Innovation in bikes & MaaS

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15 June 2017
STATEMENT 1
“In the city of the future the bike will be the means of transportation”
Agenda

Trends
Safety on bikes
MaaS
Problems of modern cities

- Population growth
- Increasing urbanization
- Increased mobility
- Pressure on the environment
- Pressure on accessibility
- Pressure on Safety
Solutions via mobility

- Digitization of mobility
- Modal shift
- Smart mobility
- Electrification
- Autonomous driving
- Use-based payment
- Freedom of choice of consumers
Citizens are choosing differently

Other individual

Other collective
Freedom of choice? How?

- Shared car
- Tram
- E-bike
- Bicycle
- Stopping train
- Car (petrol/diesel/hybrid)
- Electric car
- Bus
- Hybrid bus
- Intercity
- Aeroplane
Based on costs?

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<table>
<thead>
<tr>
<th>Mode</th>
<th>Subsidies</th>
<th>External costs</th>
<th>Infrastructure costs</th>
<th>External revenue</th>
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Government costs in billions of euros

<table>
<thead>
<tr>
<th>Mode</th>
<th>成本（十亿欧元）</th>
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<tbody>
<tr>
<td>Bus</td>
<td>2.8</td>
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<tr>
<td>Tram</td>
<td>0.3</td>
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<tr>
<td>Moped</td>
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<td>Train</td>
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<td>Coach</td>
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<tr>
<td>Bicycle</td>
<td>11.6</td>
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</table>

Government revenue in billions of euros

<table>
<thead>
<tr>
<th>Mode</th>
<th>收入（十亿欧元）</th>
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<tbody>
<tr>
<td>Bus</td>
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<td>Tram</td>
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<td>0.5</td>
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<tr>
<td>Aeroplane</td>
<td>12.8</td>
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</tbody>
</table>

Source: TUE, VU
```
Concerns about safety

Fatalities per modality in the Netherlands, 2000, 2007 and 2014

- Car
- Bicycle
- Moped
- Motorcycle
- Pedestrian
- Other

Source: CBS, Rijkswaterstaat
STATEMENT 2

“Technological innovations will have a positive effect on cyclist safety”
Agenda

Trends
Safety on bikes
MaaS
Road to safe cycling

From vehicle perspective

2012

2015

2030

Injury mitigation

Cyclist Airbag

Systems and sensors In-car
Cyclist airbag
Cyclist airbag
Road to safe cycling

From vehicle perspective

- In 2012: Injury mitigation
  - Cyclist Airbag

- In 2015: Injury prevention
  - Cyclist-AEB

- In 2030: Systems and sensors In-car
Autonomous emergency braking (AEB)
Autonomous emergency braking (AEB)
Road to safe cycling

From vehicle perspective

- **2012**: Injury mitigation
  - Cyclist Airbag

- **2015**: Injury prevention
  - Cyclist-AEB

- **2030**: Smooth interaction
  - Automated driving

- **Systems and sensors**
  - In-car
  - On the bicycle
  - On the infrastructure
Bicycle 2x communication
Road to safe cycling

From vehicle perspective

- **2012**: Injury mitigation
- **2015**: Injury prevention
- **2030**: Smooth interaction

Key technologies:
- Cyclist-AEB
- Cooperative AEB
- Connected bike & smart devices
- E-bike
- Information services

Power supply

Cooperative AEB

Smooth interaction

Cyclist-AEB

Injury prevention

Injury mitigation

From vehicle perspective

Cooperative AEB

E-bike

Information services

Power supply
Road to safe cycling

From vehicle perspective

- **2012**
  - Injury mitigation
  - Cyclist Airbag

- **2015**
  - Injury prevention
  - Cyclist-AEB

- **2030**
  - Smooth interaction
  - Cooperative AEB
  - Intelligent bike
  - Connected bike & smart devices
  - Warning & interventions
  - Information services
  - Power supply

- **E-bike**

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TNO innovation for life
next urban mobility
Self stabilizing bicycle

- Battery and breaker circuit
- IMU - lean sensor
- High torque stepper motor with a planetary gear train
- Speed sensor
Sofiets - Adjustable saddle height

Source: Roessingh RD – sofiet
Intelligent bicycle

- Tablet as HMI
- Vibrating handle bars
- Radar
- Vibrating saddle
- Computer
- Camera
- Haptic pedal assistance
Road to safe cycling

From vehicle perspective

- Cyclist Airbag
- Cyclist-AEB
- Cooperative AEB
- Connected bike & smart devices
- Automated driving
- Intelligent bike
- Information services
- Warning & interventions
- Smooth interaction
- E-bike
- Power supply

Injury prevention

2030

2015

2012

Injury mitigation
Smooth interactions

Source: TNO
STATEMENT 3

“Technology will solve all future cities problems”
Agenda

Trends 01
Safety on bikes 02
MaaS 03
Huge amount of innovative bike technologies available….

…but how to make them work for the city of tomorrow?
But technology can go too fast

Example: speed pedelec
Need for an integrated system

- Traffic management
- Up-to-date traffic information
- Freely available parking
- Car to X
- Bike to X

Innovative mobility concepts
- Short-distance mobility
- Seamless connections
- Micro mobility for the last mile
- Long-distance mobility

Efficient drive system
- Electromobility
- CO$_2$-neutral mobility
- Driver assistance
- Connected vehicles

Vehicles

Connected Mobility concepts

Infrastructure

Drivers assistance
- Connected vehicles
Connectivity will help to make it work

The development of the Internet blurs the boundaries between online and offline.
Mobility as a Service (MaaS)
A start-up with more than 40 years of experience that develops & implements smart mobility solutions for the city of tomorrow
Principles of Next

1. Change the heart of the city through the minds of the people
2. Innovations work, If we work together
3. Sustainable systems that operate long term, independent of short term policies
Concrete case: Rijn-Waalpath 2020?
Concrete case: Rijn-Waalpath

COMMUTERS
- Driving behaviour and driving style score
- Peer2peer comparison and competition
- Tax incentives based on actual vehicle and route choice
- Geofenced speed limiting

NEXT Urban Mobility
- Driving style score
- Malfunctions
- Aggregated insight into sustainability and travel behaviour

AUTHORITIES
- Overview of use and mode of transport (duration, time, etc.)
- Data complies with legal requirements
- Quantitative listing of trips and location for tax incentives
- Geofenced speed limiting in city

GPS, Route, Location, Time, Other
So, what’s next?