

Joint UNECE-UNCTAD Workshop:

Climate Change Impacts on International Transport Networks

08 September 2010, Geneva


Road Networks: A Scottish Perspective

Presentation by

Mr. Robert M Galbraith
Director of Operations, Jacobs

This expert paper is reproduced by the UNCTAD secretariat in the form and language in which it has been received.
The views expressed are those of the author and do not necessarily reflect the view of the United Nations.

JACOBS



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

**Road Networks:
A Scottish Perspective**

Robert M Galbraith
Director of Operations, Jacobs

8 September 2010

JACOBS

Topics

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

JACOBS



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

JACOBS

Background



- 9 August 2004, A85 Cairndow

JACOBS

Background



- 11 August 2004, A9 Dunkeld

JACOBS

Background

- 18 August 2004, A85 Glen Ogle

JACOBS

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.

JACOBS

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

JACOBS

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

JACOBS

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

JACOBS

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

JACOBS

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



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

**Road Networks:
A Scottish Perspective**

**Robert M Galbraith
Director of Operations, Jacobs**

8 September 2010