



**XXIVth World
Road Congress
Mexico 2011**
Mexico City 2011.

OVERVIEW of TC C3 Workgroup #2 Final Report

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Federal Highway Administration

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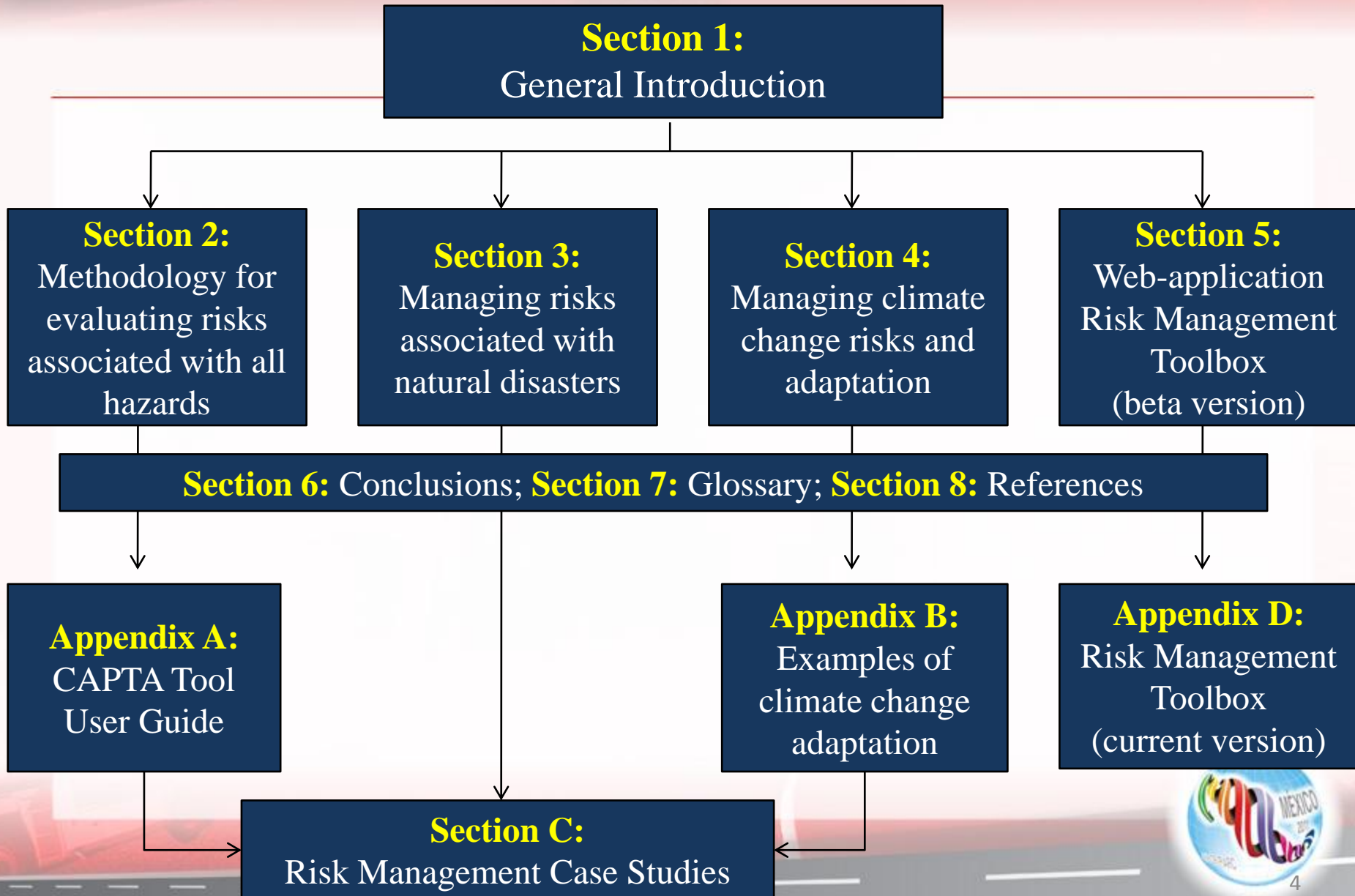


Outline of Presentation

- Report Structure
- Climate Change Issues
- Climate Change Adaptation—Examples
- Risk Management—Case Studies
- Risk Management Toolbox Web-Applications
- Conclusions



Report Structure



WG2 Terms of Reference

Risks Associated with Natural Disasters, Climate Change, and Man-made Disasters and Security Threats

STRATEGY

- **Identify approaches** being used to assess the risks associated with natural disasters, climate changes, man-made disasters, and security threats.
- **Identify strategies** that are being applied to reduce or mitigate the risks associated with these circumstances.

OUTPUT

- **Share methodologies** that have been used to evaluate the risks associated with natural disasters, climate changes, man-made disasters, and security threats.
- **Case studies** documenting strategies that have been effective in avoiding or mitigating these risks.

Risks in Road Operations

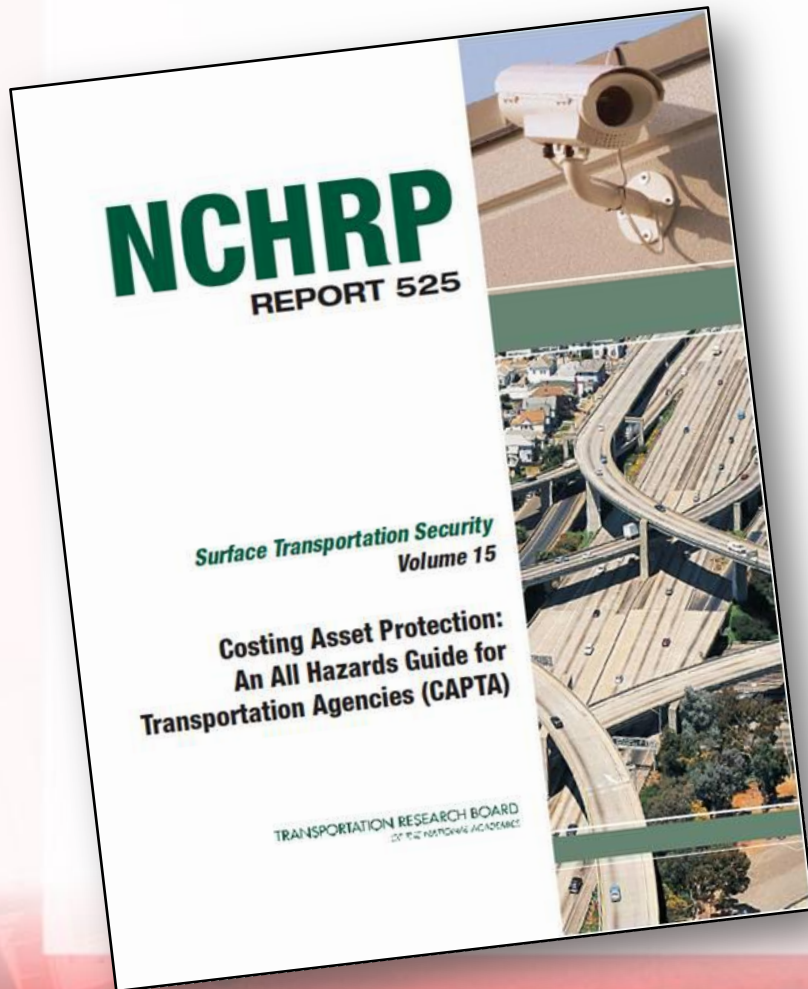
Natural risks – examples

- Landslides
- Earthquakes
- Floods
- Avalanches
- Bushfire / Fire
- Rock Fall
- Snow storm / Ice storm / Heavy Snowfall
- Wind storm / Rain storm / Heavy Rain
- Fog
- Volcanic eruption
- Drought

Man-made risks - examples

- Traffic accidents
- Work accidents
- Dangerous goods transport
- Overloading (height, weight)
- Airplane / Ship / Train crash
- Fire
- Industrial accidents
- Wartime explosives / Mines
- Strikes
- Traffic congestion
- Dam collapse
- Gas explosion
- Epidemical

Cost of Asset Protection



- **NCHRP Report 525 (volume 15): Costing Asset Protection: An All Hazards Guide for Transportation Agencies (CAPTA)**

Source:

[http://www.trb.org/Main/Blurbs/Costing Asset Protection An AllHazards Guide for T 160337.aspx](http://www.trb.org/Main/Blurbs/Costing_Asset_Protection_An_AllHazards_Guide_for_T_160337.aspx)



A Step by Step User Guide

- Shows how available funds could be allocated across all asset types
- Shows funding required to implement selected countermeasures
- Shows distribution of resources among modes
- Shows distribution of funds among countermeasure types
- Provides a record of analysis results for comparison to future iterations

Source:

http://www.trb.org/Main/Blurbs/Costing_Asset_Protection_An_AllHazards_Guide_for_T_160337.aspx

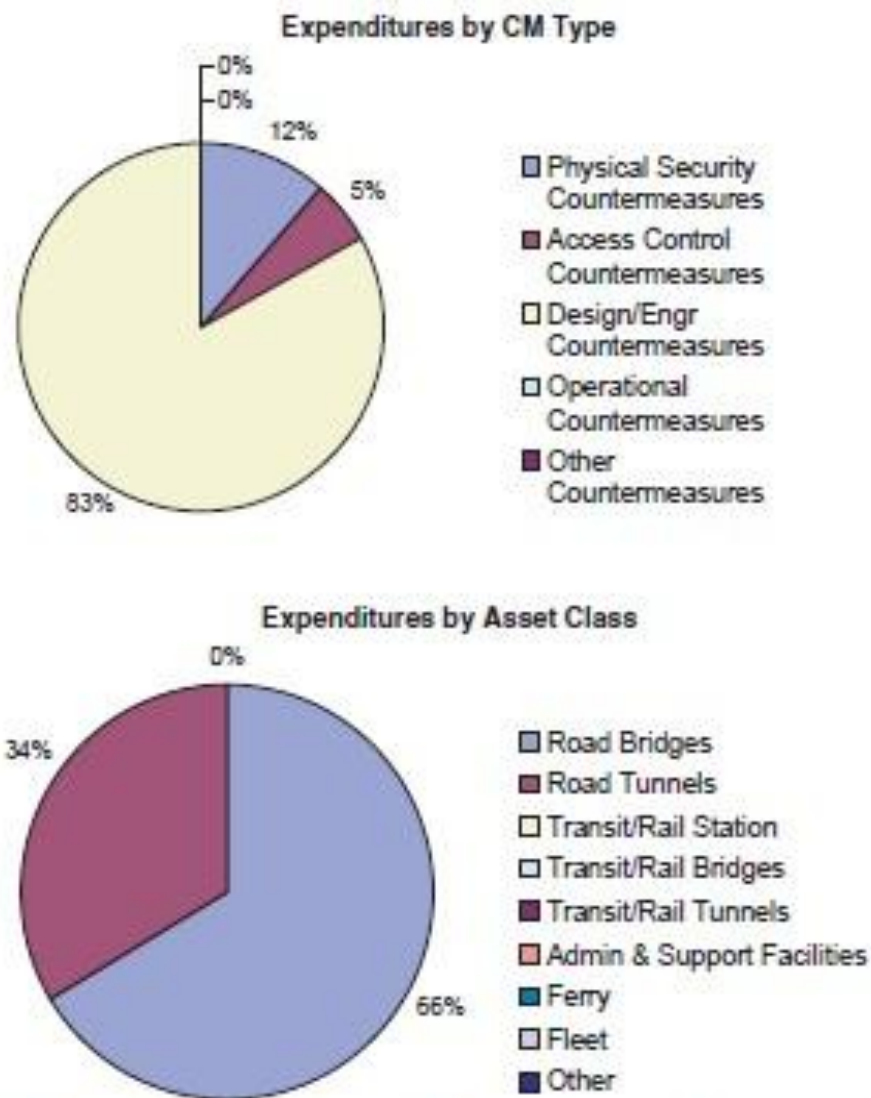


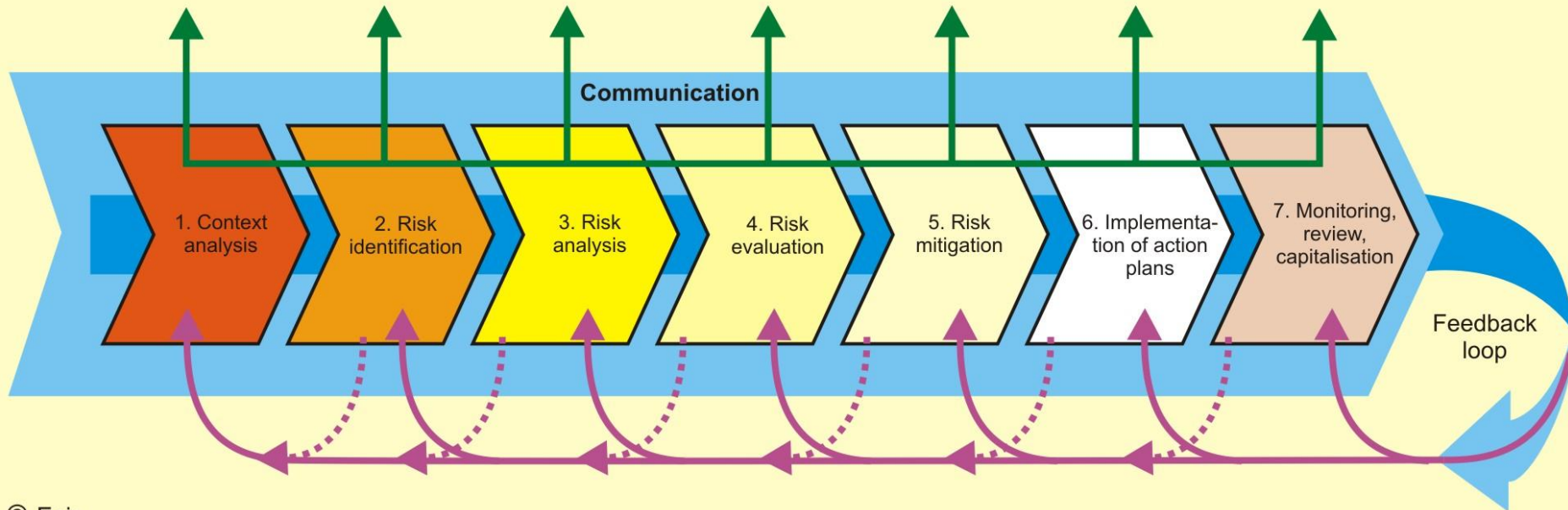
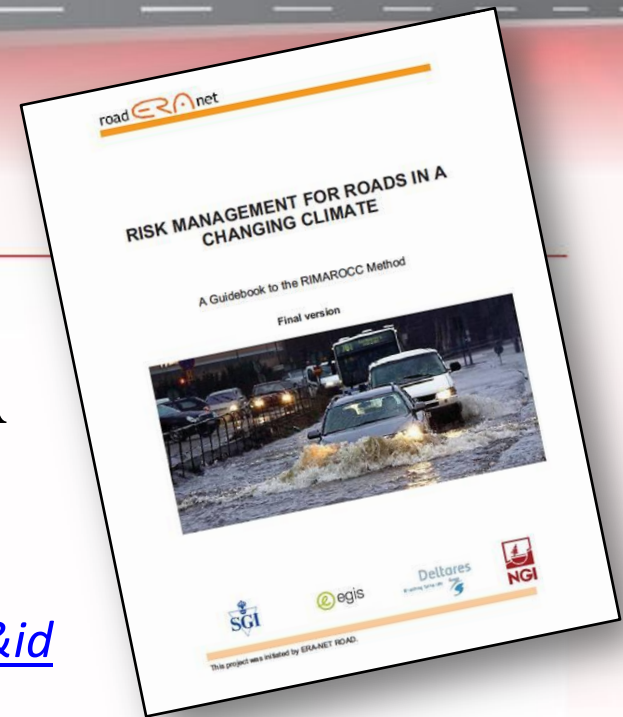
Figure 14. Pie charts of ATA example results summary.

RIMAROCC Approach

- Risk Management for Roads in a Changing Climate (RIMAROCC): A Guidebook

Source:

www.fehrl.org/index.php?m=32&mode=download&id_file=10736



Climate Change

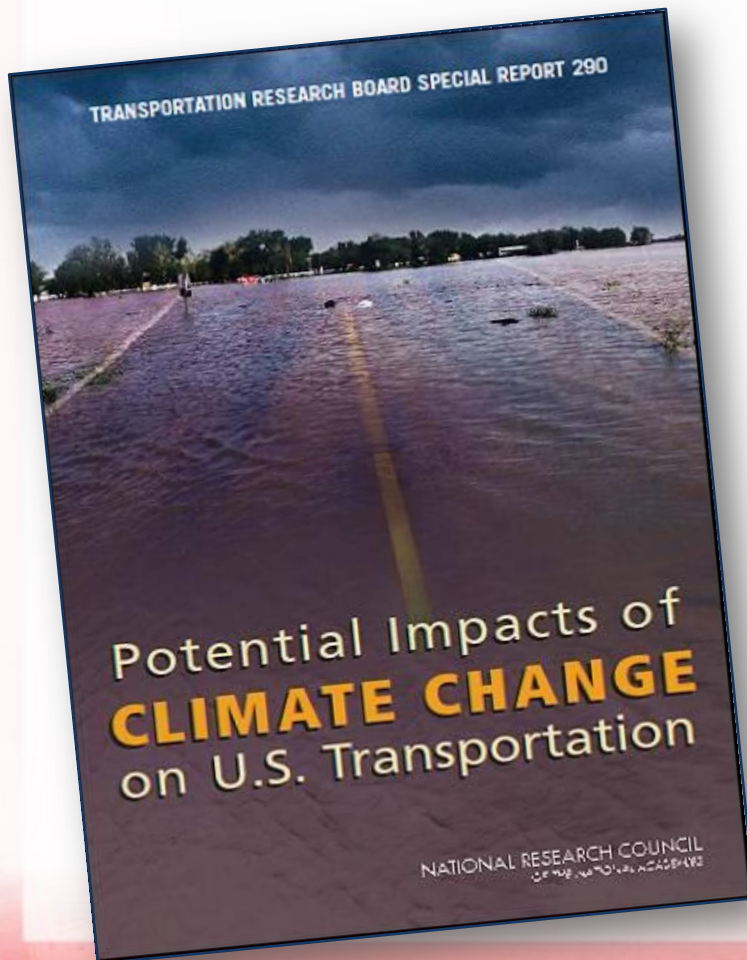
- Potential Impacts on Transportation Networks -

3 climate change issues:

- ✓ Temperature
- ✓ Precipitation
- ✓ Sea-Level Rise/Storm Surge

Source:

<http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf>



Climate Change Adaptation

- Examples -

Developed Nations	Transitioning Nations/Regions	Developing Nations
Canada	Eastern Caribbean	Africa
Europe	Mexico	Peru
Finland		Morocco
France		
Japan		
United States		

Common Themes

- Evacuation planning
- Relocation of infrastructure
- Strengthening of infrastructure
- Raising infrastructure along coast
- Protection of bridges foundations
- Increase culvert capacity
- Design standards
- Construction techniques
- Improve knowledge and decision tools



Risk Management

- Case Studies -

Nations	Title
Canada	<ul style="list-style-type: none">- Dam breaking and flooding in the Saguenay- Shoreline erosion in Îles-de-la-Madeleine- Forest Fire in Chibougamau- Management risks of landslide in clay soils in Québec- Airport infrastructure planning in Nunavik in light of climate change
Finland	<ul style="list-style-type: none">- Bridge Collapse in Brasby, Finland- Defects and Lacks in Bridge Railing Equipment- Risk Management in a Big Design-Build Project
Germany	<ul style="list-style-type: none">- Assessment of Landslide Risks by Increase of Extreme Weather Events- Impact of Climate Change on Prestressed Concrete Bridge Structures- Risk of Aquaplaning under Climate Change- Supply of Road and Structure Data for Analysis of Climate Change Effects
Japan	Risk Management for Roads against Climate Change and Natural Disasters
Mexico	Case Study TABASCO—MEXICO Example
USA	The MacArthur Maze: A Risk Transfer Case Study

Additional Information

- Related Links -

- http://arabworld.worldbank.org/content/awi/en/home/research/climate_adaptation.html
- <http://www.bipartisanpolicy.org/library/research/transportation-adaptation-global-climate-change>
- <http://www.wri.org/stories/2009/12/south-africa-experiment-climate-change-adaptation-planning>
- http://www.highways.gov.uk/aboutus/documents/CCAF-Strategy_and_Vol_1-Rev_B_Nov.pdf
- http://climatechange.transportation.org/climate_adaptation/international.aspx
- http://www.fhwa.dot.gov/hep/step/resources/archives/success_gcs.cfm



Risk Management Toolbox Web-Application

- Transfer 124+ Excel files on CD-ROM to a searchable internet database
- Design the database so that content is PIARC member driven (i.e. crowd-sourcing)
- Create a space for PIARC members to share ideas about Risk Management Tools
- Fill an information void
- Beta test site: <http://piarc.shalladata.com/node/38>



[Type](#) ▶[Man Made Event](#) ▶[Natural Disaster](#) ▶[Risk Assessment](#) ▶[Risk Communication](#)[Risk Treatment](#) ▶[Risk Evaluation](#) ▶[Structures](#) ▶[Home](#)

Welcome to the PIARC Risk Management Toolbox

In 2007, the PIARC Technical Committee on Risk Management for Roads (TC C.3.2) developed the original version of the Road Risk Management Technical Toolbox. The current TC C.3.2 work group chair has transformed that version of the Toolbox into this user-friendly web-application. The database is designed to introduce and share risk management technology and practices among different countries. The database is open to the PIARC community and they are encouraged to sign-up and contribute.

The larger purpose of the site is to foster a community of practice for technology road risks. In addition to the ability to upload risk management information and articles, PIARC members will eventually have the ability to comment on others contributions, blog, and participate in risk management discussion forums.

You can either browse the site using the menu on the left or search using relevant terms to find content. To add content to the site, select "create content" from the menu on the left.

To add content, you must create a new account or log-in.

Enjoy

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TC C.3: Managing Operational Risks

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Bridge

Changing road alignment

Submitted by PIARC on 19 May 2011 - 1:17pm [General](#) [Natural Disaster](#) [Slide \(rockfall,slope failure, landslide, debris flow\)](#) [Operation of countermeasures](#) [Risk Optimization](#) [Risk Treatment](#) [Bridge](#) [structure](#) [Tunnel](#)

Changing road alignment

When direct measures against avalanches of clay and stone or large rock fragments are difficult, an effective measure is to change the alignment of the road to avoid the danger.

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Liquefaction measure

Submitted by PIARC on 19 May 2011 - 12:59pm [Operation of countermeasures](#) [Risk Optimization](#) [Risk Treatment](#) [Bridge](#) [structure](#)

Bridge

There are frequently soils near bridges that rivers, etc., can cause to liquefy and flow. The principle is to strengthen the foundations near the abutments, but usually promoting consolidation is not normally carried out, as the foundations are under the structure. Foundation strengthening and foundation improvement with improved material are the main methods used. The consolidation method, continuous box culvert method, restraining embankment method, piling method, etc., are used.

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Foundation strengthening

Submitted by PIARC on 19 May 2011 - 12:56pm [Operation of countermeasures](#) [Risk Optimization](#) [Risk Treatment](#) [Bridge](#) [structure](#)

Bridge

Strengthening of the foundations of a structure in-service is carried out when the design loads are increased or when there has been settlement or other deformation of the foundation. When increasing the design loads, it is fundamental to increase the width of the foundation. However, when there has been deformation, sometimes it is necessary to change the construction method or the supporting strata.

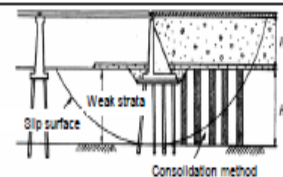
Adding extra piles is common, but when the land cannot be obtained, micropiles or similar are used.

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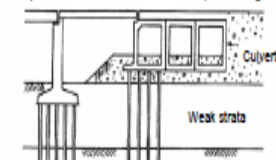
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Inventory Sheet 95

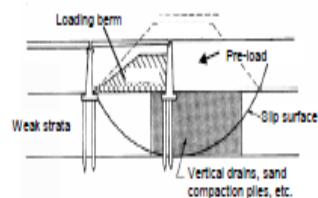
Project phase	Measure
Classification	Hard measure
Item	Bridge
Category	Liquefaction measure
Technology	Liquefaction measure
Technical summary	<p>There are frequently soils near bridges that rivers, etc., can cause to liquefy and flow. The principle is to strengthen the foundations near the abutments, but usually promoting consolidation is not normally carried out, as the foundations are under the structure. Foundation strengthening and foundation improvement with improved material are the main methods used. The consolidation method, continuous box culvert method, restraining embankment method, piling method, etc. are used.</p> <p>Effect</p> <p>Liquefaction near a structure lowers the bearing strength and also the horizontal resistance. Particularly for piled foundations, in an earthquake the horizontal reaction becomes zero because of liquefaction, and this can result in failure of the piles. Even for direct foundations, slabs can slide, so it is necessary to eliminate liquefaction as much as possible. The consolidation method, continuous box culvert method, restraining embankment method, piling method, etc. are effective for this.</p> <p>Considerations</p> <p>When a bridge is adjoining an embankment, it is obvious that if measures are taken for the bridge only, the function of the bridge will be lost if the road has to be closed. Therefore it is necessary to take balanced countermeasures, considering the importance of the road as a whole.</p>
Cost/resources	<p>Per 1 location 5 - 30 million yen</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Cost basis: Calculated by reference to Monthly cost estimating document, Keizai Chousa Kai Monthly construction costs, Kensetsu Bukka Chousa Kai Civil engineering construction cost estimating criteria manual, Kensetsu Bukka Chousa Kai</p> </div>



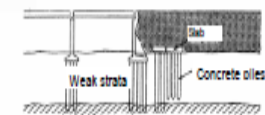
Example of the consolidation method (for a bridge abutment)



Example of continuous culvert box



Example of restraining embankment



Example of piling method

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Create Risk Inventory Sheet

Select the most relevant categories to improve search results for your contributions. BE SURE TO SELECT THE THE MAIN CATEGORY as well its sub-categories. Click the "+" to make a category expand to reveal more options.

Title: *

Type:

Tool

Risk Evaluation:

Risk Evaluation

Risk Communication:

Risk Communication

Risk Assessment:

Risk Assessment

Risk Analysis

Data Collection

Identification

Situation of road facilities and Structures (pavement, slope, etc)

Source of Man-Made Hazard

Source of Natural Hazard

Risk Estimation

Risk Treatment:

Risk Treatment

Maintenance Categories:

Create Risk Sheet

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- [Risk Inventory Sheet](#)

Conclusions

- ✓ Climate Change Issues—**Global Issues**
- ✓ Climate Change Adaptation—**Evolving**
- ✓ Risk Management—**Good Case Study Examples**
- ✓ RM Toolbox Web-Applications—**Next Steps**



Thank You!

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