



**UNECE - UNCTAD
Workshop on Climate
Change Impacts on
International Transport
Networks**

**Road Networks:
A Scottish Perspective**

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Topics

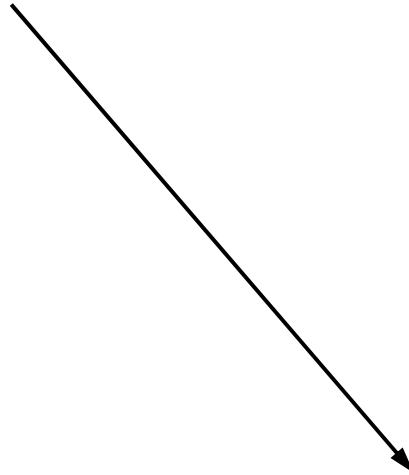
- Background
- Adaptation Study Methodology
- Types of Recommendations
- Examples of Findings and Recommendations
- Further Work Undertaken/Planned
- Wider Issues
- Conclusions

Background

- August 2004
- Over a period of 10 days, three major landslide events resulted in closures of sections of the Trunk Road network
- Each landslide was triggered by a severe rainfall event

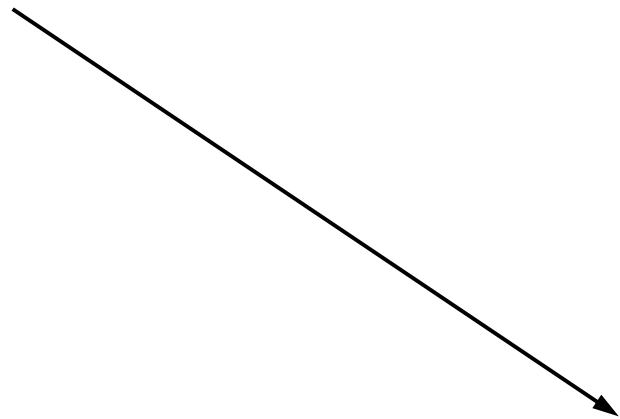
Background

- 9 August 2004, A85 Cairndow



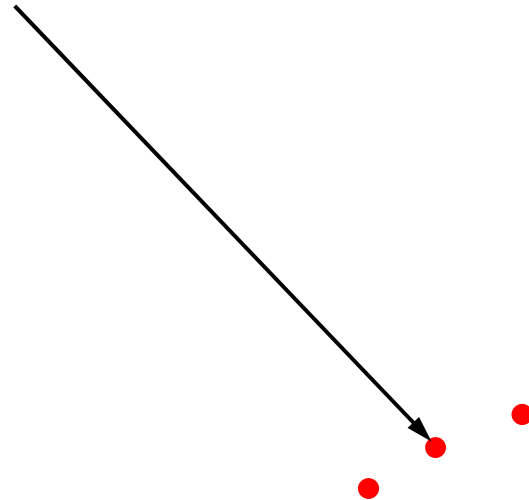
Background

- 11 August 2004, A9 Dunkeld



Background

- 18 August 2004, A85 Glen Ogle



Background

- The Scottish Government commissioned two studies through Transport Scotland:
 - **Landslides Study:** To consider current practices and recommend future approaches to landslide prediction, management and response.
 - **Climate Change Study:** To evaluate current climate change predictions, identify their potential effects on the Scottish Road network, and recommend actions as appropriate.

Study Methodology

- Study Brief:
 - Undertake a desktop analysis of current climate change predictions for Scotland
 - Determine detailed implications for operation and management of Scottish road network
 - Consider a range of weather types including: temperature, rain, snow, wind, fog, and coastal flooding

Study Methodology

- Study team led by Jacobs, and included:
 - Highways design and operation specialists
 - Climate change specialists
 - UK Met Office provided climate change prediction advice
- Climate change predictions were prepared for each weather type, for 2020s, 2050s and 2080s
- Study was based on the UKCIP02 outputs, supplemented by additional Met Office data

Study Methodology

- Implications of climate changes predictions were analysed in terms of:
 - the impacts these would have on the operation and maintenance of the road network
 - how these weather types were currently addressed in design and/or operation of the road network
- Recommendations were developed for adaptation measures based on the findings of this analysis
- It was important to recognise that there were inherent uncertainties in climate change modelling

Types of Recommendation

- Study delivered different ‘types’ of recommendation:
 - Design: changes in design approach
 - Operational: changes in operational practices
 - Research: seeking further data to support recommendation development
 - Policy: requirement to reconsider the policy approach
- Recommendations were also categorised as:
 - Priority
 - Short-term
 - Long-term

Examples of Findings and Recommendations

- Predicted increases in rainfall were found to be the issue of greatest concern
- 2020s Predicted % Changes, Medium-High Emissions Scenario
- General increase, particularly in eastern Scotland, ranging from 4-13% in 2020s to 10-30% by 2080s

Examples of Findings and Recommendations

- Predicted changes in rainfall gave rise to a number of Priority recommendations:
 - Revise parameters for surface water design by increasing storm depth by ~20% (Design)
 - Revise parameters for hydraulic design of watercourse structures by increasing capacity by ~20% (Design)
 - Identify locations of existing flooding and develop cost/benefit assessment of remedial works (Operational)
 - Pre-emptively clear detritus from watercourse structures in areas of known flooding risk (Operational)
 - Research catchment runoff estimation parameters and develop risk based design approach (Research)

Examples of Findings and Recommendations

- Other findings and recommendations included:
 - Consider the stiffness of pavement materials (Design)
 - Incorporate drainage systems during maintenance works where these are not already present (Operational)
 - Develop an integrated flood warning/road hazard system in partnership with other public bodies (Policy)
 - Assess costs/benefits of providing wind barriers at locations regularly closed to high-sided vehicles (Operational)
 - Consider a severe weather events road user education programme, supported by real-time information displayed on the network of Variable Message Signs (Policy)

Further Work Undertaken/Planned

- Following publication of the Climate Change Study in 2005, further work undertaken consists of:
 - Publication of a Report on Progress on Recommendations, 2008
 - Review of UKCP09 outputs published in 2009, which provide probabilistic predictions of climate change
 - Preparation of an Updated Study, based on the UKCP09 outputs, expected to be published later this year
 - Anticipate that monitoring of progress in delivering recommendations will continue

Wider Issues

- Although this work focuses on adaptation, the Scottish Government is also committed to mitigation
- Climate Change (Scotland) Act 2009 provided statutory framework for reduction in total carbon emissions, by 42% by 2020 and 80% by 2050
- Transport Scotland are developing a Carbon Management System to assess carbon emissions arising from its work and to assist in emission minimisation across asset life-cycles

Conclusions

- Adaptation is required in response to climate change predictions to maintain desired levels of asset performance
- This will entail changes in design approach, operational practices, and infrastructure policies
- These proposals must be evidence led, recognising uncertainties inherent in climate change modelling
- In Scotland, Transport Scotland are leading this work for the Scottish Government, and have supported the delivery of this presentation

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