

Summary:

Impact of main road investments in Bergen and Oslo

The Bergen and Oslo toll rings and infrastructure investment schemes

When the toll rings around Bergen and Oslo were established in 1986 and 1990, respectively, they were part of a major scheme to speed up road investments. In Oslo twenty percent of the revenue has been allocated to public transport investments.

The project studies the impact of these major investments in road and public transport infrastructure on car travel, public transport services and safety and environmental aspects.

The investment schemes

In Norway there is more than 70 years experience in using road toll payment as a financial instrument for building bridges and tunnels. Up to 1980, less than 5 % of the total road investments came from toll revenues. Today about one third of the national road investment budget is based on toll fees. The urban toll rings are important contributors to this budget.

The tolling tradition was one background for the toll rings in Bergen and Oslo. More important though, was congestion problems in both cities, especially Bergen. Moreover, increased car ownership, urban growth and a national road investment profile that benefited remote regions contributed to a common understanding among planners and local politicians that infrastructure investments had to be sped up.

In *Bergen* a specific road investment scheme was established as part of the toll ring scheme. The toll ring was situated very close to the city centre with no/few possibilities to avoid the ring while going from one part of the city to another. The period of operation was originally from 0600h to 2200h, Monday to Friday. Today it has changed to 24 hours a day, Monday to Saturday. Only motorists driving into the CBD area are tolled. A single ticket was originally 5 NOK and is now 15 NOK (€1.8). The investment agreement was favourable to the Bergen community. Toll revenues amounted only to 25 % of the total investment scheme and were matched by the same amount of extraordinary state funding. For the period 1986-1997 the total road investment scheme in Bergen was 2.5 billion NOK (1996-NOK). Main investment projects in Bergen were principal roads into town from west and north, some improvements to the south, and a large road intersection connecting the three transport corridors of the city.

In *Oslo* the investment scheme also included public transport investments like buss lanes, metro lines and terminals. The toll ring was located 5-8 km from the city centre forcing all car drivers to pass the toll ring while going from one part of the city to another. Only motorist driving into the city area are tolled, and the period of operation is 24 hours all days. A single ticket was originally 10 NOK and is now 20 NOK (€2.4). Both in Oslo and Bergen seasonal passes were available. Toll revenues amounted to 55 % of the total investment scheme, while government co-funding covered the remaining 45 %. For the period 1990-2001 the total road investment scheme in Oslo was 11 billion NOK (current prices). Important investment projects in Oslo were a road tunnel close to CBD, connecting western and southern/ eastern part of the city, and tunnels from north and east into the city. Other main investments were large improvements on the outer ring road (Ring 3) and a number of road projects in the neighbour county of Akershus.

Studies of the traffic impacts of the toll rings indicate about 5 % traffic reduction the first year. In 2003 87 000 and 245 000 cars passed the toll ring (one way) in Bergen and Oslo respectively.

Traffic development

Many studies indicate some level of induced traffic connected to increased road capacity (Goodwin 1996, SACTRA 1995, ENO 2002, Cervero 2003). The degree of induced traffic varies with city size, congestion level and the quality of public transport. Further, induced traffic related to single projects is more likely to occur in outer parts of the city, as traffic down town is generally suppressed by congestion and parking restrictions.

In an international context the cities of Oslo and Bergen are relatively small. Oslo is the capital of Norway and has appr. 1 million inhabitants (Oslo and Akershus county), while the Bergen region is about one third of Oslo's size.

During the 1990's the *Oslo* region experienced a traffic growth in line with national growth rates (+ 1.9 % per year) in spite of a much stronger increase in all the drivers of mobility like population, employment and income. This leaves little room for significant induced effects of road investments on car traffic, even though Oslo's share of national road investments increased from 11 to 23 %. Our interpretation is that the total volume of car traffic only to a minor extent is influenced by the investment program. One must also consider that rush hour travel times were not reduced during the period.

Bergen experienced a higher traffic growth than Oslo during the 1990's (+2.7 % growth per year). There are several reasons for this:

- The city and the region had been a laggard with respect to car ownership
- The congestion problems were severe, but have more or less been solved
- Urban sprawl took place beyond the surrounding mountains
- The local government gave low priority to public transport

In light of above arguments, it is almost surprising that Bergen did not experience even higher growth rates.

Looking at parts of the city, traffic growth in outer parts of *Oslo* was stronger than in the inner parts, as expected. The surrounding county Akershus experienced a traffic growth of 2.5 % per year whereas Oslo had a growth of 1.1 % per year. However, due to urban sprawl Akershus also experienced a much stronger increase than Oslo in the drivers of mobility, such as jobs and population. On the basis of the data available in this study, we have not been able to determine the role of road investment on urban sprawl, as scarce land resources and high prices on land will always tend to shift the growth of the city outwards. However, research suggests an interaction between urban sprawl, increased car ownership and main road investment.

Both in Oslo and Bergen growth rates in *main transport corridors* has been studied. Due to topography both cities have three distinct major transport corridors. In both cities, the findings indicate that employment and population growth contributes more to explain traffic growth in corridors than increased road capacity.

When it comes to *route choice*, there are some distinct effects of road investments. In Oslo, traffic growth occurred on the improved main roads both in the toll ring and at the city border, while there was no growth on local roads. Closer to the city centre, traffic statistics indicate a reduction by 20 % in local traffic crossing a central ring road.

In Bergen, traffic entering the city centre did not increase, while through traffic around the city centre increased by 7 % per year. Further, in the southern corridor, traffic volumes decreased on local roads, while there was a strong increase on the principal road. Thus, the goal of diverting traffic away from where people lived or stayed was to a large extent achieved.

Public transport

During the 1990s there has been a decline in the number of public transport passengers in all of the larger Norwegian cities. Bergen has experienced a larger decrease than other cities due to restricted subsidies and as a consequence increased ticket prices and reduced supply (vehicle km). Actually, the negative trend in Bergen is fully explained by a public transport model that includes fares, supply, petrol prices and income.

Oslo, on the other hand, has experienced a better development than expected by the same model. Since this positive deviance is not due to prices, supply nor income, improved public transport quality probably played an important role. Main improvements achieved through the investment program have been reserved bus lanes and fully connected metro services. Compared to Bergen, Oslo has a rather extensive public transport system.

Travel time and departure time

Reduced congestion and travel times were a main goal of the investment packages. In *Bergen* travel times have clearly been reduced. In the northern corridor delays were on average 30-45 minutes during the morning rush hour and 30 minutes in the afternoon. In the western corridor road delays were 30 minutes

both during the morning and evening rush hours. Both approach roads are now without delays after the building of a four-lane expressway. In the southern corridor delays have been around 15 minutes the last 20 years. In the southern corridor congestion problems also occur around newly developed industrial areas close to Bergen airport.

In *Oslo* travel times have been measured on a yearly basis on 18 routes. Over time there are only minor changes in travel times and delays. In total, there is a small improvement in average speed during the morning rush hour, but no significant changes in the afternoon. Increased road capacity thus seems to have counter-balanced the growth in traffic with a small positive margin. Improvements have occurred along the outer ring road (Ring 3). To the north, average travel speeds are also relatively high. To the south, delays have increased due to population growth. To the west, the situation is relatively unchanged. Delays here are the largest in the region. A peak hour round trip from west has in total an average of 30-40 minutes delay, depending on the route. Road sections 10-15 km from the city centre have the largest delays. The investment scheme strategy has been to complete projects from the inner parts of the region and outwards.

An important aspects in both cities have been increased road standard and raised speed limits. These improvements have affected the $\frac{3}{4}$ of the traffic runs that outside rush hours. Car travel is now conceived as more convenient and predictable. In Bergen, the tunnels have, in addition, contributed to shorter travel distances.

Changes in the *departure times* are most likely to occur if the congestion situation is altered. There have been only minor changes in travel times and delays in Oslo and the southern corridor of Bergen and no significant changes in departure times. However, on the northern corridor of Bergen, where congestion originally was severe, there are clear changes in departure times on working days. Here, the spread over the day shows more distinct rush hour peaks after the road investments. The share of traffic occurring during the rush hour 7-9 in the morning and 15-17 in the afternoon increased from 30 % to 37 %. This finding suggests that there is some amount of “suppressed” traffic on the shoulder of the peak hours that might switch back to the central rush hour if road conditions improved. Even though the switch back of this traffic pattern might reduce the effects of increased road capacity on average speed, the length of the peak period might still be reduced.

Transport industry

Freighters are generally satisfied with the investment packages, especially in Bergen, where delays are significantly reduced. There are still some accessibility problems connected to major freight terminals in Oslo.

Some operators in Oslo have moved their terminals way out of the city centre (20-30 km), stating that enough space and the value of land was the main location factors. But even if the quality of the road network is not mentioned explicitly, it is obvious that given the operators relative remotely location, a developed trunk road system is a prerequisite for effective distribution of goods in the region.

Land use

Both Bergen and Oslo are characterised by urban sprawl. Population, jobs and shopping centres are moving outwards, even though there are some signs of revitalisation of the central parts of Oslo with respect to population growth. A substantial part of increased car travel is due to urban sprawl.

Safety and the environment

The road accident risk has been reduced both in Bergen and Oslo. But the risk reduction is slightly smaller than the national average. There is a tendency toward less severe accidents, and the trend in Oslo and Bergen is at the same level as the national average. Even though aggregate figures does not seem to reveal any effect on accident risk, specific studies of new main roads in some corridors both in Oslo and Bergen indicate rather large, favourable effects on accident risk in these corridors.

Traffic is diverted to main roads, and many main roads are constructed as tunnels. Thus large, densely populated areas are relieved from environmental problems caused by road traffic. Noise reduction is the most important element. There is no clear trend with respect to air pollution.

Overall judgement of the road investment packages

Our evaluation should refer to the aims of the investment packages. Congestion, safety, environment and public transport (in Oslo only) were the main priorities.

When it comes to *congestion* in particular, a reference to an alternative with no forced pace of investments should be made. However, to describe a hypothetical situation with regard to road supply and the reactions on the demand side is a rather challenging task. Still, the absence of improvements in rush hour congestion levels in Oslo is not necessarily an indication of failure. Our conclusion is that increased road capacity has counterbalanced the growth in traffic with a small positive margin. In Bergen, on the other hand, congestion problems have to a large extent been eliminated.

Even though *road safety* seems to have been improved, the reduction in risk levels is slightly smaller than the national average. *Environmental problems* have been relieved due to diversion of traffic away from residential areas. Due to increased income and car ownership, public transport is declining. This trend is particularly strong in Bergen with low shares for public transport in investment programs and very low subsidy levels.

Given the growth pressure in Oslo and Bergen and a traditional national road investment profile that have benefited remote regions, a forced pace of infrastructure investment in Oslo and Bergen seems to have obtained several objectives. This understanding has also filtered through to the public, as an increasing share is in favour of the toll ring, especially if the investment scheme also includes public transport.