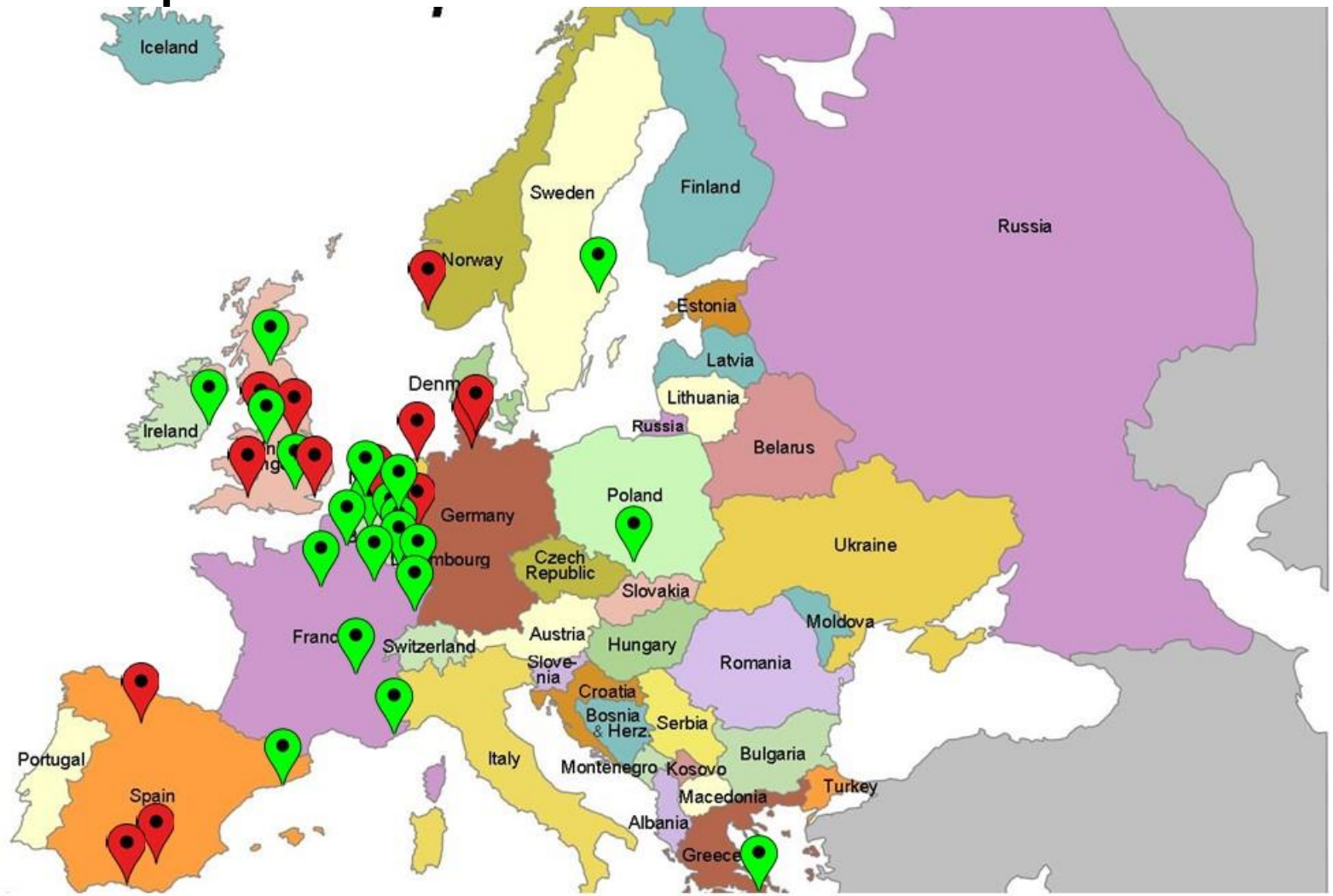
- Light rail has been successfully implemented in many urban regions worldwide.

- Several light rail projects were not that successful or even failed.

- There is much debate on the (societal) cost-benefit ratio of these systems.

Cases worldwide

Europe


Iceland
Sweden
Finland
Russia
Norway
Estonia
Latvia
Lithuania
Russia
Belarus
Ireland
Poland
Germany
Ukraine
Czech Republic
Slovakia
Moldova
Austria
Hungary
Romania
Switzerland
Slove-nia
Croatia
Bosnia & Herz.
Serbia
Bulgaria
Portugal
Italy
Montenegro
Kosovo
Macedonia
Turkey
Spain
Albania
Greece

General findings: success

Project conception

- Focus on 'why' the project (short term and long term);

Politics

- The timeframe of contracts for the project must be consistent with political timeframes;

Communication

- Residents and citizens must be involved in the project;

General findings: failure

Project conception

- Too few project variants or alternatives. Solutions for a good project are often found in the combination of different alternatives.

Project organization

- Innovative public tendering (e.g. DBFMO and alike) comes with risks;

Politics

- Changing political climate;

Communication

- A technocratic attitude jeopardizes the project;

Justification of public transport

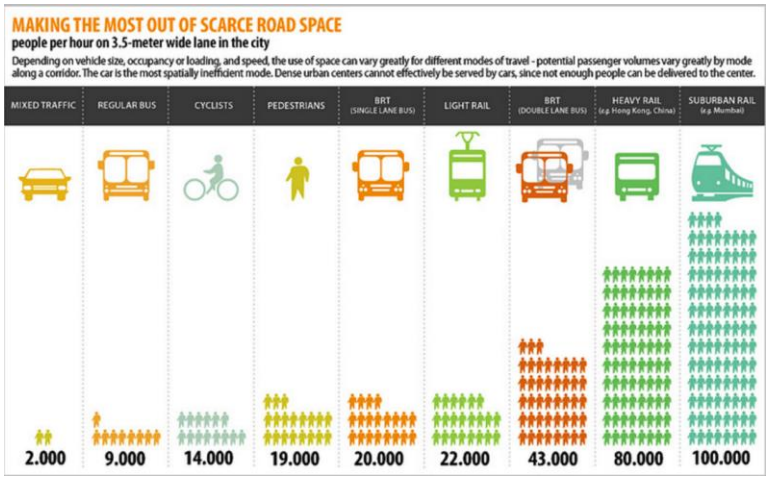
Framework of 5 E's

- Effective mobility
- Efficient city
- Environment
- Economy
- Equity

Van Oort et al. 2017

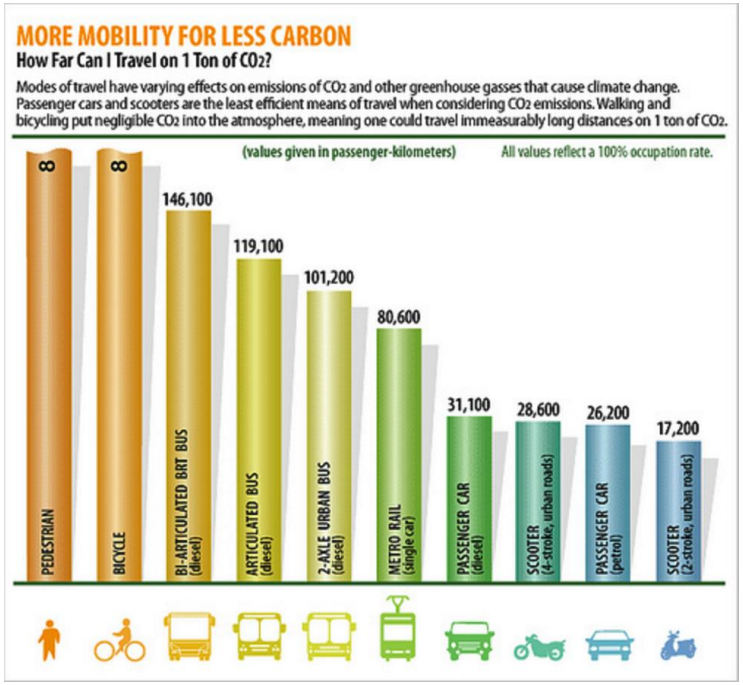
Efficient cities

- All kinds of (indirect) effects:
  - Urban planning & design
  - (Restructuring) the city
  - Quality of the city
  - Livability
  - Image & perception of the city



Environment

- More efficient regarding:
  - Energy consumption
  - (Direct) emissions
  - Land use
- Health
- Bicycle+Transit



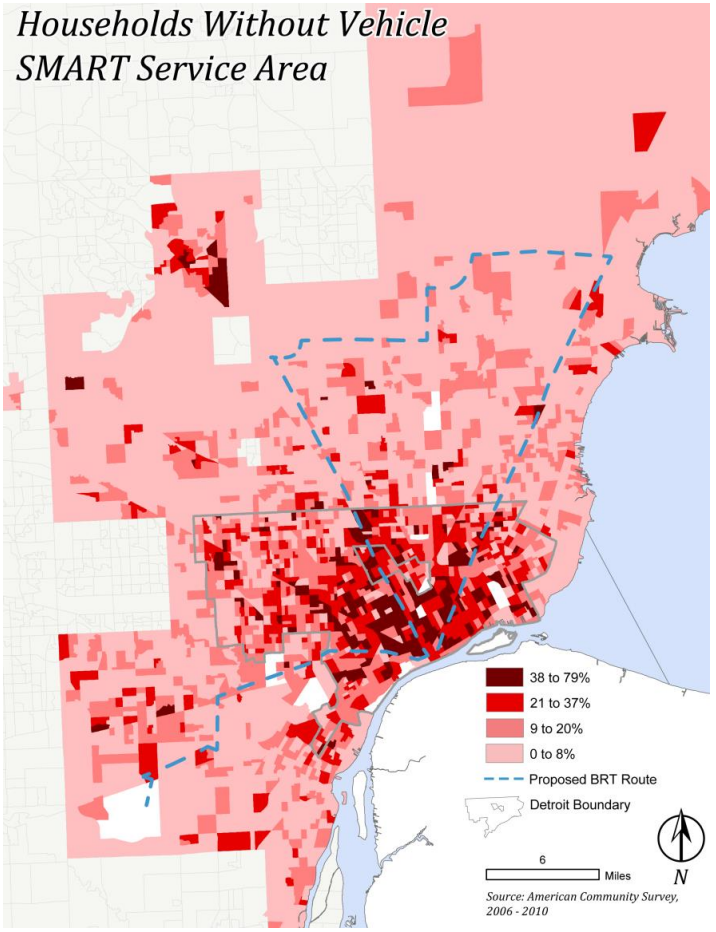
Economy

- Land value
- Real estate value
- Retail turnover & quality
- Employment
- Property development

	Increase due to high quality public transport accessibility	
Land value	+ 5%	+ 10%
House value	+ 2%	+ 5%

Equity

- Social access & connection:
  - Contra-segregation
  - Social mobility



Effective mobility

- Quality of service
  - Travel speed
  - Transfers
  - Service reliability
  - Robustness
  - Comfort
  - …

A

Light rail

19 minutes

B

Bus

15 minutes

C

Streetcar

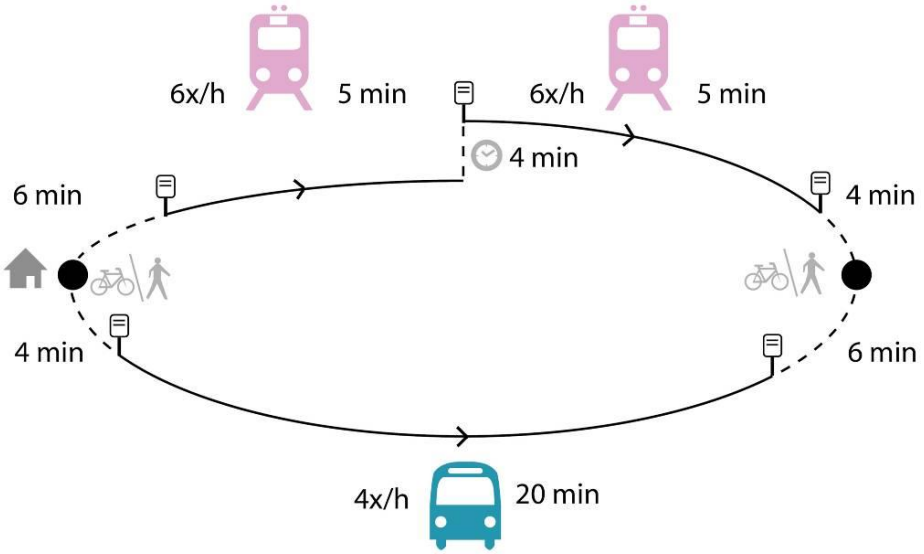
16 minutes

Rail bonus

- Research TU Delft (Bunschoten et al. 2013)
- Additional attractiveness of a rail system compared to a bus system with similar characteristics

Source	Result
Scherer (2011)	Slight pref. rail
Scherer (2009)	Slight pref. rail
Cain (2009)	Slight pref. rail
Bovy en Hoogendoorn-Lanser (2005)	Preference rail
Currie (2004)	Slight pref. rail
Ben Akiva (2002)	No difference
Welschen (2002)	0-10%
Kasch en Vogts (2002)	Preference rail
Megel (2001)	Slight pref. rail
Axhausen (2001)	Slight pref. rail
Berschin (1998)	+30%
Arnold en Lohrmann (1997)	+15%
Hüsler (1996)	+54%

Rail Bonus: approx. 5-15%



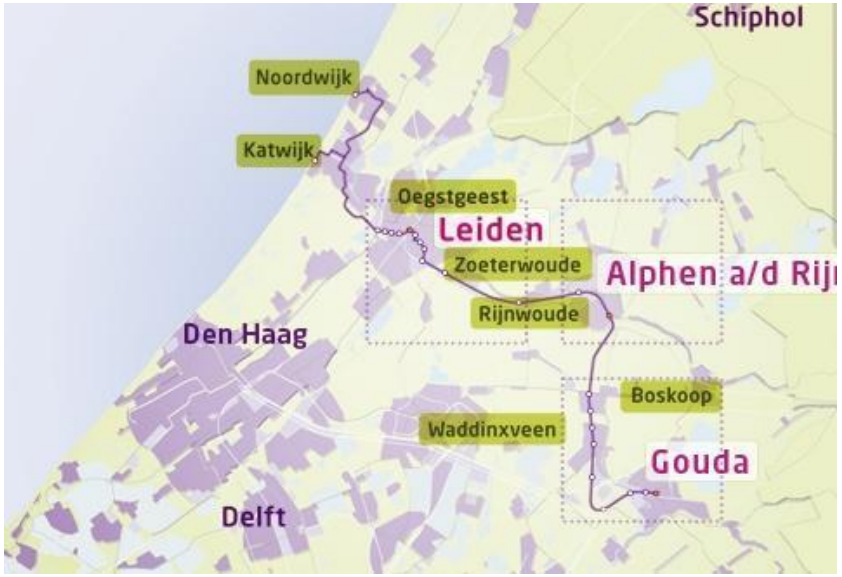
Bunschoten, T., E. Molin, R. van Nes (2013). Tram or bus; does the tram bonus exist? *European Transport Conference*.

3 example cases

Failed project

RijnGouweLijn Leiden

Trial (mixed) operations in 2003
Project cancelled in 2012



Findings

RijnGouwelijn Leiden

From 2003, first expressions of resistance occurred among residents and shop holders;

Growing resistance forced the municipality of Leiden to organize a referendum in 2007;

The referendum was not organized properly: No alternative, only yes or no;

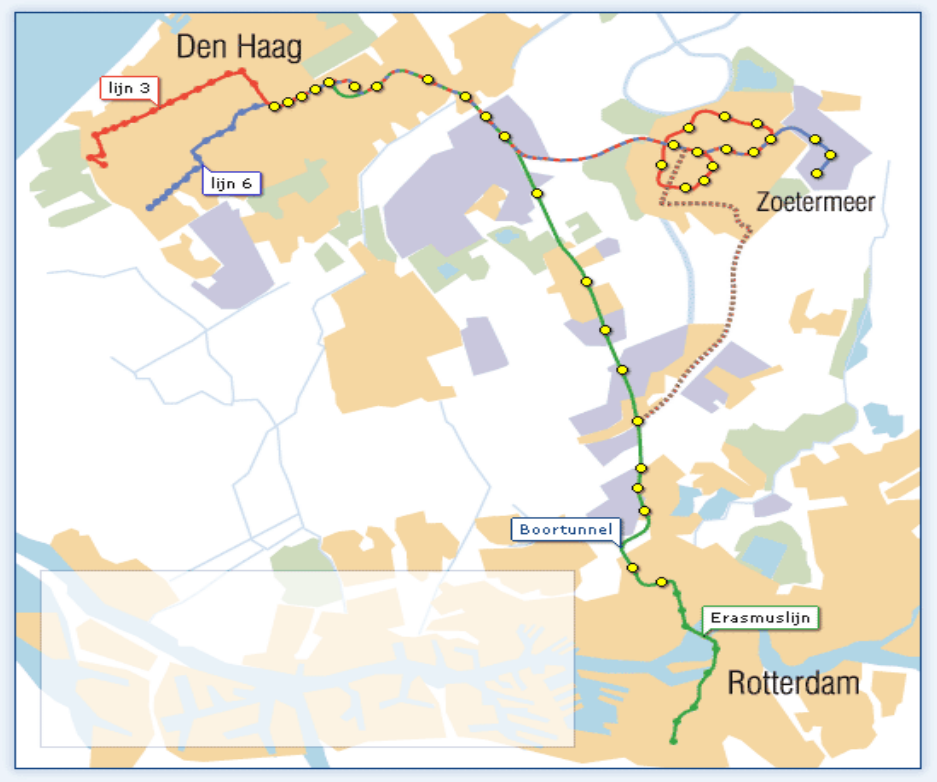
Justification of the project was unclear;

Bicycles not taken into account.

Successful project

RandstadRail The Hague/Rotterdam

In operation since 2006 (2007)



Findings

RandstadRail The Hague/Rotterdam

During the first weeks of operation, severe technical problems arose, leading to several derailments;

As soon as the system came to a stable and reliable operational stage, passenger numbers started to increase and exceeded expectations

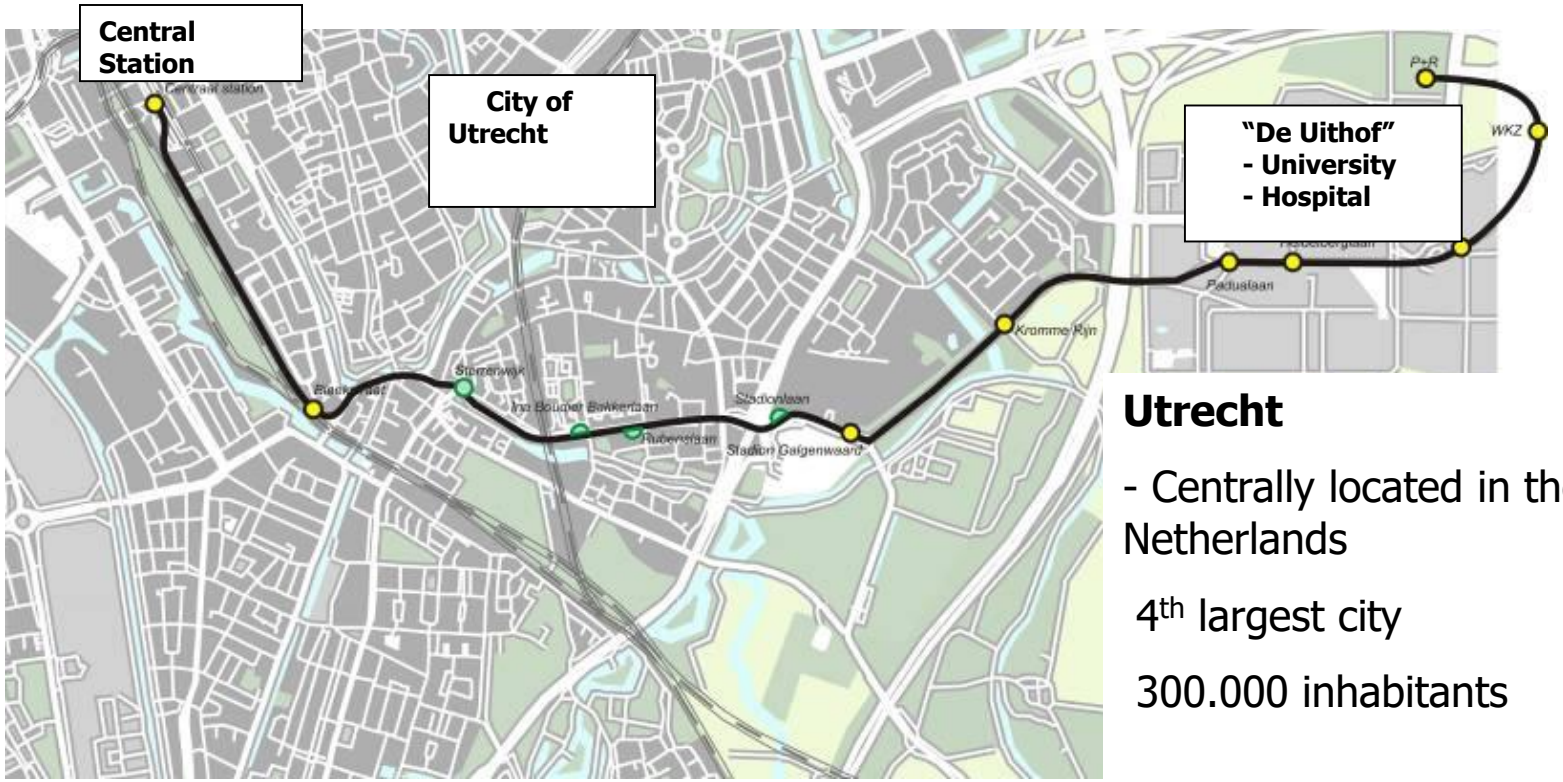
RandstadRail proved to offer high reliable services, due to a set of measures, both strategical, tactical and operational

Higher punctuality/regularity
Less passenger waiting time
Less distribution of passenger travel time

Increased ridership
Increased customer satisfaction

Utrecht Uithoflijn

Case: Uithoflijn (line 12)



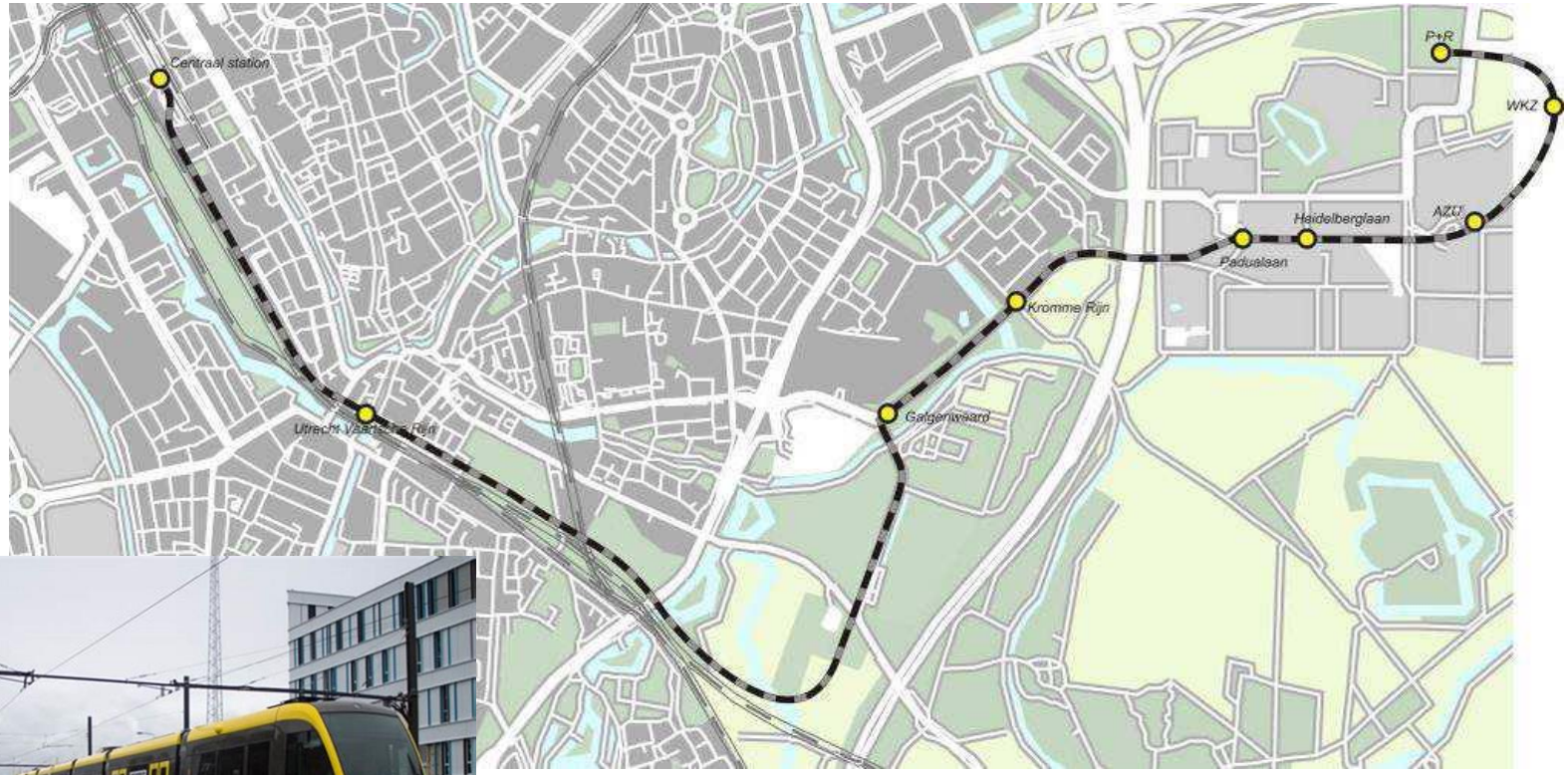
Utrecht

- Centrally located in the Netherlands

4th largest city

300.000 inhabitants

New light rail line

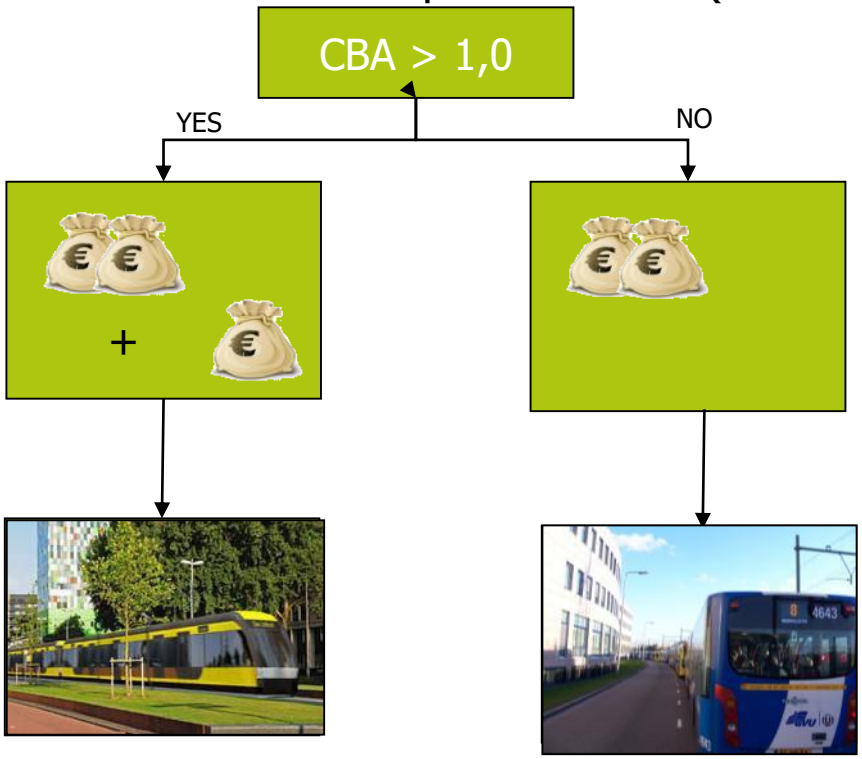


7,5 km
16-20 veh / hour/ direction

(Connected) CAF vehicles (2x37,5 m)

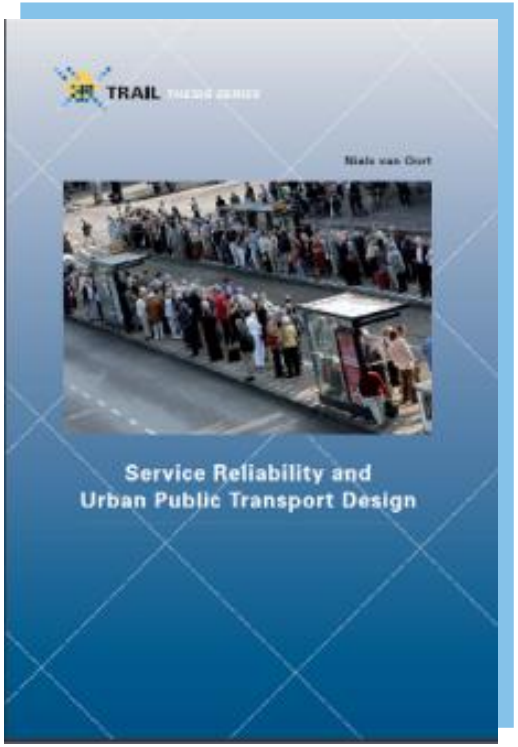
Ministry requires CBA

- Regional parties agreed with plans and finances
- €110 million of Minister of Transport available (about 1/3 of total costs)



Our approach

- **Calculations of:**
  - Future demand, including tram bonus impacts
  - Costs (infrastructure and operations)
  - Benefits
    - Travel time gains
    - **Reliability gains**



Van Oort, N. (2011), Service reliability and urban public transport design, PhD Thesis Series, Delft

Results CBA

Service reliability effects are over >60% of all benefits!

~EU 200 million of benefits were service reliability related

This method was approved by the Dutch Ministry and the Minister provided the €110 million

Light rail rail will start to operate this year

Service reliability is considered in more CBAs now

Van Oort, N. (2016). Incorporating enhanced service reliability of public transport in cost-benefit analyses. *Public Transport*, Volume 8 (1), pp 143-160.

References

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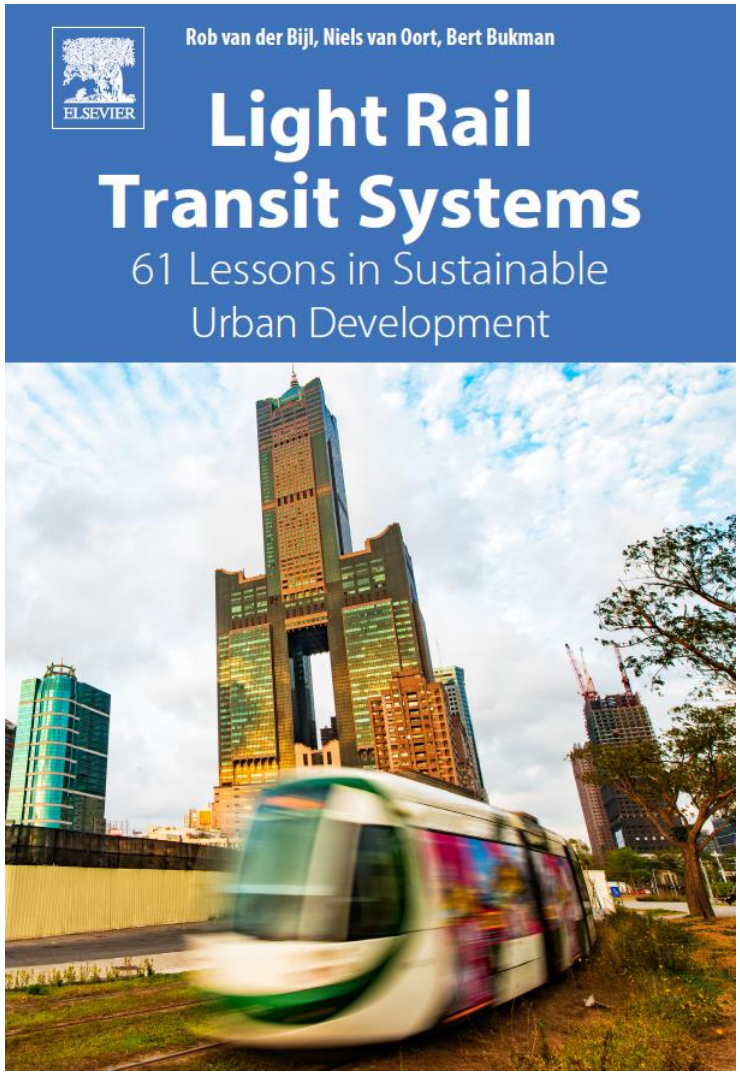

Van der Bijl, Van Oort, Bukman 2018

Elsevier

Available via www.Elsevier.com

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