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Cycle traffic in the regional transport model of Norway

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Abstract
The regional transport model developed in Norway over the last 12 years will from now on be used also for urban transport. Can the transport model also be used to model changes in the demand for cycling in its current form? Is it enough to detail the coding of the transport network in more detail, or is it necessary to include bike-specific variables in the demand model to achieve this? These two issues are addressed in this paper by going in depth in the modeled and actual travel patterns in an area south of Trondheim, where an infrastructure measure for cyclists is scheduled in 2014. The cycle measure is a bridge for pedestrians and cyclists, which will reduce the travel distance, and hilliness on the route between two districts.
Data sources for the actual travel patterns is the national travel survey conducted in 2009 and 2010, with an enhanced range of Trondheim. This is compared with model calculations at a paramount level, within areas of mode choice, trip length distribution for the various modes of transport, within the private travel purposes represented in the travel survey. Moreover, a short time registration of cycle traffic is carried out on roads in the near-by area of the scheduled bridge. In addition, two small surveys are conducted in the same period aimed at households and workers. Interviewees are asked to give information about their travel patterns over the two previous days. Trips that could potentially to use the new bridge are labeled specifically. In addition, they were asked about how the bridge could affect their travel patterns.
The results suggest that the transport net must be coded in more detail than we have done up until now. Both experience reported in the literature and results from this study, indicates that hilliness should be included in the net coding and skimming of level of service data, both because it is an important explanation factor to the demand for cycle traffic, but also to improve the net assignment.

1 Introduction
Cycling is an increasingly popular means of transport, in Norway as in many other European countries. Not least in political goal formulations, as a means to alleviate environmental issues, and to encourage health amending transport solutions, especially in cities. Actually the National Transport Plan now includs a statement which emphasizes cycling and walking as answers to the environmental challenges in cities, in addition to public transport. Earlier similar documents would typically have mentioned only public transport (Avinor (Aviation), the Norwegian Coastal Administration, the Norwegian Rail Administration and the Norwegian Road Administration, May 2012).

Tools to evaluate incentives towards cycling, and impacts on cycling from transport investments and regulations directed towards competing means of transport are lacking. If we had a transport model and cost benefit calculation tool available, which regarded changes in demand for cycling transport, planners would have an easier job analyzing and promoting effective cycling projects and prioritize between different projects based on common evaluation criteria.

The Swedish report: Utvecklingsplan för att möjliggöra samhällsekonomiska kalkyler av cykelåtgärder (Angelov, m fl., 2007) also emphasize the advantages in having a common evaluation tool for cycle measures and impacts for cyclists from other kinds of transport system measures. It also contains a thorough review of models and methods already developed in this field.
The major obstacles to making transport models for cycle measures seems to be access to detailed network data, the fact that cycle measures must be expected to have a minor impact on mode choice changes (confirmed in Strand, et al., 2010), and that the cost of making a transport model is too high compared to the expected cost of the measures and expected impacts.

The last 12 years the Norwegian Public Roads Administration, the Rail Administration Coastal administration and Aviation have developed a transport model to be used in NTP. The development of the Norwegian Regional Transport Model (RTM) has been continuous, and the latest development (version 3.0, Malmin, 2012 and Rekdal, et al, 2012a) has resulted in a tool for modelling city transport. This means that the transport model framework for an arbitrary Norwegian city is already available. The data access will gradually become a minor problem since data from the national road databank are being prepared to be used as input to transport models. This will make it easier to include e.g. hilliness (emphasized as important explanation factor in Parking et al, 2008) and more minor roads to the transport network used by the models.

Can the RTM now be used in analysis of cycle traffic, both schemes for cyclist and impacts on demand for cycling from other schemes? This is tested by studying the performance of the model. The model results are compared to travel surveys and counts.

2 How was the demand for cycling found?

The cycling pattern of Trondheim is identified by three sources:

1. The Norwegian National Travel Survey of 2009
2. A travel survey in the local area of a planned bridge dedicated for walking and cycling
3. Short time counts of cyclist near by the planned bridge

The data from the National Travel Survey of 2009 is used to validate the overall model results. The local data collection gives a view of the local traffic and attitudes about the bridge.

2.1 The Norwegian National Travel Survey 2009

The Norwegian Travel Survey 2009 NTS2009 (Vågane, 2011) is a sample survey, covering the trips of 29,000 respondents. The survey reveals the travel pattern for people aged 13 or older. It is divided in two parts, one for trips shorter than 100 kilometers and on with longer trips. For the county of Sør-Trøndelag, in which the city of Trondheim lies, the Public Roads Administration ordered a larger sample, and this led to a sample size of 2 % of the population in the county. The average national sample size was 0.6 %.
The interviews were carried out by phone, and the questions covered access to transport modes, travel pattern including how many trips the respondents made the previous day, or for long trips the previous month. The respondents were asked about the purpose of the trips and about detailed information around how the trips were carried out.

From the NTS2009, the respondents living in the Trondheim municipality were selected to study the cycling pattern, and only the data covering short trips. The selection includes 5 069 people, 17 480 trips. The average trip rate is 3.45, and the number of people without any reported trips the previous day is 610.
The NTS2009 - selection Trondheim are used to verify the general overall travel pattern from the transport model in this study.

2.2 Local travel surveys

The bridge in focus in this paper would be an improvement for cycling and walking trips to and from an area at the south of Trondheim called Flatåsen. In this area there are mainly residents, but also some activities that would attract trips to the area from other parts of the city; a nursing home, a college and a sports center.

The bridge is part of Miljøpakken (Eng: The environmental package, see (http://miljopakken.no/prosjekter/gang-og-sykkelbru-over-bjorndalen), a funding body, including toll collection, and infrastructure schemes in Trondheim and the surrounding municipalities. According to the current plans, the construction work should start in 2013, and the bridge should be finished in 2014. The projects included in the package can end up not being built. This depends on the actual cost of other projects. The bridge in focus for this study might thus end up not being built.

Impacts of cycle projects are normally hard to measure exact. This has at least two explanations. One is that improvements for cyclists are often part of a more extensive project. The impacts of the altered conditions for cyclist are thus hard to separate from other alterations. The bridge in our study is mainly changing the cycling conditions. The other explanation is that to measure impacts beyond changed route choice, it is necessary to carry out a travel survey before and after the improvement has come, and that can become very expensive. Also, since the influential area in most cases will be quite small, it is essential to have a higher response rate in order to get significant results from the survey.

Before and after studies of similar cycle projects has been carried out before, but only as counts of the cycle traffic on the new infrastructure and on competing routes. This way one can not separate impacts like new trips, new destinations for the trips, and changes in the mode choice from changes in the route choices. Also, since the amount of cycle traffic vary relatively more, due to for instance weather conditions, than other form of personal transport, it is mandatory to count traffic for a longer time span to get reliable results.

A before survey was carried out at the spring 2012. It should have been in three parts; one for residents, one for employees at Flatåsen and the third for student at the college. Unfortunately the students never got their enquiries, and therefore this part of the survey was postponed to fall of 2012.

The survey covered the trips made by the residents of Flatåsen, but not trips made by others to Flatåsen visiting them. Also the survey did not including potential users of the bridge on trips that neither starts, nor ends at Flatåsen. It was presumed that they are not of considerable amount. We invited the largest employers at Flatåsen to let their staff participate in the survey, but not the smaller ones. We assume that their travel to work pattern are more or less the same, regardless of the size of their workplace.
The survey for residents was sent to them on paper along with a response post paid envelope. Family members aged 10 or more were asked to fill out information about the trips they did the two previous work days, and their individual access to various transport modes.

The survey for employees was carried out on web. The respondents got an e-mail with information about the survey and a link to the website. The questions were limited to work trips and information about their access to various transport modes, and thus somewhat simpler than the survey for residents.
Only preliminary results from the local travel survey are included in this paper yet.

2.3 Counts of cycling traffic

Counts of walking and cycling traffic were done on May 10. 2012. It was a Thursday an ordinary week. The registrations were done in the morning at 7.00 - 9.00 hours, and in the afternoon at 15.00 -17.00 hours. The counted movements are shown in Figure 1, and the counted numbers of cyclists are displayed in Table 1.

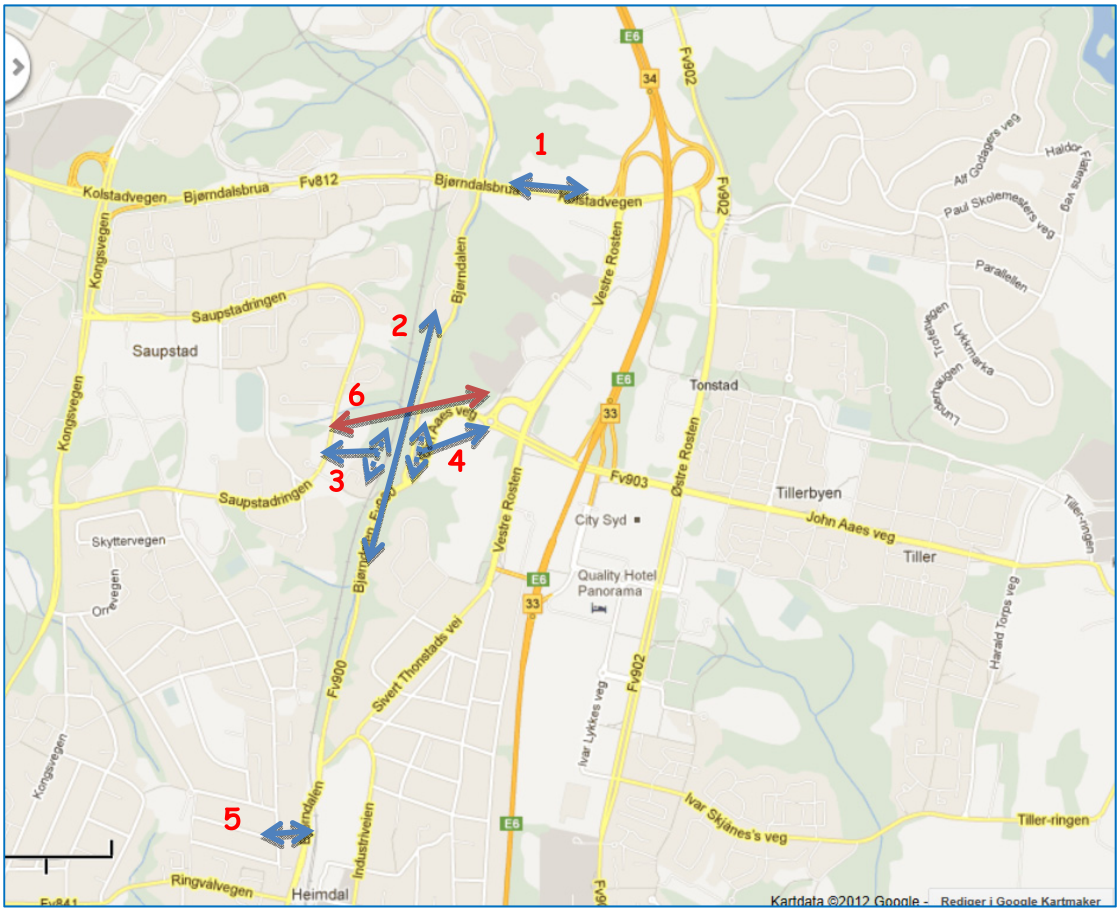

Figure 1: Map with cycle count places

Table 1: Number of cyclist counted Thursday May 10. 2012

Count number	Direction	Number of cyclists	Direction	Number of cyclists	Total both directions
1	→	86	←	71	157
2	↙	221	↗	131	352
3	→	18	←	16	34
4	→	27	←	17	44
5	→	79	←	113	192
6	→	11	←	12	23

The count points shown in Table 1 represent flows with various potential of making use of the new bridge, should it be built. The number 2 count has the least potential, since this point represents a north-south traffic flow. Number 6 represent a maximum potential, since the traffic is traversing the same stretch where the bridge is coming according to the plans. The other flows have various and unknown potential of changing to the new bridge.

The counts are not covering a whole work day, only four hours totally. Also there is no information about the variance in these numbers, since the counts were made on one single day. The counts can be compared to traffic flows from the transport model, but can only be used to consider if the numbers in the transport model are roughly in the right level. Additional counts are planned in august 2012.

A guesstimate of the average daily traffic are made, based on counts from Table 1 and the systematic season variation from the NTS2009. These have loosely been compared to the traffic flows from the transport model.

3 Modeling changes in the demand for cycling

3.1 Cycling in the Regional Transport Model of Norway

The Regional Transport Model of Norway is a strategic transport model in which we recognize the structure of the four step model (Ortúzar and Willumsen, 1990), even if it is not a sequential model structure in all the four steps.

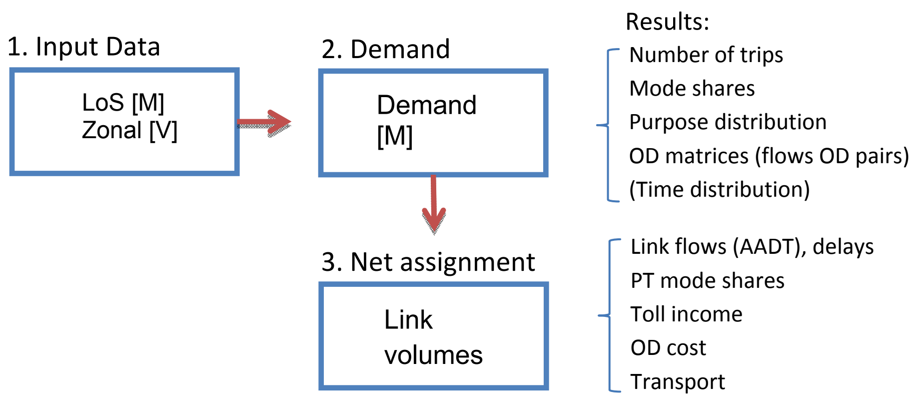

Figure 2: Model structure of RTM

The principles of the model structure of RTM is shown in Figure 2 in three stages. Input data are skims of coded network for all transport modes, giving matrices with Level of Service data (LoS). The M in brackets indicates that the results are matrices, V indicate vectors. Zonal data contains information about demographic distribution of the residents, of activities in the zones and other characteristics like space and parking costs. The demand model, called *Tramod_by* (Rekdal et. al., 2012) is calculating the probable demand based on variables defined by the input data and parameters estimated from a previous travel survey. The demand model produces matrices in five purposes (Work, Business, Spare time, Follow others and Private (shopping, Errands and maintenance), five modes (car driver, car passenger, public transport, cycle and walk). The matrices are assigned to the mode specific networks in the last stage. The first stage is not considering crowdedness in the networks, but the last stage do. The model allows for iterations between stage 3 and two, and then uses LoS data from a loaded network as input to the demand model, and thus taking crowding in the car network into account in the destination and mode choice calculations. The trips are modeled as round trips with two or three legs, as is shown in Figure 3.

The study of how cycling is treated in the model is divided into three parts. It starts with how the conditions for cyclists are represented in the input data, and proceeds with a description of how the demand model calculates the impetus to choose cycle over other modes. Last we look at how the preliminary results from the demand model are processed to get final results. This procedure is necessary to dive into explanations for results, and evaluation of the model for analysis of cycle transport.

3.1.1 Cycling in input data

In this we focus on

- Net skimming for LoS data
- Zone sizes

The Level of Service data which are input to the demand model are used to quantify attributes connected to each choice of modes between zone pairs. The LoS data are produced by skimming the transport nets. For car drivers the LoS data includes time use, cost and distance. For cyclists only distance is included as LoS data.
The transport nets were by and large coded several years ago, while regional analysis was the main task for the model, and it was considered important to include smaller roads or specific roads dedicated for walkers and cyclists. One consequence of this is that the transport nets coded in many parts of the country are quite coarse, but this might also vary. This net was also used as basis for skimming the distance matrix used as LoS for cyclists, and it was a common matrix for car, cycle and walk. In version 3.0 of RTM it is now possible to include a specific LoS matrices for cyclists based on independent transport nets.

In early phases of the model development, it was decided to use the smallest geographical unit as the zonal data came in, as Zones. This corresponds to a block in a city or a neighborhood. There are about 14,000 zones in Norway, which means an average of about 350 people in each zone and a median size of 3.4 km^2, and even smaller zone sizes in average in cities where the geographical units are denser. The small zones sizes make it easier to get more accurate distances for trips on cycle.

3.1.2 Cycling in the demand model

Variables for cycling in Tramod_by are *distance* and *age dummy* variables (age dummies are introduced for Spare time and Private trips), making it more likely to choose cycle for younger people. Another dummy is *winter*, taking into account that it is less likely to cycle in winter time.

3.1.3 Kneaded results for cycling

The resulting matrices from the demand model are separated by the following trip categories:
1) Trip from house - Return trip or
2) Round trip; Trip from house - Intermediate stop - Return trip

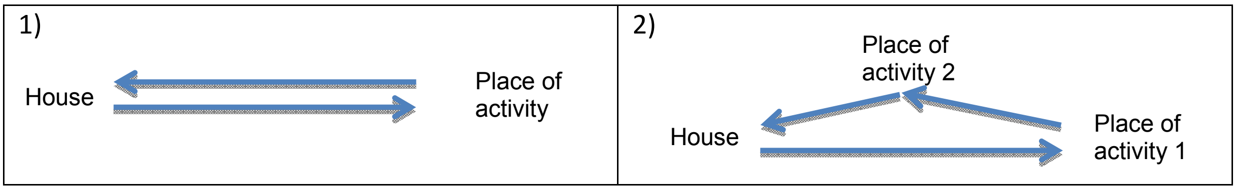

Figure 3: Trip categories

All the trips of category one is written in the OD matrices. Category 2 for the modes Car driver and Public transport are written to the matrices, but not Car passenger, Cycle and Walk. The total numbers are written in a table, thus information about the total number of trips exist, but not the OD pattern for Round trips by Car passenger, Cycle and Walk. The matrices from the first category are therefore multiplied by a factor to reach the total number of trips. This routine might overestimate the length of the trips if each leg in a round trip in average are shorter than trips in category one.

3.2 Calculations of a cycle project with the Regional Transport Model

RTM has been used to calculate impacts of a cycle bridge, which is planned to be built within about two years. This is done to illustrate how the transport model works, in the current version of it, and to discuss, or propose, possible alterations with the model, to make it more suitable for cycle analysis.

3.2.1 The new Bjørndalen Bridge

The location of the bridge is about 10 kilometers south of Trondheim (see Figure 4).

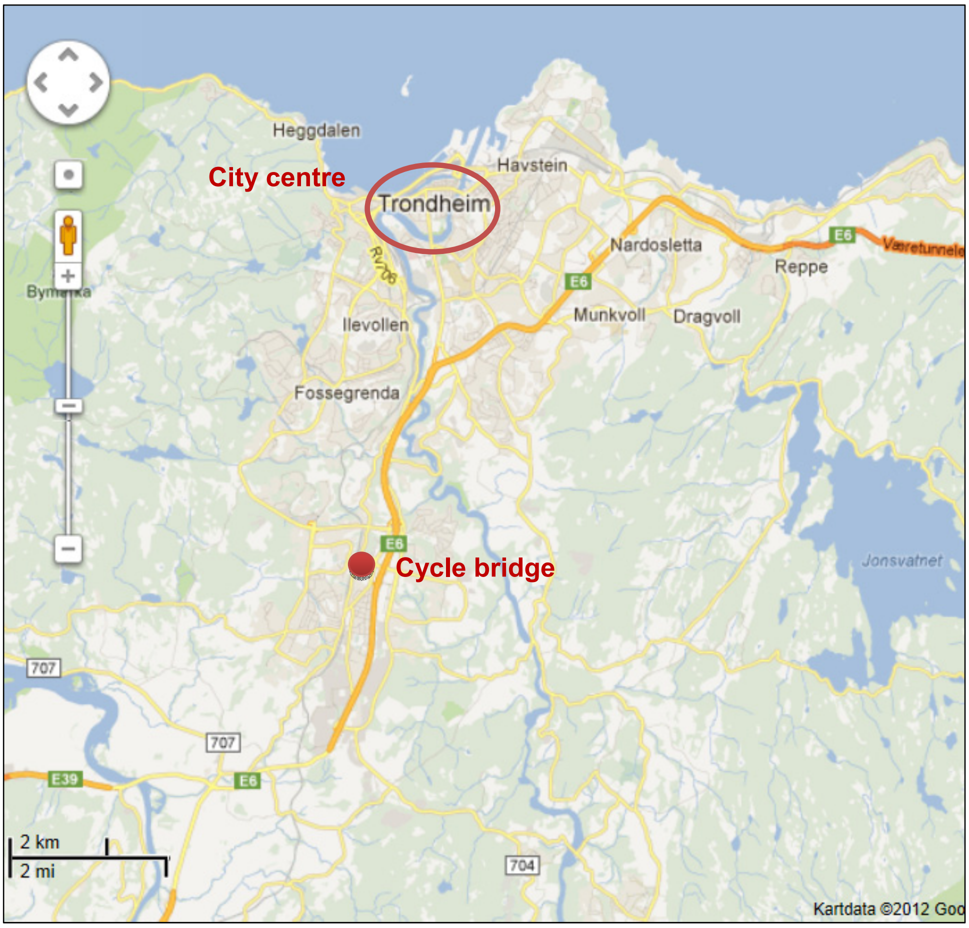

Figure 4: Map of Trondheim and placement of the cycle bridge


Figure 5: Picture (from the south) with a sketch of the bridge

The bridge will make the trip from Flatåsen (left side in the picture = west) to Rosten and Tiller (right side = east) easier because it reduces hilliness.

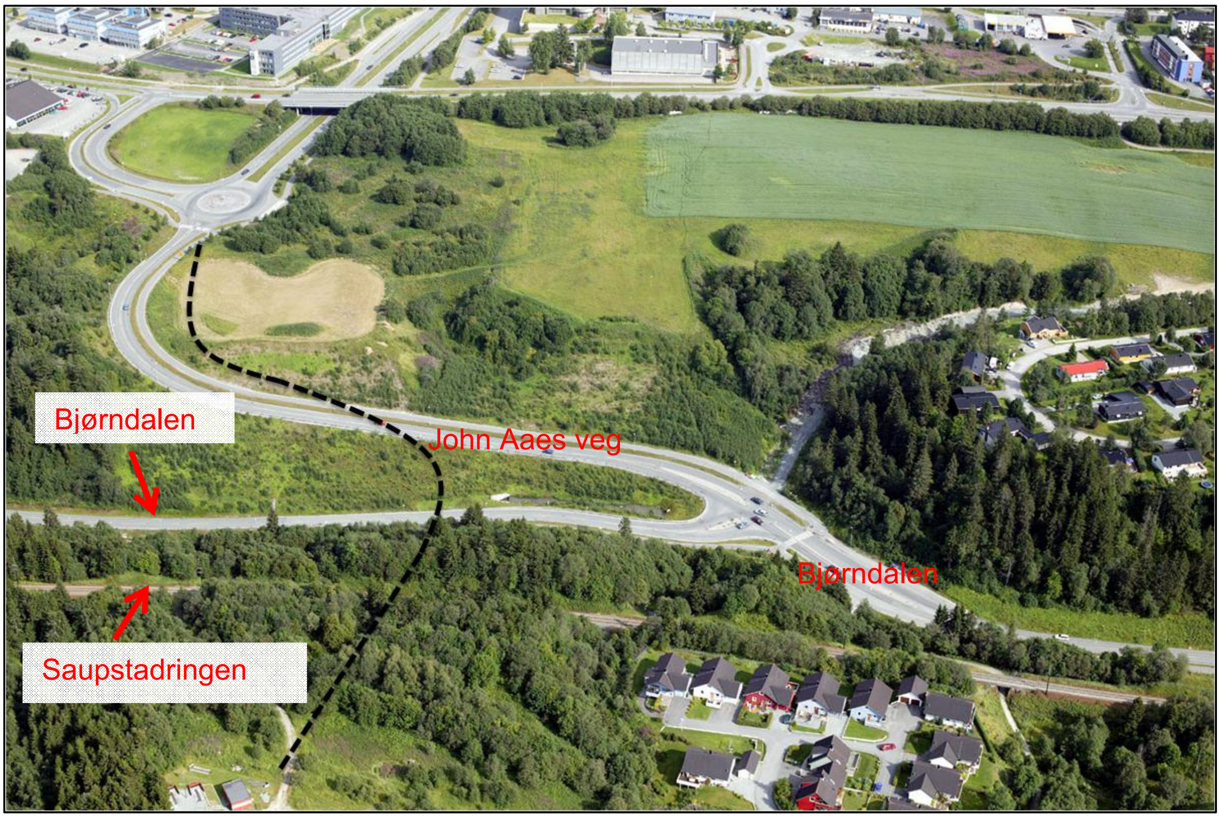

Figure 6: Picture (from west towards east) with a drawing of the project in black dots

The valley that the bridge is passing over is in the front of the picture. The bridge starts about where the lower red line is, and ends in John Aaes veg on the other side of the valley, which leads to a bridge under which the cyclists can go to get to the eastern side of the main road (E6).

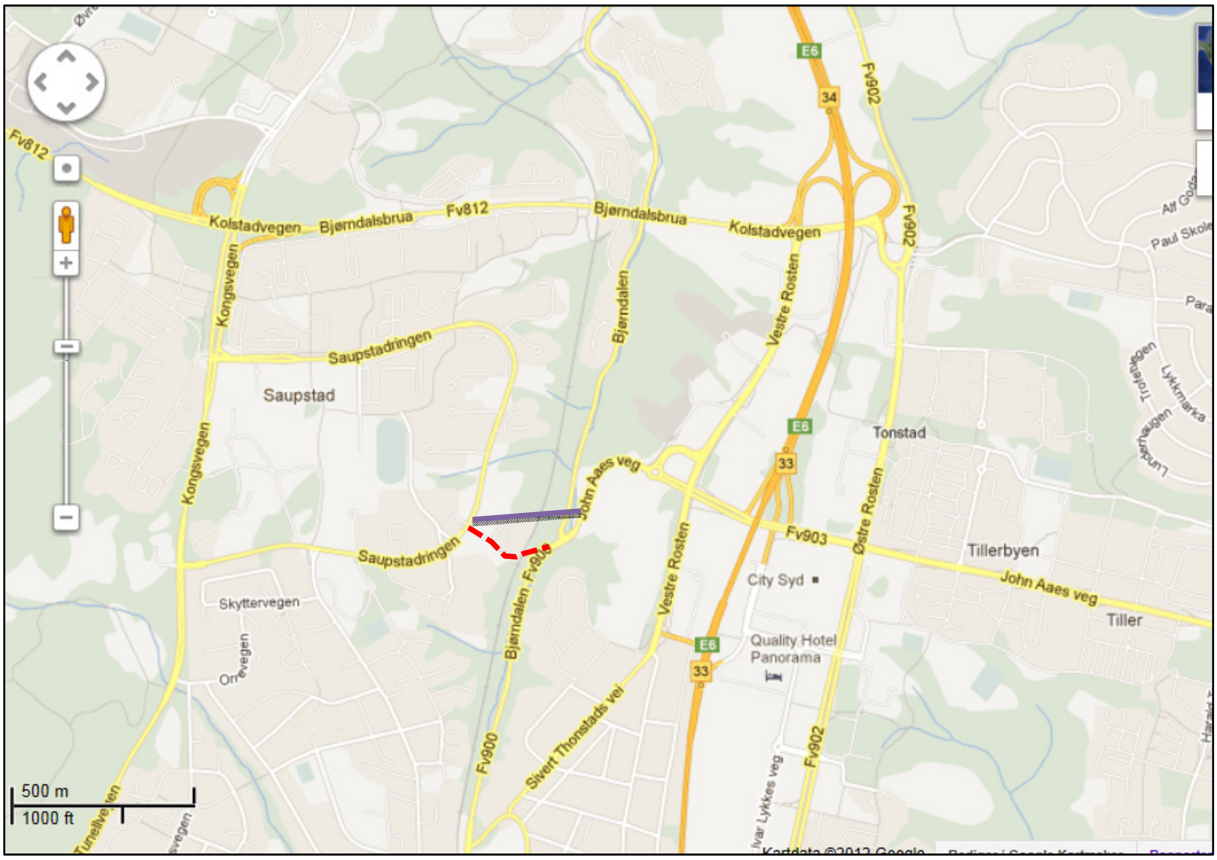

Figure 7: Map of the road network in the near by area of the bridge (red dotty line = cycle path, steep, purple line = new planned bridge)

3.2.2 Model premises

The Regional Transport Model version 3.225 was used in the calculations. The model area was Region Middle Norway, which covers the counties Nord-Trøndelag, Sør-Trøndelag and Møre- and Romsdal. Scenario year was 2010. The zonal data was updated in 2011.

The next three figures show the transport network as it was coded in the model. As we can see from the first of these figures, a lot of the connecting roads inside Saupstadringen was lacking in the original network. The basic scenario was therefore altered with several of these roads coded, and also the path from Saupstadringen to Bjørndalen was coded. The third of these figures show the same area with bridge coded. The bridge has been connected to the roundabout in *John Aaes veg* in the coded network. Details in the coding of the transport network are shown in Figure 13 page 16.

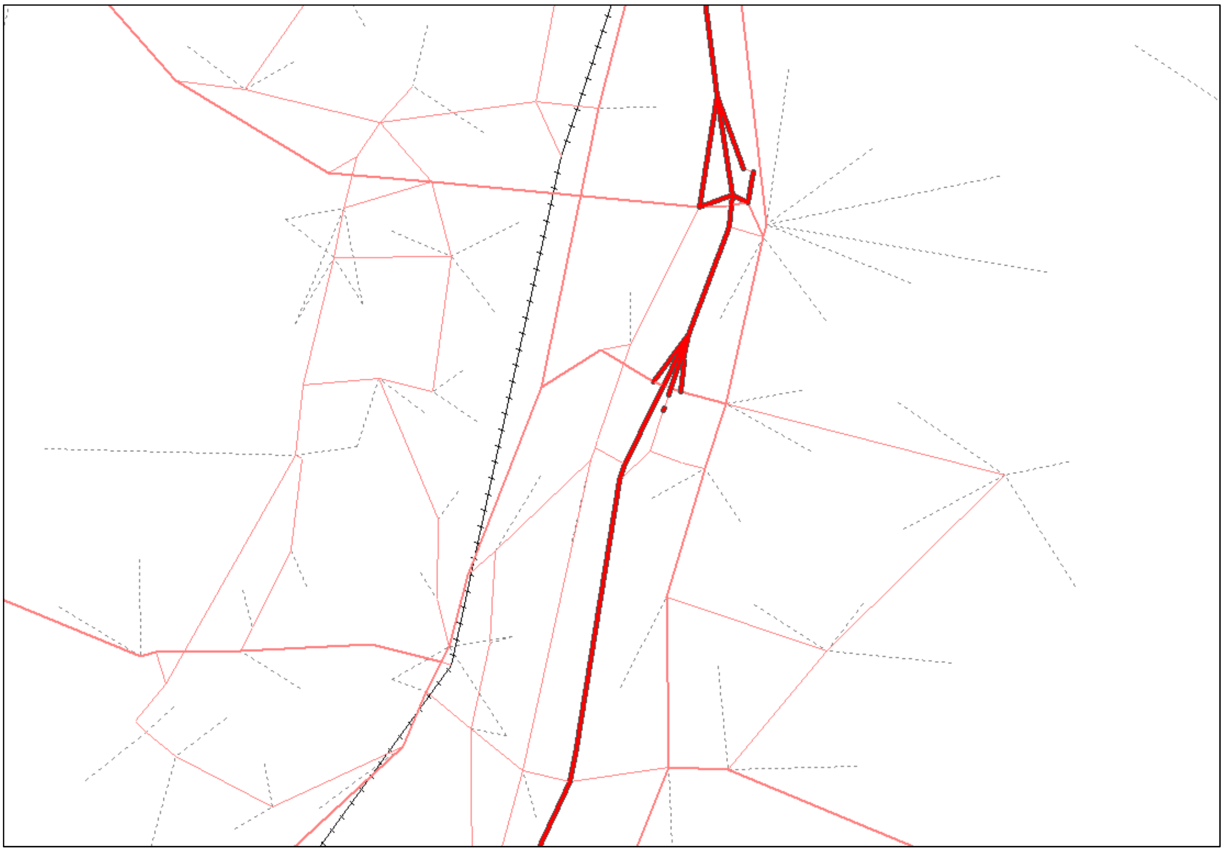

Figure 8: The original transport network in RTM Mid-Norway in the near by area of the bridge

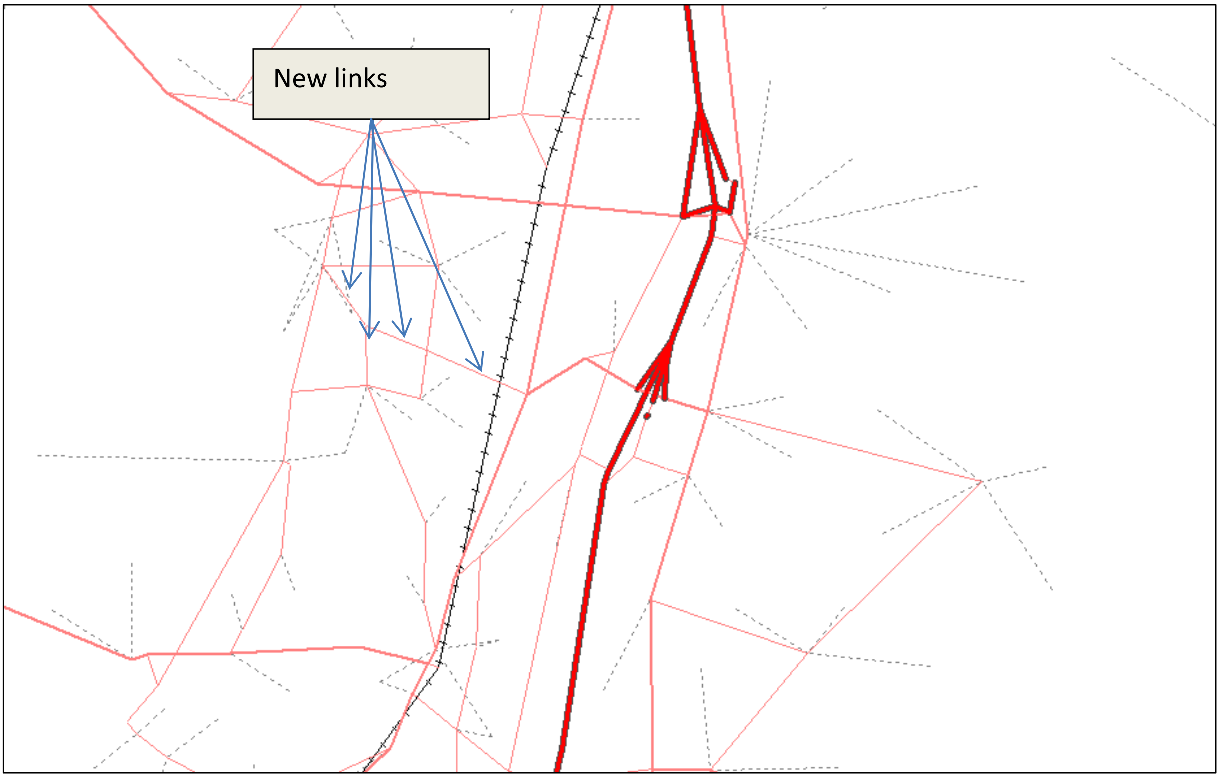

Figure 9: Altered transport network in RTM Mid-Norway in the near by area of the bridge, without the bridge

Figure 10: The transport network in RTM Middle Norway in the near by area of the bridge, including the bridge

3.3 Transport Model results

When comparing model results with the Travel Survey of 2009, the transport model data is limited to trips starting and ending in the municipality of Trondheim. The Travel Survey data is limited to trips made by residents living in the municipality of Trondheim.
This means that trips made by residents of Trondheim, and with one or both trip ends outside of the municipality, will be missing in the transport model results. An example is if someone lives in Trondheim but work in one of the municipalities adjacent to Trondheim. Their trip to work will not be included in the model results presented here.

3.3.1 Paramount model results

"Frame numbers" gives a quick overview of trip numbers in relevant purposes and modes. The frame numbers from the transport model are also presented in the first table in appendix 6.2 page 19.

Table 2: Frame number from the Travel Survey 2009 (only Trondheim)

	Work	**Business**	**Spare time**	**Follow others**	**Private**	**Total**	Mode shares
CD	53 %	71 %	48 %	76 %	41 %	292 503	**51 %**
CP	5 %	6 %	12 %	6 %	19 %	69 808	**12 %**
PT	12 %	7 %	5 %	1 %	8 %	39 316	**7 %**
C	16 %	5 %	5 %	4 %	8 %	44 375	**8 %**
W	13 %	11 %	30 %	13 %	24 %	128 994	**22 %**
Purpose shares	**19 %**	**3 %**	**33 %**	**12 %**	**33 %**	**574 996**	**100 %**

Table 3: Frame numbers from the Regional Transport model (only Trondheim)

	Work	**Business**	**Spare time**	**Follow others**	**Private**	**Total**	Mode shares
CD	66 %	74 %	49 %	79 %	59 %	398 674	**61 %**
CP	5 %	4 %	15 %	6 %	12 %	68 544	**10 %**
PT	12 %	6 %	7 %	2 %	5 %	41 483	**6 %**
C	7 %	3 %	5 %	2 %	3 %	25 849	**4 %**
W	11 %	12 %	24 %	10 %	22 %	120 615	**18 %**
Purpose shares	**18 %**	**5 %**	**25 %**	**12 %**	**39 %**	**655 166**	**100 %**

If we consider the numbers from the travel survey as answers, the model has too many trips, about 80 000 trips, which is almost 14 %. The car driver share seems to bee higher in the model than in the travel survey, and the difference is particularly pronounced in the Work and Private Trip purposes. The cycle shares are overall too low, and the number of cycle trips is also too low in the model.

The general trip length distribution in the Travel survey is shown in Figure 11, while the distribution of cycle trip lengths is shown in Figure 12. The median trip length on a cycle is 2.1 km.

The average trip lengths are shown in Table 4. The motorized trips are in average longer, while the non-motorized trips are shorter in the model compared to the trips in the Travel Survey.

Table 4: Average trip lengths from the travel survey and from the RTM (Trondheim)

	Travel Survey 2009 [km]	RTM [km]
Car driver	7,86	9,8
Car passenger	9,65	10,5
Public transport	8,91	10,3
Cycle	3,66	2,7
Walk	1,76	1,3

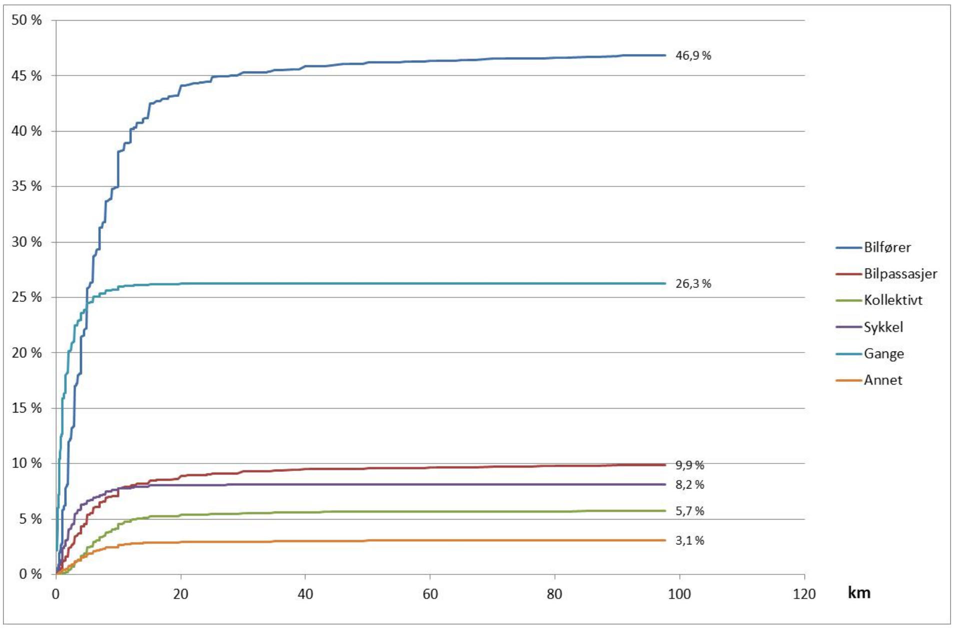

Figure 11: Trip length distribution from the Travel Survey 2009 (Trondheim)

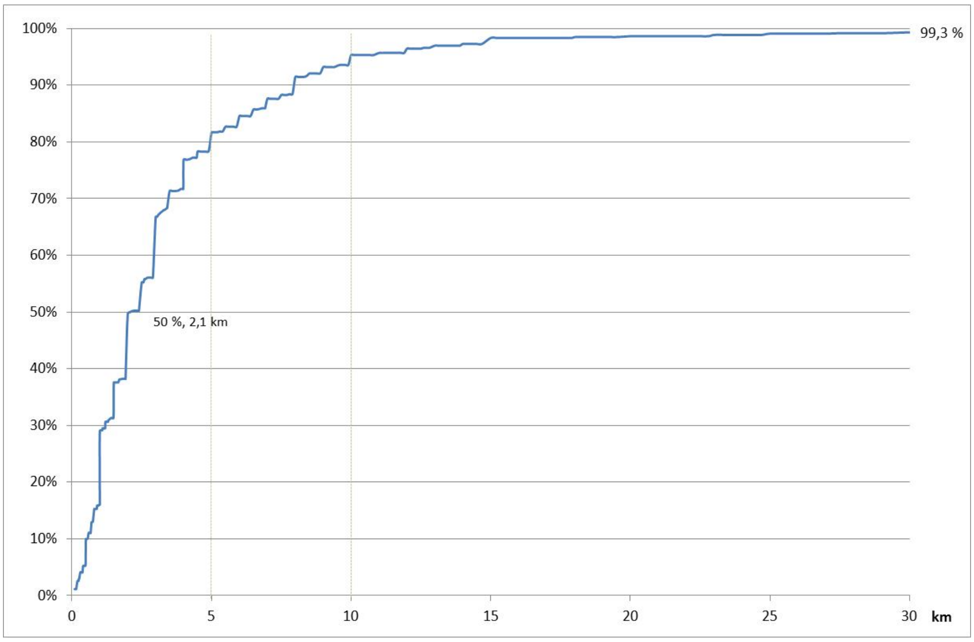

Figure 12: Cycle trip length distribution from the Travel Survey 2009 (Trondheim)

The traffic in May 2009 was 30 % higher than average for cyclists, Thursdays had 40 % more cycle traffic then average, and the time period of the counts had 40 % of the total daily traffic. Put together this means that we should increase the counted number by 37 % to get a guesstimate of the real traffic (See appendix chapter 6.3 for traffic variation tables) an average day.

Table 5: Link volumes from counts and transport model

Count number	Counts May 10.	Guesstimate of Aadt[1]	Model link volumes
1	157	215	140
2	352	480	66
3	34	45	156
4	44	60	227
5	192	265	310
6	23	30	?

The numbers in Table 5 indicate a poor fit between the counted cycle traffic and the transport model link volumes. This has at least three explanations: The total number of cycle trips in the model is too low, and the net assignment is not using the real network (it lacks many of the minor roads and cycle paths) and lacks information about hilliness. In the model this leads to cycle traffic on John Aaes veg which probably would choose Bjørndalen in real life. It also leads to an overestimation of the traffic on the path to Bjørndalen and up John Aaes veg.

3.3.2 Modelling the cycle bridge

Details in the model results are presented in appendix. See chapter 6.1 for the net assignment results and chapter 6.2 for results from the demand model.
Introducing the bridge in the model leads to a total of 14 more trips. It reduces the number of car and public transport trips, and increases the number of trips by cycle and foot, 22 cycling trips and 99 walking trips, respectively. This change was expected, since the new bridge is open only for non-motorized traffic. The new bridge gets 310 cycle trips in the transport model. The trips are mainly redistributed from the old path between Flatåsen and Bjørndalen and John Aaes veg to Bjørndalen, but also 80 trips from the existing Bjørndalen bridge (count 1).

3.4 How the bridge is received by the residents and workers in the neighbourhood area (preliminary results from local survey)

There was not time to examine the survey results in detail, but in both surveys the respondents were invited to give comments, and some of these are summarized here.

3.4.1 Workers

About 10 % of the 102 respondents have answered that they might change their transport pattern on their work trip if the scheduled bride came. Most of these have explained that they would change to cycle, and some state that is would be easier and safer to use this new bridge.

3.4.2 Residents

The travel survey includes 225 households with a total of 400 people of more than 10 years. The respondents were asked to comment about the bridge project, both positive and negative responses. Some are worried about the costs, and think that other road projects perhaps should be prioritized over this one.
Some say that the present alternatives, the existing Bjørndalen bridge or the path down to Bjorndalen (road) and up John Aaes veg, are poor cycle alternatives, especially at winter time. It is stated that the conditions on these roads should be improved, to give a safe cycle alternative.

[1] Aadt = Average Annual Daily Traffic

The new bridge gets mainly positive response, both because it would be a safer and a faster alternative, and it would decrease the barrier between shopping center area on the right side of E6, and Flatåsen and surrounding areas.

4 Model performance and development suggestions

The Regional Transport Model in its present state would probably underestimate the number of cycle trips in Trondheim. This level could be increased by calibrating the parameters which are used by the demand model. However we have studied results for Trondheim in this paper, and the parameters are already calibrated for the modeled area (three counties). The reason why the model underestimate the number of cycle traffic in Trondheim and probably overestimate the number of traffic outside of Trondheim, is related to the explanation variables used by the demand model. It implies that important explanation variables, which should explain why people choose or not choose cycle, are lacking in the demand model, in its present state. Including such variables would not only improve the demand calculation for cycle transport, it would also explain in more detail why people not chose (or choose) cycle.

The model would distribute the cycle trips on the transport net by using the shortest path between zone pairs, and in doing this, using mostly main roads, which are the ones which are coded. This could give link volumes which might differ a lot from registrations of cycle traffic on specific roads.

Hilliness is one element which should be included in the Level of Service data as input to the demand model, as an important explanation factor for why people chose cycle. It also turns out to be an important variable in the route choice modeling for cycle traffic.

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6 Appendix

6.1 New coding in RTM

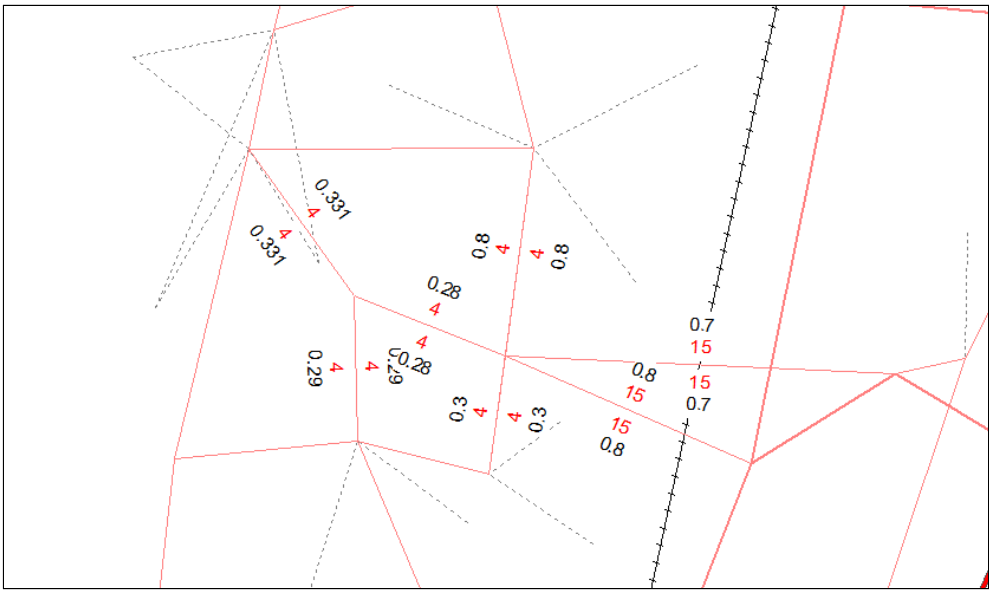

Figure 13: "Link type" (red) and "Link distance" (black) as coded on the new links

Figure 14: Net assignment of the modes "Walk" (black) and "Cycle" (Blue) for Scenario 0

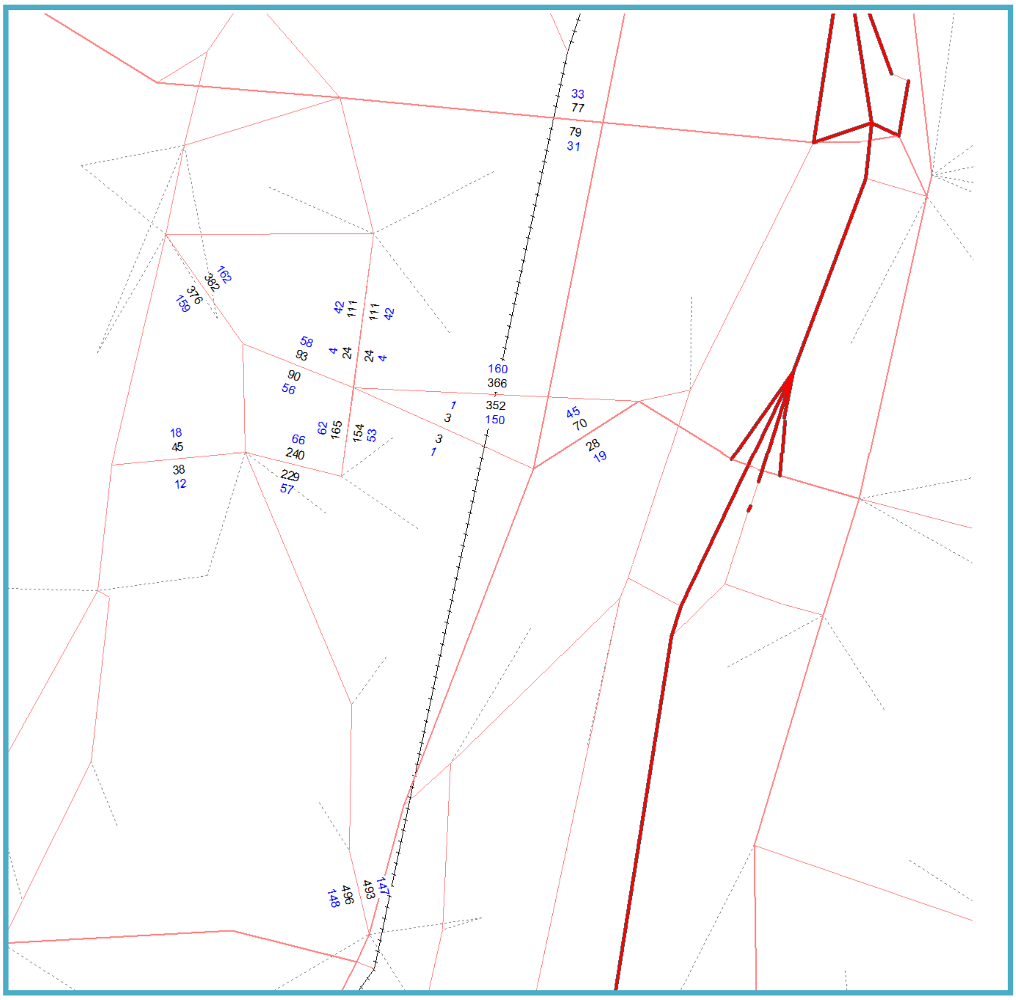

Figure 15: Net assignment of the modes "Walk" (black) and "Cycle" (Blue) for Scenario 1

6.2 Results from the demand model in RTM for the municipality of Trondheim

Alt0	Arb	Tje	Fri	HeLe	Pri	Gods	NTM5	TotTramod	Tot
CD	78 403	26 204	79 649	63 793	150 626	7 212	982	398 674	406 868
CP	6 141	1 587	25 182	5 014	30 621			68 544	69 267
PT	14 032	2 297	10 899	1 587	12 667		248	41 483	41 730
C	7 801	1 057	7 578	1 721	7 692			25 849	25 849
W	12 892	4 325	39 178	8 396	55 824			120 615	120 615
Tot	119 269	35 469	162 487	80 511	257 429	7 212	1 230	655 166	664 329

Alt1bru	Arb	Tje	Fri	HeLe	Pri	Gods	NTM5	TotTramod	Tot
CD	78 396	26 201	79 642	63 791	150 610	7 212	982	398 640	406 834
CP	6 140	1 587	25 179	5 013	30 615			68 533	69 256
PT	14 008	2 292	10 887	1 584	12 649		248	41 421	41 669
C	7 809	1 058	7 582	1 723	7 700			25 871	25 871
W	12 923	4 334	39 197	8 400	55 861			120 714	120 714
Tot	119 276	35 471	162 486	80 510	257 435	7 212	1 230	655 179	664 343

Diff.	Arb	Tje	Fri	HeLe	Pri			TotTramod
CD	-7	-2	-7	-2	-15			-34
CP	-1	0	-4	-1	-5			-11
PT	-24	-5	-12	-3	-18			-62
C	8	1	3	1	8			22
W	31	8	19	4	37			99
Tot	7	2	0	-1	6			14

Alt0	Arb	Tje	Fri	HeLe	Pri	Gods	NTM5	TotTramod	Tot
CD	66 %	74 %	49 %	79 %	59 %	100 %	80 %	60,9 %	61,2 %
CP	5 %	4 %	15 %	6 %	12 %			10,5 %	10,4 %
PT	12 %	6 %	7 %	2 %	5 %		20 %	6,3 %	6,3 %
C	7 %	3 %	5 %	2 %	3 %			3,9 %	3,9 %
W	11 %	12 %	24 %	10 %	22 %			18,4 %	18,2 %
Tot	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100,0 %	100,0 %

Alt1bru	Arb	Tje	Fri	HeLe	Pri	Gods	NTM5	TotTramod	Tot
CD	66 %	74 %	49 %	79 %	59 %	100 %	80 %	60,8 %	61,2 %
CP	5 %	4 %	15 %	6 %	12 %			10,5 %	10,4 %
PT	12 %	6 %	7 %	2 %	5 %		20 %	6,3 %	6,3 %
C	7 %	3 %	5 %	2 %	3 %			3,9 %	3,9 %
W	11 %	12 %	24 %	10 %	22 %			18,4 %	18,2 %
Tot	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100,0 %	100,0 %

Table 6: Average trip distances from the Regional Transport model (Trondheim)

	Car driver	Car passenger	Public transport	Walk	Cycle
Trips #	405 412	68 659	41 535	120 609	25 833
Km	3 964 506	719 896	425 798	156 199	69 115
Min	5 798 821	1 038 055	1 812 485	156 199	69 115
Km/h	41,0	41,6	14,1		
Km/trip	9,8	10,5	10,3	1,3	2,7
Min/trip	14,3	15,1	43,6		

6.3 Month traffic and week traffic variation in Trondheim

The variation is extracted from the Travel Survey from 2009, but only data from Trondheim. The tables show the traffic level compared to average numbers in each category.

Table 7: Month variation

	Car driver	Car passenger	Public transport	Cycle	Walk	Total
January	0,4	0,5	0,6	0,2	0,6	0,5
February	0,5	0,5	0,9	0,2	0,4	0,5
March	1,1	1,8	1,4	0,2	1,3	1,2
April	1,4	1,2	1,5	1,2	1,3	1,3
May	1,2	1,4	0,9	1,3	1,3	1,2
June	1,2	1,0	1,0	1,9	1,0	1,2
July	1,4	1,4	1,1	1,9	1,4	1,4
August	1,2	1,3	1,0	1,5	1,2	1,2
September	1,6	1,4	1,3	2,3	1,6	1,6
October	0,6	0,5	0,6	0,6	0,7	0,6
November	0,8	0,4	1,0	0,5	0,7	0,8
December	0,6	0,7	0,6	0,2	0,5	0,5

Table 8: Week variation

	Car driver	Car passenger	Public transport	Cycle	Walk	Total
Monday	1,1	0,9	1,0	1,2	1,0	1,1
Tuesday	1,0	0,7	1,2	1,2	1,1	1,0
Wednesday	1,1	0,9	1,3	0,9	1,2	1,1
Thursday	1,2	1,1	1,4	1,4	1,2	1,2
Friday	1,1	0,9	1,1	1,3	1,0	1,1
Saturday	0,8	1,6	0,7	0,6	1,1	0,9
Sunday	0,6	1,0	0,3	0,4	0,5	0,6

Two holidays would normally influence the traffic in May. It is Labor day May 1. and the National day May 17. In 2009, May 21. was the Ascension, which is also a day off in Norway.

Table 9: Day variation

Start hour	Car driver	Car passenger	Public transport	Cycle	Walk	Total
6	0,4	0,1	0,7	0,5	0,1	0,3
7	1,3	0,3	1,7	1,9	0,6	1,1
8	1,0	0,3	1,0	1,2	0,7	0,9
9	0,6	0,4	0,8	0,4	0,5	0,6
10	0,9	0,8	0,7	0,5	0,9	0,8
11	1,1	1,1	0,9	0,9	1,2	1,1
12	1,1	1,2	1,0	0,8	1,5	1,2
13	1,2	0,9	0,9	0,7	1,4	1,2
14	1,2	1,4	1,5	1,1	1,4	1,3
15	2,0	1,9	2,4	2,0	1,8	1,9
16	1,7	1,7	1,7	2,3	1,7	1,8
17	1,3	1,8	0,9	1,4	1,2	1,3
18	1,2	1,8	1,1	1,2	1,3	1,3
19	1,0	1,2	0,8	0,8	1,0	1,0
20	0,8	1,0	0,8	0,9	0,9	0,9
21	0,6	0,8	0,4	0,7	0,6	0,6
22	0,4	0,5	0,4	0,5	0,4	0,4
23	0,2	0,3	0,4	0,3	0,3	0,3