State-of-Practice in Incorporating Reliability into Cost-Benefit Analysis

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International Transport Forum at the OECD

► An inter-governmental organisation with 53 member countries focussing on transport

► A strategic think tank for global transport policy issues

► An annual summit of Ministers
Key messages

► **Reliability** is a major network characteristics that should be recognised when considering investment options

► **We know enough** to start incorporating reliability into CBA

► Need to make sure **research is not falling behind implementation**
Importance of reliability

- Review of ITF/OECD countries
- Importance of reliability is acknowledged
- Costs of unreliable travel may rival those of congestion
Applications: Stockholm bypass road

Reliability adds 10% of benefits

Source: Transek 2006
Applications: Ramp metering at A6W, France

Planning time

No Control

Ramp metering

Buffer time

Travel time

50.4 min
25.0 min
25.4 min

36.2 min
13.8 min
22.3 min

- 28%
- 45%
- 12%

Source: Bhouri & Kauppila 2011
Applications: Ramp metering at A6W, France

<table>
<thead>
<tr>
<th></th>
<th>No control</th>
<th>ALINEA</th>
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<tbody>
<tr>
<td>Average travel time</td>
<td>25.4</td>
<td>22.3</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>11.8</td>
<td>7.7</td>
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</tbody>
</table>

\[4.1 \times 0.8 \times VTT = 3.3 \times VTT\]

Source: Bhouri & Kauppila 2011
Importance of reliability

- Review of ITF/OECD countries
- Importance of reliability is acknowledged
- Costs of unreliable travel may rival those of congestion
- Shift in policy focus
Importance of reliability

- Current focus in reducing average travel time
- Future focus in reducing also variability
Importance of reliability

- Projects are designed to improve reliability
- Cost-benefit assessment represents the best option to deliver optimal levels of reliability
- Still, assessments often disregard variability and only use mean travel time
- Lack of systematic analysis of the economic benefits is a major drawback
State-of-practice

➢ Review shows that few countries have started incorporating reliability into transport planning or project assessment

➢ Few countries have incorporated reliability into appraisal guidelines...

    ...while others have used on a pilot basis
State-of-practice

Basically requires three sets of data:

1. Existing travel time variability

2. Anticipated reliability levels after policy initiative

3. Monetary values of reliability
Netherlands

“CBA must be carried out for large governmental infrastructure projects” – 2004 annex on reliability

- If possible, use standard deviation as a measure
- Work is done to incorporate reliability into national transport models to estimate reliability impact
- The value of reliability based on reliability ratios (0.8 for pass tr by car; 1.4 for public tr; 1.2 road freight)
- Defined in an international expert meeting as value of one minute of standard deviation / value of one minute of travel time
- SP and RP study on-going
United Kingdom

“TAG guidance on the appraisal of transport projects should be seen as a requirement for all projects that need governmental approval”

- Most recent document recommends ways to assess improving journey time reliability for private vehicle travel and public transport
United Kingdom (private vehicle travel)

- Reliability measured by the **standard deviation of travel time**

- **Forecasting the change** in the level of reliability
  - Urban roads: day-to-day variability main source of unreliability – DfT data to forecast std from journey time and distance for each origin destination flow
  - Inter urban: incidents main cause of unpredictable variability – use of INCA model (reflects how incidents affect delays)

- Value of reliability: use **reliability ratios** derived from the Dutch study
United Kingdom (rail)

- Delay measured as **difference between scheduled arrival time and actual arrival time**

- Scheduled arrival time as a proxy for preferred arrival time

- Disutility of arriving late measured as **lateness factor** (value of arriving late in relation to in-vehicle time)
  - Recommends factor of three (1 min late = 3 min in-vehicle)

- Includes also disutility related to unpredictable variation in delay
Sweden (road traffic)

“Delay and unreliability should be included into cost-benefit analysis”

- National Transport Investment Plan 2010-2021: reliability included in CBA for the first time
- Valuation based on the standard deviation of travel time
- Forecasting impacts: estimated relationship between congestion and std.dev. of travel time (Eliasson 2006) - implemented in Emme/2 model
- Relative value of variability – “reliability ratio” recommended 0.9 based on Eliasson (2003)
- All trips (private, business, freight)
Sweden (long distance rail)

- “Delays” are defined as the difference between actual and scheduled arrival time.

- No official modeling method for forecasting impacts of investments/measures/timetables on delays.

- Practice: use statistics and subjective judgments.

- Average delay (risk*length) valued as 2 times travel time:
  - should be higher?
  - Freight treated as person travel.
New Zealand

“Improved trip reliability should be incorporated in economic efficiency evaluation of projects”

- Day-to-day variation (not incident related delay) measured by the standard deviation

- Data to forecast std for different road types, intersection types, and road environments

- The value is derived by multiplying the value of time by 0.9 (urban traffic mix) or by 0.8 for cars and 1.2 for trucks (other vehicle mix)
  - adjustments made for “% of variance occurring outside study area”
Australia

“Where benefits (costs) account for more than 10% of total benefits, they should be quantified”

- Proceeedures may differ in the different states

- Travel time variability measured by the **standard deviation** of travel time
  - Based on volume/capacity ratio for road link, intersection or route segment

- Value of reliability based on **reliability ratio**
  - Citing research results in Bates et al 2001
  - “Values around 1.3 appear plausible for car travel”

- Day-to-day variation (congestion related)
Danmark

“Travel time variability is not yet included in the general Danish economic appraisal practice”

- However, several (public transport) authorities use different reliability measures to evaluate travel time variability
- Variability is computed as the total passenger delay minutes relative to the timetable
- In 2005 a unit price of 1.5 times VTT was applied to assess the value of the variability (has since been changed to 2 times VTT)

• Copenhagen-Ringsted railway project analysis included the estimated benefits from both travel time savings and improved reliability
Norway

- Official cost-benefit guidelines for rail investments include a value of delay

- The cost-benefit guidelines for road investments has not included values of reliability so far
Recent research

- The value of reliability in freight transport in Norway
  - Stated preference (SP) survey with choice experiments involving time, variability and delays
  - Derived both a value for reductions in the standard deviation and values of early and late arrival (TØI report 1083/2010) www.toi.no

- Dutch valuation study
  - Results available second half 2012
  - VoTs and VoRs to be used in official Dutch CBAs

- Germany
  - Feasibility study underway – SP survey planned for coming years

- Sweden
  - Revision of official variability valuation guidelines underway
Lessons from current practices (road)

1. Existing travel time variability
   - Standard deviation can be applied with relatively little difficulty in CBA

2. Anticipated reliability levels after policy initiative
   - Traffic forecasting tools need to be improved to provide estimates of changes in standard deviations and numbers of trips on links
   - Existing models could be expanded to identify impact of investment on reliability (INCA UK, EMME/2 SWE, National Model System NL)

3. Monetary values of reliability
   - Reliability ratio used in many countries; but value of reliability is inevitably granular with spectrum of values (varying from one circumstance to another)
   - How to ensure we capture representative distribution
   - How to measure the relevant wtp for improved reliability
## Appraisal Summary Table

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<th>Qualitative/quantitative assessment</th>
<th>Monetized Values (BCR)</th>
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<td>Biodiversity</td>
<td>Regeneration</td>
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<td>Heritage</td>
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Conclusions

- Reliability a major network characteristics that should be recognised when considering investment options
  - Need to ensure optimal levels of reliability are delivered
- Reliability should be incorporated in the assessment
  - Can be done for road and rail
  - Will change priorities / ranking of projects
- Reliability is a rapidly developing area – new research will likely bring new insights
- At the same time countries are moving ahead using the existing knowledge base
  - Make sure research is not behind of implementation
2012 Annual Summit

Seamless Transport

2-4 May in Leipzig, Germany

Presidency Japan
Thank you

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