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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 5 of the provisional agenda

Database on adaptation measures

Proposal for developing guidance on adaptation pathways in the transport sector

Note by the secretariat

I. Background

1. The Group of Experts on Assessment of Climate Change Impacts and Adaptation for Inland Transport (GE.3) at its twenty-second session discussed the importance of adaptation pathways in the transport sector. The GE.3 suggested that examples of adaptation pathways in transport and related sectors are collected through an intersessional work and a proposal is made on how to address this topic.

2. In course of its intersessional work and after having carried out a few internal meetings, the small group recognised the importance of developing a guidance document on the development of adaptation pathways in the transport sector.

3. Extreme weather events can damage and disrupt transport infrastructures in a multitude of ways. For instance, heavy rainfall events can result in flooding or landslides that cause road and rail closures or increase road congestion and the frequency of accidents. High temperatures can lead to various issues for railway infrastructures, such as failure of electrical equipment, track-buckling, which can further cause service disruptions. Overall, climatic changes such as increasing sea levels and temperatures along with growing intensity and frequency of extreme weather events (such as heavy rainfall and heatwaves) are threatening to compromise transportation services and transport infrastructure. Such impacts on the transport sector can have destructive consequences and thus, transport infrastructure operators and owners must increase their preparedness by adapting to a range of hazards associated with climate change in order to reduce weather-related service disruption and subsequent financial costs. Future climate should be taken into account when installing new assets since transportation infrastructures have a design life of several decades in order to prevent unstable infrastructure or costly retrofitting. However, with existing assets and networks, these may need to be adapted in response to increasing climate hazards in order to continue providing and maintaining service provision and/or to avoid rising costs due to the consequences of extreme weather.

4. Adaptation pathways seem to be a promising decision-focused approach to incorporate flexibility into decision-making and account for future uncertainties. Adaptation pathways can be broadly described as a sequence of actions that can be progressively implemented based on future dynamics to assist adaptation to climatic changes. While the adaptation pathway approach helps improve long-term planning for climate change under future uncertainties, more local applications are important to understand the usefulness of the approach to asset owners and planners.

5. Development of adaptation pathways and their implementation by infrastructure operators and owners can help adapt their current assets and networks to maintain current or improved levels of service and desired operational performance under future climate conditions. In a typical adaptive plan, adaptation pathways capture the implementation process by specifying which measure(s) are to be considered now and which are planned to be implemented once certain conditions (often defined with thresholds for climate variables) occur over time.

6. The small group through the intersessional work reviewed different adaptation pathways currently being used in transport and related sectors. The small group identified the importance of exploring further the different adaptation pathways that are being used for enhancing the resilience of transport infrastructure. It was also recognised that while there are sources available that provide some successful adaptation measures for transport infrastructure, the question that remains is how easy it is for transport infrastructure managers and infrastructure asset users to identify these measures in times of need. It was therefore decided that in order to find ways to ease the decision-making approach for infrastructure owners and operators of transport assets, a guidance framework based on the development of adaptation pathways should be drafted. This guidance can be used to identify appropriate adaptation measures and to develop climate-change-ready transport infrastructure, regardless of the infrastructure owners and operators' current level of knowledge or preparedness for climate change.

7. Further to the consideration of the proposed outline and based on the feedback received on this proposal from the GE.3, the small group would like to conduct further research on this topic and produce a framework as well as a guidance document possibly in time for the twenty fourth session in March 2023.

II. Proposed outline of the guidance document

8. The outline of contents for the proposed guidance document is as follows:

1. Literature review of current best practice and research on adaptation pathways

This section will provide a brief overview on adaption pathways, the importance of implementing them and their subsequent benefits, particularly for the transport sector.

2. Overview of commonly used terminologies for adaptation pathways

An overview of the terminology often used to describe the adaptation pathways approach by different groups of researchers and practitioners will be provided here through a list of terminologies and their respective definitions.

3. Prerequisites on the understanding of adaptation pathways

This section will discuss the expected level of knowledge and understanding that is needed by any transport infrastructure asset owner or operator in order to fully comprehend the proposed guidance document and thereafter implement it. For instance, one of the main prerequisites would include that the asset owners and managers have an understanding of

the vulnerabilities of their individual assets and have performed appropriate risk assessments.

4. Framework for developing adaptation pathways for transport infrastructure resilience

A framework for developing adaptation pathways for transport infrastructure resilience will be delivered in this part of the guidance document. The framework shall combine approaches developed by major transport adaptation projects and their substantive experience of working with organisations and global transport stakeholders. This section will discuss in detail the different steps needed to develop adaptation pathways. The framework will elaborate the thresholds approach and its significance in adequate adaptation planning for transport infrastructure resilience. Through this understanding of applying an adaptation pathway approach, it would become possible for transport infrastructure owners and managers to identify points at which new adaptation actions are needed and to be able to pinpoint when to begin the lead-in processes for implementing adaptive actions. The framework shall also provide guidance to evaluate the possible adaptation actions and adaptation actions available (including through economic assessments, multi-criteria analysis, etc.). Therefore, it will help in planning to develop lower cost and timely options to meet new objectives.

5. Examples and case studies

Exemplar adaptation pathways from the transport infrastructure sector will be reviewed and discussed in this section to demonstrate the need for adaptation pathways in the transport sector. Also, the applicability of the developed framework shall be tested through utilising specific case studies and by interviewing interested asset managers. In addition, the guidance will present a worked example demonstrating the use of the proposed approach. This will be the final step of the guidance to strengthen the ideas put forward and therefore will be carried out only once all prior actions are completed.

6. Conclusions

Concluding insights and recommendations for applying adaptation pathways in the transport sector will be provided in this section.

III. Anticipated benefits of the guidance

9. The developed framework and the resulting guidance document will have the overarching objective to embed climate change adaptation within the organisational procedures for transportation infrastructures. The guidance will advocate adaptation pathways as a series of adaptive actions which will not compromise future actions. Adoption of this guidance can help transport infrastructure owners to self-identify their own levels of adaptation readiness and thereafter identify ways to make suitable enhancements. Understanding of adaptation pathways and being able to develop these for one's organisation can enable preparation for future adaptation actions to be accommodated in the design of earlier actions, particularly for longer-life assets. This in turn can make transition between actions more cost effective and efficient, and inform investment decision-making processes towards the selection and implementation of adaptive actions now or in the future. Overall, the guidance document will be applicable to be used by any transport infrastructure operator, or other transport related stakeholders, irrespective of their preparedness levels to start or facilitate the process of climate adaptation.