# Why light rail?


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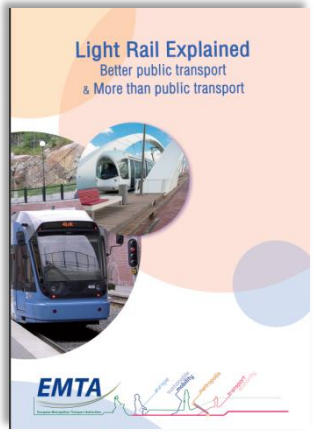
# Background


Dutch light rail experiences:
success and fail aspects
- Justification
- Not only about transport
- Smart cities

Today:
Framework impacts of light rail
Case of neglected benefits: service reliability



# Justification of light rail

**Framework of 5 E's**

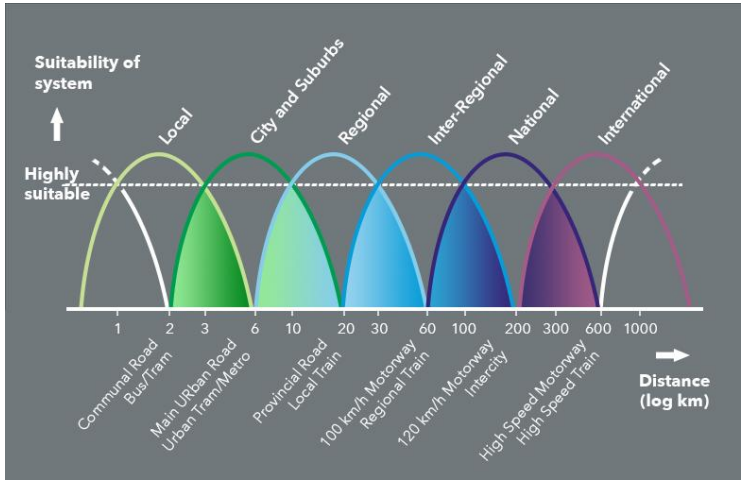
- Efficiency
- Effectiveness
- Environment
- Economy
- Equity

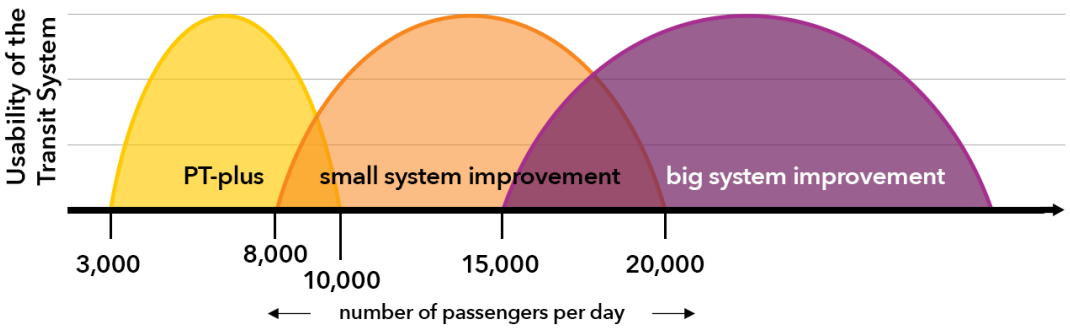
SMART CITIES

# Why light rail? Why public transport?

## *Efficiency (network and operations)*

- Meeting demand
- Optimizing operational costs
- Use of (public) space
- Quality of service
- Railbonus (Bunschoten et. al)



# Why light rail? Why public transport?

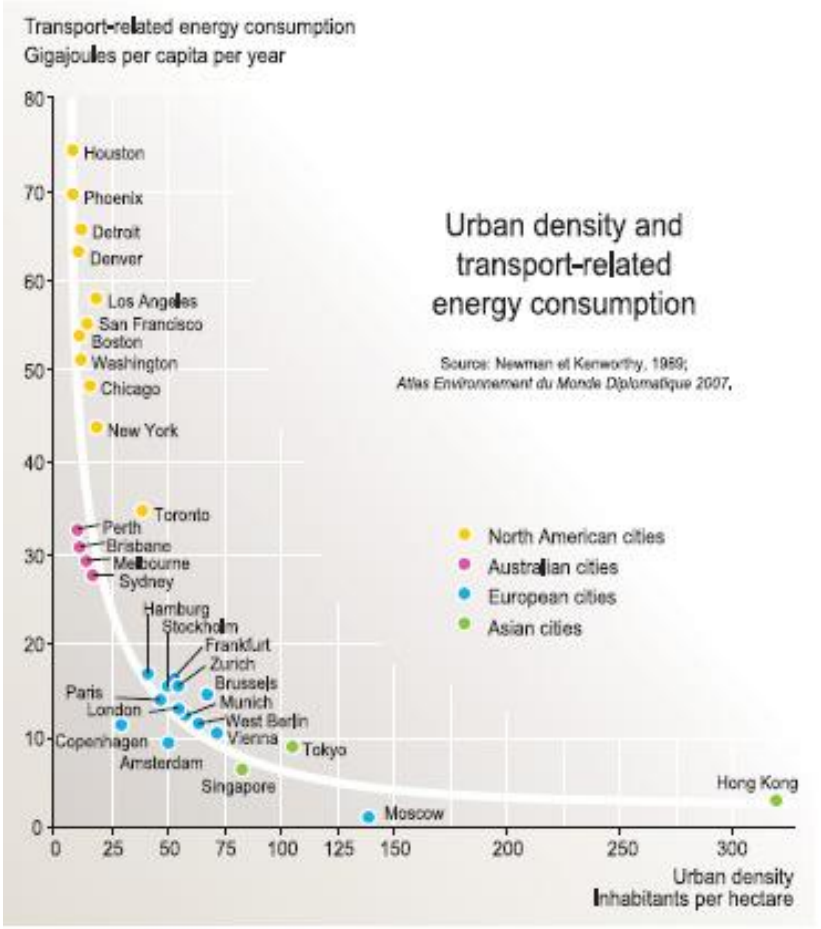
***Effectiveness (urban design)***

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

# Why light rail? Why public transport?

***Environment***

- More efficient regarding:
  - Energy consumption
  - (Direct) emissions
  - Land use



# Why light rail? Why public transport?

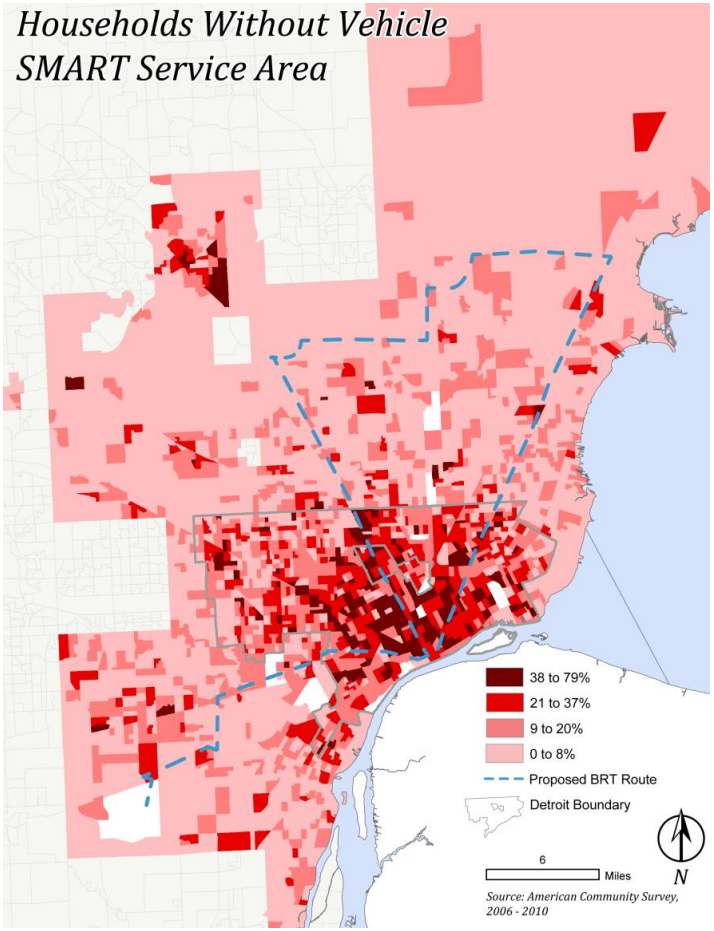
***Economy***

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

# Why light rail? Why public transport?

***Equity***

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



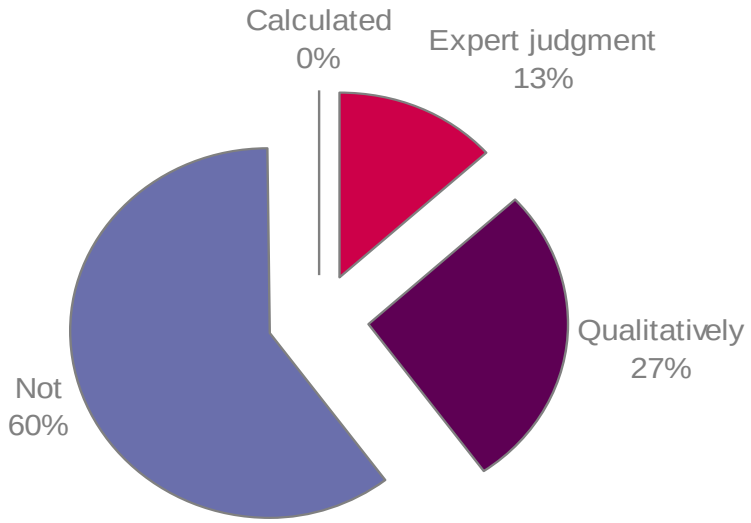
# Example efficiency

**Actual case**

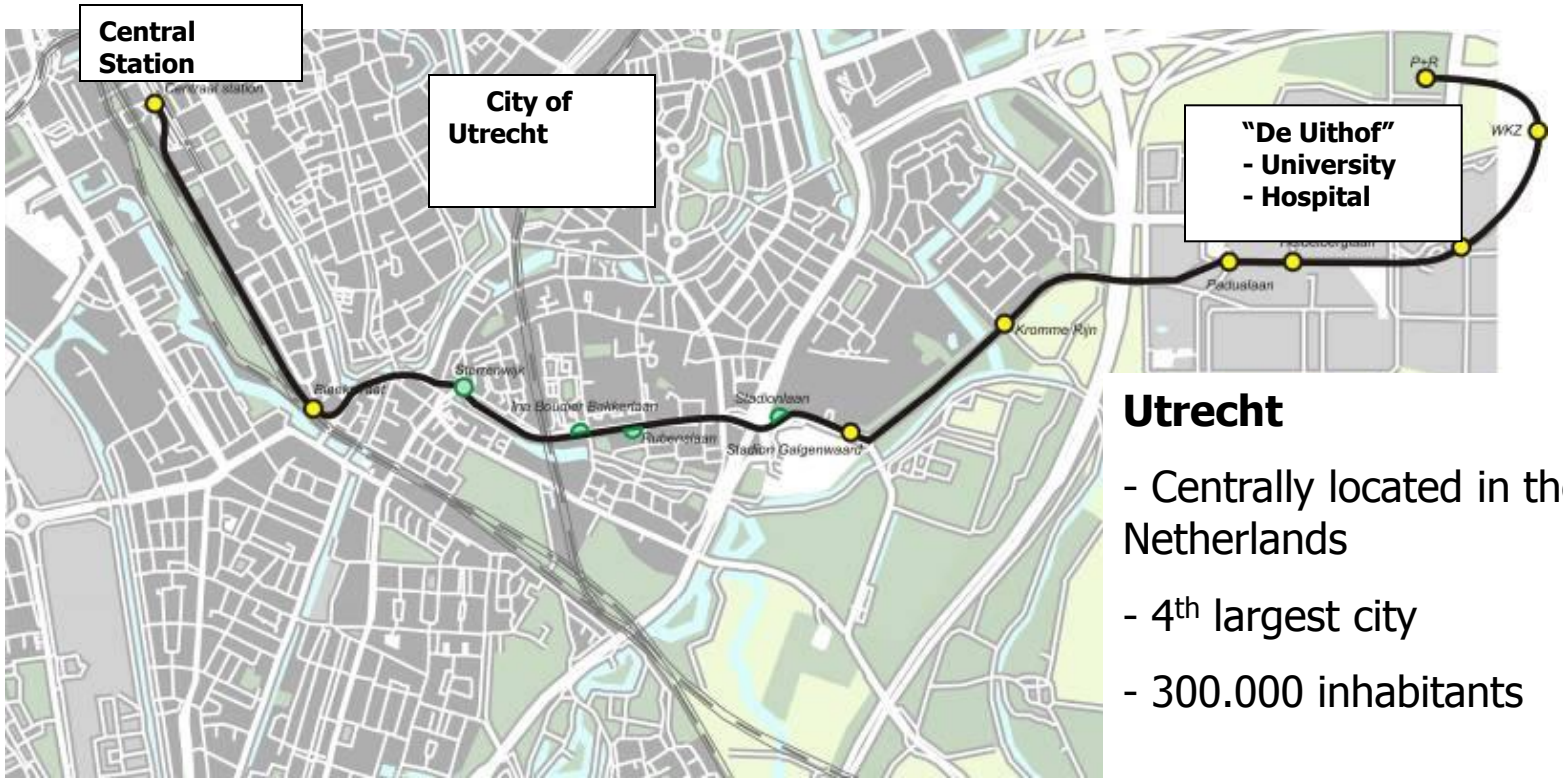
Uithoflijn Utrecht

# Decision making in public transport

- Most PT projects aim at enhanced reliability
- Service reliability is often missing in CBA and transport models
- We developed:
  - Methodology to incorporate passenger impacts of service reliability:
    - Transport models (reliable forecasts)
    - Cost benefit analyses
- Applied in Utrecht



# Case: Uithoflijn (line 12)




**Utrecht**

- Centrally located in the Netherlands
- 4th largest city
- 300.000 inhabitants

# Problem analysis

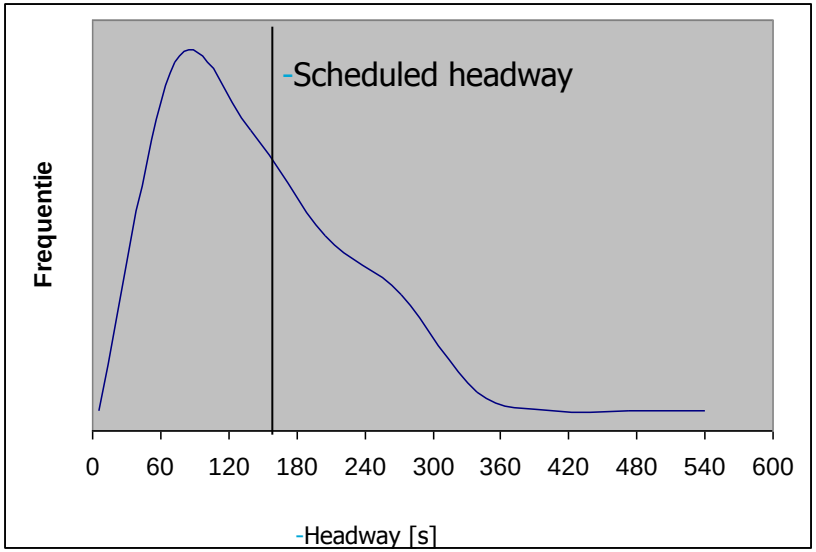
- Busiest bus line in the Netherlands: 27.000 passengers per day
- Frequency of 23x/hour/direction using double-articulated buses: 30x/hour/direction necessary
- Poor reliability and lack of capacity

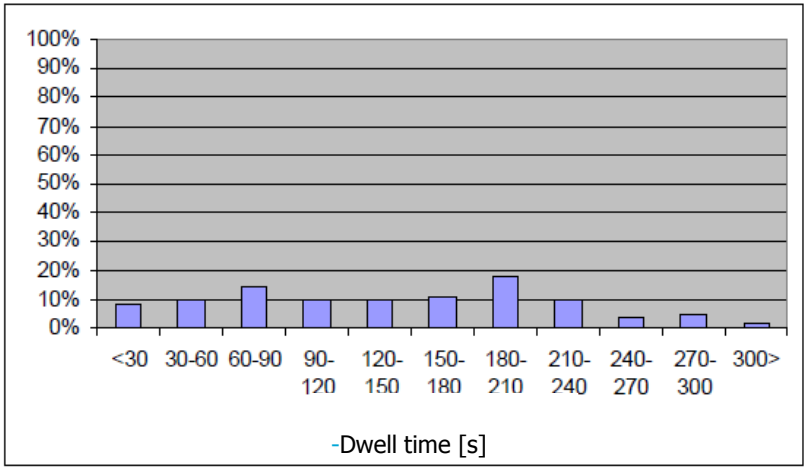
- Mobility is still growing
  - +25% planned property in the Uithof: +8.000 students, +10.000 employees
  - Total: 53.000 students, 30.000 employees and 3.500 visitors (hospital)
  - No additional parking space
  - Demand forecast: 46.000 passenger per day

**Solution**

- **Introduction of a light rail line: 16-20x/hour**

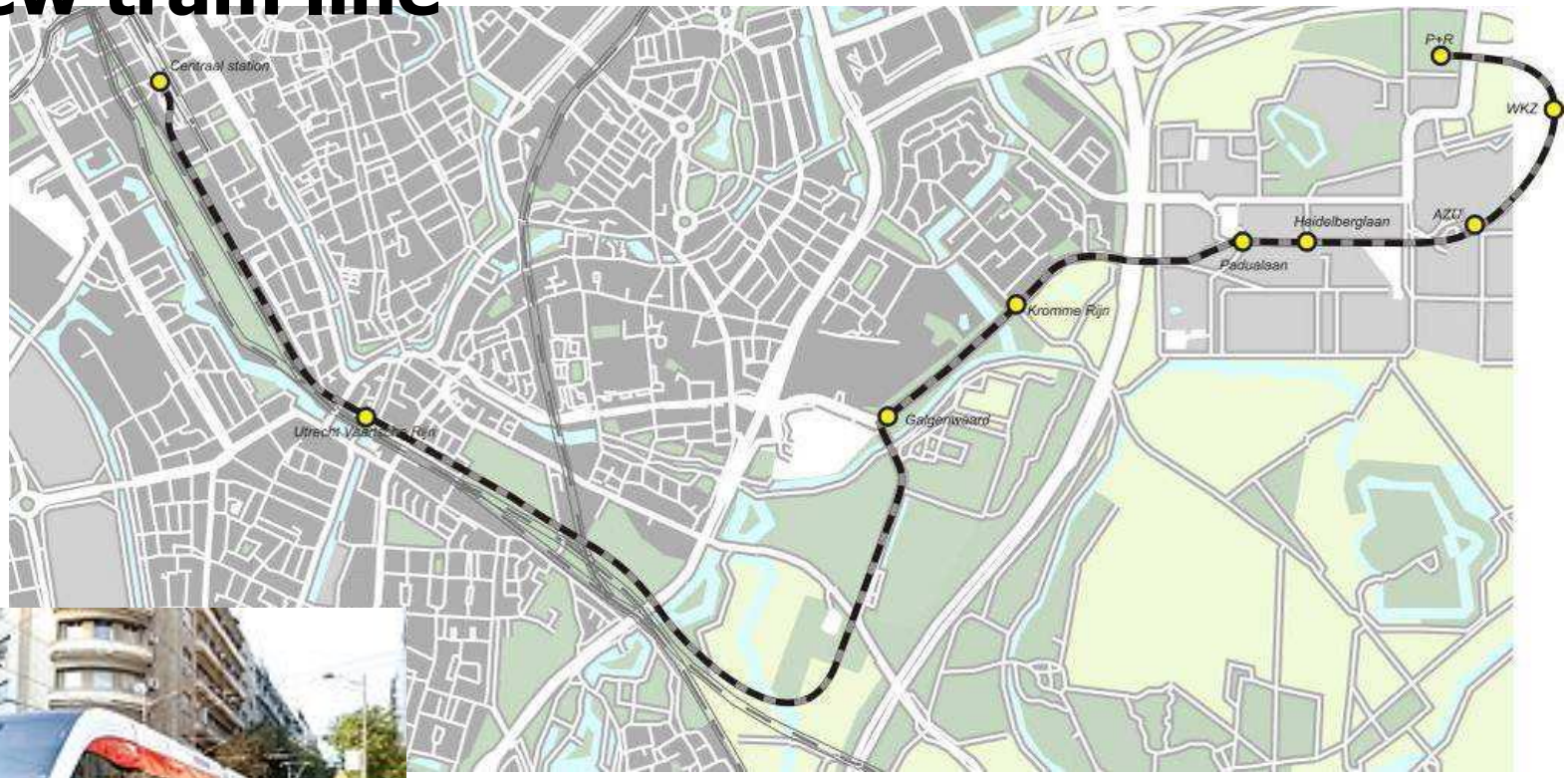
# Poor reliability


-Avg. =2,5 min; σ= 1,3 min

# New tram line

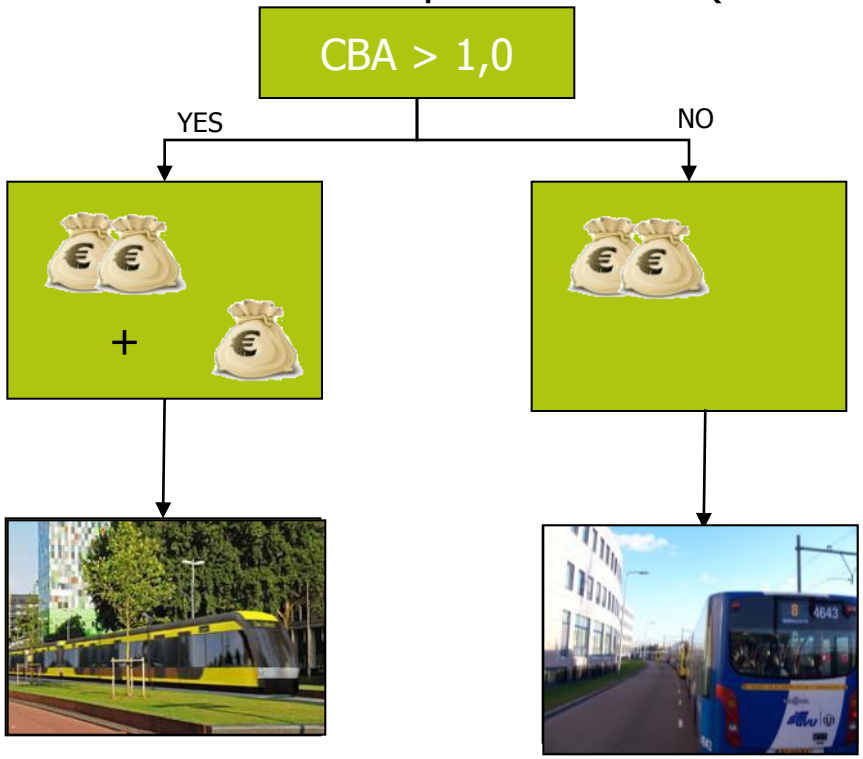



7,5 km
Operations are planned to start in 2018

-12 connected CAF vehicles (2x37,5 m)

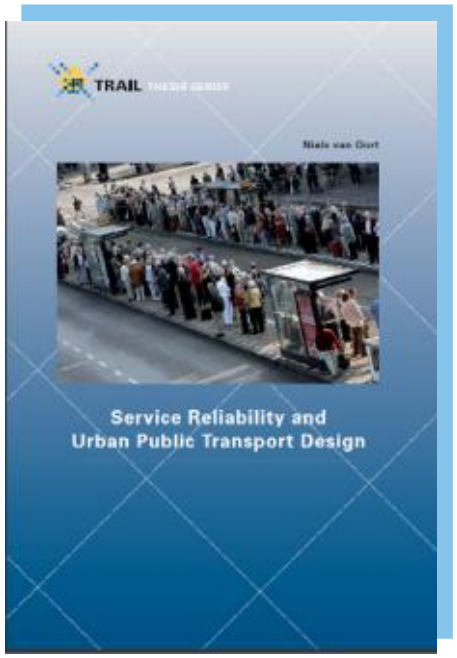
# Ministry requires CBA

- 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**



# Results CBA

| | Value compared to reference case (millions in 2011) |
|---|---|
| Investment costs | -€222 |
| Operating costs | €66 |
| *Total costs* | *€288* |
| | |
| Additional ticket revenues | €40 |
| Increased travel time | €67 |
| Service reliability effects | |
| - Less waiting time | €123 |
| - Reduction in distribution | €78 |
| - Increased probability of finding a seat in the vehicle | €4 |
| External effects (emissions, safety, etc.) | €8 |
| *Total benefits* | *€336* |
| | |
| **Benefits-costs** | **+€48** |
| **Benefit cost ratio** | **1.2** |

Additional waiting time due to unreliability

Distribution of travel time due to unreliability

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

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

# Summary

- Lessons from light rail projects: justification and broader scope than transport
- Framework of 5 E's
  - Efficiency
  - Effectiveness
  - Economy
  - Environment
  - Equity
- Smart City

*Case*

- Light rail enables increase in service realibility
- Little attention to service reliability in cost-benefit analyses
- Service reliability benefits made the difference in Utrecht

*Future work*

- Sharing knowledge and insights

# Light rail book

## Investing in the City

### Lessons from 47 light rail projects

Rob van der Bijl, Bert Bukman & Niels van Oort

Dutch version launched this month
English one expected within a year

# Questions?

Niels van Oort

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**Papers:**
https://nielsvanoort.weblog.tudelft.nl/


**Light rail:**
www.lightrail.nl

**EMTA report: Light rail explained**
www.emta.com -> Publications -> Surveys