

**Summary:**

# Environmental effects of central nodal point developments

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*Rom Eiendom AS administrates large, central areas close to public transport nodes in several Norwegian cities. When developing a new strategy for redevelopment of such areas, Rom wanted a knowledge basis for assessing transport-related consequences, as well as a specific analysis of Rom's development in Bjørvika, close to Oslo Central Station. The literature shows that central nodal point developments generate far less car traffic compared to development in more peripheral areas in the urban structure. In the concrete analysis we found that construction of office buildings for 12.500 jobs in Bjørvika will save Oslo 7.3000 car trips and 104.000 vkm by car a day compared to locating these work spaces similar to the current distribution in Oslo. This saves 12 tonnes CO<sub>2</sub> emissions, 20 kg NO<sub>x</sub> emissions and 7 kg NO<sub>2</sub> emissions a day, as well as 18 MWh of energy for transport.*

## Background

Institute of Transport Economics (TOI) has, as a commissioned work for Rom Eiendom AS, developed a knowledge base for assessing transport-related impacts and consequences of development near urban transit stations (often referred to transit oriented development or nodal point development). Moreover, a specific analysis of transport related and environmental impacts of Rom's development in Bjørvika, close to Oslo Central Station, was conducted. The aim of the analysis is to identify how much less traffic can be expected to be generated from this development compared to locating the same workplaces in more peripheral parts of Oslo. Moreover, the effects on greenhouse gas (GHG) emissions, energy consumption, and local air pollution, resulting from lower growth in traffic volumes are calculated.

This work can be viewed in light of the trend of similar developments close to central train stations in Europe and elsewhere. The objectives of such projects are often quite similar. It regards i) contributing to land use and transport development that reduces car dependence, traffic volumes and the various consequences of this (sustainable urban development), ii) strengthening urban and national economies by providing good and attractive sites for knowledge-based companies, and iii) strengthening the city's position in an increasingly more global competition. Many objections are also similar, among others that the utilization rate is too high, that the architecture is alien and undesirable, that such projects does not contribute to a better city at large, gentrification and increased social inequality.

The expected positive and negative effects and consequences of such developments are, however, only to a limited extent empirically investigated. When developing a new strategy for redevelopment of such areas, Rom wanted a strengthened knowledge base for assessing transport-related consequences.

## **Methods**

Developing this knowledge basis, we have summarized state-of-the-art knowledge regarding how residential, commercial and workplace location affect regional traffic volumes. To ensure that recent contributions to knowledge are included we have conducted a thorough literature search. By obtaining a number of travel surveys conducted in companies located in the Oslo area, we have also ensured a good local basis for comparison and for discussing conditions other than location affecting employees' travel behaviour.

In order to provide a sound basis for assessing effects and consequences of Rom's development of 12.500 workplaces in Bjørvika, data from the 2009 Norwegian National Travel Survey were analysed. The analysis arrived at modal splits and travel lengths by various modes on commuting to workplaces located in five different zones in Oslo. The amount of traffic generated from commutes at work sites in the Central business district (CBD) was calculated, as well as traffic generated from commutes to workplaces on average in Oslo. The difference was used as an estimate of how much traffic is saved by constructing new office buildings and workspaces in Bjørvika. Empirical data related to transport-related GHG emissions, energy consumption, and local emissions were obtained from the literature. This was used for calculating effects and consequences of developing office spaces for 12.500 employees in Bjørvika, rather than as the current average workplace locations in Oslo.

## **Knowledge basis**

Given current theoretical and empirical knowledge, one might expect centrally located housing, retail and workplaces to generate less traffic than if such activities were located more peripheral. Particularly large effects can be expected from locating knowledge-intensive workplaces and specialized trading centrally. This has been proven in research from different parts of the world, and for decades. The main explanations for this are that central location means many people living within walking and bicycling distances to their workplace. Further, the best public accessibility is normally to these areas, as is the worst conditions for driving (queues, relatively few parking spaces). Localization in less central areas will often mean that activities are more easily accessed by car than by other modes. Housing-related activities, such as grocery stores and nurseries, should ideally be located in the residential areas they serve.

Qualities of the various modes of transport affect travel behaviour. Improvement of car accessibility, by making it cheaper, reducing queues or improving parking availability, contribute to increased shares of car usage. If improvements to accessibility by public transport, walking or cycling trump improvements to accessibility by car, these modes of transport will gain higher patronage.

Analyses of 12 travel surveys conducted in companies in the Oslo area confirmed this. Employees working in the most centrally located companies have the lowest proportion of car usage on commutes. Furthermore, variations in modal shares could be explained by variations in accessibility by different modes of transport.

## Analysis of commutes to Oslo

The findings from analyses of data from the 2009 Norwegian National Travel Survey were as expected. Car usage is far lower on commutes to the CBD (7 %) and the inner city (25 %), than they are to workplace locations in outer parts of Oslo<sup>1</sup> (44 - 63 %). Furthermore, average trip lengths for all employees working in each zone were shortest to and from jobs in the inner city and in Oslo south (22 km, round trip), while the figures for the city centre were 27 km and the average for all employees at workplaces in Oslo were 25 km. Among those driving to work, those working in CBD has the longest commutes (53 km round trip, while the average was 33 km). Trip lengths for public transport users are longer for those working in eastern Oslo (34 km round trip), followed by those working in the city centre (33 km). Average trip length for commutes made by public transport was 29 km.

When multiplying, for the zone distinctive car shares and average travel lengths by car, it was found that workplaces in CBD generate far less traffic per employee (3.7 vehicle kilometre (vkm) per employee per working day, roundtrip) compared to the average of all workplaces in Oslo (12 vkm per employee per working day). Workplaces located in CBD generates twice as many person kilometre (pkm) per employee per day (21.2, roundtrip), compared to the average for all workplaces (11.4). This is illustrated in figure S1.

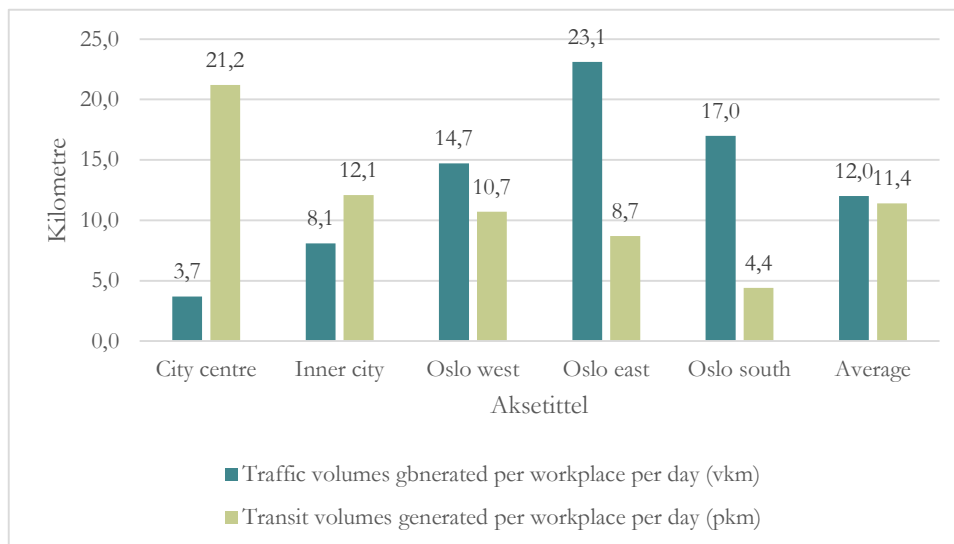


Figure S1: Average total vehicle kilometres travelled by car and person kilometre by public transport per employees at workplaces located in different parts of Oslo (roundtrip).

<sup>1</sup> The comparison was made to the average modal splits and average travel lengths for workplaces located in Oslo municipality, not for the Oslo Metropolitan area. This was done in order to simplify the analyses. If including the metropolitan area, the differences would have been larger.

## Analysing effects of Rom's development in Bjørvika

When analysing environmental consequences of Rom developing 12.500 new office workplaces in Bjørvika compared to if they were located as current average in Oslo, it was assumed that those working in these building have the same travel behaviour as others working in the CBD.

The difference represents 7.300 car trips per day, or more than 1.5 million car trips per year (230 working days per year). Traffic volumes, as vkm by car were also analysed. Findings indicate that Rom's development in Bjørvika will generate approximately 46.000 vkm by car per day, while the same jobs would generate about 150.000 vkm by car being located according to the current distribution in Oslo. This represents a difference of 104.000 vkm by car per day, or more than 24 million vkm per year.

Further, effects on energy consumption, GHG emissions and local emissions were calculated. The calculations included emissions from and energy consumption for public transport. Despite the fact that expansion in Bjørvika also increase the number of passenger km by public transport, it was found that developing workplaces here saves the city for 18 MWh for transport, 23 tonnes GHG emissions, 20 kg NO<sub>x</sub>, and 7 kg NO<sub>2</sub> per day. Annually, this sums up to 4 GWh, 2800 tonnes GHG emissions, 5 tonnes NO<sub>x</sub>, and 1,5 tonnes NO<sub>2</sub>

Good public transport and limited parking access are important conditions for delimiting car usage and traffic volumes. Parking capacity in the project means that approximately 4% of employees can park in the facilities. The project also includes measures to increase capacity at Oslo S and thus to help improve accessibility by public transport. These aspects will further help reduce commutes by car for employees in the area.

The main conclusion is that Rom's new office spaces located in and around Bjørvika provides significant savings in the number of newly generated car trips and traffic volumes (vkm), compared to if the same workplaces were located elsewhere in the city or the region. This contributes to less growth in energy consumption, GHG emissions, and local air pollution, caused by road traffic.

## Concluding discussion

An important question is whether one can expect similar effects when comparing workplaces developed in centrally located nodal points to developments in other locations, in other cities as well. The literature review revealed that similar effects have been found in a number of similar studies elsewhere. We conclude, therefore, that one can expect to find same types of effects in other cities too, while the *strength* of the effects is likely to vary. Likewise, we concluded that one could expect less traffic generated by housing, commercial and service activities located in central areas of cities than by the same activities located elsewhere in the urban structure.