Institute of Transport Economics
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Summary

Effects on traffic and emissions of densification in nodes in Bergen, Kristiansand and Oslo

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We have investigated if, and to what extent, densification in nodes contributes to less car traffic, and how possible effects varies with functions and other properties connected to the nodes. We found that workplaces and dwellings located in nodes generates less car traffic per inhabitant and per employee than dwellings and workplaces located outside the nodes, city centre or the inner city. However, the traffic reducing effects were significantly higher for the city centre than for the nodes. That means that cities who wishes to minimise the amount of car traffic and emissions should locate new dwellings and workplaces in and in immediate proximity to the city centre, before considering the nodes outside the city centre. To increase the traffic reducing effects of locating dwellings and workplaces in nodes, the main approach should be to reduce private car accessibility to better accommodate bicycling as well as make the nodes more walkable and urban.

Background

The densification of public transport nodes is defined as an important step in strategies to reach the government's goal of zero growth in private car traffic in Norwegian cities. This is based on an understanding that dense development close to high standard public transit gives more inhabitants, employees and visitors the possibility to choose public transport, but also walking and bicycling for travelling to and from the area. Thus, dwellings and workplaces generates less car traffic per inhabitant and per employee. Further, that co-location of dwellings and local retail, service and the like, in nodes, contributes to the inhabitants walking, bicycling or shorter car travel for these kinds of trips. There is, however, few Norwegian studies documenting if and to what extent localisation in nodes contributes in generating less car traffic, and how possible traffic reducing effects varies with functions, mixed use and other properties of the nodes. This project will contribute to fill knowledge gaps on the effects of the nodal point strategy often chosen as an important part of the integrated land use and transport planning in Norwegian cities.

Research questions

The overarching question is to answer if and to what extent densification in nodes can contribute to achieve the goal of zero growth in private car traffic, as well as under which conditions. We have operationalised this question into the following research questions that we aim to answer in this project:

1. How much car traffic and emissions are generated by activities located in four predefined case nodes compared to how much car traffic and emissions are generated by the same type of activities in other parts of the municipality and in the city centre?
2. How does the traffic reducing effect vary with the types of functions and the degree of mixed use in the nodes?
3. How does the traffic reducing effect vary with the characteristics of the case areas themselves?

4. If and to what extent densification in nodes outside the city centre, can contribute to achieve the goal of zero growth in private car traffic, and which characteristics are crucial in this regard? What is the benefits of densification in nodes outside the city centre compared to densification in and in immediate proximity to the city centre?

The project is a case study. We have analysed four nodes in three different Norwegian cities: Vågsbygd in Kristiansand, Danmarks plass in Bergen and Nydalen-Storo and Bryn-Helsfyr in Oslo. We have estimated the amount of traffic generated in the different nodes based on data from The Norwegian National Travel Survey (NTS), gathered data connected to different characteristics of the nodes (statistics, registrations and interviews) and based on this we have analysed how different features of the nodes influences the pattern of the car traffic.

The amount of traffic and the effects of nodes

We have calculated the amount of vehicle kilometres generated per trip for inhabitants and employees in the four predefined nodes, in the city centre of the three cities, the remaining part of the municipalities as well as the inner city of Oslo based on data from The Norwegian National Travel Survey from 2009 and 2013/14. There are inaccuracies in the material that leads to uncertainties, but we still claim that the tendencies that the data shows are valid.

The four nodes are in three cities that are quite different. These differences could result in quite substantial dissimilarities in the amount of traffic generated per inhabitant and per employee. Therefore, we have calculated the *relative* effect of the nodes to make possible to compare the amount of traffic generated in different parts of the municipality or city. Thus, we can also (to a certain extent) discuss differences between the cities.

The effect of the nodes for inhabitants' trips compared to the rest of the municipality (excluding the node and the city centre) varies from 1,7 at Bryn-Helsfyr to 1,2 in Nydalen-Storo (see Figure S 1). The node-effects for Oslo are lower than they would have been be if we used the borders of the functional city of Oslo, instead of Oslo municipality, when we calculate traffic volumes generated in 'the rest of Oslo'.

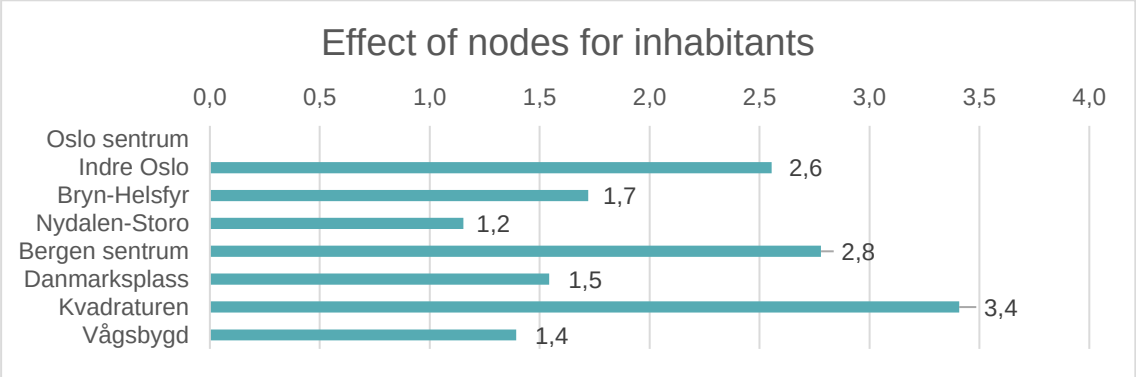

Figure S 1: Effect of nodes for inhabitants in nodes and city centres versus the remains of the municipality. High numbers indicate a high effect of the node. Some of the number of respondents for inhabitants (N) in the data are low which creates uncertainty for the validity of the data. The effect for Oslo City centre (Oslo sentrum) is not calculated due to a low number of respondents).

This means that inhabitants in the dwellings located in the remaining part of the municipality generate 1,2 to 1,7 times as much car traffic as the inhabitants in the node. The effects of the nodes are even larger for the city centres (as well as the inner city of Oslo) when compared with the remaining part of the municipality. The effects vary from 2,6 in the inner city of Oslo to 3,4 in Kristiansand (the effect for Oslo City centre is not calculated due to a low number of respondents).

When we measure the effects of locating workplaces in the nodes instead of the remaining part of the municipality (outside the city centre and the node) we find that the effect varies from 1,1 at Bryn-Helsfyr to 1,4 at Vågsbygd and at Danmarks plass (see Figure S 2). This means that workplaces located the remaining part of the municipality generates 1,1 to 1,4 times as much traffic as the ones located in the nodes. The effect of locating workplaces in the city centres and the inner city of Oslo is significantly higher than for the nodes, and varies from 2 in Kristiansand to 3,9 in the city centre of Oslo.

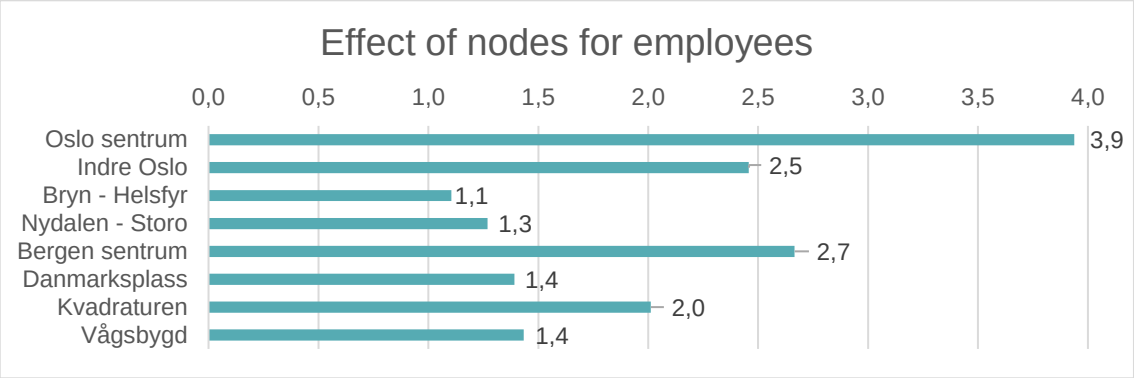

Figure S 2: Effect of nodes for employees in nodes versus the city centre and the remaining part of the municipality. High numbers indicate high effect of the node. The number of respondents is low for Vågsbygd (N=26) which creates uncertainty here.

Effects of type of function and mixed use in the nodes

What kind of functions that are located in a node, influences how much car traffic that is generated per inhabitant. We found that all the nodes generate less car use per inhabitant than in the remaining part of the municipality (city centre and nodes excluded). All nodes except Vågsbygd, have significantly higher shares of walking and lower car shares than the remaining part of the municipality. This could indicate that god access to retail and service in walking distance leads to less car use and more walking. We were not able to differentiate between the inhabitants work trips from their other trips due to a low number of respondents in The National Travel Survey. This makes the material hard to analyse in a definite manner when it comes to the effects of the nodes for inhabitants.

What kind of companies that are located in the nodes influences the trips of the employees. Regionally recruiting businesses (mainly large office workplaces) generates longer work trips than other types of businesses. It is therefore crucial that these are located in the areas of the city where the private car shares are lowest. This is normally the city centre, which is also true for our cases. In cities like Oslo it can however be necessary to locate some businesses outside the city centre due to the size and role of the city. When this is required the location should stimulate towards a low car share for work trips.

Effects of other characteristics of the nodes

The accessibility with different modes of transport influences how inhabitants and employees travel. Accessibility for cars are higher and the accessibility for other modes of transport are lower in the nodes when compared to the city centre but opposite when the node is compared to the remaining part of the municipality. In all the cities, the car share is significantly lower than in the nodes, that in turn has lower car shares than the remaining part of the municipality. This influences how much car traffic that is generated. When we compared the work trips to Bryn-Helsfyr with the ones to the city centre of Oslo, there are some differences. The share of regionally recruiting businesses are more or less the same and the work trips to these areas are longer than in the rest of Oslo, but the vehicle kilometres per work trip is lower in the city centre due to a lower share of car use (11 per cent) than Bryn-Helsfyr (47 per cent).

The investigated nodes have very good access to public transport, but still have high car shares on work trips (from 40-58 per cent). The accessibility of parking varies but there seems that the availability of parking is ample and that all that wants a parking space can find one (with or without a parking fee). Since the nodes have very good public transport access, but the car shares remain high on work trips, it is probable that further restrictive measures against private car use can be used to achieve reduced traffic and less emissions. The introduction of further parking fees (including parking fees for work places) can contribute to reduce levels of car use especially if it is combined with the removal of parking spaces as well.

Further, the accessibility for bicycles was assessed as relatively poor for all the nodes except from Vågsbygd, and the bicycle share was low as well, except from Vågsbygd. We know from earlier research that better facilitating bicycling, especially the bicycle infrastructure leads to increased levels of bicycling. The further building of infrastructure to and within the nodes might therefore contribute to increased competitiveness for the bicycle versus the cars and lead to less car traffic.

Walkability, that in our definition also includes urbanity, influences how people travel, particularly within the nodes. In our opinion, none of the four nodes have good walkability and none of them are considered very urban in their character. This points to the potential of the nodes when it comes to walkability and urbanity, and to strengthen the competitiveness of walking and reduce car use.

The usefulness of densification in nodes to reduce traffic and emissions

The main purpose for this project has been to investigate if and to what extent the densification in nodes outside the city centre is a good strategy for achieving the goal of zero growth in traffic, also compared to the alternative of densification and transformation in the city centre. Based on what we have found, the short answer is yes, if new dwellings and workplaces are located in nodes outside the city centre, the new dwellings and workplaces will generate less car traffic than if they were located outside the node and outside the city centre. It is useful when it comes to minimising the amount of traffic and emissions, to locate dwelling and workplaces in nodes rather than as sprawl. Our findings also show that the effects are even larger if dwellings and workplaces are located in and in close proximity to the city centre, than in a node.

If the nodes can be developed in ways to generate less car traffic

We have deliberated how the cities to a greater extent can achieve the zero growth objectives to minimise car traffic generated by the functions located in the nodes. Summed up, the following measures could be implemented:

- Steer developments of housing an workplaces towards the nodes that are located in or close to the dense urban structure, which in smaller cities will be areas close to or in the city centre
- Develop nodes with a high density of functions and a certain degree of mixed use
- Locate regionally recruiting businesses with high land use intensity to areas that have the best public transport access and lesser car accessibility (normally the city centre first and then the nodes)
- Introduce parking restrictions (also for workplaces), if possible in combination with removal of parking spaces
- Develop the nodes to become more walkable and more urban
- Build better bicycle infrastructure and facilitate bicycling in general