Experiences with capacity reductions on urban main roads – rethinking the need for urban road capacity?

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Studying natural experiments in Oslo

- 2015 - 2020: Substantial changes in different parts of the transport systems in Oslo, Norway
- Including temporal capacity reduction on 10 main road tunnels
- A golden opportunity for research, knowledge, learning and innovation
- Large-scale research project: Studying effects and consequences of changes in urban transport systems – for the systems and the users
- Here: Results from a pilot study – The Smestad tunnel

<table>
<thead>
<tr>
<th>Tunnel</th>
<th>ÅDT</th>
<th>Åpningsår</th>
<th>Lengde</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammersborgtunnellen</td>
<td>18 500</td>
<td>1989</td>
<td>381 m</td>
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<tr>
<td>Vaterlandstunnellen</td>
<td>18 500</td>
<td>1990</td>
<td>369 m</td>
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<tr>
<td>Brynstunnellen</td>
<td>66 000</td>
<td>1970</td>
<td>267 m</td>
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<tr>
<td>Tåsentunnellen</td>
<td>50 000</td>
<td>2000</td>
<td>1338 m</td>
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<tr>
<td>Smestadtunnelen</td>
<td>48 700</td>
<td>1983</td>
<td>494 m</td>
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<td>Granfosstunnellen</td>
<td>32 000</td>
<td>1992</td>
<td>2197 m</td>
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<td>E18 og E6</td>
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<tr>
<td>Operatunnellen (del Festning)</td>
<td>72 200</td>
<td>1990</td>
<td>1741 m</td>
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<tr>
<td>Operatunnellen (del Ekeberg)</td>
<td>67 000</td>
<td>1995</td>
<td>1525 m</td>
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<tr>
<td>Operatunnellen (del Svartdal)</td>
<td>27 500</td>
<td>2000</td>
<td>1251 m</td>
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<tr>
<td>Vålerengtunnellen</td>
<td>56 000</td>
<td>1989</td>
<td>832 m</td>
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The Smestad tunnel
Results from a pilot study - preliminary

- Before-situation: Dual tunnel, two lanes in each direction
- About 50,000 vehicles/day
- Two lanes closed due to construction works - capacity reduced by about 50 per cent (June 2015 – May 2016)
- Information campaign up front – warning of congestions and delays
- Mitigation measures
Hypotheses

**Behavioural adaption** (from literature, a.o. Cairns et al. 2001):

- Rerouting
- Changes of transport mode
- Starting earlier or later
- Travelling more seldom/ more home office

**Effects and consequences:**

- More congestion, delays etc. on this and other routes, and on other modes
- Increased travel time, changes in travel behaviour, changes in household routines, changes for freight operators
Methods, data (in the pilot)

- Case study design
- Data collected in two-week periods before, right after and three months after the capacity reduction was implemented (and similar weeks in 2014 where available)
- Data (included in analyses reported here):
  - Traffic volumes, speeds, etc. from counting points (cars, bicycles)
  - Passenger data, etc. for public transport
  - Surveys to employees in 10 companies located in affected area before (May 2015, 247 respondents) and in the stable situation (September 2015, 313 respondents)
  - Data from the fleet steering systems of a large freight operator
  - Interviews with truck-drivers right after (June 2015) and in the stable situation (September 2015)
Findings: Traffic volumes on this link

**First week (morning rush)**
- Minus 25 % (2500 vh) compared to 2014
- Minus 22 % (2100 vh) compared to week 19 and 21
- Stable under way: Back to normal

**First days (morning rush)**
- Minus 37 % (3500 vh) first day compared to prev. Tuesday
Speed and delays on this link
Measured: 9 kilometre link including the Smestad tunnel

**Morning rush:**
- Normal state – freeflow
- Delays the weeks before
- Right after: freeflow
- Stabil under way – some extra delays (0.6 and 1.8 minutes)

**Afternoon rush:**
- Freeflow eastwards, delays westward
- Delays the weeks before
- Right after: some extra delay
- Stabil underway: Some extra delays (1.2 and 0.8 minutes)

**Reported:** 10 minutes extra delay
Somewhat increased variability
No rerouting found
On alternative main roads and smaller roads
Changes of mode?

- From survey (comparing before and stable under way): No significant changes

- From counting: More bicyclists first weeks
Change of mode?

- From counting: More public transport first weeks?
Effects and consequences
Comparing before and in stable under way situation

- If they had experienced that their travel to work had become better or worse:
- 32% of car drivers and 6% of PT-users reported increased travel time
- Average 10 – 11 minutes
- Consequences for the household (changes in responsibilities etc.) – less than 5%
- Freight transport – no effects or consequences (delivery-precision, rerouting, delays, stress…)

![Chart showing the distribution of responses to the question about travel time changes.]

- Much better: 0%
- Better: 3%
- No changes: 68%
- Worse: 15%
- Much worse: 2%

*Legend: All, Car-drivers*
Successful information campaign

<table>
<thead>
<tr>
<th>Information Received</th>
<th>Count</th>
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<tbody>
<tr>
<td>Yes, I got sufficient information</td>
<td>66</td>
</tr>
<tr>
<td>I got some information, but not sufficient</td>
<td>10</td>
</tr>
<tr>
<td>I did not get information about this</td>
<td>7</td>
</tr>
<tr>
<td>I don’t know/other</td>
<td>17</td>
</tr>
</tbody>
</table>

**Traffic Tåsen tunnel, traffic volumes in morning rush-hours**

<table>
<thead>
<tr>
<th>Day</th>
<th>Traffic (vehicles)</th>
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<tbody>
<tr>
<td>Monday</td>
<td>9688</td>
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<tr>
<td>Tuesday</td>
<td>9459</td>
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<tr>
<td>Wednesday</td>
<td>9847</td>
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<tr>
<td>Thursday</td>
<td>9777</td>
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<tr>
<td>Friday</td>
<td>9245</td>
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<td>Monday</td>
<td>8433</td>
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<tr>
<td>Tuesday</td>
<td>6010</td>
</tr>
<tr>
<td>Wednesday</td>
<td>7378</td>
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<td>Thursday</td>
<td>7919</td>
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<tr>
<td>Friday</td>
<td>7939</td>
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**Editorials in newspaper, radio, TV**

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<tr>
<th>Source</th>
<th>Count</th>
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<tbody>
<tr>
<td>Newspaper ads</td>
<td>16</td>
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<tr>
<td>Information along the road</td>
<td>12</td>
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<tr>
<td>Co-workers, friends</td>
<td>11</td>
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<tr>
<td>Employer, for instance Intranet</td>
<td>10</td>
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<tr>
<td>Vegvesen.no</td>
<td>5</td>
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<tr>
<td>Social media</td>
<td>4</td>
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<tr>
<td>Other information from NPRA</td>
<td>3</td>
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<tr>
<td>Not relevant/other</td>
<td>6</td>
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</table>
Summing up – what happened?

- Two lanes closed - capacity reduced by about 50 per cent
- Congestions and chaos were expected
- Communicated this in successful information campaign
- People adjusted the first week – traffic down 37/25/22 % in morning rush, a little less in afternoon rush
- No/marginal extra congestion and delays
- Adaption to ‘no congestion’ - traffic volumes back to normal – only marginal increases in delays
- Stable underway situation – no effects or consequences measured
Reflections

What this is it NOT a case of:
- It is not a case of capacity being reduced below traffic volumes in the tunnel – the tunnel had capacity enough to carry all the traffic (about 50,000 vehicles per day) also with one lane in each direction.

What is this a case of?
- Exaggerated expectations of congestion and chaos due to road capacity reductions.
- *Expectations* of increased congestions led to behavioural changes – urban commuters do have alternatives.
Smarter use of existing road capacity?

- Stated objectives by Norwegian Government and Cities: Zero growth in urban road traffic volumes combined with improved transport quality for segments of the traffic.
- Obvious solution: Using existing road capacity differently.
- Hindered by fear of chaos and negative consequences.
- Theory and experiences across countries: Capacity reductions cause less problems and negative consequences than expected.
- Results can open up discussion on smarter and more targeted use of road capacity as alternative to investing in new road infrastructure and capacity.
- Contributing to transforming urban mobility!
I hope for input on:

- Others’ experiences with doing similar research (data, method, findings…) – our project is very much ongoing!
- Research and other works on ‘understanding and handling congestion in urban road transport systems’ (mainly works ‘on reality’ – not so much on transport models)
- ate@toi.no
Thank you!
Research question (Smestad case)

- How did the capacity reduction in affect the traffic on this link (traffic volumes, speeds, congestion levels)?
- How did commuters (all modes) and freight transport adapt to the capacity changes?
- Which effects and consequences were experienced in other parts of the transport systems (alternative roads, public transport system, bicycle network)?
- What were the consequences of their adaptions or non-adaptions for commuters and freight transport?
- Did the information measures reach the public and the users of the road, and did they have any effects?
Research questions (whole project)

- How do different actors (travelers, freight and commercial traffic, PT) adapt to the capacity changes?
  - *Changes in mode, timing, destination, route, travel frequency, etc."
- How do these adaptions affect the transport systems?
  - *Traffic volumes, delays, crowding, redistribution of traffic, etc."
- How can urban congestion better be understood and handled?
- What are the consequences of adaption for travelers, public transport, freight and commercial transport?
- Do information and mitigation measures work? What can improve?
- How can the situation be used to calibrate and improve transport models and other methods?
- How can the new knowledge be used in future planning and development of transport systems?
Aim - relevance

- **Aim:**
  - Documenting effects and consequences of changes in the urban transport systems for the transport systems and for users of the transport systems (commuters, PT-passengers, freight transport, taxis)

- **Highly relevant for two main reasons:**
  - Improving authorities’ knowledge of responses and adaptations to such changes, and on efficiency of mitigation- and information measures
  - Strengthening the knowledge base for developing the more efficient and climate-friendly urban transport systems for the future

- Close cooperation with transport and planning authorities, as well as other transport actors
Objectives for the research

Exploit the opportunity of a natural experiment to:

i. Analyse adaption strategies and how those affect travellers and freight transport, the transport systems, society and environment

ii. Develop our ways of understanding and handling congestion in urban road transport systems

iii. Analyse effects of information campaigns and mitigation measures, and improve these

iv. Verify and improve methods and transport models

v. Explore new possibilities for developing environmentally friendly and efficient urban transport systems for the future

Also:

- Explore the use of New data (GPS) and Big Data (mobile phones)
- Pilot a digital platform for data sharing
Work packages

WP1: Management scientific quality, expenses
WP2: Data gathering and sharing
WP3: System perspective: effects and consequences for travelers, transport system, society and environment
   - better understanding and handling of urban congestion
WP4: Travelers' perspective: adaption strategies and how they affect them (travels to work, freight, taxi)
WP5: Mitigating measures and information strategies
WP6: Verify and further develop models and methods
WP7: Implications for analyses, planning, and development of the future’s urban transport systems
   - For example, in discussions about how road capacity can be used more smart/efficiently / sensible / targeted
WP8: Dissemination
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<td>Vaterland- og Hammerborgtunnelen</td>
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*Kun ett tunnellop er stengt om gangen  **Tåsentunnelen: natt- og helgestenging  
***Ekebergtunnelen: døgnsperring sommer 2017/2018, natt- og helgestenging resten av perioden