Institute of Transport Economics
Norwegian Centre for Transport Research

Summary

BYTRANS: Effects and consequences of capacity reduction in the Smestad tunnel. Final report

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The capacity of the Smestad tunnel, located on the outer ring-road in Oslo, was reduced from four to two lanes in the period June 2015 to May 2016 due to rehabilitation works. As the tunnel carries about 50 000 vehicles a day (annual average daily traffic, AADT), it was expected and communicated that the capacity reduction would significantly increase congestion. This report summarises findings from a study of how road-users adapted to the situation, and what effects and consequences they experienced. Key findings are that a successful information campaign resulted in a strong reduction in traffic volumes in rush hours the first day (down 33-37 percent) and weeks, and reduced rather than increased congestion. As the press reported this, traffic rapidly grew back to normal levels. Interestingly, this caused only marginal reduction in average speed in rush hours. It turned out that the tunnel carried the AADT 50 000 well, also with two lanes. Hence, it was found that road users made only limited adaptions (except from the first weeks), and they experienced almost no effects or consequences. The findings open for new ways of thinking about how we can develop more sustainable urban transport systems, and it calls for further investigations into congestion in urban road systems.

Background, objectives and case Smestad tunnel

In the period 2015-2020, large scale changes took place in the transport systems in Oslo. This could be understood as natural experiments, offering great opportunities for research and knowledge production. The research project BYTRANS was set up to exploit these opportunities, and gain knowledge on how different groups of road user (commuters, truckdrivers, taxidrivers) adapted to the changes, what effects and consequences they experienced, and what consequences the interventions had for the transport systems and environment. This could provide useful input, that could help authorities to more effectively developing sustainable urban transport systems. Findings would also be useful for authorities in reducing effects of future similar changes to the transport systems.

This final report summarizes results of analyses of adaptions to, and effects and consequence of, the capacity reduction in the Smestad tunnel in Oslo from four to two lanes in the period of 2. June 2015 to 22. May 2016. The capacity reduction was due to rehabilitation works, and the tunnel regained the same capacity as before after the works were finished. The Smestad tunnel is located on the outer ring-road called Ring 3 in Oslo, and it carries annual average daily traffic (AADT) of about 50 000 vehicles. Ring 3 distributes traffic between different parts of the city, the region and the country. Traffic is similar in both directions, also in rush hours. Speed limits are normally 70 km/h, and was reduced to 50 km/h in the tunnel and nearby during the rehabilitation period.

Smestad was the first of ten tunnels on the Oslo main road system planned to undergo rehabilitation works in the period 2015-2020, see location of the Smestad tunnel and the nine other tunnels undergoing rehabilitation in the period in Figure S1.

Figure S1: Map showing the main road system in Oslo and the location of the Smestad tunnel and nine other tunnels undergoing significant rehabilitation works in the period 2015-2020. Source: Norwegian Public Roads Administration.

Research questions and methods

Adaptions could among other things be to change routes, modes of transport, trip-timing, trip-frequency, etc. (Cairns et al. 2002). Effects could be changes in congestion, delays, time-usage, traffic situation reliability, etc. Wider consequences for commuters could concern if they changed routines and responsibilities within the household, and if they experienced that satisfaction with their commute changed. For freight transport and taxi transport, this could concern variability in delivery time, needs for detours, and quality of the workdays for the drivers.

The research was designed to answer the following research questions:

- How did the capacity reduction in the tunnel affect traffic volumes and average speeds in and close to the tunnel?
- What changes could be observed the first days?
- How did different groups of road-users (commuters, truckdrivers and taxidrivers) adapt to the capacity changes?
- What effects and consequences did the road-users experience?
- Did the information about the changes reach the road-users, and did they have any effects?
- What can we learn from the case Smestad tunnel?

Several data sources and methods were used to investigate adaptions to, and effects and consequences of, the capacity reduction of the Smestad tunnel. The main sources of data were: Traffic data (volumes, speeds) from national and regional transport authorities; Surveys to and interviews with truck-drivers, taxi-drivers and commuters to workplaces located within the borders of Oslo municipality (here we use a subset, including employees of businesses located in an area expected to be more affected by the Smestad capacity reduction); and document studies. The main research design was to collect data in similar ways in the before-, underway- and after-situation, and to compare data from different phases when analysing changes over time.

Results

The main finding from investigating adaptions to, and effects and consequence of, halving the capacity in the Smestad tunnel, was that not much happened (see Tennøy et al. 2015 and 2016 for fuller descriptions). It caused only minor effects, and hence only marginal adaptions and consequences.

Before the Norwegian Public Roads Administration (NPRA) started the rehabilitation works, they run large information campaigns warning road-users that the capacity reduction would cause heavy congestion, and encouraged users to find other ways of travelling (Tønnesen et al. *in review*). The press followed up and informed widely about the potential problems. The day the capacity was reduced, the press geared up to cover congestion and chaos, but ended up reporting that traffic was flowing smoother than ever.

This was a result of many road users responding to the expectations of severe congestion by finding other solutions than driving through the Smestad tunnel, and in Oslo in general, this day. The traffic in the Smestad tunnel and on this part of Ring 3 was hence significantly reduced. Compared to the normal situation, it was reduced by 37 percent (3 500 vehicles) in the morning rush hours from 07.00 to 9.00, and by 33 percent (3 200 vehicles) in the afternoon rush hours from 15.00 to 17.00. There are no indications in our data that they chose other routes on the road network, and we assume that commuters chose other modes or worked from home. As a result, the average traffic speeds was higher in week 23 (when the capacity reduction was effectuated) than in the normal situation. Figure S2 shows average traffic volumes and speeds in the rush hours (7.00 – 9.00 and 15.00 – 17.00) in the same two-week-periods in 2014, 2015 and 2016, and illustrates the drop in traffic volumes and the peak in average speeds in week 23 in 2015.

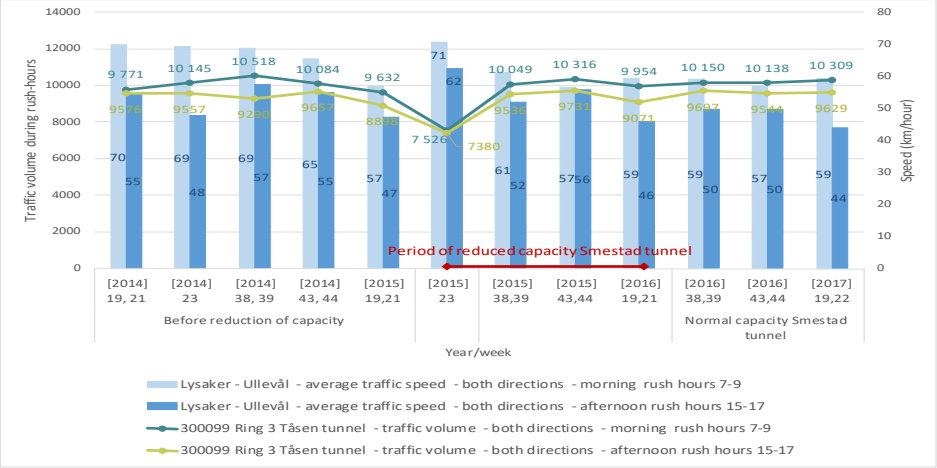

Figure S2: Average traffic volumes and traffic speed, weekdays in selected two-weeks periods, in morning rush hours (7.00-9.00) and afternoon rush hours (15.00–17.00).

Already the second day after the capacity reduction was effectuated, traffic started to increase. When measuring the stable underway-situation, three months later, traffic volumes were back at normal levels, as also shown in Figure S2. Despite the fact that the road capacity now was halved, only small increases in delays were found. Based on the data on average speeds, it was calculated that it took between 0,7 and 1,1 extra minutes to drive the 9 kilometre between Ullevål and Lysaker, including the Smestad tunnel (speed limits in and close to the tunnel were reduced from 70 to 50 km/h). In accordance with this, there were no indications in the data that traffic was redistributed to other roads, or that road-users made significant adaptions to the situation. Commuters reported no or few adaptions, effects and consequences, as did truckdrivers and taxidrivers.

Our understanding or explanation for the lack of effects of the capacity reduction, was that the Smestad tunnel had enough capacity, also with one instead of two lanes in each direction, to carry the traffic load it had before the capacity reduction (AADT about 50 000, maximum load one direction about 1 400 vehicles per hour). The traffic volumes are about equal in both directions, also in rush hours, and much of the traffic is dispersed throughout the day. Hence, peak traffic volumes are probably lower than for many other roads with similar AADTs. Interestingly, these findings caused debate among professionals working in the Oslo area, and some doubted that the results could be correct. This concerned among others the maximum capacity per lane per hour, and we understood that this had been discussed before the capacity reduction was effectuated.

So what? What can we learn from case Smestad tunnel?

Three key findings stand out as important:

The effects and consequences were less severe than expected: The effects (increased congestion), and thus the adaptations and consequences, were significantly smaller than expected and communicated. This is a well-known phenomenon from the research literature, see e.g. Cairns et al. (2002).

***Expectations of* severe congestions caused major traffic reductions the first days**: The successful information campaign and the press-coverage, warning about severe congestions, caused many road-users to adapted in ways resulting in significantly reduced traffic (33 - 37 per cent during rush hours) in the Smestad tunnel on the first day, and higher average speeds than in the normal situation. The information from the press, that the expected congestion had not manifested, caused road-users to return to their normal routines, and traffic increased rapidly to normal volumes. This illustrates the adaptability among road-users in urban transport systems, that also is well-known from the research literature, see e.g. Cairns et al. (2002), Noland and Lem (2002) or Tennøy et al. (2019).

Two lanes in the Smestad tunnel were sufficient capacity for AADT 50 000 vehicles: When the traffic had stabilized, there was as much traffic in the Smestad tunnel during rush hour as in the normal situation. However, the reduction in average rush hour speeds were not severe, and only minimal adaptions and consequences among different groups of road-users were reported. This led to discussions, that provided new insights into traffic issues for some.

The study and the results can open up new ways of thinking and for new opportunities in developing more efficient and sustainable cities and urban transport systems, by:

- Providing new insights on congestion in urban road transport systems, traffic engineering issues and the traffic in Oslo
- Expanding understandings of what interventions are possible and relevant in developing more efficient and sustainable cities and urban transport systems
- Illustrating that building replacement capacity might not be necessary if, for various reasons, road capacity is to be reallocated for other uses
- Contributing to reduce investments in road capacity expansions in urban regions aiming at zero-growth or reduction in road traffic
- Providing transport authorities with a better knowledge base for reducing disadvantages associated with future tunnel rehabilitation projects in urban areas
- Pointing at the need for more research and competence concerning congestion in urban transport systems and traffic engineering

This might accelerate implementation of measures that contribute to achieving prioritized goals, including the zero-growth objective.