Assessment of risks for highways in the Netherlands due to Climate Change

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Content

• Introduction Rijkswaterstaat
• Why do we assess risks
• Methods – tools
• Examples
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Botlek area, Rotterdam Harbour
Rijkswaterstaats Infrastructural networks

Highway network: 3.102 km

Waterway network: 8.000 km

Water system 90.000 km²
Rijkswaterstaat Mission

- Protection against flooding
- Sufficient clean water
- Smooth and safe transport by road and water
- Reliable and useful information
- Sustainable living environment

Three roles: network manager, project manager and crisis manager
Uncertain future

more dependancy on telecom, electricity, chain effects

influenced by climate and extreme weather
Impacts of Climate Change on different levels

what are the costs – what investments are necessary, efficient?
Rijkswaterstaat program
Climate resilient infrastructure

• Which performance do we accept in the future?
• Adapt on key moments: when planning, building, maintaining, replacing
• Risk-based asset management
• Learning by doing: PILOTS (projects and regions): learning, testing, exchanging
• Work together with: water authorities, municipalities, research institutes
Applied methods and tools in The Netherlands

- SWAMP (2008 call) > Investigation of blue spots in the Netherlands
- ROADAPT (2012 call) > input for InnovA58 Plan Development Phase

Several tools available, like Guide for stress test and Climate Impact Atlas, focus on urban areas, on http://ruimtelijkeadaptatie.nl/english
Investigation of blue spots (2012)
Water op de weg door 1x per 10 jaar buien, nu en in 2050
Maps for regional flooding, risk maps
Blue spots

Flooding from primary defences
> Major damage,
Low to moderate risks

Extreme rain, water on the road
> Moderate to major damage,
Major risks
Rotterdam – Ruhr corridor – Roadapt Quickscan

Top risks identified in workshops:
- Flooding due to failure of secondary flood defences
- Inundation of roads in coastal areas due to sea level rise and storm surges
- Overloading of hydraulic systems crossing the road
- Bridge scour

Currently the vulnerability in the area will be updated!!
The InnovA58 project

Perfect test case – Plan development phase
Aim of InnovA58 project

- Increase the robustness and resilience of the InnovA58 and its surrounding environment for the effects of climate change, now and in the future
- Derive lessons for broader application in the main Dutch highways network

Challenge

to use risk and vulnerability assessment tools in such a way that the most cost effective approach is achieved, both short and long term, resulting in a climate and extreme weather resilient highway
## ROADAPT method to develop climate adaptation strategy

<table>
<thead>
<tr>
<th>ROADAPT step</th>
<th>Details</th>
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| 1 Quick Scan | 2 workshops:  
1. to determine climate threats for the A58 infrastructure and the surrounding environment  
2. to determine key risks and potential measures |
| 2 Vulnerability Assessment | GIS methodology with several steps to determine vulnerabilities in the road network. The output consists of maps with these vulnerabilities. |
| 3 Socio-economic Assessment | 2 methods:  
- Cost Effectiveness Analysis  
- Cost Benefit Analysis |
| 4 Adaptation Strategy | Dynamic adaptation pathways to determine an adaptation strategy |
Potentially vulnerable locations for pluvial flooding
Dynamic Adaptation pathways

Example pluvial flooding

- Drainage via 7 cm thick porous layer (double layered PA)
- Drainage via 10 cm thick porous layer
- Drainage via 18 cm thick porous layer
- Current Situation (storage in PA taken into account)
- Enlarging capacity of stormwater drainage system
- Use of gutters instead of manholes
- Water storage under the road or in weirs barrier
- Adaptive maintenance
- Ensuring levelness of longitudinal profile

precipitation in 2 hours [mm]

Deltaras

Map generated with Pathways Generator, 900 Li, Deltaras, Carthage Consultancy

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Potential measures for the A58

Measures that are identified (amongst others) are:
- Culverts - increasing capacity by enlarging the culverts or intensifying maintenance, as well as upstream water retention
- Increasing inclination of the road
- Increasing the thickness of the asphalt (can be done every 10 years, during replacement of the asphalt)
- Realization of water retention, adjacent to the road
- Elevating the road
Assessing regional vulnerability

Area oriented approach in Utrecht, like with InnovA58, together with municipalities, water boards, province

*Pluvial flooding affecting roads (HDSR water board map)*
Conclusion

- Multiple tools, methods and examples available, and are developed, e.g. within CEDR program, and on a National level in The Netherlands.
- Cost effectiveness and coupling with asset management is an important step, basis for decision making.
- Hard work to make it part of the normal process and policy – we are making progress.
- Adaptation and resiliency often mean: short term costs, long term benefits. Requires long term thinking and strong and visionary leadership.