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Guidelines for integrating climate change considerations in planning and operational processes

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Note by the secretariat

Summary

This document contains the initial text proposal for chapters 1 and 2 of the quick guide for assessing criticality of transport network or asset. It was prepared by a task force consisting of Chair, Vice-Chair (France), PIANC, BAST and the secretariat. In particular, the text for the introduction to the guide (Chapter 1) and the steps to determine transport asset criticality (Chapter 2) has been proposed. Chapter 3 only lists for now the various methods for the criticality assessment and proposes a structure for describing them in detail. GE.3 is invited to consider the draft, provide specific comments on chapters 1 and 2 and general guidance on chapter 3.

Quick guide for assessing criticality of transport network or asset

I. Introduction

Transport plays a crucial role for countries' economies but also for human well-being as it enables both people and goods to reach markets, and people to reach essential services as well as leisure destinations. This role is provided through the availability of linear infrastructure such as roads, railway lines, inland waterways, as well as non-linear/nodes infrastructure such airports, ports or terminals as well as the availability of transport operations on or at this infrastructure.

In situations when the transport infrastructure or operations are disrupted, destructed or degraded, this can lead to negative consequences on the economies and human well-being due to the fact that access to markets is either limited or interrupted for people and goods. Hence there is or there should be a desire to prevent such situations. Yet, given the exposure to various natural and man-made hazards, maintaining the entire transport infrastructure and operations resilient to all hazards at all times is an impossible endeavour and one which would not be economically feasible. Notwithstanding that transport infrastructure is designed to withstand hazards up to a certain threshold, extreme events may exceed this threshold, or the age or condition of the asset may mean it no longer fulfils its design objectives. In such cases, decisions must be made on where investment is needed to strengthen infrastructure and operational resilience (or parts thereof) based on an understanding of where impacts would have most significant consequence on transport service and through it on economy or human well-being in case of exposure to given hazards. With other words, it is important to identify which of the infrastructure or parts of it and operations are most critical to transport service objectives and need to be prioritized for action to avoid loss of connectivity or reduction of performance below an acceptable level.

This quick guide is addressing therefore the criticality facets of transport infrastructure and operations in order to assist transport professionals in identifying in a transparent way transport assets and operations that are most important to delivery of transport services. With other words, criticality is to be understood as a relative measure of the importance of an infrastructure or transport operation in relation to the consequences that a disruption or functional failure has for delivery of transport service (e.g. access to markets for people and goods).

Assets are meant in this guide as roads, railway lines, airports or ports or their components such as bridges or tunnels or jetty, terminals, dykes, etc.

This guide, on the one hand, looks at the transport networks and guides how to identify in a transparent way within the networks the roads or railway lines or ports which are the most critical to rendering the transport service. On the other hand, this guide also looks at the components of any specific linear or nodes infrastructure to assist in identifying the components of roads, railway lines, inland waterways, or of airports, ports or terminals, which again are the most critical to provision of transport service in the context of impact on economies and human well-being.

Because transport is important to both economic performance and human well-being, the criticality assessment needs to be inclusive of economic, social but also environmental aspects. Hence social/health but also environmental aspects cannot be missed out in the assessment. At the same time, the importance attached to the given aspects may vary depending on which is the essential service or function that specific transport assets provide, e.g. movement of goods versus access to health services, and also depending on the scale at which the assessment is carried out (e.g. national or local).

II. Steps to determine transport asset criticality

The following steps are recommended to be followed in assessing transport network or asset criticality:

Step 1: Define transport asset/network and criticality assessment aspects.

Step 2: Examine availability of data for the assessment.

Step 3: Define resources available for the assessment.

Step 4: Choose a method for assessment.

Step 5: Apply the method, present and analyse the results.

Step 6: Incorporate the results in transport resilience action.

Step 1:

This step involves determining a transport network or asset for assessment and confirming the appropriate scale for the analysis.

In case of a given local or nationally and internationally important network, the objective of the assessment would be to identify parts of the network (e.g. roads or railway lines) that are most critical to this network for it to maintain its connectivity and to provide an acceptable service performance level. Examples of such networks will be: a national road or railway network, regional rail network, network of nationally important ports or a single strategically important port that acts as a node for a region, municipal road network, etc..

In case of a specific transport asset the objective would focus on identifying components whose performance is critical to maintaining the service of this asset at or above an acceptable level. Examples of such assets will be (a section of) a specific motorway or a railway line, or an airport, a port, a train station or a multimodal terminal. The assessment should then be conscious of the scale at which the assessment is carried and which services and assets components providing these services need to be assessed, e.g. criticality of a container port serving a region or a country versus criticality of a berth for unloading timber serving a local paper mill. From the perspective of the paper mill, the port's berth will be critical to its operation. If the paper mill was a critical infrastructure in the region e.g. as an important employer, it would be also critical for the region. However, if from the scale of the region the importance of the paper mill would be minimal while trade and transfer of containers would be key, this would require that criticality assessment is focused on different components and so services of the port.

This step also involves consideration of the function or functions of the network or asset to determine aspects which the criticality assessment should focus on. This means in additional to the economic aspects also social or environmental aspects. Further to the work done by World Association for Waterborne Transport Infrastructure (PIANC, 2020), the following functions may be considered to help determine the single focus or alternatively assign weights to economic, social or environmental aspects relevant to criticality:

- Business continuity/economic effects on transport stakeholders (economic),
- Public effects including security and safety of people/impact on local community (social),
- Environmental degradation (environmental).

Understanding the primary function of the network or asset(s) is key especially if a decision is taken to focus on single criterion/indicator criticality assessment. In this case the criterion/indicator should adequately match the primary function – e.g. maintaining safe access to hospitals.

Step 2:

This step involves verification of data available for use in the assessment. The abundance or scarcity of data may be decisive in selection of a specific assessment method. The verification of data may directly focus on a preferred assessment method or methods.

The following data may be required for the assessment:

- Network/asset purpose(s) (key functions)
- Traffic volumes
- Type of traffic
- Transport of dangerous goods
- Network/asset accessibility data
- Core sites/critical components for fulfilling the network/asset function
- Type of infrastructure
- Available alternative assets (e.g. alternative routes in the network, alternatives ports in a region or berths at a particular port)
- Capacity of alternative assets
- [other data sets]

Step 3

In this step resources available for the assessment should be determined. They will be decisive in the selection of a specific criticality assessment method. Where both human and financial resources are limited for the assessment, the application of the more sophisticated methods including such as multicriteria analysis or modelling may not be possible and hence simplified methods should be prioritized. Selection of the more sophisticated methods would in particular require sufficient resources for assessing complex networks or assets.

Step 4

In this step, and with full awareness on the availability of data and resources for the assessment, a decision on the assessment method should be made.

The following methods can be used in the assessment:

- When the focus of criticality assessment is on loss of connectivity:
    - Accessibility analysis (accessibility indicator analysis)
    - Crisis scenario analysis
- When the focus of criticality assessment is on loss of performance:
    - Single criterion/indicator analysis
    - Multi-criteria, multi-indicators analysis
    - Traffic modelling
    - Multimodal criticality assessment

Each method is described in the next section of this guide.

As mentioned in Step 1, the function or functions of the network or asset(s) should be in the focus of the criticality assessment. The criteria or indicator selection in single criterion/indicator analysis should match the primary function. For multicriteria/indicator analysis weights should be assigned to the specific criteria/indicators to match the functions.

The functions can be assessed by applying the below indicators:

- Business continuity/economic effects:
    - Business difficulty: 0 – isolated difficulties which has no medium to long term impact on business, 1 – moderate difficulty – can have impact on business in medium term, 2 – serious effects on business continuity in medium term, 3 – long-term viability of business affected.
    - [other indicators?]

- Public effects/ impact on local community including safety aspects:
    - Risk of safety incident, e.g.: 0 – minor/no or sporadic cases requiring hospitalization/medical support; 1 – small/small number of people may require hospitalization/medical support, 2 – medium/instances of serious injuries and need for immediate hospitalization, 3 high/risk of large number of serious injuries and high need for immediate hospitalization.
    - Physical suffering (no access to health service): 0 – no or low level, 1 – moderate levels, 2 – high levels, 3 – unacceptable physical suffering.
    - Access to essential services: 0 – imminent disruption, 1 – frequent disruption, 2 – sever disruption, 3 – access to essential services lost.
    - [other indicators?]
- Environmental degradation:
    - Level of degradation: 0 – negligible damage, 1 – minor, reversible damage, 2 – severe and continuing environmental loss, 3 – irreversible environmental loss.
    - Breach of environmental protection low: 0 – no breach, 1 – action needed on compliance, 2 – compliance failure, 3 – proven breach and legal responsibility
    - [other indicators?]

Step 5

In this step, the selected method should be applied, and the results described and concluded. Shortcomings faced during assessment should also be shown including their bearing on the results and a conclusion whether in view of the shortcomings faced the results are considered satisfactory or not. In the latter case, shortcomings should be addressed before the assessment is repeated or a different method is used which should not be exposed to the same shortcomings.

Step 6

The available results should be used in the activities aimed at strengthening the resilience of transport networks or assets, hence allowing the network or asset to sustain or improve its transport service provision level.

[further text to be included on how to use criticality assessment in a broader resilience strategy, to trigger adaptation measures when used in combination with a vulnerability assessment]

III. Methods for assessing criticality of transport asset/network

Accessibility analysis

What is the essence?

How is it used?

When does it make sense to apply it?

What are the data needs?

Crisis scenario analysis

What is the essence?

How is it used?

When does it make sense to apply it?

What are the data needs?

Single criteria/indicator analysis

What is the essence?

How is it used?

When does it make sense to apply it?

What are the data needs?

Multi-criteria, multi-indicators analysis

What is the essence?

How is it used?

When does it make sense to apply it?

What are the data needs?

Traffic modelling

What is the essence?

How is it used?

When does it make sense to apply it?

What are the data needs?

Multimodal criticality assessment

What is the essence?

How is it used?

When does it make sense to apply it?

What are the data needs?

IV. Case studies