Climate Change Impacts on the Scottish Transport Network

Graham Edmond
Head of Network Maintenance
• Outline of Climate Change policy in Scotland
• Scottish Road Climate Change Study
• Adaptation Plan and Risk Assessment
HIGH WINDS

FLOODING
COASTAL EROSION

HIGH TEMPERATURES?
LANDSLIDES

A83 Cairndow

A9 Dunkeld

A85 Glen Ogle
Climate Change Factors

- Occurrence of extreme high temperatures
- Occurrence of freezing conditions
- Length of growing season
- Extreme storm event rainfall
- River and stream flooding
- Groundwater
- Soil and sub-soil water content
- Occurrence of snow
- Extreme wind
- Occurrence of fog
- Coastal flooding
Rain

- Road drainage design
- River flood plains
- Areas of known flooding
- Channel Scour
- Earthworks – Landslides
Wind

- Extreme wind events affecting vehicles and infrastructure
Temperature

High Temperatures
- Pavement
- Growing season

Snow and Ice
- Winter maintenance arrangements
- Freeze-thaw: durability aspects
Summary

• Climate Change is likely to result in greater impacts on the road network, through:
  – Higher temperatures
  – less freezing (freeze/thaw cycle change uncertain)
  – less snow
  – more rain
  – probably higher wind speeds
  – longer growing season
  – more river, stream and coastal flooding

• Uncertainty in predictions has to be recognised

• 28 recommendations for adaptation
Update on Recommendations

Priority Recommendations

- 6 priority recommendations
- 5 relate primarily to rain
- This is an area where changes are already being observed
Update on Recommendations
Priority Recommendations

Rain, recommendations 1 & 2

Design

• Revise surface water design storm event parameters
  - HD33/06 updated to include sensitivity test for 20% increase in design storm intensity
• Revise water course structure design storm event parameters
  - Follows above guidance although documents not yet revised
Update on Recommendations
Priority Recommendations

Rain, recommendations 3, 4 & 5

Operations
• Identify flooding locations and consider solutions
  - Number of individual schemes progressed but no consolidated schedule of locations, development of asset management programme will assist completion.
• Pre-emptively clear watercourses in flood risk areas
  - Requirement of term contractors managing the trunk road network

Research
• Further research into catchment runoff parameters
  - Research under way at present
Update on Recommendations
Priority Recommendations

Severe Weather Events, recommendation 6

Policy
- Severe weather information on VMS Network
- Weather warnings on network supported by information on Traffic Scotland web-site
Update on Recommendations
Other Recommendations – Short Term

Summary

• 10 recommendations for implementation in the short term
• cover temperature, rain, wind, coastal flooding and general issues
Other Recommendations – Short Term

**Temperature, recommendations 7 & 8**

**Design**
- Review local experience of surface dressing durability
  - update to Road Note 39, assessed on scheme specific basis
- Consider implications of extended growing season
  - to be addressed in next revision of Cost Effective Landscaping guidance
Update on Recommendations
Other Recommendations – Short Term

Rain, recommendations 9, 10 & 11

**Design**
- Design drainage systems with additional storage capacity
  - Current practice is to encourage this approach
- Introduce surface/sub-surface drainage during maintenance work
  - Current practice is to encourage implementation of this recommendation on individual schemes

**Operations**
- Clarify scour inspection requirements
  - Requirements clarified in term maintenance contract documents
Update on Recommendations
Other Recommendations – Short Term

Wind, recommendations 12, 13, 14

Design
• Consider wind barriers in new designs
  – To be implemented on individual projects as appropriate

Operations
• Continue development of high winds strategy
  – Strategy at final review stage for issue shortly

Research
• Undertake further research into predicted changes in wind
  – To be addressed following issue of next UKCIP datasets
Update on Recommendations
Other Recommendations – Short Term

Coastal Flooding, recommendation 15

Design
- Consider coastal flooding risks in new designs
  - To be implemented on individual projects as appropriate

General Issues, recommendation 16

Research
- Update assessment following publication of next UKCIP reports
  - To be addressed following issue of next UKCIP datasets
Update on Recommendations
Other Recommendations – Long Term

Summary
• 12 recommendations for implementation in the long term
• cover temperature, rain, wind, coastal flooding, winter conditions and severe weather events
Current Work

• Update to report using UKCP09 data

• Ongoing work on
  • Landslide/Rock Slopes
  • High Winds
  • Durability of Pavements
  • Sustainability – carbon reduction
2080s High Emissions Scenario – Change in Mean Precipitation
• Climate Change Adaption Plan – Update
• UK Risk Assessment

• Flooding Disruption 1 1
• Subsidence 2 7
• Energy Demands 2 7
• Thermal Loading on Hard Surfaces 4 14
• Hear Stress on Rail Infrastructure 4 7
• Cold Weather Working 6 14
• Erosion/Landslides 12 2
• Wind/Storm Damage 10 3
• Wind/Storm Disruption 20 4
• Insurance Cover 10 4
• Leaf Fall 19 -
• Disruption to Road Repairs 14 -
- UK Risk Assessment

- Flooding Disruption 1
- Subsidence 2
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• Biggest risk ?