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# ADAPTATION TO CLIMATE CHANGE

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**Statens vegvesen**

# Introduction

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- Climate change is an issue of global concern.
- As such, PIARC has incorporated it into its strategic themes and technical committees (2008-2011).



# Introduction (Cont.)

- Copenhagen 2009 summit did not yield an agreement regarding CO<sub>2</sub> emissions.
- Therefore rate of current CO<sub>2</sub> emissions anticipated to continue, and climate change remains an issue of global concern.
- Regarding to road bridges global warming can:
  - Raise sea levels,
  - Increase heavy rain incidents,
  - Increase flooding, and
  - Increase typhoon frequencies.



# Introduction (Cont.)

- Will these changes in extreme weather conditions affect how we design, construct and manage our bridge structures?



# Scope of study

## Investigate:

- How various countries define climate change.
- What policies or plans they may have in place to address climate change impact on bridges.
- If any cases of extreme weather conditions have resulted in change of how we design new bridges.



# Survey

- Survey was developed by the working group to get an idea of climate change preparedness among PIARC members.
- Thirteen countries from five continents responded to survey.
- Respondents responsibilities within these countries ranged from:
  - Few hundred kms to tens of thousands kms of roads
  - Few bridges to substantial number of bridges



# Survey Respondents



# How is Climate Change defined?

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"a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

- United Nations Framework Convention on Climate Change





# Is this definition used by Bridge Engineers?

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- Survey response indicates:
  - 38% have formal definition of climate change
  - 46% have an informal definition climate change
  - 15% do not have a definition of climate change
- Among the responses:
  - Varying definitions are used among bridge engineers
  - No common formal definition of climate change was found



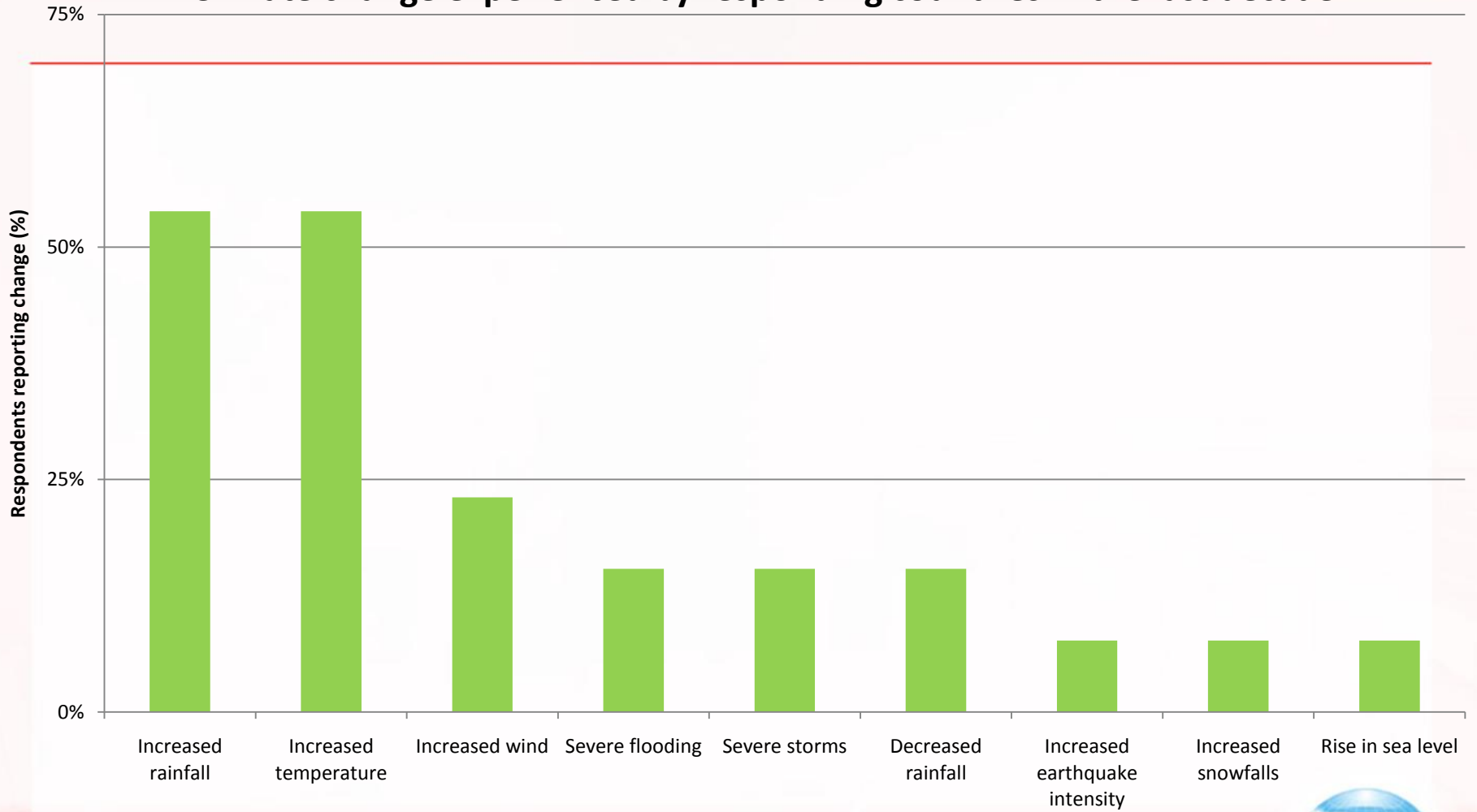
# How did you experience climate change in the last decade?

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- Respondents believe that climate change has potential to affect every day weather occurrences.
- The most noted climate change impacts were:
  - Increased temperature
  - Increased rainfall



# Climate change experienced by responding countries in the last decade



# How did climate change affect bridges?

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## Survey responses:

- In most cases clear impacts arising from climate change were not seen.
- Biggest risk seems to be an increase of intensity and frequency of heavy rains affecting flooding and scouring around bridge foundations.
- Some countries report several collapses of bridges due to floods.





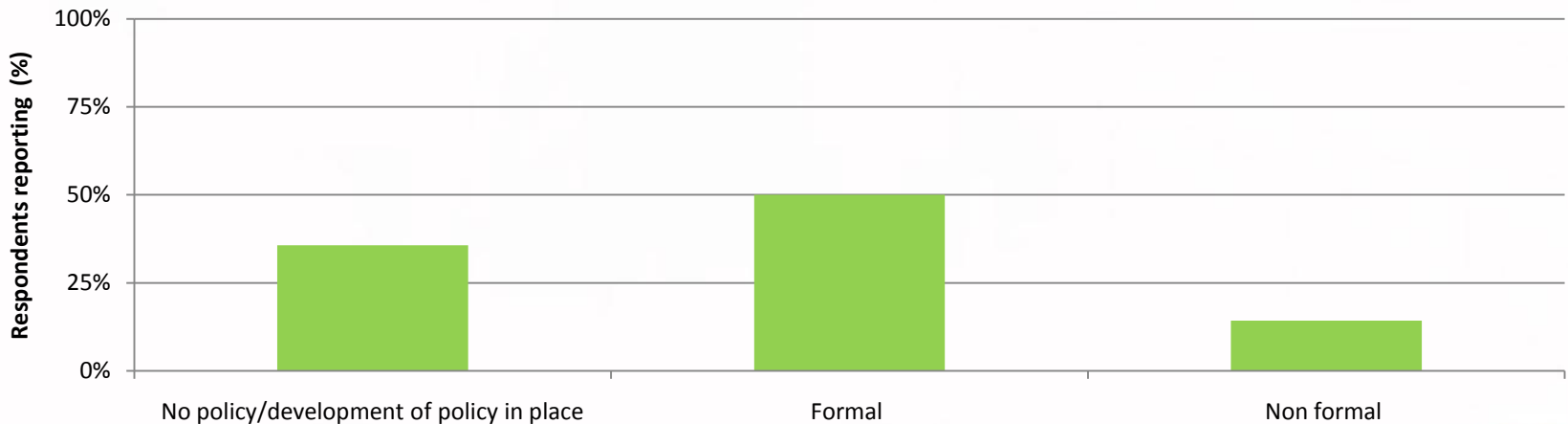
Collapse of a Bridge in Finland



# What climate change policies have been put into place?

## Survey indicates:

- 50% of respondents have formal policies in place
- 36% of respondents have no policy in place



# Have bridge codes been altered due to climate change?

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- 79% of respondents reply that no bridge design codes or similar regulation for management of existing bridge stock have been altered.
- Switzerland appears to be the only country with specific code generation to treat existing structures.
- Only a few countries (Japan, Switzerland and Norway) running specific research programs on effects due to climate changes.



# Conclusions

- √ Climate change:
  - An issue of global concern.
- √ Climate change definition:
  - Varying definitions are in use.
  - No common formal definition of climate change was found among bridge engineers.
- √ Experienced climate change:
  - Increased rainfall and increased temperature were the most reported changes among respondents.





# Conclusions (Cont.)

## ▸ Impact on bridges:

- Clear impacts arising from climate change were not seen.
- Highest risk due to bridge foundation scouring following increased intensity of heavy rains and flooding.

## ▸ Alteration of policies:

- 64% of respondents report that general climate change policies have been put into place.
- 21% of respondents have implemented bridge policy/design codes due to climate change.



# Recommendations

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- Future bridge design may need to consider sensitivity to climate change effects.
- There is a need for deeper understanding of different effects of climate change on bridges.



**THANK YOU!**

