Demand analysis – Role of a national model

NP Event on CBA in the Transport sector
Zsolt Berki – FOMTERV Ltd.
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Goals of the demand analysis

a) Real understanding of the economic and social needs
b) Creation reasonable view of the future and future of transport
c) Identification of measures
d) Selection and evaluation of projects
e) Be on the safe side at the end in terms of financing, operating and public acceptance
1. Objectives of the modell capabilities
2. Modell Setup
3. Functional analysis
4. Liaison with CBA
5. Institutional set up the model operation
Lessons learnt

- Former practice of strategy planning caused tradition driven project lists, overdesign, non realistic forecasts in some cases
- Systematic approach is needed
- Admission of data gaps
- Importance of the analysis layer
- Close connection with economic and territorial strategies

- Our answer from the authority: Transport model was required by the call
Objectives

• Cover all modes what are important including
  – Road
  – Rail
  – IWW
  – Aviation

• Cover all demand layers
  – Passengers by trip purpose
  – Freight by commodity group

• To be detailed enough to model strategic projects,
• Look behind the borders
• Made in a transparent way – documentation, open formats
• Let to use by all professional institutions
## Input data catalog

<table>
<thead>
<tr>
<th>Data seed</th>
<th>Availability</th>
<th>Quality</th>
<th>Suggested data generation plan for the future</th>
<th>Used in the strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>International data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ETIS+</td>
<td>2005, 2010</td>
<td>Fairly good at NUTS3 level but <em>serious correction was made in South-East!</em></td>
<td>In every 5 years</td>
<td>Direct matrix</td>
</tr>
<tr>
<td><strong>National Statistics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Census data, with OD flows of H-W, H-S interurban trips</td>
<td>2011</td>
<td>Large sample but only for 2 purposes</td>
<td>In every 10 years</td>
<td>Direct matrix</td>
</tr>
<tr>
<td>Road and Rail freight by commodity type</td>
<td>2005, 2010</td>
<td>NUTS 1, data quality issues</td>
<td>Yearly reporting, and NUTS 3 would be preferred</td>
<td>Corrected by rail statistics of 2005.</td>
</tr>
<tr>
<td><strong>Cross sectional data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road freight</td>
<td>MCC in 2012, at the main border stations and key points</td>
<td>Good</td>
<td>Yearly update</td>
<td>No correction needed</td>
</tr>
<tr>
<td>National Count programme</td>
<td>2011, full coverage</td>
<td>Reliable where the ATC are available</td>
<td>Yearly update</td>
<td>No correction needed</td>
</tr>
<tr>
<td>Rail infrastructure statistics</td>
<td>2011</td>
<td>Good</td>
<td>Yearly update</td>
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<td><strong>O-D data</strong></td>
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<td>Road freight</td>
<td>in 2012, at the main border stations and key points</td>
<td>Good</td>
<td>In every 2 years</td>
<td>Direct matrix</td>
</tr>
<tr>
<td>Public transport on-board survey</td>
<td>2008</td>
<td>User classification was rough</td>
<td>In every 5 years would be necessary</td>
<td>Direct matrix</td>
</tr>
<tr>
<td>Roadside survey for motorized vehicles</td>
<td>Latest in 1999</td>
<td>Pretty old</td>
<td>No real chance anymore</td>
<td>Used only to check assumptions</td>
</tr>
<tr>
<td>Roadside survey for bicycles</td>
<td>2012</td>
<td>Pretty old, but for Budapest region only</td>
<td>National survey (done last month)</td>
<td>Appropriate to evaluate measures</td>
</tr>
<tr>
<td>Hungarian performance based tolling regime</td>
<td>Introduced in 2013</td>
<td>Fairly good but pure national, round trips</td>
<td>Periodic statistics</td>
<td>Not used but should be in the update</td>
</tr>
<tr>
<td><strong>User behavior</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User behavior surveys</td>
<td>2008, and 2010-2012 for bigger cities</td>
<td>Good</td>
<td>Periodic survey would be better</td>
<td>Used in the Strategy</td>
</tr>
<tr>
<td>Behavior of bikers</td>
<td>2012</td>
<td>Budapest region only</td>
<td>National survey</td>
<td>Appropriate to evaluate measures</td>
</tr>
</tbody>
</table>
Model setup

- Two model layer
  - Macro model: International flows based on corrected TransTools* (It was especially used to evaluate rail freight schemes and measures)
  - National model

*TRANS-TOOLS ("TOOLS for TRansport Forecasting ANd Scenario testing") is a European transport network model that has been developed in collaborative projects funded by the European Commission Joint Research Centre's Institute for Prospective Technological Studies (IPTS) and DG TREN.
Macro model

- The original Trans Tools network model had to be extended → the national network is more detailed, with connections to the foreign network was also updated.

- The original impedance was used with extensions → the speed set for the links is based on MÁV (Hungarian State Railways Comp.) database.

- The original Trans Tools demand model was on NUTS2 level → NUTS3 level zones adopted from ETIS+, 1-5 connectors used on the Hungarian network for more detail.

- NUTS2 level demand matrices converted using ETIS+ data on NUTS3 level.
Macro model

- The trip generation and distribution is based on the TransTools framework with commodity group matrices converted to vehicle matrices → loaded runs
- Correction factor to obtain actual vehicle flows → empty runs
Macro model - Conclusions

• The available EU wide transport model is not detailed enough on national level, but necessary in countries with open and interconnected economies

• Increase in detail requires quite a lot of time and work

• Increase in detail will increase the usefulness of the next generation of Trans Tools

• Even a more detailed model on European level can not answer all question if used on national level e.g. on infrastructure development studies → more detailed micro level tools are also needed with small spatial coverage.
National model

• National model covers Hungary and the surrounding countries with a 100-200 km buffer

• Road network based on the 1:50 000 scale map of road directorate
  » road type, number of lanes,
  » terrain, characteristics (urban vs non-urban),
  » speed limit (more significant),
  » pavement width (capacity decreasing issue)

• Rail network
  – Includes all lines and major stops/stations
  – Links were coded with average rail freight speed

• Public transport
  – Regional bus services playing real role in interurban traffic
  – Rail services at train level
  – Timetable based coding
National model - Zoning

- 1166 zones:
  - 933 zones outside of Budapest
  - 68 foreign zones
  - Large cities were disaggregated to zones of 15-25 000 inhabitants
Demand segments

• Direct matrices
  – Road- vehicle categories cars, 3.5t, 3.5-7.5t, 7.5-12t, >12t
  – Public transport: passengers in one

• Analytic model
  – Freight: 10 commodity groups
  – Passenger traffic
    • Generation by settlement type (administrative rank and distance from Budapest)
    • Demand purposes: work, school, other
    • Access to car (mode choice model)

• Generalised cost functions
  – Road: $IMP_{ij} = C_{Length} + C_{Tcurr} + C_{Toll} + C_{X}$ (freight restrictions)
  – PuT: $JT_{ij} = (AT + OWT + \sum IVT + \sum TWT + \sum WKT + ET)_{ij}$
  – Rail freight: Average speed based on link type and measures
Calibration and validation

- Calibration: equations and some matrix corrections
- Validation: Sense check of changes in case of test cases
Forecasts

- Economic tendencies at NUTS3 level for the whole Europe – thinking in scenarios
- Demography, including migration (internal as well)
- Motorisation (access to car)
- Welfare
- The coupling effect
- BAU is modelled
- 2011, 2020, 2030, 2050

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What does the economy / society look like?

• Understanding regional policy demand
  – Performance of the regions
  – Detect the larger functional areas
  – Exposing characteristics of regions
  – Identify the key drivers of transport demand in and through the regions

• How:
  – Look into the statistics
  – Read and process the economic strategies
    National Development and Spatial Development Concept (OFTK)
Methodology

Socio-economic analysis
- Industry layer
- Social layer
- Co-operations

Transport demand
- Current patterns

Current supply
- Capacity utilization
- Infrastructure bottlenecks

Drivers of change
- Objectives of economic and social development
- Climate changes
- Sustainability

Definition of objectives
- In terms of travel time
- In terms of measures needed
Population

Az érintett települések népesség-kategóriái szerinti megoszlása, 2010

Jelmagyarázat
A település népessége, fő
- 100001 - 1694900
- 50001 - 100000
- 30001 - 50000
- 20001 - 30000
- 10001 - 20000
- 5001 - 10000
- 3001 - 5000
- 2001 - 3000
- 1001 - 2000
- 501 - 1000
- 1 - 500
- nincs adat
Internal migration

Ezer főre vonatkozó belföldi migráció, 2011-2013

Jelmagyarázat
Ezer főre jutó belföldi vándorlási különbözet
- 10,1 - 318,8
- 0,1 - 10,0
- 4,9 - 0,0
- 9,9 - 5,0
- 29,9 - 10,0
- 600,0 - 30,0
Ageing

Az öregedési index értéke a vizsgált térségben, 2010

Jelmagyarázat
Öregedési index, %
- 200,1 - 2500,0
- 150,1 - 200,0
- 100,1 - 150,0
- 50,1 - 100,0
- 0,1 - 50,0
- nincs adat
Functional regions in economic planning
Functional regions in transport planning
Transport model – demand analysis
Rail trips broken by distance

Jelmagyarázat
Vasúti utasforgalom
Hosszú távú (>50km)
Rövid távú (<50km)
Road trips broken by distance
Rail freight
Road freight
Functional infrastructure - rail

Network role
1. National core network part of the trans-European rail freight network
2. National core network part of the trans-European rail freight network
3. Regional rail track
4. Other rail track

Traffic needs
- Main public transport
- Significant public transport
- Additional transport
- Freight transport
- Freight and main public transport
- Freight and significant public transport
- Freight and additional transport

Development
- Priority lines
Functional infrastructure - road
Bottlenecks
Conclusions ➔ Objectives

• Nature of the transport development needs
  – Whom? - answer by demand segment and better assumptions for future demand
  – Why? – Identified real bottlenecks
  – Which way? – decision on mode
  – What? – derive of planning/design parameters

• Not obvious findings
  – Missing links
  – Realistic forecasts
  – More specific design against real needs
Missing links in transport
Liaison to CBA

• Natural figures
  – Traffic performances (vehkm, vehhour, …)
  – Link speed and volumes
  – Number of trips
  – Composition of flows

• Nature of the benefits
  – Change in transfers
  – Generated traffic
    • Diverted trips
    • Induced trips (mode choice, new trips)
    • Longer trips (destination change)
  – Queue lengths
Application in Corridor Studies/Projects

Change in train km/year

Change in train hour/year

V0_2_1_1  V0_2_2_1  V0_2_3_1  V0_2_4_1  V0_2_6_1
-84,251   -131,543  -154,037  -244,340  24,790

V0_2_1_1  V0_2_2_1  V0_2_3_1  V0_2_4_1  V0_2_5_1  V0_2_6_1
-6,675    -7,920    -7,140    -11,175   -10,427   -9,379
CBA uses VOT

Modell uses a GC for route choice

Behaviour model uses an other GC for destination and mode choice

- Other influencing factors like comfort, access to the mode, charging policy
- Modal shift in freight: very specific since decisions can be made by client, freight forwarder or the haulier
- Non-temporal decisions: buying a car, buying a monthly pass

Definition of the without case

- Generated traffic could cause overloading of links in Without case
- Issue of convergence
Institutional set up

• Officially owned by Hungarian Transport Administration
• Open to use
• We admit that we still facing data issues
• That calls for surveys and model upgarding
Thank you for your attention!
For info or further questions on the CBA forum meetings and the activities of the JASPERS Networking Platform, please contact:

Massimo Marra  
JASPERS Networking and Competence Center  
Senior Officer  
ph: +352 4379 85007  
m.marra@eib.org

www.jaspersnetwork.org  
jaspersnetwork@eib.org