Methodology for the Rapid Assessment of Climate Impacts Along Transport Corridors incl. application between Madrid-Lisbon

Jerome Simpson & Greg Spencer, Smart Cities and Mobility
Monday 5th September, 2016
29th session of the UNECE Working Party on Transport Trends and Economics

Photo credit: ERA Net/RIMAROCC

Photo: ERA Net/RIMAROCC

Photo: ERA Net/RIMAROCC
CONTENTS

- Smart Cities and Mobility
- ClimaCor
  - Initiative
  - In Brief
  - Method
  - Approach
  - Process
  - Survey
  - Workshop
- Case Study: Madrid-Lisbon

ABOUT REC

- Helps “solve environmental problems in the region” through 13 ‘Topic Areas’
- Head-quartered north of Budapest but with a network of country offices, established in 1990
- Activities across Europe, North Africa and beyond
Smart Cities and Mobility

Strategic Areas of Interest

• Cleaner and Better Transport in Cities
  • Secretariat services to European Mobility Week and the CIVITAS Initiative
  • Szentendre/Budaörs Bike-share Scheme Feasibility Study

• Smarter Cities
  • Secretariat services formerly to KIC InnoEnergy
  • Smart Cities and Communities Information System
  • SMART Move; Grow Smarter; OPTIMUM

• Technology Development and Know-how Transfer
  • Sustainable Commuting Initiative
  • CLIMACOR – Rapid Risk Assessment of Transport Routes

• Information provision
  • SEiSMiC - Societal Engagement in Science, Mutual Learning in Cities
  • Traffic Snake Game Network; PLANHEAT

• Partnerships
  • EC; EIT; EEA; UNECE; RCC; Morgan Stanley; Toyota
The CLIMACOR Initiative(s)

Develop a risk assessment methodology on international passenger and freight corridors (road/rail/ports and waterways), test and pilot it

- Funded by the Ministry of Infrastructure and Environment of The Netherlands
- Contribution to the work of the Inland Transport Committee of the UNECE/WP5 (and EU acquis)
- December, 2015-September, 2016

Refine and simplify the methodology and apply on two west Balkan corridors (one waterway, one road) and prepare state-of-the-art assessments

- Funded by the Regional Cooperation Council (RCC) Secretariat
- To support implementation of the “South East Europe 2020 Strategy” (and EU acquis)
- Collaboration with SEETO – South East European Transport Observatory
In Brief

Scope

- Transport infrastructure;
- Substitute routes and transport modalities;
- Other adaptation measures (i.e. resilience).

Target Countries

Trials and application in 2016:

- Kyiv, UA – Chisinau, MD; Lisbon, PT – Madrid, ES
- Sava, BiH – Duna, Srb;
  Orient/East-Med Corridor Srb, Kos* & fYRoM

Approach and Rationale

- Borrow from existing methodologies;
- Must work in different countries & contexts
- Complete in a short time (4-6 weeks)
- Must be cost-effective
The ClimaCor Method …

- Borrows the general approach of ROADAPT Quick Scan method – ‘crowd sourcing’ of experts, rather than gathering of data and mathematical analysis.
- Adds in consideration of railways and inland waterways.
- Simplifies and shortens procedure (3-day workshop to 1-day ‘validation’ event).
- Can be considered a “Pre-Scan” that can guide decisions about where to focus more scientific trouble shooting.
- Centers on involving local climate and transport experts who:
  - Identify top climate threats in studied corridor*;
  - Map the main threats; and
  - Propose response strategies for these threats.
The ClimaCor Approach

Two lines of enquiry (horizontal/vertical):

• transport assets, filtered by their importance and by vulnerability to climate change; and
• climate change threats

Transport assets:

• Road surface and road infrastructure
• Railways
• Inland waterways and ports

Climate threats:

• Heat waves, droughts
• Increased precipitation, storms
• Heat and cold variability
• Erratic weather
• Higher wind force
• Melting permafrost
The ClimaCor Process

- Identify and define *corridor/routes* to be analysed
- Engage a local *consultant* to manage in-country process; *host a ‘train-the-facilitator’ webinar* to illustrate the methodology
- Consultant assembles cca. 10-15 *experts* with help of national ministries of environment and infrastructure:
  - climate change specialists
  - transport experts - road management agencies, inland port authorities, railway companies, etc.
  - NGOs, decisionmakers and other stakeholders..
- Consultant surveys experts’ views on climate threats for given transport infrastructure, *assembles results into a scene-setting presentation* and *organizes/hosts validation workshop* at key location to review/agree findings and recommend next steps.
- Local consultant drafts *country report* (according to template incl. maps, scenarios and recommendations)
- Coordinator prepares integrated *corridor assessment*
**The ClimaCor Survey**

Identification and evaluation* of threats in four online steps:

- Identification of **top 10** threats
- Evaluation of **consequence** (i.e. if threat comes to pass, how serious are the human consequences?)
- Evaluation of **likelihood** (i.e. how often would the threat occur in the corridor, under current conditions and under worst-case scenario of climate change?)
- Evaluation of **risk** (i.e. a factor of consequence and likelihood)

*Scorings are based on experts’ subjective judgements

<table>
<thead>
<tr>
<th>Threat category</th>
<th>Main threat</th>
<th>Sub-threat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High sea levels</strong></td>
<td>Bridge scour (roads, railways or waterways)</td>
<td>Damage to energy supply, traffic communication network (roads and railways)</td>
</tr>
<tr>
<td><strong>Flooding</strong></td>
<td>Overloading of hydraulic systems crossing inland transport infrastructure (roads and railways)</td>
<td>Overloading of hydraulic systems crossing inland transport infrastructure (roads and railways)</td>
</tr>
<tr>
<td><strong>Debris flow</strong></td>
<td>Failure of flood defence systems of traffic and lakes (roads and railways)</td>
<td>Failure of flood defence systems of traffic and lakes (roads and railways)</td>
</tr>
<tr>
<td><strong>Ground subsidence</strong></td>
<td>Bridge scour (roads, railways or waterways)</td>
<td>Bridge scour (roads, railways or waterways)</td>
</tr>
<tr>
<td><strong>Groundwater level increase (roads)</strong></td>
<td>Damage to energy supply, traffic communication network (roads and railways)</td>
<td>Damage to energy supply, traffic communication network (roads and railways)</td>
</tr>
</tbody>
</table>

*To be upgraded to Google Survey Format*
The ClimaCor Survey: Consequence

Evaluation of degree of consequence

<table>
<thead>
<tr>
<th>Threats</th>
<th>Consequences</th>
<th>Availability</th>
<th>Safety</th>
<th>Weighted average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bridge scour due to heavy showers (roads, railway's or waterways)</td>
<td>3.8</td>
<td>3</td>
<td>1.6</td>
<td>7.26</td>
</tr>
<tr>
<td>2. Erosion and slide of embankments due to heavy showers (roads or railway's)</td>
<td>3.6</td>
<td>3</td>
<td>3.7</td>
<td>3.67</td>
</tr>
<tr>
<td>3. Increased ground subsidence, rock fall, landslides or collapse on transport infrastructure due to heavy showers (roads or railway's)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Damage to energy supply, traffic communication networks (roads or railways) due to heavy showers</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>5. Fluvial flooding due to heavy showers (overland flow after precipitation, groundwater level increase) (roads)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Loss of driving ability due to reduced visibility and vehicle control due to heavy showers (road's)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Bridge scour due to long periods of rain in catchment area (roads, railway's or waterways)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threat to route availability/usability</th>
<th>Score</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negligible impact on the availability (Up to a few hours)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A minimal negative impact on the availability (up to a day)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>A serious impact on the availability (several days, up to a month)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A catastrophic impact on the availability (more than a month of unavailable transport to significant 4 numbers of people)</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Human &amp; route safety hazard</th>
<th>Score</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A negligible impact on user safety (light material damage), injuries that won't result in hospital visit</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>An influence that reaches the boundaries of acceptable user safety, with as a consequence a number of extra accidents with temporary loss of health or injuries without absence (material damage, slight injuries)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>An influence to such extent that the boundaries of user safety are exceeded, with as a consequence a serious increase of the number of accidents with permanent loss of health (serious material damage, heavy injuries)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A catastrophic influence on user safety, with as a consequence extra deadly danger during normal use (serious material damage, heavy injuries)</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

To be upgraded to Google Survey Format

Proposed weighting of 3 for availability, 7 for safety
The ClimaCor Survey: Likelihood

Evaluation of *likelihood* (current conditions vs worst-case climate change scenario)

- Threats:
  1. Bridge scour due to heavy showers (roads, railways or waterways)
  2. Erosion and slide of embankments due to heavy showers (roads or railways)
  3. Increased ground subsidence, rock fall, landslide, or collapse on transport infrastructure due to heavy showers (roads or railways)
  4. Damage to energy supply, traffic communication networks (roads or railways due to heavy showers)
  5. Fluvial flooding due to heavy showers (overland flow after precipitation, groundwater level increase) (roads)
  6. Loss of driving ability due to reduced visibility and vehicle control due to heavy showers (roads)
  7. Bridge scour, due to long periods of rain in catchment

- Likelihood under current conditions

- Likelihood under ‘foreseen’ climate change conditions?

<table>
<thead>
<tr>
<th>KEY</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Often (more than once every 3 years)</td>
</tr>
<tr>
<td>3</td>
<td>Sometimes (once every 3 to 10 years)</td>
</tr>
<tr>
<td>2</td>
<td>Seldom (once every 10 to 50 years)</td>
</tr>
<tr>
<td>1</td>
<td>Very seldom (once every 50 years)</td>
</tr>
</tbody>
</table>

‘Foreseen’ is based on credible x-referenced sources explained during the workshop opening.

To be upgraded to Google Survey Format
The ClimaCor Survey: Risk

Evaluation of risk (factor of consequence and likelihood)

<table>
<thead>
<tr>
<th>Threat</th>
<th>B: Consequences</th>
<th>C: Likelihood under current conditions</th>
<th>D: Likelihood under climate change</th>
<th>B*C: Risk under current conditions</th>
<th>B*D: Risk under climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bridge scour due to heavy showers (roads, railways or waterways)</td>
<td>2.6</td>
<td>1.0</td>
<td>2.0</td>
<td>2.6</td>
<td>5.2</td>
</tr>
<tr>
<td>3. Increased ground subsidence, rock fall, landslide, or collapse on transport infrastructure due to heavy showers (roads or railways)</td>
<td>3.7</td>
<td>3.0</td>
<td>3.0</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td>4. Damage to energy supply, traffic communication networks (roads or railways due to heavy showers)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Erosion and slide of embankments due to heavy showers (roads or railways)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Fluvial flooding due to heavy showers (overland flow after precipitation, groundwater level increase) (roads)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scale of risk (per threat) is generated for current and future climate change conditions (i.e. 2 scenarios) which can then be ranked to generate a priority list, with alternative scenarios added during workshop if consensus not found.
The ClimaCor Workshop

Validation Workshop Structure - Facilitated by local expert (host)

• Welcoming remarks - Donor/client
• Introduction to project and methodology - REC
• Present state of the ‘in-focus’ transport infrastructure and foreseen climate change conditions – Project partner/client
• Present preliminary results (ppt slides) of survey of experts’ threats, consequences, and their likelihood to the given transport infrastructure - host
• Review the findings, agree on the rankings and the different resulting scenarios - host
• Prepare recommendations on how to tackle foreseen climate threats/risks through future investments in/ex-situ - 2-3 working groups
• AOB incl. feedback on method - host
• After: Fold the workshop results into a country report (aka vulnerability assessment) - host
Case Study: Lisbon-Madrid international transport corridor

Chosen for its:
- Economic importance
- Location in Western Europe

Comprised of:
- Two major motorways
- One rail link

Main Climate threats:
- Heavy showers run the risk of **ground subsidence**, **rock fall** and **landslides** onto roads and railways.
- Future threats include more frequent **bridge scour** at river crossings.
Study carried out in spring 2016 to identify priority climate threat along major transport routes. Included three phases:

- **Preparation:** Spanish and Portuguese experts inventoried transport assets and submitted preliminary list of relevant climate threats

- **Workshop:** 12 transport and climate change experts (10 from Spain, two from Portugal) met in Madrid and discussed and agreed by consensus on priority threats needing government action

- **Homework:** Where national transport experts map threats and propose response strategies

**Threat checklist, Spain**

**Transport asset inventory, Spain**
Madrid workshop – June 2

Thirteen total participants
• 11 participants from Spain, two from Portugal Ministry of Infrastructure
Madrid workshop summary

- Started with list of **27 relevant threats**, (Submitted by Spain’s Ministry of Environment)

- **Introductory briefing from climate expert**, Spanish State Meteorological Agency

- **Narrowed threats list** to 2 high-risk threats under current climate conditions and 5 high-risk threats under climate change

- Agreed on homework (mapping of threats, response strategies). Still pending.
Case study lessons

• **Describe the method early and clearly.** Applying expert judgement – subjective opinion -- in scientific assessment is new to many people, so they need convincing that this approach can be useful – not as a replacement for scientific analysis, but as an additional tool for practitioners.

• **Manage expectations.** This approach is a first step in a larger programme of risk assessment. Before responses are agreed and funded, more focused research is needed.

• **Results depend on the participants.** A good range of experts is desirable – representing scientific, political, environmental and transport viewpoints. Essential are at least one climate change expert and transport experts with authority on all the modes in the studied corridor.
Thank you!
Jerome Simpson, Project Manager

Contact Details
Regional Environmental Center
Ady Endre ut 9-11

jsimpson@rec.org
jspencer@rec.org

@jeromesimpson2
@HGSpencer