

Distr.: General
24 January 2019

Original: English

Economic Commission for Europe

Inland Transport Committee

Working Party on Transport Trends and Economics

**Group of Experts on Climate Change Impacts and
Adaptation for Transport Networks and Nodes**

Sixteenth session

Geneva, 29 and 30 January 2019

Item 4 of the provisional agenda

Discussions on the final report of the Group of Experts

Adapting the infrastructure network to a changing climate - a case-study of the Netherlands

Submitted by the Government of the Netherlands

This document provides a brief summary of the work done in the Netherlands on adapting the infrastructure networks to climate change. The Group of Experts will be invited to consider this document and discuss its inclusion in chapter 3 of the final report.

Adapting the infrastructure network to a changing climate - A case-study of the Netherlands

The effects of weather- and climate change in the Netherlands

Water management has been important for the Netherlands for a long time, since a large part of the country is located below sea-level. Sea-level rise and coastal- and fluvial flooding are therefore threats that require ongoing innovation and adaptation. Since 1999, Dutch water management policies, land use and spatial planning have been re-evaluated by the Dutch Delta Program to incorporate climate adaptation with the aim of protecting land from floods, ensure the quality of the fresh water supply and to increase resilience to heavy rainfall, droughts and heat.

Climate change also has an impact on the transport infrastructure of the Netherlands. This contains intensively used networks of different modalities, including roads, railroads, airports, harbors, waterways and piping, which are essential for the functioning of the economy and our wellbeing. The infrastructure is also connected and dependent on other types of (vital) infrastructure, such as energy, telecom and IT. The effects of climate change create risks for our economy, health and safety and it is therefore of great importance that the Netherlands adapts to these changes.

Threats climate change to Dutch infrastructure

Extreme weather- and climate change affect the infrastructure of all modalities. For example: In the case of extreme precipitation, fluvial and pluvial flooding of the roads can occur, causing threats such as aquaplaning and the erosion of embankments, but can also cause instability on the railroads. Heat waves can threaten infrastructure due to deforming steel which can cause bridges to get stuck or not able to close, which affects both roads and railways. In the case of droughts, inland shipping is affected the most, since shallow water obstructs shipping. In the case of highway infrastructure, droughts can cause unequal settlements and wild-and-vege fires. More extreme windstorms may cause problems with electricity for trains, cause problems with loading and unloading of containers in harbors and result in safety hazards due to falling trees. For harbors, sea level rise is an increasing threat and leads to more frequent closing of storm surge barriers. The majority of these threat already occurred the past few years and are likely to become more frequent in the upcoming decades.

Policy

- The Delta Program

The Delta program was initiated in 2010 and started in January 2012. The aim of the program is to fully integrate climate adaptation into water management policies, spatial planning and land use. In line with the findings of the IPCC, the Delta Program also developed future scenarios about the impact in the Netherlands. As part of the Delta Program, the Delta Decision for Spatial Adaptation has a goal to achieve climate resilience and flood proof vital infrastructure in 2050. Following from the Delta Decision, municipalities, provinces, water

boards and infrastructure operators are required to perform climate stress-tests. To work towards country wide resilience, close cooperation between stakeholders is essential.

- The National Adaptation Strategy 2018-2019 (NAS)

The National Adaptation Strategy covers the entire policy on climate adaptation and includes the activities additional to the Delta Program. The program is mainly focused on raising awareness about the impact of climate change to parties from different sectors and to convince them to adapt their activities to a changing climate. The main ambition is to achieve concrete goals and actions, and to divide the tasks and costs among the parties. The parties themselves are responsible for their own actions. Within this strategy, infrastructure is one of the six focal points of the program. The level of ambition for infrastructure and mobility is not yet formalized, but has to be connected with the desired functionality and performance of the networks. The current discussion is about the extent of performance loss as a result of climate change that can be accepted and to what costs.

Assessment of Vulnerability and Risks

As mentioned before, authorities, such as provinces, municipalities, water boards, and road and rail operators (such as Rijkswaterstaat and ProRail) are required to perform stress tests to investigate risks and potential measures due to climate change. For different levels, guidelines to performs stress-tests are available.

As for infrastructure, ProRail, responsible for the railroads, will finish the stress-test in mid-2019. Rijkswaterstaat, the executive part of the Ministry of Infrastructure and Water Management, will finish the stress-test of the highway network in 2019. After that, also stress-tests of the main waterways and the main water system will be carried out. The goals of these stress-tests are to gain more insight about the vulnerable spots of infrastructure, to assess what the consequences of these threats may be, and to decide on a strategy on what measures need to be implemented and to what cost. For highways, examples of measures are change of design of pavements, pump systems and drainage taking into account extreme precipitation, different maintenance and management strategies. With a wider perspective, measures can also include spatial planning, traffic management and multimodal transport.

In advance of the nationwide stress-test several local stress-tests of the road sections have been performed by Rijkswaterstaat.

One example is the InnovA58 project, a highway which will have extra lanes, and where possibilities to innovate have been investigated. One of the goals is to increase the robustness and resilience against the impact of climate change. In 2016 and 2017, the risks, vulnerabilities and possible measures have been investigated, including the surrounding environment. Workshops included stakeholders and experts from different sectors such as provinces, advisory agencies, Rijkswaterstaat, research institutions and locals. With the results of the workshops, a Vulnerability Assessment was conducted with the use of GIS-methodology to map the vulnerabilities in the highway network. In the next step, the results were used to do a Socio-Economic Impact Assessment, which was divided into a Cost Benefit Analysis and a Cost Effectiveness Analysis. The last step, was to formulate an adaptation strategy and

included to assess the effectiveness of measures. Different pathways have been identified as a response to future climate change. By using adaptation tipping points, an overview of several measures and combinations becomes visible, which provides different routes to reach a certain state in the future.

As a result of this analysis, several risks, ranging from flooding of infrastructure caused by inundation and extreme precipitation, erosion of embankments and the flooding of streams and urban areas could be identified. Besides the risks, a set of measures, as for instance better management and maintenance of verges and rainwater drainage, road pumps, lowering emergency lane, build water storage under/next to road, and infiltration of pump water into aquifers were chosen as examples of suitable adaptation methods.
