

Distr.: General
10 October 2022

English only

Economic Commission for Europe

Inland Transport Committee

Working Party on Transport Trends and Economics

Group of Experts on Assessment of Climate Change Impacts and Adaptation for Inland Transport

Twenty-third session

Geneva, 31 October – 1 November 2022

Item 6 of the provisional agenda

Guidelines for integrating climate change considerations in planning and operational processes

Framework for transport system stress test to climate change hazard

Note by the secretariat

I. Introduction

1. At its twenty-second session, the Group of Experts on Assessment of Climate Change Impacts and Adaptation for Inland Transport (group of experts) requested interested experts to initiate elaboration of a guide and/or standard for transport system stress tests. Such guide/standard should assist in defining stress test including test scenarios and usage of indicators.
2. Experts from France, Germany, Swiss Federal Institute of Technology (ETH) Zurich, Climate Sense, UNACE Engineer Research and Development Center and National Center for Atmospheric Research (NCAR) with the support from the secretariat researched and discussed in the period since the previous session the stress test for transport systems to climate change hazard. They have developed an annotated outline for the framework for transport system stress test to climate change.
3. This outline is presented in this document. It is building on earlier work done by ETH Zurich.¹ The small group is interested to collect feedback and comments from the group of experts.
4. Further to the consideration of the outline and positive feedback received from the group of experts, the small group would like to elaborate the framework, possibly in time for the twenty fourth session in March 2023, and subsequently to carry out a few case studies in which the framework would be applied to perform a stress test of selected transport assets. For the latter, collaboration is explored with ECE Trans-European and Motorway (TEM) and

¹ Adey B.T., Hackl J., Lam J.J.C., van Gelder P., van Erp P.N., Prak P. et al. 2016, Ensuring acceptable levels of infrastructure related risks due to natural hazards with emphasis on stress tests, 1st International Symposium on Infrastructure Asset Management (SIAM), Kyoto, Japan, January 21–22, 2016

Trans-European Railway (TER) projects. Further collaboration opportunities for application of the framework will be also explored with other potential partners.

II. Outline for the Framework

(1) Climate change hazards

This section should discuss climate change hazards: incremental climate change and extreme weather events (e.g., heat waves, heavy downpours, high winds and extreme sea levels and waves) and their potential impact on transport infrastructure leading to various level of disruptions.

(2) Use of stress test as a tool/task to determine if an intervention program is needed to ensure transport infrastructure provides an adequate level of service in the context of climate change hazard

This section is to discuss the objective of work of an infrastructure manager, which is the provision of adequate service level, in the context of climate change hazard. It will describe aspects typically affecting the balance of costs and benefits associated with the managed infrastructure. This is to be done with or without execution of interventions for increasing climate hazard resilience. Also, the aspect of different bearers of costs and benefits should be discussed.

The section is to also cover the notion of acceptable level of risk (economically optimal level of risk).

It should further talk about the stress test task as a part of a process to achieve a satisfactory level of service of transport infrastructure consisting of 3 phases:

- Initial phase
- Stress test phase
- Intervention program phase

The above section may explain why the initiation phase is important, explain the function of the stress test, and briefly discuss when an intervention program needs to be put in place.

(3) Stress test task

This section is to explain the steps of the stress test task such as: (i) determine your stress test, (ii) determine your approach to the stress test, (iii) determine your transport infrastructure representation and hazard representation, (iv) estimate risk, and (v) evaluate risk.

For (i) determine your stress test, this sub-section should describe:

- The acceptable level of risk in the context of the provision of service level
- The resources required for a stress-test: man-power and time to be spent
- The output level: multi vs one hazard assessment
- The acceptable uncertainty level of the stress test output

For (ii) determine your approach to the stress test, this sub-section should focus on:

- Approaches such as qualitative, quantitative, or other
- Use of technology or models - how and when
- Involvement of stakeholders - who and when

For (iii) determine your transport infrastructure representation and hazard representation, this sub-section should discuss:

- Determination of transport infrastructure including its objects, sources and time of hazard events and location and time of their consequences (spatial and temporary boundaries to be observed in the stress tests)
- Determination of events, scenarios and their relationships – identification of events such as source, hazard, infrastructure, network and societal events and linking those events in scenarios taking into account the events' relationships.

For (iv) estimate risk, this sub-section should describe:

- Estimation of values for the probability of occurrence of the selected scenarios and values attributed to costs using software packages/models
- Uncertainties in estimating the probabilities (uncertainties related to modelling/model limitation)

For (v) evaluate risk, this sub-section should focus on:

- Verification of the meaning of the estimated risk (risk perception)
- Evaluation of the test in terms of its appropriateness regarding steps (i) to (iv) and conclusion of a test performance (satisfactory vs unsatisfactory)
- In terms of unsatisfactory test result, a determination of elements in step (iii) for more detailed testing
- Determination of a start of intervention program

(4) Stress test case studies

This section is to describe case studies on the application of the framework which would have been carried out.

The specific case studies may cover but do not need to be limited to the following:

- Rainfall hazard to a specific roadway
- Rainfall hazard to a specific railway
- Heatwave hazard to specific roadway
- Heatwave hazard to specific railway
- Selected hazard to inland waterways

(5) Additional recommendations

This section is reliant on successfully conducting the case studies on the application of the framework. Hopefully, additional recommendations can be collected from carrying out the case studies, and shared, possibly as Dos and Don'ts.
