KVU OSLO-NAVET

Second opinion

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Basler & Hofmann

Date	19 February 2015
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Experts advice for Oslo Navet

Based on updated information the project wants to challenges the experts to write a short memo summarising their advice for Oslo Navet. This involves advice earlier have given during workshops in Norway, and also adding any comments to the four concepts left after the second screening.

1. Introduction

Ulrike Huwer and Gisela Stete are part of the expert team of Norconsult to support the development of the KVU Oslonavet.

Ulrike Huwer has a wide range of experience in urban transport strategies, development of public transport and its interchange points, station design and pedestrian flow studies as well as the design and feasibility of infrastructure for all modes of transport. 18 years' experience in transport planning in German, UK and since 2004 in Switzerland. She can contribute the experience of the Zurich success story of developing puplic transport and traffic management combined with an emphasis on mobility culture.

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We appreciate very much the process of the KVU. We were early involved, well informed and could take part in important discussions of the team. The workshops and the discussions have made it possible to ask questions and give remarks, facing the works with our own experience of other cities. Especially the workshop of the concept evaluation was a good method: the international experts were discussing at one table and at the same time other interdisciplinary local teams at other tables. Comparing and discussing the results of the different tables was very good and showed the depth with which the overall network was analysed and developed as well as identified points that needed to be deepen.

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Basic presentations and input:

_ **The Zurich experience (April 2014)**
The presentation gave an overview on the transport policy and public transport strategy of the Zurich area. Focussing on the functions and the playing together of S-Bahn, Tram and Bus. Main points:
Metropolitan area Zurich, transport policy and transport achievements
Cross Rail / Suburban Railway System (S-Bahn)
LRT – across the city borders and within the city (Tram)
Mobility Strategy – PT is only one pillar

_ **Interchanges and feeder systems (June 2014)**
Pointing out the importance of high quality interchanges – from Train / S-Bahn to Tram / Bus as well as between Tram/Bus and Tram/Bus. High importance has also other feeder systems as taxi and good walking conditions and especially cycling facilities. In the first part of the presentation different types of interchanges in Zurich are presented, in the second part Swiss examples of bike & ride facilities and the regulations and planning guides were introduced.

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_ Memo 'Rolling Stock Capacity used in Switzerland' (UH Dezember 2014)

Statements and recommendations:
We expected to come to a tram-city and found a bus-city. The street life is dominated by modern green and red busses (corporate design). Trams are looking like the forgotten old brother. Where is the corporate design here?

In the street life and the station design we were missing cycling infrastructure. Doesn't the bicycle has a role as a feeder to PT for low density housing? We noticed a bicycle rental system in the City of Oslo but no systematically connection with PT. Potential to address a new market for PT and changes in the modal split.

Many roundabouts make it difficult for pedestrians and for the priorisation of PT. Traffic management seems not to be a big issue at the moment. Another potential to make PT more attractive.

Modern rail services, lot of infrastructure, many ideas and visions on how to improve single parts of the infrastructure. However: Question of the future demand and its localisation is not yet clarified.

Land use and population analyses are an important tool for the understanding of the network. Where are the development areas and where are the high density areas? Which development might be activated by the transport development.
To solve the capacity issue it's important to understand, where capacity needs to increase for the future development. Is it only the point / tunnel in the centre? Are there other points or not? What result does the needs assessment show?

New infrastructure should help the urban development and offer a sustainable growth of the city. The aim is to improve the network instead of improving the infrastructure. Examples in Switzerland and Germany show that a good PT service needs to be in place before people moving into the development areas. This is an important precondition to reduce car dependence and to obtain a modal split in favour of PT.

To deal with the capacity issue in the centre depends and will also influences the system as a whole. I think it needs to be seen as one corridor, where you need to define what capacity can be offered in the underground with rail/metro/... (with and without the existing ideas for additional tunnels) and what on the surface above with tram/bus/... and how do they play together. From where to where do people want to go? The 'playing together' is then very much a question of where are the interchange points and how are they designed.

Tram operates in the same functionality and parallel to the bus. Metro and bus have most passengers. Apart from Nationaltheatre and Jaernebarnet only the bus has interchanges with rail (except of the Tram in Skoyen), therefore interchanges are focused on NT and JB. Many routes are faster and more comfortable through the centre than on other interchange-relations. This leads to high density in the

centre because of the interchange options and low importance of interchanges anywhere else.

Functions of the different modes need to be defined. Which one serves longer distances which is feeder for the others? Especially the role of the tram needs to be cleared.
Interchanges are necessary. Capacity increase (number of people reaching the inner city) is only possible with interchanges – not with more direct lines.

Tram = Metro

- Tram should become functionality of the metro, support the metro
- tram needs to be faster, priorisation in the streets necessary
- perhaps less stops
- surely more links with bus, perhaps more links with rail

Bus = Feeder and connecting system

- Bringing people to metro/tram and rail
- Connecting interchanges, offering direct tangential routes
- reduce demand in the inner city

Bicycle = extended accessibility of interchanges.

- the access area of a PT-stop or station is six times as big as by walking
- the last mile is faster by bicycle than with PT
- Cyclists reduce peak load of PT in the centre
- Bike & Ride offers access to PT for a new group of people
- Bicycle rental systems in combination with PT extend the options for more multimobility
- Bike & Ride infrastructure needs to be introduced. Standards for interchanges need to be defined, where cycling has a potential to improve the accessibility of the stops and stations.

Pedestrian = as the feeder in near space

- sufficient wide sidewalks in the feed of stations and stops of Tram and busses
- barrier-free accessibility of stations (without detours or disabilities)
- easy access
- sufficient waiting areas

With a systematic linking of different mobility services the observed increase - especially among the younger generation - of a multimodal transport behaviour is promoted.

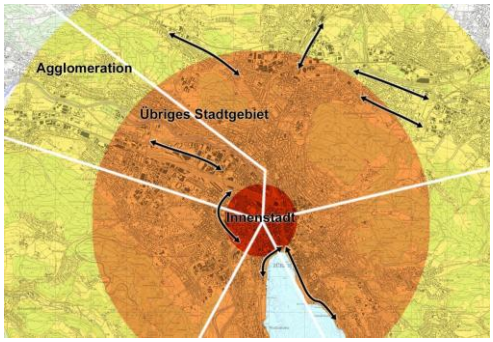
Complement and supporting the expansion of PT mobility management should be systematically implemented as a strategy to influence the modal choice to stimulate and to facilitate a more environmental friendly mobility. By means of “soft” measures (communication, organization, cooperation, services, etc.) people should

be encouraged and enabled to reduce motorized private transport and to use PT as an environmental friendly alternative. This includes financial incentives such as comprehensive parking management in the centers or the provision of jobtickets or a mobility card that combines the use of PT with discounts for carsharing, bike rental and use of taxi.

Tram and bus are running on the streets and have a high potential to achieve better public spaces. At the same time space on the streets is limited and it needs to be decided how the space is distributed. It's important that the PT vehicles fit into the streets. Vehicles longer than 35 meter (e.g. tram trains) offer high capacity. However barrier free stops for such long vehicles are often very difficult to integrate in an high quality urban space.

Integrating PT in the street surface is often only possible when car traffic is reduced. At the same time this is a necessary step necessary to achieve the overall modal split change from the car to PT. Priorisation of PT is not only possible by separated lanes, even more important is the priorisation at junctions (see input Traffic Management / Nov 2014).

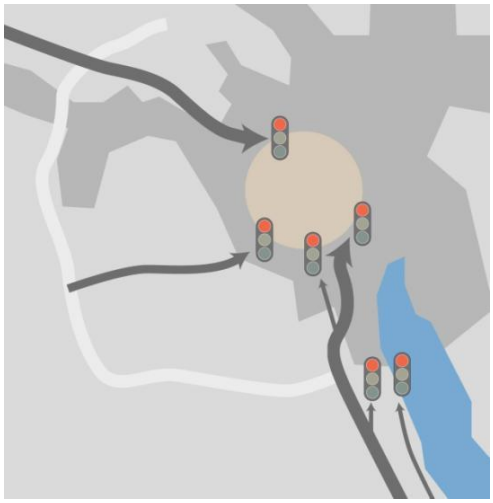
Additional input on Traffic Management (UH, Memo November 2014)
For any new system an attractive feeder system with tram and busses requires changes in the managing of the streets. PT has to be prioritized so that travel time is only influenced by breaks at the stops but not at any traffic junctions or jams. Street design and traffic management can fulfill this. To reach good results it needs to be accepted that capacity for car traffic decreases.
Wherever possible separate alignments should be achieved. Broad sideways and cycle lanes should not be touched, as walking and cycling playing together to reach a higher share of pt. At junctions with traffic light pt needs direct green, at roundabouts special measures. In general it’s easier to manage traffic with traffic lights than with roundabouts.
If a separate alignment is not possible, a timed priorisation can help the pt. Traffic junctions need to play together and need to be influenced by the pt: when the bus reaches a stop or another defined point, he announces his arriving and the system prepares the free flow for the bus (empty necessary lanes, preparing the green for the bus over the following lights). This system requires that only such an amount of traffic is in the system as queue lengths can be handled (enough ‘stacking space’) without disturbing pt. Critical junctions need to be defined where car traffic can be stopped in the case that the system is full (only possible for the traffic flow into the city center, e.g. to the second or third ring).
In Zurich all traffic lights are controlled in one traffic management center. The amount of traffic into town is controlled and the access for cars into the city can be limited. The traffic lights at the city boarders are used to control the incoming flow so that only as many cars get in as can be handled. With sensors placed on the roads, the system reacts to actual traffic volume. This means automatic adaption of traffic lights.



Legende:

Innenstadt - übriges Stadtgebiet - Agglomeration (verkehrsabhängig gesteuerte VRA) — Management depends on the amount of traffic

Städtische Hauptein-/ ausfallachsen (zeitabhängig gesteuerte VRA) — Urban arterials with timed management



Traffic lights at the city boarders to control the flow into town - automatic adaption according to the traffic volume with sensors

To speeding busses and trams up there are three working points:

1. Routes need to be unobstructed by private cars between intersections by creating dedicated tracks and separate bus lanes, including the abolishment of parking places along the roads with trams and major bus-lines.
2. A traffic control system with automatic vehicle location. So the control centre – but also the driver on a cab display – is informed at any time of timetable changes and disturbances and it is able to intervene with prepared corrective and assistance measures. Punctuality and therefore regularity can thus be considerably improved.
3. The SESAM system: Maximum priority for public transport vehicles at traffic lights. According to the principle, that trams and buses do not need a long green light but do need a green light when they are approaching an intersection, Zurich has developed a control concept for traffic lights which advantages public transport. The system can be used by every tram and bus at all intersections regulated by traffic lights and independently of the time-table. When traffic lights are located directly after stops, the tram or bus signalises its arrival at the stop. After 10 to 15 seconds the light switches green and stays on until the departure signal is given after the vehicle has passed.

These measures do not only help to attract pt. They also help to restrict car traffic in general and with this to achieve the aimed change in modal split.

3. Intermediate KVU-results

Stage of work

The second screening of concepts has now officially been approved by the client and we are now analysing four concepts further. Cost estimations have been carried out and all concepts from the first screening process have been analysed in the transport model.

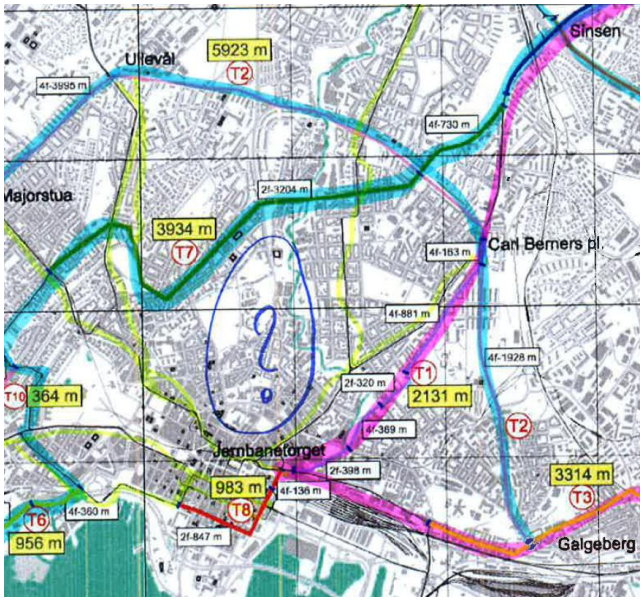
Concept Study – Screening

The relation to the land use strategies are not pointed out. An illustration showing the most developing areas as well as the most populated areas (perhaps as a background for the scenarios) would be helpful for the understanding of the scenarios – and the later evaluation. Which development might be activated by the transport development?

The superposition of spatial development and existing PT with the scenarios also show the gaps in the provisions as a function of population density and demanded relations. At what size / density which PT services make sense? Where can be linked, which can be developed and expanded?

4 different strategies are described, that summarise very well the discussions of the former workshops. It's good to see that the network effects and good interchange nodes are important in all concepts. Although it's not totally clear, which of the scenarios are stand-alone solutions and which are steps of one idea. Is the tram concept also part of the metro concepts? Seems that this might doubling the service on some routes...

Tram concept: All buses ending at the interchange nodes at the city borders? Does the concept offer enough services for Grünerlokka? No bus feeder system within ring 3 towards the tram stops (or are they just not named)?

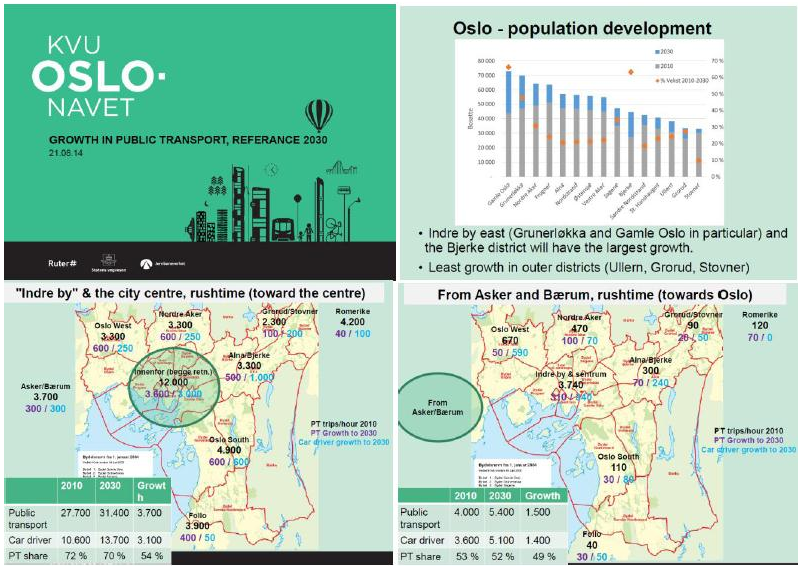


S-Bahn: 6 new stations in the city. Stations seem to be very many and very close together. Are they all necessary? And feasible? Which function does each of them has / priorisation possible?

Metro: 3 new stations in the city. Tram concept not included? Which role has the tram? Says: "Growth in passengers outside of the metro city are allocated to bus."

The feasibility for the alignment is suggested. We cannot see how new stops and stations will be integrated in the urban realm. The accessibility and capacity of the new stations depends very much on the location and design of the station entrances in the public space. How deep will the alignment and the stations be? Are intermediate levels possible or do the stairs and lifts directly access the surface? Are there prominent points / places were the entrances can be located? Is there space for bus stops and other feeder systems? Some typical examples might be helpful to get an idea of how they will be integrated and how good the interchange to other modes will be – to evaluate the benefit of new stations and the service in a total.

Which conclusions are taken by the modelling of the reference basis?
The plots are showing the passenger numbers of 2010. How will they develop until 2030? This would help to identify the capacity lacks (in numbers of passengers).
The population and mobility analysis (see slides included on the following page) was a good starting point. However we are missing the conclusions (perhaps a problem of the translated contents?).



Would still be nice to see some objectives resulting out of the analysis of the transport structure/market and the spatial development. With these objectives it will be easier to describe how good the concepts are in fulfilling the future mobility demand.

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Date	28 March 2015
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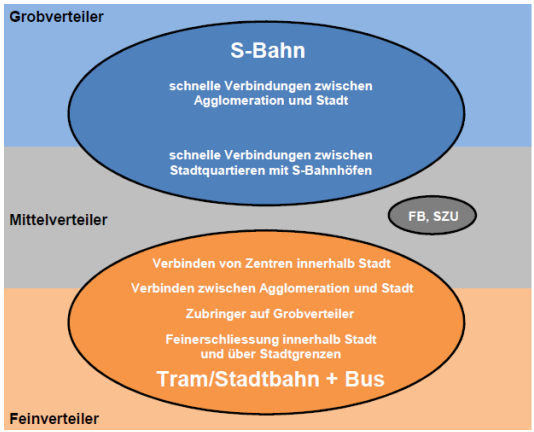

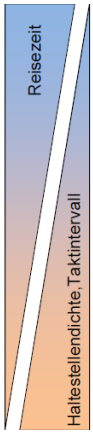

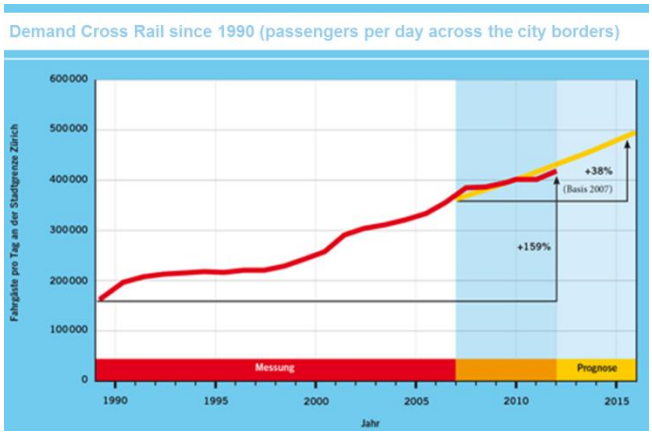

Metropolitan area Zurich, transport policy and transport achievements
Cross Rail / Suburban Railway System (S-Bahn) for the quick connections between the suburban agglomeration and the city as well as quick connections between the different stations within the city. Connections between the different centres of the city, connections between suburban areas and the city, feeder system for the S-Bahn and the coverage of the whole area is provided by tram (within the city as well as across the city borders). PT is only one pillar and is integrated in a Mobility Strategy that covers all modes of transport.

_ **Interchanges and feeder systems (June 2014)**
Pointing out the importance of high quality interchanges – from Train / S-Bahn to Tram / Bus as well as between Tram/Bus and Tram/Bus. High importance has also other feeder systems as taxi and good walking conditions and especially cycling facilities. In the first part of the presentation different types of interchanges in Zurich are presented, in the second part Swiss examples of bike & ride facilities and the regulations and planning guides were introduced.

_ **Input to special topics**
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2.2 Statements and recommendations

We expected to come to a tram-city and found a bus-city. The street life is dominated by modern green and red busses (corporate design). Trams are looking like the forgotten old brother. Where is the corporate design here?

In the street life and the station design we were missing cycling infrastructure. Doesn't the bicycle has a role as a feeder to PT for low density housing? We noticed a bicycle rental system in the City of Oslo but no systematically connection with PT. Potential to address a new market for PT and changes in the modal split.

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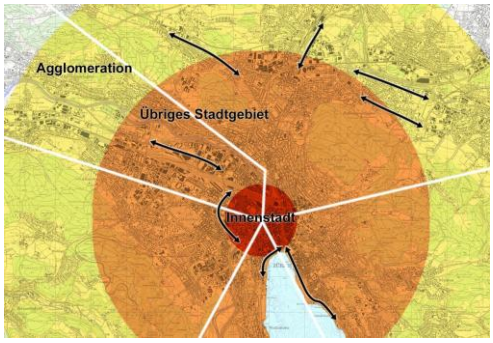

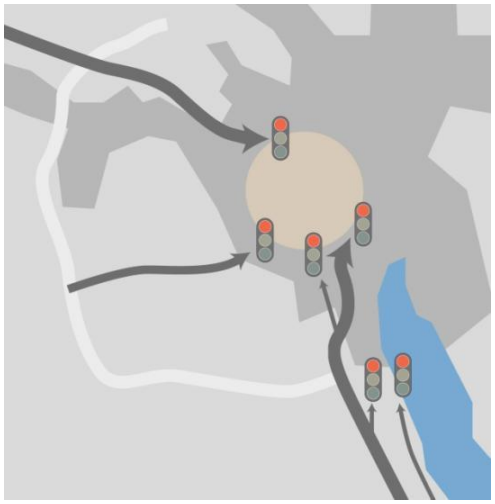

Traffic lights at the city boarders to control the flow into town - automatic adaption according to the traffic volume with sensors in streets

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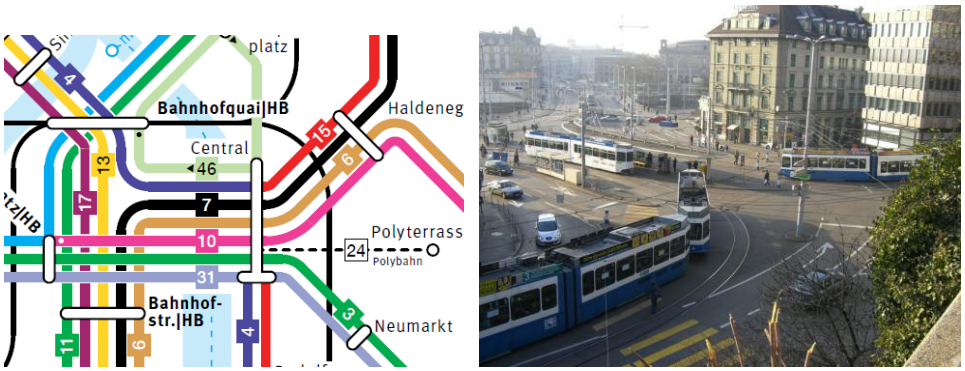
These measures do not only help to attract pt. They also help to restrict car traffic in general and with this to achieve the aimed change in modal split.

2.4 Trams and street capacity

We would strongly recommend a maximum number of 24/h as a practical capacity. More trams per hour are difficult to prioritize in the junctions and the capacities of the tram stops are not sufficient.

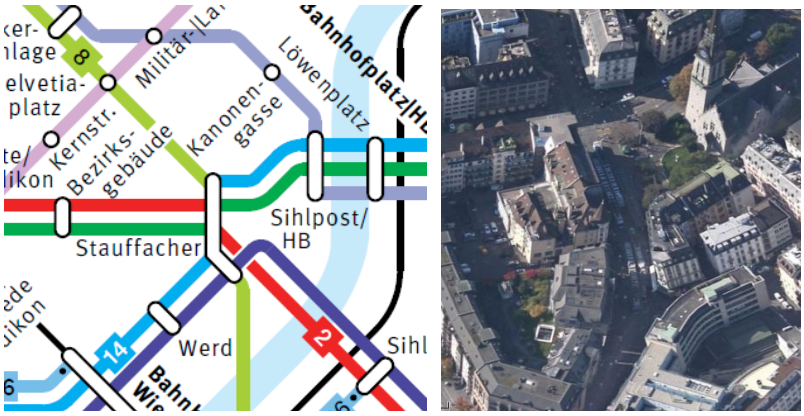
In Zurich for example there are on most important axes 16 or 24 trams/h (or a mixture of trams and busses), each line with 8/h. Only some bottlenecks of the network like the bridges have a load of up to 40/h. That's very difficult to manage and the trams are losing regularly time on these axes. This high capacity only works in the 'Bahnhofstrasse' which is a pedestrian zone.

A point where it does not work is the Bahnhofbrücke close to Central with 40 Trams/h and 16 Busses/h: Two traffic junctions are very close together and trams are hindering themselves. Since several years the VBZ is looking for a solution with a third or even fourth track on the bridge to reduce time lacks of the services.

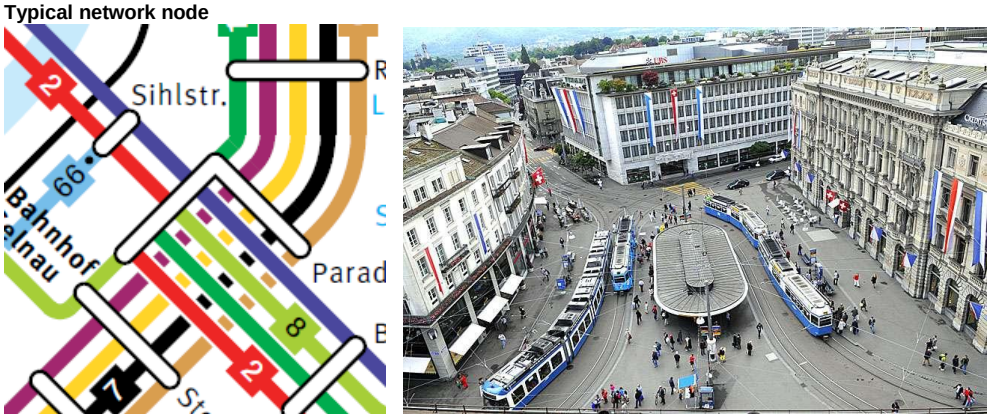


Tram services in several directions are crossing and overlapping – together with car traffic its hardly manageable.

At the interchanges/nodes of the network the meeting of more lines is possible: 16...32/h from two or three directions. These are very complex points also for car traffic, but it's possible to manage them.



Typical network node



Maximum load of a network node – without car traffic (Paradeplatz Zürich)

The Luisenplatz in Darmstadt, the central interchange in the Darmstadt public transport system in the pedestrian zone (trams and buses with a total frequency of 40 / h from three directions at three stops) shows that when observing the capacities a lively, urban area with trains and buses, pedestrians and cyclists characterizes urban life positively. Public transport is well represented in the public space and is well perceived.

A busy coexistence of public transport, walking and cycling without cars - Luisenplatz in Darmstadt

2.5 Accessibility of rural extensions

The accessibility of more rural development areas is an important part of the network. It's also important for mixed uses in these areas. Some shops and services will only be there if the accessibility of the location is ensured. Such services have an important influence on the travel behaviour of the people living in this area. They become the chance to do some short trips by walking and cycling. A liveable community can be achieved.

Which mode of pt is used needs to be defined depending on the potential of the wider area, subareas that need more or less accessibility etc. Objectives need to be defined and the different options evaluated along this aims. A few differences can be identified in general:

Direct metro lines or train connections are nice to have. However they depend very much on the service for the last mile. Only few people will live in walking distance to such stations, so another bus service is required to give access to all people of the area that should be addressed.

A tram service within this area can give access to strategically points where fast services into Oslo or other centres are provided. At the same time, such a tram itself gives access to much more people as it offers more stops than a metro service and comes closer to the people. It also provides good connections within the area. Last but not least a tram is able to support the development of a functioning subcenter within this area. Short distances for several functions can be offered and more sustainable travel behaviour can be supported.

The provision of Bike & Ride and Park & Ride at selected nodes (e.g. at the rate limits) should complement the services to ensures that a whole system is established, instead of the optimization of single services.

The decision for the right transport mode depends on the travel time and the accessed persons and the travel options (linkage to several nodes).

3. Concept Study – Screening

After the second screening four concepts are now further analysed. Cost estimations have been carried out and all concepts from the first screening process have been analysed in the transport model. The 4 different strategies summarise very well the discussions of the former workshops. It's good to see that the network effects and good interchange nodes are important in all concepts.

Although it's not totally clear, which of the scenarios are stand-alone solutions and which are steps of one idea. What happens to the tram in the metro concept is not totally clear. But can also be detailed in a next phase. Clearly a doubling of services on same corridors need to be avoided.

Tram concept: Tram is in the inner city functioning as a pt backbone connecting at the city borders with the suburban buses ending at the interchange nodes. However the tram network is not dense enough to functioning without bus feeder system within ring 3. But that's again a point that needs to be detailed later on.

With the S-Bahn concept 6 new stations in the city are shown. Probably not all of them at the end would be necessary and feasible. But still 4 or 5 new stations offer a very high potential for new transport hubs apart from the existing ones. Possible functions (for transportation and urban development) of each of them will later on show a possible priorisation.
The S-Bahn concept offers the possibility of quick connections between the sub-centres of the Oslo area and the city as well as quick connections between the different stations within the city. With this it offers much more connectivity and nodes to metro / tram / bus as the regional train services.

The Metro concept offers 3 new stations in the city. Metro stations have for sure not the same role and possibilities as S-Bahn stations, but need to be embedded in the overall system as well. Growth in passengers outside of the metro city is mainly allocated to bus.

The feasibility for the alignment of new services is suggested. Another important point is, **how new stops and stations will be integrated in the urban realm**. The accessibility and capacity of the new stations depend very much on the location and design of the station entrances in the public space. How deep will the alignment and the stations be? Are intermediate levels possible or do the stairs and lifts directly access the surface? Are there prominent points or places were the entrances can be located? Is there space for bus stops and other feeder systems? Some typical examples might be helpful to get an idea of how they will be integrated and how good the interchange to other modes will be – to evaluate the benefit of new stations and the service in a total.

A special issue in this perspective is the station Majorstuen. The new short term metro Fornebu Line forms requirements at this station as well as several other concept ideas. A new tunnel as well as an intermediate rebuilding for the next 5-10 years is discussed. To evaluate the best strategy for this station the surrounding area and its developing potential needs to be analysed. A detailed study for the area might help to decide on the phases the station needs to take.

An important conclusion for all concepts: restrict car capacity instead of increasing it. The restriction of car traffic (e.g. speed reduction, reduction of lanes, traffic lights porter, restricting the passage through to the prevention of driving relations) should be significantly increased, so that improved public transport services can achieve its full effect. Otherwise a modal shift will not be achieved.

Only K1 reduces the capacity of car traffic in principle as it depends on more space and time in the streets. For the other concepts accompanying measures need to be defined for restricting and managing car traffic. Less demand of public transport on the street surface provides the opportunity to force the improvement of cycling and walking infrastructure.

The **relation of all concepts to the land use strategies** (most developing areas as well as the most populated areas) need to be pointed out. Which development might be activated by the transport development? The superposition of spatial development and existing PT with the scenarios also show the gaps in the provisions as a function of population density and demanded relations. At what size / density which PT services make sense? Where can be linked, which can be developed and expanded? This might help to detail the favorite concept in a next phase.

Conclusion

We appreciate very much the comprehensive approach in which all aspects of the overall transport system are considered. The wide spectrum of a possible future public transport system and its successive reduction to 4 promising scenarios involving many local and external experts from various disciplines has resulted in a good result.

Although this stage is not exhaustive and cannot cover all aspects to be studied in detail, the result provides a sound basis for decisions that need to be made for the development of a sustainable public transport system in the Oslo region.

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Memo of Experts advice

February 2015

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INTRODUCTION

José Laffond is a Civil Engineer with more than 18 years of experience in transport planning and transport economy (all modes) in Europe, Africa, Latin America and the Middle East.

His main areas of expertise include planning, modelling, economic and financial analysis and concession of transport projects including multimodal infrastructures. He is also experienced in developing national transport action plans and in conducting and reviewing transport sector policy reform studies. He has solid skills for the establishment and implementation of data collection and analysis mechanisms and the definition of indicators for the evaluation and selection of priority investment infrastructure projects.

Mr. Laffond has been the Team Leader of several Technical Assistances for PT projects worldwide such as the Gaziantep CNG Bus Project - Public Transport Improvement Programme and the restructuring and reorganization of the urban public transport routes of buses in Madrid (Spain) or the Sustainable Urban Transport Mobility of Alcobendas, also in Madrid.

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Carlos Cristóbal-Pinto is a Civil Engineer and a M. Sc. in Urban and Regional Planning with more than 30 years experience in public transport and mobility, most of them as public servant worker at Madrid public transport authority (CRTM).

His main areas of expertise include mobility studies and network models; Demand: surveys; Planning studies and economic evaluation of alternatives of new extensions of the underground and commuter train network, with more than 180 km of new metro and suburban trains lines under operation; Buses lanes and BRTs, Bus-HOV lane in motorway A-6 under operation; Multi-modal interchanges, 5 under operation; Light Rail system, more than 35 km of new light rail under operation; Sustainable mobility plans in Madrid region, more than 25 plans were developed in Madrid region; etc.

Great experience in European projects, associations (UITP and EMTA), conferences and training programmes.

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2. COMMENTS ON THE SECOND SCREENING OF CONCEPTS

After the review of this second round of screening it is clear that previous recommendations about focusing on building up a better network in a comprehensive way rather than aim blindly to the development of new infrastructure have been taken into account. The four concepts have a strong multimodal scope and are designed to boost intermodality, enhancing the co-operation between modes by the creation of new mode-transfer hubs and avoiding redundancies while alleviating the commuter load that existing terminals bear during peak hours.

Comments on basic measures

The general "basic" measures common to all four concepts (K1 (A2/A4), K2 (C1/C2), K3 (D2/D5) and K4 (D3/D4/D1)) respond to those recommendations made by the international experts team regarding the promotion of tramways as a "high-standard" mass transport option.

The remaining measures aimed to deter car usage –namely the parking restrictions within Ring 3 and the traffic calming solutions- can only be described as positive. There are several interesting international experiences about attempts to use parking policy to stimulate the local economy. These experiences demonstrate that relaxing the parking restrictions has proven inefficient to stimulate the retail trade in city centres. One example can be found in Oslo, when parking during weekends was made free, resulting in higher occupancy rates and parking duration, which derived in less turnover and an increased difficulty for drivers to park. Comparing with Madrid case, it is found that rather expensive parking fees in the inner city, have not affected the attraction of costumers neither the retail economy.

To support the shift to public transport it would be advisable to include parking in transport demand management; supporting this "push" measures (Traffic regulatory measures, parking restrictions, etc.) with more "pull" measures such as park and ride areas close to Ring 3 interchanges (i.e. Skøyen, Sinsen and Brynseng).

In a similar way, cycling can be highly encouraged with infrastructure measures. It could be a good idea to take advantage of the space created by the reduction of motorized traffic within Ring 3 derived from the measures taken to create segregated lanes and Bike and ride facilities close to the interchange terminals. This issue cannot be neglected. As observed during the attempts to raise awareness about the use of the bicycle in Madrid; the use of bicycle as a transportation mode requires suitable parking measures, without them, fear of theft or may keep people from cycling, undermining the impact of other measures to encourage cycling.

It is necessary don't forget the walking step of all public transport trips, and improve public space around hubs, stations and stops would be a necessity in order to facilitate this step.

Finally, the core city and CBD need to have some kind of isotropic accessibility. Today Oslo has a very good accessibility in the axis Central station and Theatre station; it is clear that the new developments around the sea border require also good accessibility in the future, but also the other parts of the city need to improve the accessibility. The mix of radial and transversal lines with different modes, rail modes and driver modes must provide in the future this kind of isotropic mobility in the city.

Comments on K1 (A2/A4) Tram Concept

This scenario is by far the less intrusive and less investment-requiring among the four concepts.

According to the reference alternative (2010), E-Bus is the main mode to reach the city centre from the western metropolitan area during peak hours, and it competes with the rail in the access from the east (Lillestrøm area). This issue makes the concept of creating bus terminals connected with the tramway network a good alternative for the early stages of the development.

The huge difference between the commuters arriving by bus to Sinsen and the low occupancy rates of the No.17 Tram line –which connects Sinsen with the centre-, reveals inefficiencies in the passenger-transfer mechanisms at that point. Similar issues can be observed in the western access at Skøyen, where the tram is nowadays a minority choice for people commuting to the centre. The envisaged bus terminal proposed in these areas should deal with this issue to assure connectivity between means of transport in order to create a "reduced bus area" within Ring 3.

But Tram Concept only would be a success if speed of tram improves and trams have priority at traffic lights and crossings.

Comments on K2 (C1/C2) Metro Concept

Among the K2 concept, the new tunnel envisaged in the alternative C1 is expected to allow east-west / west-east trips through the city centre complementing the existing metro lines and relying in the tramway and the bus to support the service.

However, following the objective of reducing the bus service in the city centre, there are some aspects that turn C2 and C3 into more attractive alternatives. Those alignments run through a corridor located further north, connecting St. Hanshaugen area with important hubs such as Majorsturen and tøyen.

Passengers commuting south by bus through Ullevålsveien will be able to take the tramway and perform the same route while funnelling the metro trips at Stortinget could derive in a competition among modes, and to move away from the grid network concept.

Comments on K3 (D2/D5) Commuter Rail and Metro Concept

Agreeing with other fellow international experts, option D2 (B2+C3/C2) seems to follow the networks principle in a more satisfactory way. This solution integrates all modes within a single grid, creating a new important hub at Bislett and facilitating connections with Akershus. Thus, the roles of each mode –which one serves as feeder for the others- are understood more clearly for the users.

The new commuter rail tunnel contemplated in this concept shall complement the metro network stretching under Ring 3 facilitating the transversal connections between Ring 3 and Ring 2.

D5 variation rely on C1 metro alternative, so aforementioned comments on C1 alternative apply also here, besides, the estimated cost of this alternative is the highest among the screened options, which, in our opinion, turns D5 into a less attractive option.

Given the nature of the investments required, further analysis should be made on aspects regarding the operational costs to ensure a proper cost-benefit balance.

Comments on K4 (D3/D4/D1) Regional Rail and subway Concept

This concept strengthen the relationship of the city with Akershus; but it may concentrates the transport supply in the south to the detriment of the northern areas, whose commuters shall rely on only two tram lines for the transversal north-south trips. This offer should be complemented with urban buses.

Final Considerations

In these final paragraphs, we would like to remark the importance of continuing using the contributions of the international experts in the forthcoming phases of the planning process

Land use planning is necessary to assure sound urban and balanced regional development and has a strong impact on the mobility. For that reason, the impact of future shifts in land use should be incorporated to the planning process and the coordination with land planning departments of Oslo municipality and the other municipalities is basic for the project.

On a more practical way, neglecting the metropolitan area is a mistake given that surrounding towns' commuters often travel to the city for a number of obligated/non-obligated trips. This circumstance underlines the importance of consider both areas together in the modelling process.

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Regarding frequencies of tramways, we recommend to use 20 trams per direction and hour in the most loaded sections as a capacity standard. Of course, it depends on the number of stops and level of priority at junctions in these sections. But if we use a higher capacity, it will be difficult to assure regularity and punctuality in the line. Therefore, we would not recommend higher capacity than 24 trams per hour.

Comments on K1 (A2/A4) Tram Concept

This scenario is by far the less intrusive and less investment-requiring among the four concepts.

According to the reference alternative (2010), E-Bus is the main mode to reach the city centre from the western metropolitan area during peak hours, and it competes with the rail in the access from the east (Lillestrøm area). This issue makes the concept of creating bus terminals connected with the tramway network a good alternative for the early stages of the development.

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But Tram Concept only would be a success if speed of tram improves and trams have priority at traffic lights and crossings.

Comments on Model Results

Results from demand assignment with the transport model reveal that the implementation of K1 concept would have rather different effects inside and outside Ring 3 beltway.

Regarding the accesses to the city centre during the morning peak hour, the bus traffic reduction is remarkable, dropping almost to the half at east accesses –Trondheim road and Østre Aker vei- and even more at west accesses. Demand would have shifted from busses to the railway and metro. Particularly, the short-distance railway demand will experience a significant growth in the Lillestrøm-Oslo S. Line; which could be considered a positive outcome but maybe different from the expected.

Results inside Ring 3 are more modest, but promising. On the one hand, bus would have been swept out Ring 2 beltway –commuters would have shifted to tram as expected-and bus demand at districts between Ring 3 and downtown would have experienced a minimal growth which could be derived from increasing population.

As considered in previous comments, the model shows that new tram developments and improved passenger-transfer mechanisms at bus stations will increase the tram demand in lines connecting the new transport nodes with downtown, reducing the bus demand at a time. This fact is particularly remarkable at Sinsen.

On the other hand, according to the model, bus demand at Bryn-Oslo S.-Nationaltheatret axis will remain similar to the base model. Increments in tram demand in downtown are only moderate. This reveals that even more steps shall be taken to create a reduced bus service area. Tram prioritization at junctions or maybe increased frequencies in east-west lines could be a good starting point.

Model results in 2060 show that the trends established in 2030 model will continue regarding corridor demand in all modes abreast. One-off trend changes can be found at new stations, where the number of boarding passengers shall increase more sharply than alighted users. This circumstance during morning peak hours can be understood as a symptom that downtown stations are becoming real intermodal nodes, not just origin/destination points.

Comments on K2 (C1/C2) Metro Concept

Among the K2 concept, the new tunnel envisaged in the alternative C1 is expected to allow east-west / west-east trips through the city centre complementing the existing metro lines and relying in the tramway and the bus to support the service.

However, following the objective of reducing the bus service in the city centre, there are some aspects that turn C2 and C3 into more attractive alternatives. Those alignments run through a corridor located further north, connecting St. Hanshaugen area with important hubs such as Majorsturen and tøyen.

Passengers commuting south by bus through Ullevålsveien will be able to take the tramway and perform the same route while funnelling the metro trips at Stortinget could derive in a competition among modes, and to move away from the grid network concept.

Comments on Model Results

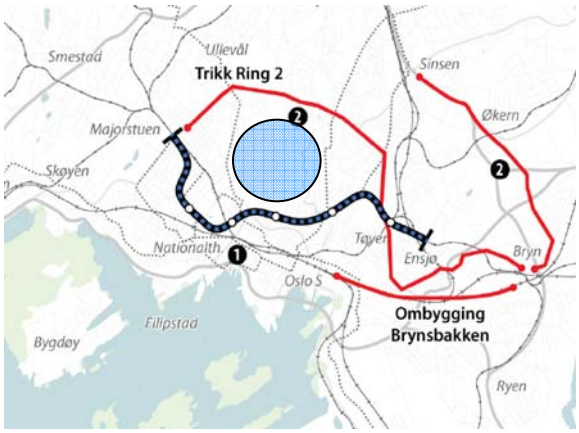
The results of the model do not reveal unexpected outcomes.

Regarding the bus, passengers in Sentrum district have been reallocated to the Metro; however, the modal shift is less accused outside that area. Bus would continue playing an important role in the connexions of peripheral stations with downtown.

Improvements in metro service will attract travel demand in the whole network; remarkably, metro would have become the main transport choice to travel along Ring 3, significantly reducing bus demand.

Identified downsides inherent to C1 option are confirmed by model results. Inside Ring 3 North-South trips continue to be covered by bus and no direct transversal communication in Majorstruen – Tøyen corridor dampens the effect of other bus-reduction measures.

Bus demand inside Bus Reduction Area would be higher in this concept than in K1. This issue may be related with letting big areas inside Ring 2 out of any rail-based transit catchment zone.



Thus, in order to complement C1 tunnel option, it would be advisable to include further tram developments as in K1 concept.

Comments on K3 (D2/D5) Commuter Rail and Metro Concept

Agreeing with other fellow international experts, option D2 (B2+C3/C2) seems to follow the networks principle in a more satisfactory way. This solution integrates all modes within a single grid, creating a new important hub at Bislett and facilitating connections with Akershus. Thus, the roles of each mode –which one serves as feeder for the others- are understood more clearly for the users.

The new commuter rail tunnel contemplated in this concept shall complement the metro network stretching under Ring 3 facilitating the transversal connections between Ring 3 and Ring 2.

D5 variation rely on C1 metro alternative, so aforementioned comments on C1 alternative apply also here, besides, the estimated cost of this alternative is the highest among the screened options, which, in our opinion, turns D5 into a less attractive option.

Given the nature of the investments required, further analysis should be made on aspects regarding the operational costs to ensure a proper cost-benefit balance.

Comments on Model Results

After assessing model plots, as specified in previous comments, this concept seems to be the most appropriate to meet the requirements of a Reduced Bus Area.

The new Metro tunnel crossing Grünneløkka and St. Hanshaugen districts collects a high amount of demand alleviating occupation in bus routes. A remarkable demand reduction –at least compared with other concepts- is obtained in north-south lines and a minor reduction but still positive in west-east lines.

The new north rail tunnel would facilitate the north-eastern connections with the metropolitan area, attracting demand from regional buses coming from Trondheim road and Østre Aker vei. However, according to model plot, this shift is lower than expected comparing with other concepts. Growth by 2060 does not seem to be remarkable either. Further data may be necessary to assess why this is happening. Maybe 6 avg/t at that line is not sufficiently frequent to encourage the use during rush hours.

A significant amount of transport demand would be collected by the tram within Ring 3, further decreasing bus dependency. Such result would reassert the role of the tram as a complement of the Metro network for north-south communications, as expected.

Comments on K4 (D3/D4/D1) Regional Rail and subway Concept

This concept strengthen the relationship of the city with Akershus; but it may concentrates the transport supply in the south to the detriment of the northern areas, whose commuters shall rely on only two tram lines for the transversal north-south trips. This offer should be complemented with urban buses.

Comments on Model Results

As happened in K2 concept, boarded/alighted passengers at Nationaltheateret Metro station are comparatively low. In contrast, alighted passengers from commuter rail are somewhat high. Given that this station does not have connexions with tram, demand allocation model results may reveal that Metro is failing to attract transport demand at that point and, therefore, the creation of a Metro hub in that location could be revised.

Regarding the contribution to the creation of a Reduced Bus Area, this option achieves the higher reduction in bus usage along the East-West corridor, which is the most bus-loaded. However, north-south lines are still broadly used due to the lack of rail options.

Final Considerations

In these final paragraphs, we would like to remark the importance of continuing using the contributions of the international experts in the forthcoming phases of the planning process

Land use planning is necessary to assure sound urban and balanced regional development and has a strong impact on the mobility. For that reason, the impact of future shifts in land use should be incorporated to the planning process and the coordination with land planning departments of Oslo municipality and the other municipalities is basic for the project.

On a more practical way, neglecting the metropolitan area is a mistake given that surrounding towns' commuters often travel to the city for a number of obligated/non-obligated trips. This circumstance underlines the importance of consider both areas together in the modelling process.

Maturing process of the metropolitan area of Oslo is a natural process and a more complex mobility will be a natural outcome of this process. Sustainable mobility must be the solution, solution based not only in bicycle and public transport but also walking would be part of the solution as other kind of options, as car-sharing, car-pooling, company mobility plans, (as university or hospital mobility plans) land use and so on. Electric cars and buses also would be part of the solution.

KVU OSLO-NAVET

Final statement Kühn og Nielsen

Ferdigstilt:	29. april 2015
Prosjekt:	KVU Oslo-Navet
Forfattere:	Axel Kuehn, Karlsrue og Bernt Nielsen, Göteborg
Vedlegg til:	Hovedrapporten

Sammendrag:

Dette er de uavhengige, utenlandske ekspertene Kuehn og Nielsens oppsummerende kommentarer til KVU-arbeidet.

Introduction

Axel Kuehn and Bernt Nielsen have been asked in early 2014 by Jernbaneverket to accompany the KVU Oslo-Navet as independent experts.

Axel Kuehn has started working in the public transport sector in 1986 – first as a civil servant for the Karlsruhe public transport operating companies VBK/AVG, later for AVG's consultancy subsidiary and since 2002 as an independent consultant. As such he has extensive experience with international state-of-the-art public transport solutions and especially with urban and regional rail projects including tramways, light rail, TramTrain, TrainTram and regional railways. He has a comprehensive overview of the international market and its technologies and trends. Since the mid 1990s he has been involved with international projects.

As a part of his international activities the consultant has been since 1995 more or less continuously involved in Norwegian projects (Stavanger, Bergen, Oslo) and is therefore familiar with the "local conditions and requirements". From 2003-2005 he played a comparable expert role in the INTERREG NorthSea project HITRANS which involved various international partners (eg Rogaland Fylkeskommune, Oslo Sporveier, Jernbaneverket). Peer review activities are also part of the consultant's activities in Denmark (Aarhus, Odense).

The consultant is knowledgeable enough in the Norwegian language to read Norwegian reports and texts, respectively to understand basic discussions on transport related issues.

Bernt Nielsen worked as PT consultant since 1975 with clients among many PT authorities and operators in Sweden and Norway. During eight years – 1999-2007 – he had the role of director of PT in the city of Gothenburg. From 2007 he returned to the consultancy field – with mostly the same type of clients as before the Gothenburg period. For 2½ years he had a part time commission at UITP, Brussels, as representative for Swedish PT Association. In Norway he has been involved in PT commissions in several counties, in Trondheim and Bergen and to a great extent in Oslo region. 1980 – 84 he was project leader for "Oslo Linjenettanalyse". After that he has been involved in several larger or smaller tasks in Oslo – especially for tram and metro purposes.

Process

It should be noticed that the consultants' team of Norconsult which has been engaged for the KVU-work includes also four international experts from Germany, Spain and Switzerland. Even if having worked together in a series of meetings as "the expert group" the formal role of the two "client experts" must be seen as different.

The expert advice given by these was from the very beginning of the project requested to be independent from the client or any other authority (2nd opinion).

- The experts' main activities included:
- Reading of project documentation and commenting on those,
- Discussion with Norconsult and/or the client in regard of methodology and results,
- Introduction of international best practice to the project,
- Participation in project workshops and meetings,
- Preparation of meeting presentations related to expert comments,
- Final statement regarding expert activity and evaluation results.

Other activities have surfaced during the project and have been handled in a pragmatic way. Those included a number of deliverables described further below.

Above description of activities highlights already a basic, important approach: to use the international experts continuously during the process and thus allowing to feed comments timely into the working process!

Such approach is appreciated by the experts. It avoids principally a situation which could easily emerge with a single, late review activity of a final KVU-report when pointing to weaknesses or alternative approaches in a work phase which allows no more or only limited reactions to such comments. In this regard the chosen approach for involving the international experts was always a "continuous, forward looking" and never a "single, backwards looking" one. However, there is some "water in the wine", as especially the final weeks showed out to be difficult in regard of taking into account hints and requests. This issue is also described further below.

The final review of the international experts was originally intended not needing to elaborate in all detail on comments made during the process but to concentrate on summarising basic statements and contributions (as stated still in the intermediate statement of early February 2015). This commenting strategy required, however, some adaptation to cover the more reent experience in the project.

Understandably, any expert views and statements in regard of KVU-approaches and results (now or during the process) are / have been always linked to the information available at the time of comments respectively on the client request which specific documents should be commented. Even for this final review the vast amount of different reports made it completely impossible to check the complete range of reports! The quality and consistency control for the whole KVU-documentation was never envisaged to be the task of the independent experts.

Expert contributions

Meeting participation

The international experts have been participating in the following meetings:

- 8th-9th April 2014 Oslo
- 14th May 2014 (AK only) Oslo
- 4th June 2014 Oslo (public workshop)
- 18th June 2014 Oslo (public workshop)
- 24th-25th June 2014 Oslo (AK only 24th)
- 8th-9th September 2014 Oslo
- 13th-15th October 2014 Munich, Stuttgart and Zurich (studytour)
- 3rd-4th November 2014 Oslo
- 21st January 2015 Oslo (AK only)
- 26th January 2015 Oslo (BN only)
- 5-6th March 2015 Darmstadt (AK+BN internally on 5th, 6th with KVU-Staben, Norconsult and Norconsult experts)
- 30-31st March 2015 Gothenburg (AK+BN internally)

Deliverables

Deliverables did consist in the period up to February 2015 of presentations at some of the meetings above and other comments made by e-mail or verbally during meeting. In the last phase of the project the independent experts have also been tasked with three specific reports which are summarised below in regard of main conclusions.

Presentations

Basic presentations given by the experts:

Axel Kuehn

On the way ... for a future Oslo transport strategy (April 2014)

> Introductory expert thoughts including the recommendation not only to look at new hardware (new infrastructure) but also at software (new network, new operational features etc...). First introduction of benchmarking and PT-effectivity thoughts.

Benchmarking Oslo vs other European Cities (June 2014)

> Benchmarking compared Oslo with 8 other European agglomerations: Gothenburg, Stuttgart, Frankfurt, Leipzig, Zurich, Lyon, Amsterdam, Manchester. Focus on PT-effectivity: Input/Output. Raising effectivity of a PT-network as an evaluation criteria. Means looking on operational costs and not only at investment costs. Recommendation to use the “Oslo Navet” strategy also as an opportunity to shape a more efficient network with quality interchange nodes and less parallel operation into the city centre.

PT-modes, scope, success conditions and capacities (June 2014)

> This second benchmarking presentation looked at the roles and shares of different modes in some of the above-mentioned agglomerations. One conclusion was that the Oslo tramway despite of its slightly doubted role in the last 30 years appears rather successful looking at its input/output ratio – this implies that an improved tramway network (new rolling stock, more priority…) would likely be even more successful. It was also highlighted that the capacity problem of metro/railway in Oslo (at least today!) is not really apparent and possibly more a peak-hour only issue which speaks for strategic changes respectively a revision of operational patterns.

Network toolbox (November 2014)

> The idea for such a toolbox was initiated by various insights during the KVU-studytour in October 2014. The presentation highlighted a number of tools to create a high quality network including different/alternative approaches how to use specific modes within a network (eg suburban node stops to reduce pressure on main station, tramways/light rail as sub-urban feeders etc).
>
> Axel Kuehn was also responsible for organising and guiding a studytour to Munich, Stuttgart and Zurich in October 2014 with contents directly related to the issues at stake within the KVU Oslo-Navet.

Bernt Nielsen

K2020 – future PT system in Gothenburg Area (June 2014)

> Overall program for developing PT system in Gothenburg area with the aim – Doubling PT ridership in 2025. Starting already in 2002 the project has been the role model for similar projects in Sweden and other European countries.

PT developing in Stockholm, Helsinki, Copenhagen, Oslo and Gothenburg (June 2014)

> Comparison of state of the art for PT development in the main Nordic cities. The main advices from Gothenburg horizon are:
>
> - Develop the light rail system
> - Develop the trunk bus system
> - Develop the nodes

Developing a Light rail system à la Gothenburg (June 2014)

> How to create an efficient LR network – based on Gothenburg experience

Statements and recommendations:

Out of the continuous commenting of the international experts (within above presentations but also beyond in meetings, e-mails etc) the following statements and recommendations are worth highlighting in a summaric way:

- Don't look primarily at infrastructure but aim for a better (more attractive, efficient...) network which, however, may be based on new infrastructure.

- Don't just concentrate on therapies in regard of mobility growth (after it has grown!) but try early to use "soft" measures for a sensible reduction (holistic mobility concepts, better adaptation of land use plans in regard of PT, more mixed areas combining business and housing instead of separating those, etc...). This should also include measures to reduce peak hour travel.

- There seems to be spare capacity in the commuter train system ("the tunnel is full with trains but the trains are sparsely full"). Check operational patterns!

- Today's metro-network shows, as a result of its history, many similarities with the commuter railway network (one core tunnel taking principally all lines). This is fundamentally different from most other metro networks developed in other agglomerations which have been developed much more as "star shaped" networks with often a maximum of two lines per tunnel. The opportunity to achieve a second city-centre tunnel should be used to reshape the network and to catch other parts of the city with such new infrastructure.

- Oslo's metro lines, again as a result of the network history, are actually rather long compared to many other systems and some lines serve low-density outskirts of the agglomeration. Expensive extensions even further into the countryside need to be carefully evaluated and it is recommended to use light rail/tramway instead as local connectors even if this might be an "island function".

- Current network inefficiency (= large input, low output) appears to a considerable extent resulting from bus services, especially in the outer areas of the agglomeration.

- Aim for a more efficient network and try to concentrate operational resources where and when they are most required.

- Get rid of a point of view which sees metro as the only urban HQPT-offer which can be "sold" (as HQ) to the public.

- "Give tramway a chance" – both in regard of its historic centre oriented function but also in regard of new roles in the agglomeration (eg sub-urban feeders). A state-of-the-art tramway or light rail system offers very good value for money to the society and should be seen much more as a high end offer (as metro) and definitely not as part of the low-end (as buses are usually seen). It is time to appreciate the tramway (again) as part of a high

quality PT-system and to support its success by a proper political decision regarding its future.

- It is not only “development areas” which may deserve new and better HQPT-offers (new infrastructure). Don’t forget the existing city quarters.

- Try to use modes differently and with less competition between PT-modes; means especially a reduction of bus traffic into the city centre and instead the creation of sub-urban interchange nodes.

- Existing and future nodes within the overall network are essential both for city development and PT development. This aspect should find some specific focus.

- Don’t misuse earlier study results for single lines or corridors (eg Fornebubanen) by assuming that those results will be fully valid within a whole network perspective. This comment is meant in regard of line destinations and combination of different line branches within a total network perspective.

- Even if the main focus may be seen now on the core city where the capacity problem has been located it is strongly recommended to evaluate complete agglomeration networks including the outer parts.

- The Oslo network both today and even more in the future will be based on several PT-modes interacting or even running parallel in certain corridors. To evaluate the pros and cons of different network options in the very detail and to allow a more precise modal shift discussion it appears necessary to implement a new transport model on agglomeration level. There is considerable doubt whether the current model is able to deliver required modelling quality.

Reports

The following reports have been requested from the independent experts:

- Future PT-capacity in Oslo (delivered 3/2015)
- Bus Terminal Structure for Oslo (delivered 3/2015)
- S-Bahn features (AK only; delivered 4/2015)

The first two reports resulted from discussions in the Steering Group in regard of two specific reports presented by Norconsult:

- Følgenotat Spesialanalyse: Kapasitet og rullende materiel 5. Februar 2015. (Styringsgruppe mote 10.02.2015, Sak 13)
- Følgenotat Spesialanalyse: Bussterminaler 5. Februar 2015. (Styringsgruppe mote 10.02.2015, Sak 9)

The request was to review the reports and to deliver information on international best practice in regard of the relevant themes.

The third report was requested by KVU-Staben in regard of the term S-Bahn playing a rather prominent role in the KVU-discussions (and scenarios) while at the same time there appeared to be not enough information on this type of commuter rail operation to decide on its potential application for Oslo.

Regarding **future PT-capacity** in Oslo the experts came up with conclusions and recommendations summarised below (main findings only):

1. A proper introduction chapter which gives an overview of international views on mode capacity appears missing. Such introduction would also allow highlighting the interaction between PT-demand, PT-capacity and PT-offer and thus help explaining the available planning range and flexibility, especially in regard of peak-hour traffic.

2. The definition of peak hour comfort conditions for Oslo appears a bit "luxurious" compared to the approaches in other central European countries. In this regard re-think the handling of peak hour traffic, either by adapting offer and capacity (operational patterns) more to different load situations over a day or, if this is not wished, to accept use of 100% total capacity during peak hours for central network sections.

3. Re-evaluate the operational concepts for both railway and metro. As already identified within earlier benchmarking considerations, the operational approaches used so far seem to give some scope for efficiency increases (eg by changing frequencies more often during a day and/or by "sectioning" of lines and operation of lower frequencies on outer sections and/or shortening / lengthening of trains). Such change of the operational patterns may involve additional infrastructure requirements as eg storage tracks at certain stations. This should be evaluated to ensure that such features can be included to the planning process as early as possible.

4. For the tramway sector in the capacity report some brief introduction would be helpful which highlights some basic dependencies between main parameters (including aside of length and width eg seat configurations, ratio seating / standing, impact of possibly using bi-directional trams in the future). Also the presentation of a few specific tramway vehicle types should be avoided and changed towards a more general presentation of capacity issues depending on a range of parameters (otherwise one should show the available vehicle range of European suppliers in a more complete way). Similarly for the bus sector today's vehicle market should be taken more into account.

5. In order not to overstress system capacity of the surface systems 24 trams per hour and direction should be used as a maximum threshold for corridor capacity. The same value should be used for any "busway" considerations. Any higher frequencies would likely mean jeopardising priority, reducing commercial speeds and thus the total quality of the system.

Regarding the **bus terminal structure** in Oslo the experts came up with conclusions and recommendations summarised below (main findings only):

1. All four scenarios K1-K4 have scope to allow changing bus network structures more towards high standard feeder and tangential services for both regional and local city buses using the described nodes at feasible distance from Oslo

centre. Out of the range of terminals being discussed the Bryn terminal is a very crucial tool for the South and East of the Oslo agglomeration and deserves both priority in establishing it and quality in its layout!

2. A substantial part of today's regional buses terminating in Oslo Bus terminal will in the future not require any central terminal facility. For the remaining (few) regional buses and the other three types of terminal users today's terminal area will probably be enough. The calculations shown in the report seem to be reliable.

3. A strategy towards more "through running" bus lines will also reduce the need for big terminals at nodes and allow replacing them by smaller and easier to handle standard "bus stops" in regional or sub-urban quarters.

4. There are several international examples presenting strategies and approaches which are applicable for the Oslo situation. Among others, these examples show how a large, centrally located, terminal can be substituted by a number of small(er) terminals in the outer parts of the city or region.

Regarding the **international approach to S-Bahn operation** the expert came up with conclusions and recommendations summarised below (main findings only):

1. It is important to understand that "S-Bahn" is not a new PT-mode but a handy name for a dedicated commuter railway operation in agglomeration areas (similar to the use of eg "Flytoget" for dedicated airport services).
2. S-Bahn operation is not just a German phenomenon but something to be found in various European countries (also in Scandinavia). While the German term "S-Bahn" has been used as kind of a synonym within the KVU-project, it is worth mentioning that similar operational features can be found in a variety of European countries under different names:

   ⇒ Germany: S-Bahn (big variety of systems)

   ⇒ Austria: S-Bahn (Vienna)

   ⇒ Switzerland: S-Bahn (Zürich, Basel, several more)

   ⇒ France: RER (Paris)

   ⇒ Spain: Cercanias (Madrid, several more)

   ⇒ Denmark: S-tog (Copenhagen)

   ⇒ Sweden: Pendeltåg (Stockholm)

3. The majority of nowadays systems of the S-Bahn genre are operating jointly with other railway traffic. Segregation from other railway traffic, if existing at all, is limited to core and dedicated infrastructure as eg city-tunnels. In other sections of the network railway corridors may have been extended (eg from 2 to 4 tracks) to mitigate capacity limitations. Technical layouts which hinder co-operation between S-Bahn and other railway traffic (specific power supply features, conductor rails, differing voltages) are by no means a requirement for those services but much more a historical feature surviving in few systems from pre-WW2 times. Such features are not found in any S-Bahn system created since the 1960s.

4. S-Bahn features are usually not just of technical nature but often linked to a variety of issues covering infrastructure, rolling stock, opperational patterns and adaptability, branding, fare integration and the organisational framework. This means also that S-Bahn is not a fixed definition but can include different features even within single networks
5. S-Bahn like systems may be but are not required to be treated as separate rail systems with regard to tendering and operator choice, they may also exist within classic “state railway” environments. Important is, however, in order to give S-Bahn-like operation the highest success opportunities in agglomeration areas, that those who require the offer (= the agglomeration) are able to influence (to decide) the layout of services and to ensure proper integration in the PTA’s other PT-offers.

Satisfaction and concerns

The experts had already confirmed in their intermediate statement, that the “short list” of 4 scenarios K1-K4 was principally supported.

All experts (including those from the Norconsult-team) have always been urging to use the chance of new infrastructure(s) to better serve the city area and to develop the network away from the existing corridors and a pure doubling of capacity at the same location. There is an opportunity to let the PT-network not only react to land-use developments and growing mobility (you are always late, unfortunately!) but also to better steer land-use developments in an early phase.

In this context the international experts have been convinced that scenarios as K3, despite of their rather bold infrastructure needs will be best suited within a long-term strategy to ensure “quantum jump” success – as they allow to create a better spread of HQ-corridors across the city/agglomeration area.

Such expectation seems to be fulfilled when looking at the final results presented over the last weeks in conjunction with (infrastructure) cost issues being available now.

The new wording “from node to network” implies an important new approach. It includes also a more positive approach to interchanges which means also a higher openness to reduce parallel PT-offers (especially bus traffic). We also notice that interchanges will have an important role both for city development and for the efficient PT network.

It appears also and is seen very positive that the tramway “stayed in the race”, not only as part of “its own scenario” (K1) but also as kind of a “supporting tool” within metro and railway scenarios (K3 and K4).

Honestly, the experts didn’t expect that any statement from their side during the process would lead to immediate action and result in 100% reflection in relevant reports. Some of their comments have been taken serious - others less. This is principally no problem even if we believe that the “continuous input” approach intended for the expert activity faced some problems during the last phase of the project. As “time was running”, some comments, contributions and recommendations – in an atmosphere driven by the deadline – appeared more to be put into the corner of “scientific sideviews” and seen more disturbing the delivery process than helpful to achieve a better overall product quality.

The experts conclude that the whole process would have deserved more time to allow for optimising and re-evaluating different scenarios after having looked at initial results.

If one simplifies the KVU project and reduces the process to the 4 steps

- Identification of most promising network scenarios
- Modelling of the scenarios + evaluation (infra cost, operational cost)

- **Optimisation of scenarios (iterations => further modelling)**
- Choice/recommendation

the experts fear that there was no or not enough time for the third step which involves a certain danger that choice and recommendation is not based on fully optimised scenarios. Whether this is seen as a major problem depends on the answers to two questions:

- How big are the differences between the results for the four scenarios?
- Is their scope for optimising the results further after the "formal" delivery of the KVU report?

If there is a clear winner for all kind of reasons, any weaknesses scrutinised in any scenario might not influence the ranking. And if the current results are presented as kind of an "intermediate result" which requires further refinement to shape the details of the future Oslo-network, then there is no problem either. It would be dangerous, however, if politics and public would be made believers that the KVU-content respectively recommendation would exactly be what will be implemented "tomorrow". **Optimisation and refinement is a definite requirement – whether it takes place within the KVU now before the delivery deadline or after it in a second phase. Such optimisation and refinement should definitely include operational cost evaluations to increase efficiency.**

If one talks about optimisation we point especially to the complementary tramway and bus network(s) in the K2-K4 scenarios where we note that several measures included and tested in K1 are not included. Not to be misunderstood, there is no aim for using K1 completely in the three other scenarios as clearly some of the new metro or railway corridors offered in the K2-K4 scenarios make surface tramway in the very same corridor obsolete. So what the experts would like to get rid of are some inconsistencies which will be reported in a separate memo.

Tramway / light rail are high importance tools in any future network. Even if metro and railway are leading the way in those scenarios from a capacity perspective it needs to be made very clear that tramway /light rail are a decisive partner in delivering a high quality network. In this context the categorisation of two sub-modes within the tramway / light rail field

- Tramway / "Bytrikk"
- Light rail / "Bybane"

bears considerable danger as it easily connects in the given Oslo background tramway with something outdated, not state-of-the-art and just surviving from the old times while with a look to Bergen Bybane, light rail is seen as the only "modern way" of delivering high quality. **The experts would like to state that such perspective is completely wrong.** Nearly the complete renaissance of railbound surface PT in France in the last 30 years is in the tramway field and these systems are without any doubt all modern and state-of-the-art. Light rail should therefore not be seen as something of higher quality than tramway but as a tramway with slightly different characteristics (eg higher level of segregation, possibly longer trains, likely more sub-urban/regional roles). It is definitely possible to combine both features in one network and there are even single lines in many schemes which are operating more "light rail" style in sub-urban quarters and as a "tramway" in the

city centre. What does this mean for Oslo? It means that **there is scope to "update" the classic tramway in the centre respectively in the existing network and to add light rail or light rail features to the network in new (or convertable) corridors where this appears required. The question is not "either – or" but "doing both"**. As pointed out in earlier benchmarking statements during the KVU process, the existing tramway with all its weaknesses appears astonishingly effective and well used/accepted by Oslo citizens. Such starting point gives every reason to believe that a modernised system is able to play a much more important role in a well configured network.

The experts see the definite need to use the "public transport masterplan" as which one could see the network scenario refined within the KVU-process as a clear statement in regard of the status and the future of tramway / light rail within the Oslo "team of modes". **And the statement needs to be: Yes, we need it, it is a definite partner in our high quality PT-team and we need to modernise it.** The important role of tramway / light rail in all network scenarios appeared for the experts slightly undervalued in the KVU-discussions and evaluations.

Looking at the evaluation approach taken forward in the KVU the experts notice some **bias linked to the political zero growth target**. Understandably this target has lead to a concentration on capacity or better maximum capacity. To deliver such capacities a variety of measures or more precisely new infrastructure is being proposed. However, when looking at the patronage which the modelling process forecasts for 2030 and 2060 one can notice that the values reached here for peak hour conditions (3h peak) in some parts of the network are considerably below thresholds which are usually applied for the justification of new infrastructure. The experts don't see this being evaluated or commented in any detail in the documentation? **One is talking only about the high end (maximum capacity offered) but not about the low end (minimum demand required).** The experts have spent some thought about the "low end" issue and will present those thoughts in a separate memo. Without going into detail here: **the "low end" view is a required step to shape the network respectively stages of any network. The initial results support the expert's recommendation to stop further metro extensions in the wider region but they also touch on existing corridors – also in the tramway / light rail field.**

This issue clearly supports the stated need for further refinement and optimisation of the network scenario(s). It is also linked to the efficiency discussion raised earlier in the process. It is strongly recommended that the required optimisation process includes such features in regard of the operational patterns applied to different modes.

Within an iterative refinement and optimisation process, modelling the effects of different but possibly interacting measures is a crucial part of the job. Besides of the impact on modelling quality linked to the need of combining two different transport models – one for Oslo/Akershus and one for the outer region – the experts see a definite need for improving the "modelling punch" available to the planning process.

The review of the modelling results gave the impression of rather small differences both between the scenarios but also between the two timeframes 2030 and 2060. This appears surprising and raises concerns about the model not showing enough

reactivity respectively being “too strategic”? It is the impression of the experts that the available model appears more suited for high level strategic evaluations but not for much more detailed microscopic views into certain corridors which see 3 or even 4 PT modes involved and “competing”. In other words: the modelling results which have been presented to the experts are -beyond some spotted inconsistencies which can be eliminated- not detailed enough to dimension PT-modes under peak-hour conditions. **The experts see the need to equip the wider Oslo agglomeration with a more sophisticated modelling tool which can be used also on a more microscopic level and even ranging into the simulation field.**

The presented 3h peak values are satisfying as indicators and for comparing between the different modes but they appear not really suitable **for dimensioning a PT-system or mode – one requires information for the real peak hour.** Some cities are even looking at 20min peaks within a peak hour for dimensioning purposes! The experts would like to refer here also to the discussion raised above about “low end” thresholds needed for justifying new infrastructure and the discussion about quality levels in peak-hour conditions taken forward in the “capacity report”.

The experts have also noticed that so far for all four scenarios principally the same “land use patterns” have been used as a condition for the modelling process. This is an understandable and pragmatic approach in this phase. However, it means that the interaction between land use and transport planning is limited to a one-way relation: public transport needs to (can only) react to an independently developed land-use set-up! **The recommended optimisation phase should also include an opening here and allow for land-use patterns reacting /being adapted in regard of the new PT-network structures.** This should give the masterplan even more strengths.

Even if the experts have only looked into specific excerpts of the total documentation the comparison of different products has raised certain **concerns with regard to consistency in specific reports and /or between different reports**. The experts strongly recommend to check the complete documentation carefully in this regard and they will furnish a memo describing some inconsistencies spotted by the experts.

A general impression was that future strategies have been discussed here and there with **too much focus on features or conditions of the existing network(s)** without taking into account properly the new scope offered by new networks respectively network structures and the increased freedom offered by those. Another “neighbouring” impression was, that despite of the involvement of international experts and the impressions gathered during the studytour which was performed as part of the project, **approaches have been here and there stuck or limited too much in the “local world”**.

The experts recommend to develop within the forthcoming activities kind of an **“Oslo manual”** describing –based on international best practice and local experience- the planning philosophy, the network principles, related operational patterns, infrastructure alternatives and also technical parameters for the different “players” in the PT-team (railway, metro, tramway/light rail, busway/bus, ferry…) as

a basis for future planning steps. Such a planning manual should more aim to motivate and initiate creativity and could be based on a variety of existing information (Hitrans principles, the Ruter network principles derived from Hitrans, the “toolbox approach” raised by the experts, the reports on capacity, bus terminals and S-Bahn features etc) while presenting them in an easy-to-read integrated document.

Looking finally at the way which this very complex KVU-study has taken within only about 15 months the experts are really appreciating the efforts and the progress made. **Good job – but there is always scope for improvement.**