Assessment of measures in Växjö municipality

Summary of results in Växjö, group of activities 3.2.

2022-02-02

During the SUMBA+ project, Växjö municipality used the help of its PTV Visum transport model to assess two important measures from its commuting master plan as a means of promoting sustainable mobility: cycling walking and public transit. These measures include a circulation plan that uses a series of street closures to direct car traffic to a ring road that, in turn results in safer streets for cycling and walking within and between zones. Similar has been done in cities in the Netherlands (Groningen, Haag) Belgium (Gent, Leuven) with good results.

In addition, transfer points such as park and ride and bike and ride were assessed in the model to predict their potential for increased intermodal travel from neighbouring villages to Växjö city.

Circulation plan

A proposal for a circulation plan was presented by consultant Ramboll, based on a study including analysis of current situation, review of good practice, goal formulation, principal suggestions, and analysis with the traffic model. The concept of the circulation plan includes a series of road closures that prevent through-traffic between zones or city districts. Cars must instead drive out to a ring road to gain access to adjacent zones. The result, as seen in other cities, is calmer streets with less through-traffic, providing better conditions for pedestrian and bicycle traffic. In some examples, the street space could be repurposed to green space, play areas for children, outdoor gyms or additional seating for cafes and restaurants.

From the alternatives provided by Ramboll, Växjö municipality staff chose two alternatives to be examined in more detail and assessed with help of Växjö's transport model. These are referred to Alternative C and Alternative E shown below. The alternatives include two different geographical sizes, the first of which includes five zones and central roads in the city that Växjö municipality is responsible for. The second alternative includes a more expanded region, with 11 zones and including highways that the Swedish Transport Administration is responsible for. Alternative C, smaller of the two and measuring 1,5 km across, is considered a more viable solution in the near future and a further, more detailed analysis was included in Ramboll's report.

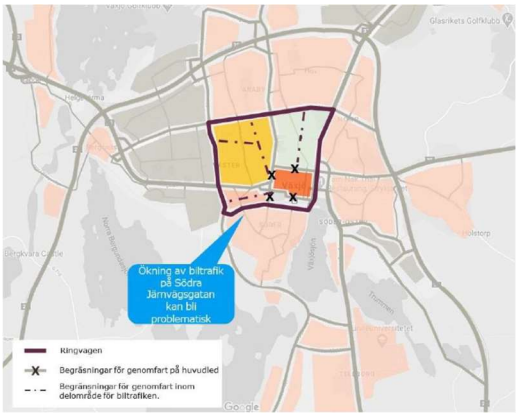

Figure 1 - Alternative C

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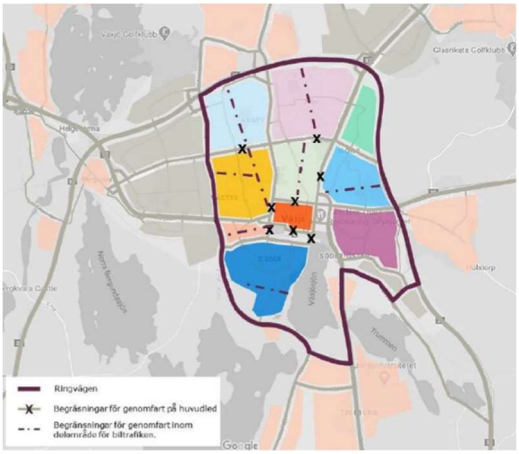

Figure 2 - Alternative E

The model was used to review changes to car traffic and cycling traffic. As expected, car traffic is reduced in the zones, along roads with barrier to through-traffic. Traffic decrease in alternative C compared to the 2018 baseline (current situation) is shown as blue lines in Figure 3 below. Reduced car traffic could reduce the barrier effect that car traffic has on cycling. The model shows an increase in cycling trips through the city center however the scale is minimal, around 150 increased trips per day on some roads. Red lines indicate where traffic has increased compared to the baseline. The ring road, highlighted with yellow, experiences higher traffic volumes, including up to 10 000 cars per day on the road south of the city center (Södrajärnvägsgatan). This increased traffic volume, in turn, creates an increased barrier effect for cyclists and pedestrians trying to cross these streets.

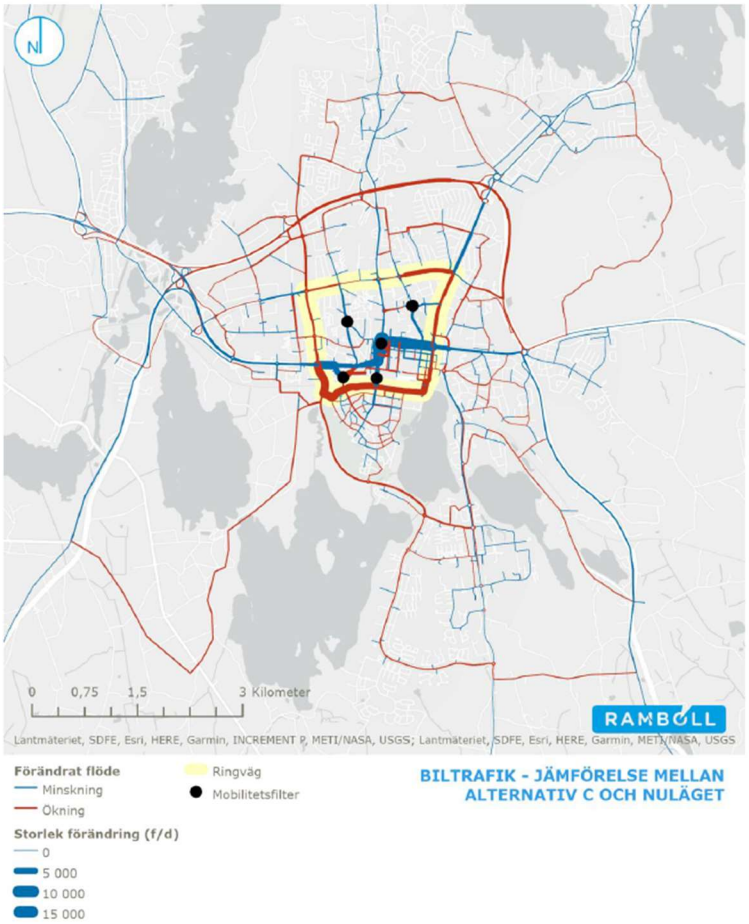

Figure 3 - car traffic, alternative C compared to 2018 baseline (red = increased car traffic, blue = decreased car traffic)

Similar results for Alternative E are shown in Figure 4 – increase car traffic along the ring road. However, here city traffic within the city is mixed with through traffic along the highways. Increased congestion results in longer travel times and car traffic begins to spill over to other routes. This is indicated by the thick red lines in Figure 4, north of the ring road, through housing and commercial areas that would otherwise struggle with the capacity. Traffic in the city, between the zones, however, is decreased, indicated by the blue lines.

Travel times for bike and car are compared between the different alternatives, C, E and E+. E+ is a variation of E with added infrastructure investments at traffic junctions Fagrabäck and Helgevärma, as well as additional lanes on Norrleden. Travel times between the baseline 2018 and C are similar, with car travel increasing by 0,5 to 5 minutes. With E, however, the results are more drastic with an increase of 40-50 minutes due to a large increase in congestion. At this point it is expected that should E be implemented, that a portion of car traffic would change to other modes and travel times restored somewhat. However, the sensitivity of the transport model to modal shift is not sufficient to shift trips away from the car despite such long travel times.

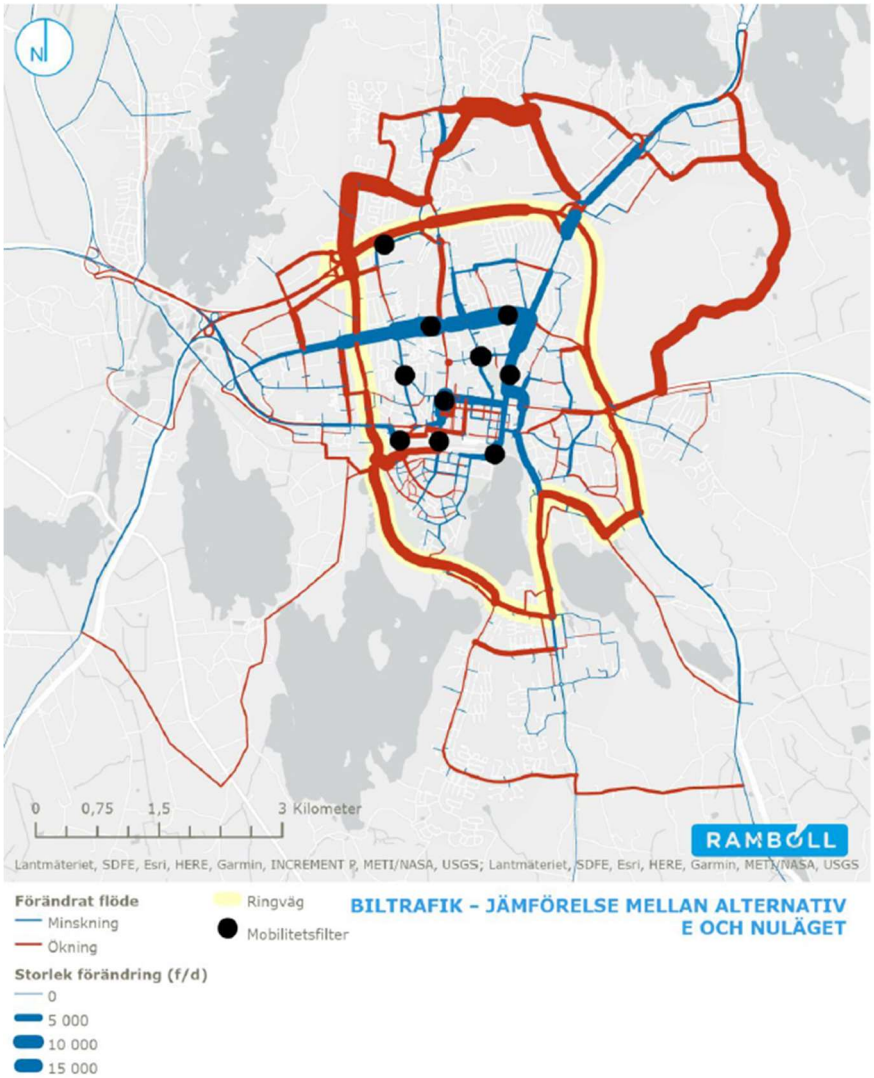

Figure 4 - car traffic, alternative E compared to 2018 baseline (red = increased car traffic, blue = decreased car traffic)

Table 1 - Travel times between common start/destination points in the city. Travel by car and bike according to 2018 baseline and Alternatives C, E and E+.

		Beräknad restid nuläge		Beräknad restid alternativ C		Beräknad restid alternativ E		Beräknad restid alternativ E (med planerade ombyggnader)	
Från	**Till**	**Bil**	**Cykel**	**Bil**	**Cykel**	**Bil**	**Cykel**	**Bil**	**Cykel**
Högstorp	Centrum	0:08:19	0:09:18	0:09:08	0:09:35	0:21:12	0:12:25	0:25:13	0:12:35
Centrum	Högstorp	0:11:37	0:09:54	0:15:37	0:08:55	1:06:26	0:08:55	0:42:49	0:8:47
Högstorp	Västra Mark	0:12:10	0:18:03	0:12:31	0:18:27	0:23:27	0:18:52	0:21:10	0:18:7s
Västra Mark	Högstorp	0:12:20	0:16:38	0:14:32	0:16:40	1:01:19	0:17:43	0:26:24	0:18:1
Centrum	Teleborg	0:11:58	0:15:07	0:15:16	0:15:04	1:04:26	0:14:55	0:55:27	0:15:42
Teleborg	Centrum	0:10:38	0:14:38	0:12:03	0:14:39	0:20:52	0:15:28	0:19:20	0:15:34
Teleborg	Västra mark	0:14:35	0:21:25	0:15:15	0:21:40	0:23:39	0:23:40	0:22:00	0:23:37
Västra mark	Teleborg	0:13:35	0:21:40	0:15:59	0:23:38	1:04:14	0:23:49	0:50:29	0:24:56
Hovshaga	Centrum	0:08:10	0:11:22	0:09:21	0:11:30	0:14:44	0:11:26	0:14:27	0:11:26
Centrum	Hovshaga	0:09:04	0:11:14	0:09:41	0:11:13	0:15:01	0:12:25	0:24:45	0:14:21

Park&Ride and Bike&Ride

To better understand the potential for intermodal trips between villages and rural areas of the municipality and Växjö city, Växjö's transport model was assess park&ride and bike&ride locations throughout the municipality. Locations were identified based on documentation from Länstrafiken Kronoberg, the regional bus operator.

As a measure to reduce travel by car, the "park and ride" concept has been evaluated using the traffic model for Växjö. The concept of park and ride means that you can easily park at one of these places and easily change to a bus to get into town.

24 "park and ride" places have been analysed, these have initially been developed by the municipality, and then connected to the nearest bus stop in the traffic model. The location of the "park and ride" and which public transport lines cross these are shown below.

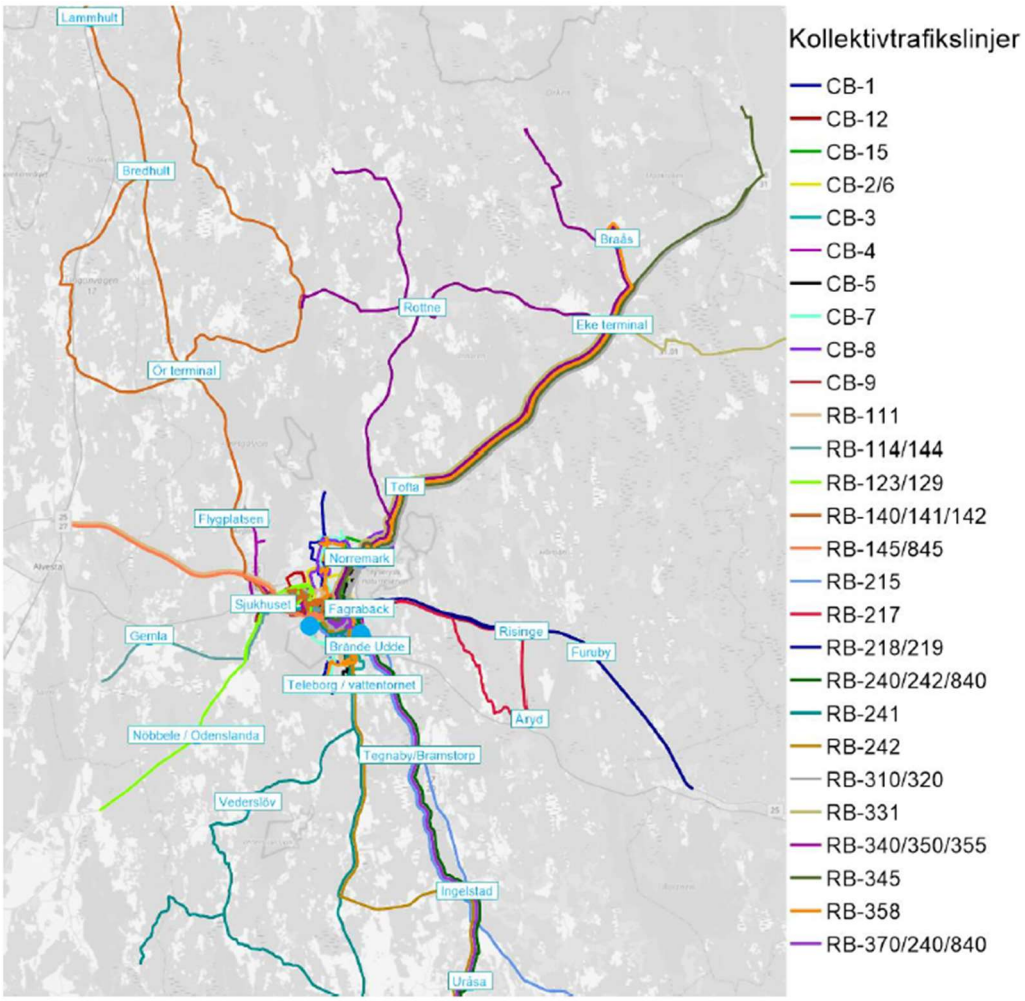

Figure 5 - bus routes and transfer points in Växjö municipality that are included in the analysis

To identify if there are people who might consider changing means of transport, the start and finish point have been analysed for everyone who passes one of these "park and ride" places. Due to the structure of the traffic model, each area in the model has only been connected to a "park and ride" place.

To get an effect in the analysis, a parking penalty has been added in central Växjö in the traffic model in the form of an extra time. The time supplement that has been used is 10 min or 15 min, which corresponds to a parking cost of SEK 13 and SEK 20 respectively (when the Value of Time is assumed to be SEK 80 / h).

As the traffic model is not considered sufficiently sensitive to changes in travel time and create a modal shift, the travel time ratio between travel time by car and public transport has instead been used for the analysis. The relationship between the travel time ratio and the proportion of public transport passengers is shown in the figure below, the black line showing the relationship from various studies in Sweden (study 1) while the orange line a study in Stockholm (study 2).

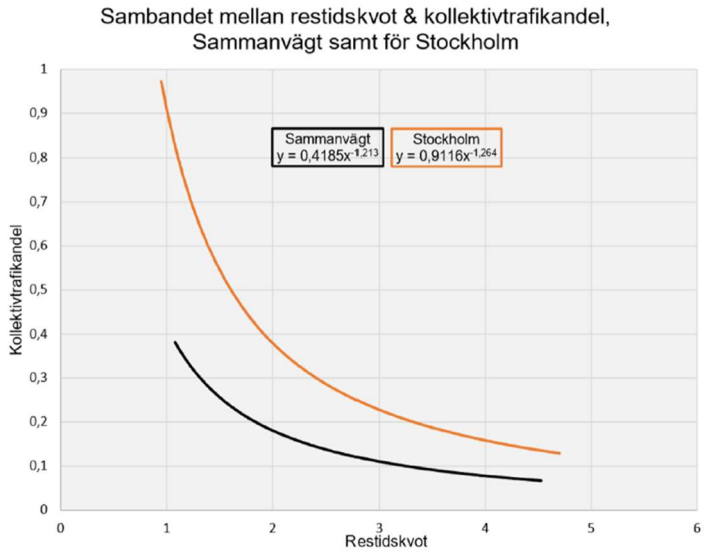

Figure 6 - Relationship between public transit modal share and travel time ratio between transit and car

The table below shows the results of the park and ride analysis, the potential number of travellers that drive today who could instead combine the car with bus. The most probable outcome should be in line with the result for study 1, travel by public transport in Stockholm (study 2) is generally higher than in the rest of Sweden.

Table 2 - results, potential of shift from car to park&ride

	TP10		TP15		TP30	
	Studie 1	**Studie 2**	**Studie 1**	**Studie 2**	**Studie 1**	**Studie 2**
Vehicle	15.5	47.3	63.3	192.5	227	693
Person	18.6	56.7	76	231	272.2	831.4

A similar analysis was done for travel by bike & ride where travellers could combine the bike with the bus. In addition, the results of the park and ride analysis have been used as a basis for further investigating how many of these may consider taking the bicycle to the park and ride site instead of a car. As there are no studies for the connection between travel time for car and bicycle, the connection for car and public transport (Figure 6) has been used instead. The analysis with travel time ratio has thus been applied to the result in table 2 and thus resulted in the number of people who can imagine taking the bike to the park and ride site and the bus from there, which is shown in the table 3 below.

Table 3 - results bike & ride

	TP10		TP15		TP30	
	Studie 1	**Studie 2**	**Studie 1**	**Studie 2**	**Studie 1**	**Studie 2**
Vehicle	2.5	23.1	9.35	87.23	41.02	384.7
Person	3	27.7	11.22	104.7	49.2	461.64

The traffic model is limited in the aspect that parking fees have been levied only in the most central parts of the urban area and are levied at the area level. In reality, it usually differs depending on where you stand, for example the street or in a parking garage. The time penalty used is apparently high, but in correspondence with the parking cost of 13 and 20 SEK, respectively, the time penalty could have been higher. To make intermodal trips more attractive, it is important to be able to challenge the travel times by car. For example, with express bus lines, increased parking fees and measures similar to the circulation plan. Potentially, park and ride would have more benefits in combination with a circulation plan and with parking spaces closer to the city. In this way, the long-distance car journeys are made just as they are today, but with a larger investment in city buses, the short-distance car journeys can be reduced and replaced by bike and ride to a greater extent, easing congestion in the city center. From the emissions analysis work done in SUMBA+ we can see that the number of cold starts in the Växjö city is relatively high, in order to reduce the climate impact due to car traffic in Växjö municipality, these should be focused on.

The results will help traffic planners in Växjö to prioritise measures such as car and bike parking, real-time bus information displays, weather shelters and adjustments to timetable to help attract increased travel through these transfer points. The top eight hubs are identified in the table below, with 15-minute time penalty for car users and study 1 result. The results from the model are low but reflect only travel times compared to the car. When other factors are considered, such as using bus travel time to work or removing the need for a second car when bike is combined with bus, a greater potential, in reality, could be experienced.

Table 4 - Hubs showing highest potential for modal shift from car to park&ride.

Hub	Number of trips, TP15 study 1
Norremark	33
Furuby	13
Sjukhus	9
Risinge	7
Teleborg	4
Nöbbele	3
Fabrabäck	2
Brände Udde	2