Oslo-Stockholm corridor, compilation of previously studied measures

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Introduction

Region Örebro County is a partner in the EU financed project Baltic Loop, which consists of several regions in the corridor, *The Northern Growth Zone* (Örebro-Stockholm-Helsinki-St. Petersburg). The project's aim is to identify bottlenecks in the transport system, develop solutions to minimize the travel and shipping times for passengers and goods, and to reduce emissions.

At the end of March 2020, Trivector was commissioned by Region Örebro County to compile previously studied measures implemented for the Oslo-Stockholm corridor. The study consisted of the compilation of 8 documents related to the corridor, where in which the most important proposed measures and the expected effects were compiled. The proposed measures have been analysed, commented on, and assessed by Trivector.

Compiling of previous studies

The following sections summarise the most important proposed measures from previous studies. The measures greatest advantages are also reported. The measures for the Measurement Selection Studies (*Åtgärdsvalsstudier* in Swedish) are divided into 4 steps of measures (steps 1-4). The section is introduced with a brief background which generally describes the potential for increased train travel along the corridor, in addition to an overview of ongoing studies along the corridor.

Background

Train traffic today has a difficult time competing for the market shares with air and car traffic along the Oslo-Stockholm corridor. Between Oslo and Stockholm there are about 1.4 million flights per year with the travel time of approximately one hour. The corresponding figures for train traffic are 0.3 million trips per year with a travel time of over 5 hours (Sweco, 2017). With investments in the railway that will reduce travel time, the market share is increasing. Forecasts predict it will be possible to achieve the target for train shares of all train/flight trips of 60% with a 3-hour travel time (Sweco, 2017). Furthermore, there is a link between regional growth and accessibility, where lack of accessibility can cause a municipality or region to lose competitiveness and experience inhibited development (the Swedish Transport Administration, 2017a).

However, the infrastructure along the corridor has shortcomings for both passenger and freight transport which impacts development opportunities. The shortcomings concern punctuality, travel time, operation and maintenance, levels of standard, capacity, and redundancy. In addition to these shortcomings, there are missing links in the rail network (the Swedish Transport Administration, 2017a; Sweco, 2017). Four important railway links along the corridor include: the Kongsvinger rail line

(*Kongsvingerbanan*) (existing), the Border rail line (*Gränsbanan*) (missing), the Värmland rail line (*Värmlandsbanan*) (existing), the Nobel rail line (*Nobelbanan*) (missing), and the Mälaren rail line (*Mälarbanan*) (existing). Specific capacity shortcomings discussed in previous studies apply amongst the Värlmand rail line, the Mälaren rail line, and the Svealand rail line, and create obstacles to achieving set goals for regional and national competitiveness (the Swedish Transport Administration, 2017a). To study the corridor, the Swedish Transport Administration conducted a measurement selection study in two parts during 2016 and 2017 "*Improved accessibility along the Stockholm-Oslo corridor*" (the Swedish Transport Administration, 2017a). There are also several other completed and ongoing studies along the corridor, see Figure 1.

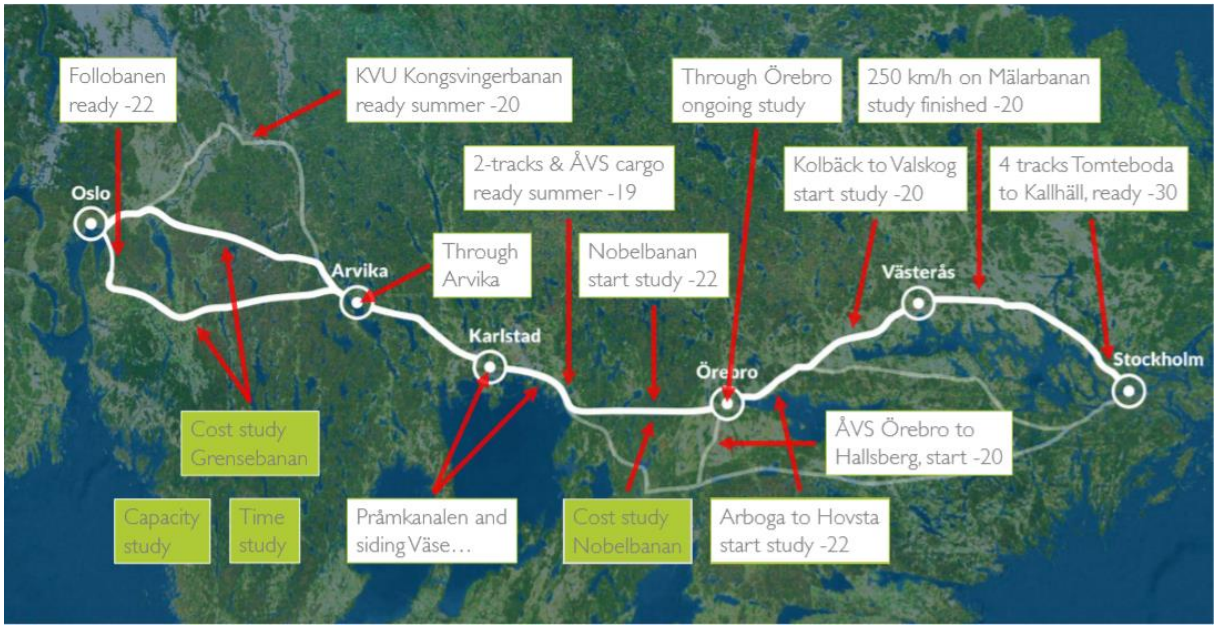

Figure 1 Ongoing studies along the Oslo-Stockholm corridor 2.55

The Measurement Selection Study Part 1 presents the governing targets and a preliminary list of measures proposed for the corridor. In Part 2, a deeper analysis and impact assessment of the preliminary measurement proposals was conducted, and the study presents a number of measures connected to the target years for 2030 and 2040, respectively. For the target year 2030, the focus is on increasing capacity on the existing railroad, while the focus for target year 2040 is to build new railway links (the Border rail line and the Nobel rail line) as a way to achieve set goals.

The starting point for this compilation is the goals and measurement proposals in the Measurement Selection Study parts 1 and 2, and is supplemented with measures from various other documents that appear in the reference list, wherein some parts are studied in more detail.

Project goals for the corridor

The general goals for the Stockholm-Oslo corridor (the Swedish Transport Administration, 2017a) are:

- The corridor's accessibility should be improved and thereby contribute to creating a coherent functional region with a positive social development and a competitive business sector.
- Development of the corridor's infrastructure should be done within the framework for the Consideration Goal.

The goals for 2030 (the Swedish Transport Administration, 2017a) focus on punctuality, travel times, and traffic and are:

- The railway system should be reliable.
- The use of existing railways should be streamlined.

- The railways capacity should gradually be adapted to meet the traffic development along the corridor.

The goals connected to the railway for target year 2040 (the Swedish Transport Administration, 2017a) are:

- The railway's competitiveness to air and vehicular traffic should be strengthened and its market shares for passenger and freight traffic should be increased.
- The railway should enable:
    - maximum three hours travel time between Stockholm and Oslo.
    - competitive travel times between node cities, where the designated node cities are Stockholm, Eskilstuna, Västerås, Örebro, Karlskoga, Karlstad, and Oslo.
    - a service frequency on par with an attractive transport system.

The goal for measures independent of traffic type (the Swedish Transport Administration, 2017a) is:

- Efficient transport should be enabled through increased coordination and appropriate access points for freight and passenger traffic.

Identified investment needs and measurement steps

To achieve the set goals, the Measurement Selection Study Part 2 states that the extensions of existing railways between Örebro and Västerås, as well as Kil and Kristinehamn, are necessary for the railway's functionality and to meet the market's demand for increased traffic by 2030. To reach the set travel time target of 3 hours between Oslo and Stockholm, further developments will be required and two new rial links will be necessary to reach goals for the target year 2040. In addition, this new development will need an increase of possible speeds of up to 250 km/h along the

corridor. The new links are assumed to be able to relieve parts of the existing railways and the proposed measures are expected to benefit both freight and passenger traffic (the Swedish Transport Administration, 2017b). Similar proposals for measures and investment needs are presented in Sweco's traffic audit from 2017, which states that extensive capacity improvements along the corridor are needed for the train to be competitive with flight and car traffic.

Figure 2 below illustrates how the stated goals coincide with the scope of the measures.

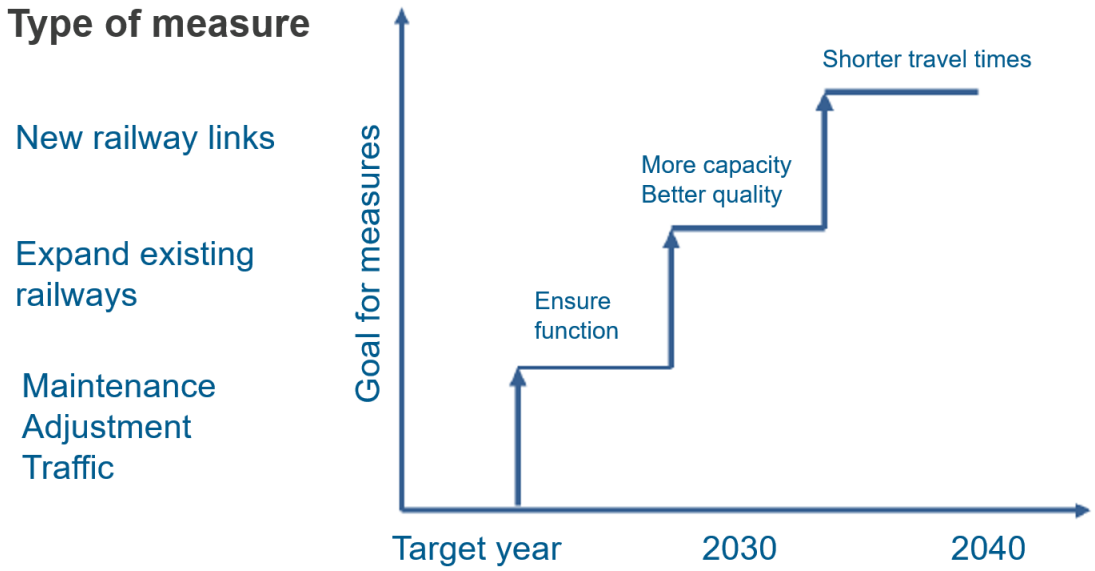

Figure 2 Measurement steps, source: the Swedish Transport Administration, 2017b.

In the coming sections, a review of measures already decided upon, followed by measure proposals for the sections of railway, are presented.

Decided measures

Measures have been decided upon for various sections of railway along the corridor. The National Plan for Investments in Infrastructure (2018-2029) includes the construction of new meeting stations between Kil and Laxå for about 300 million Swedish kronor. Work on this measure has already begun. Further these measures will improve capacity between Laxå and Arvika for about 500 million Swedish kronor. In addition, ongoing measures along the corridor include capacity improvements for about 17,000 million Swedish kronor between Tomteboda and Kallhäll. According to the Swedish Transport Administration report (2019), the development of a complete four lane track is underway on the section between Tomteboda and Kallhäll (the Mälaren rail line). The last section through Solna and Sundbyberg is estimated to begin earliest 2022 and take about eight years to complete. [1]

There are also plans for the expansion of a 250 km/h section along the corridor, which requires development of an ERTMS signal system. According to the National Plan for Investments in Infrastructure (2018-2029), all developments in addition to the Malm track, as well as the *Scan Med Ost* and *Scan med Väst* projects have been postponed until after 2029 and are planned to be ready by 2035. According to the Swedish Transport Administration's report (2019), the Mälaren rail line is planned to be expanded to 250 km/h only after 2030 and would lead to a travel time gain of 2-3 minutes between Stockholm and Västerås and 1-2 minutes between Västerås and Örebro (The Swedish Transport Administration, 2019). This measure would have a positive but marginal effect on the travel time between Stockholm and Oslo. The report

[1] The Swedish Transport Administration's website: https://www.trafikverket.se/nara-dig/Stockholm/vi-bygger-och-forbattrar/Malarbanan-Tomteboda-Kallhall/

further states that the railway between Stockholm and Oslo will be planned for speeds up to 250 km/h, however this will depend on several redevelopment and extensions.

In Norway, there are also decisions being made to implement the ERTMS signal system from the year 2030 on the Kongsviner rail line.[2] On the Kongsvinger rail line, new meeting stations and switching contact lines have been decided upon (the Swedish Tansport Administration, 2017). In addition to the above, several smaller capacity enhancing measures have been decided upon for the Swedish rail network I the form of steps 3 and 4, which include, for example meeting stations, intermediate blocks, and lane change opportunities (the Swedish Transport Administration, 2017b).

Significant measurement proposals

This section presents the most important measurement proposals that have emerged in the studied documents. The starting point for the review is the Measurement Selection Study Part 2, which is supplemented with measurement proposals from other documents wherein some documents have been studied in more detail. The measures are presented with the target years 2030 and 2040 for the respective sections along the corridor in steps 1-4. A summary of compiled measures in table form can be found in attachment 1.

The proposed measures for the target year 2030 aim to develop the existing rail systems by strengthening capacity, increasing traffic punctuality, and establishing shorter travel times. For the target year 2040, the measures aim to further strengthen the existing rail system, open new regional connections, as well as significantly reduce travel times between Oslo and Stockholm.

[2] Jernbanesektorens handlingsprogram 2018–2029

In Figure 3 below, the development strategy for the Oslo-Stockholm corridor is illustrated.

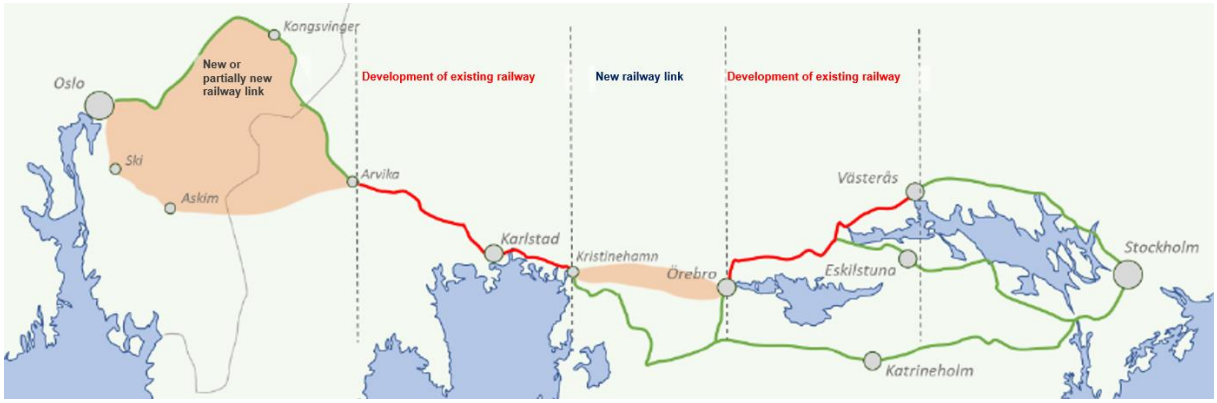

Figure 3 Development strategy for the Oslo-Stockholm corridor source: the Swedish Transport Administration, 2017b.

Step 1 and 2 measures

According to the measurement steps, steps 1 and 2 are within the framework of the target year 2030. Theas measurement proposals can function as catalysts for the benefits of infrastructure investments in road and rail, as well as increase efficiency (the Swedish Transport Administration, 2017b).

The step 1 and 2 measure presented are

- Development of existing travel centres with transfer opportunities between train and bus (flight).
- Parking lots at some stations and larger stops.
- Common ticketing system for passenger traffic.
- Develop mod functions for freight transport. This includes planning for efficient nodes for reloading of different traffic modes (combination terminals) and deciding on specific points for multimodal shipping, in addition to marketing and informing about these opportunities.

- Develop common forecast models for social benefits across national borders.
- Invite future researchers to take part in dialog about passenger transport.
- Digitalization that can make information readily available, which can then be used to coordinate transport and find more efficient travel solutions (the Swedish Transport Administration, 2017b).

Steps 3 and 4

Target year 2030

For the various section of railway along the corridor are measures are listed in order of priority. Priority 1 measures have the aim of increasing traffic and improving travel times and punctuality, while Priority 2 measures are needed to fully reach the goals for travel times and punctuality (the Swedish Transport Administration, 2017b).

Örebro-Västerås, The Mälaren rail line

To enable a continued development of traffic along the section, measurements such as capacity extensions and speed increases will be necessary. The proposed measures would shorten travel times by 2 minutes and therefor increase capacity by 40%, in addition to improving punctuality.

For this section, step 3 and 4 measures are mainly proposed in the form of expansions of double (two-lane) tracks at several locations, a new bypass track at Munktorp station so, that passenger traffic can pass freight trains, as well as the rebuilding of the connection point in Hovsta between the Mälaren rail line and the freight corridor through Bergslagen, so that the tracks are on differing levels for increased capacity and flexibility. The proposed measures create a cohesive double track from Örebro to Valskog, as well as between Björke and Västerås.

In Figure 4 below, the various measures and their order of priority are illustrated (the Swedish Transport Administration, 2017b).

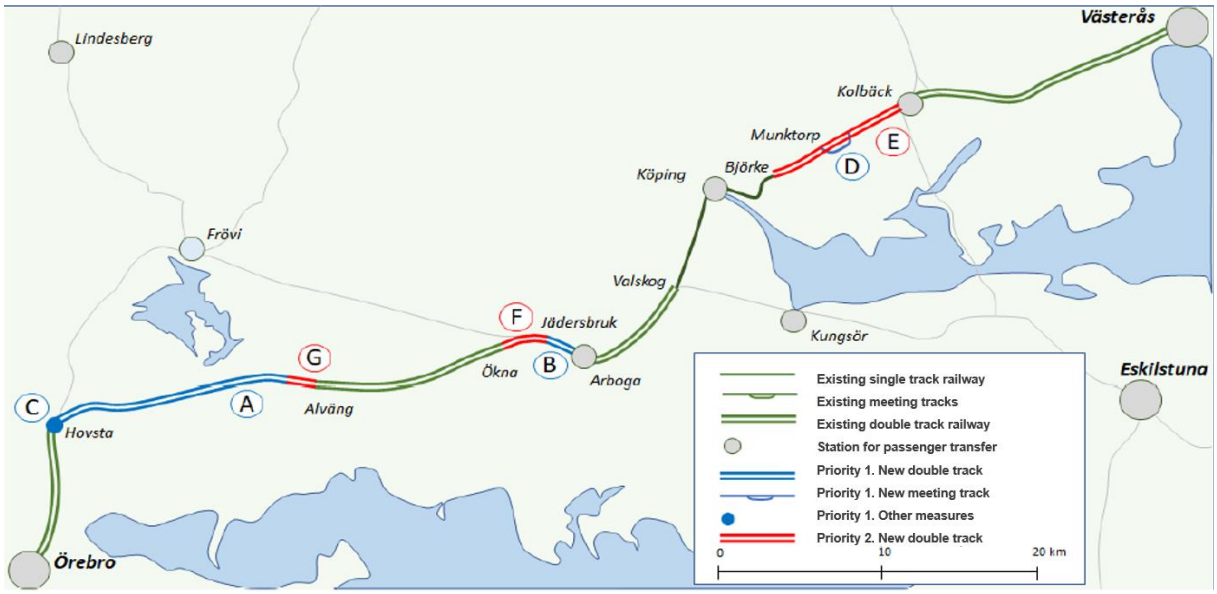

Figure 4 Measurement needs for the Örebro-Västerås section, for target year 2030, A-D correspond to priority 1 measures, E-G correspond to priority 2 measures, source: The Swedish Transport Administration, 2017b.

Kristinehamn-Kil, the Värmland rail line

The capacity utilization in this section is too high, which contributes problems of punctuality. The entire section is considered a bottleneck and the possibilities of increasing traffic is currently limited. The development of the section will require several speed increasing measures and larger capacity expansions. The proposed measures would shorten travel times by 7 minutes and therefore increase capacity by 30 %, in addition to improving punctuality.

For this section, the proposed measures (all 3 and 4 measures) include:

- expansion of double track at several locations (priority1)

- A new freight rail yard with parking tracks at Välsviken (priority 2)
- Connecting tracks between Välsviken and Kalstad's port, (priority 2)
- new switchgears in Kil (priority 2)
- new triangle tracks east of Kil between the Värmland rail line and the Norway-Värnern line, as well as west of Karlstad central between the Värmland rail line and the Skogdhall rail line (priority 2).

In Figure 5 below, the various measures and their order of priority are illustrated (the Swedish Transport Administration, 2017b).

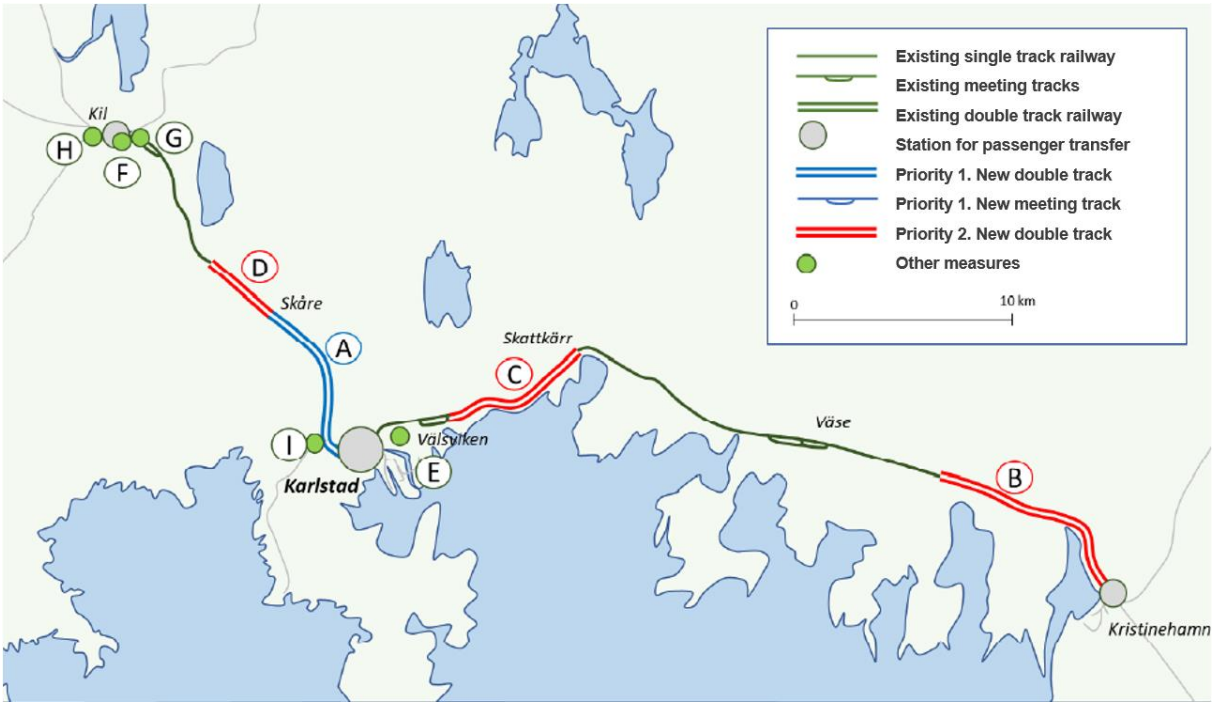

Figure 5 Measurement needs for the Kristinehamn - Kil sections for target year 2030, A corresponds to priority 1 measures, EB-I correspond to priority 2 measures, source: The Swedish Transport Administration, 2017b.

Assessment of impacts of the measures for target year 2030 shows increased accessibility and punctuality and reduced travel times, as well as positive

socioeconomic effects for train passengers (the Swedish Transport Administration, 2017b).

Target year 2040

The timetable analyses that have been conducted show that double tracks along the whole corridor between Oslo and Stockholm will be required to manage the traffic included in the traffic scenarios for year 2040. The Measurement Selection Study Part 2, conducted by the Swedish Transport Administration, proposes the following developments:

- Existing single tracks between Köping and Valskog be expanded to double tracks (8 km)
- 3.5 km expansion of double tracks along a new direct path between Björke and Köping for increased capacity and shorter travel times.
  Befintligt enkelspår mellan Köping och Valskog byggs ut till dubbelspår (8km)
- Expansion of about 6 km double tracks Väse and east.
- Expansion of about 9.5 km double tracks from Skattkärr and east.
- Expansion of about 4.5 km double tracks between Välsviken and east.
- Expansion of about 4 km double tracks from Stenåsen (directly south of Kil) and east towards Karlstad.
- Expansion of the Nobel rail line.
- Expansion of the Border rail line (the Swedish Transport Administration, 2017b).

The Swedish Transport Administration's report from 2019 highlights the importance of the new links, the Border rail line, and the Nobel rail line. The report assesses that the Oslo-Stockholm corridor maybe be suitable for speed increases to 250 km/h after 2035, provided that the new links are built and that extensive double track expansions are made. Between Oslo and Stockholm, today's travel time is in accordance with current timetables is about 5 hours and 35 minutes. The forecasted travel time for target year

2040 is 4 hours 35 minutes, which is far from the goal of 3 hours. The study finds that these measures, in addition to traffic being conducted along the Mälaren rail line, is a prerequisite for reaching the goal for travel times (the Swedish Transport Administration, 2019). Possible sections for increased speeds of 250 km/h are illustrated in Figure 6 below.

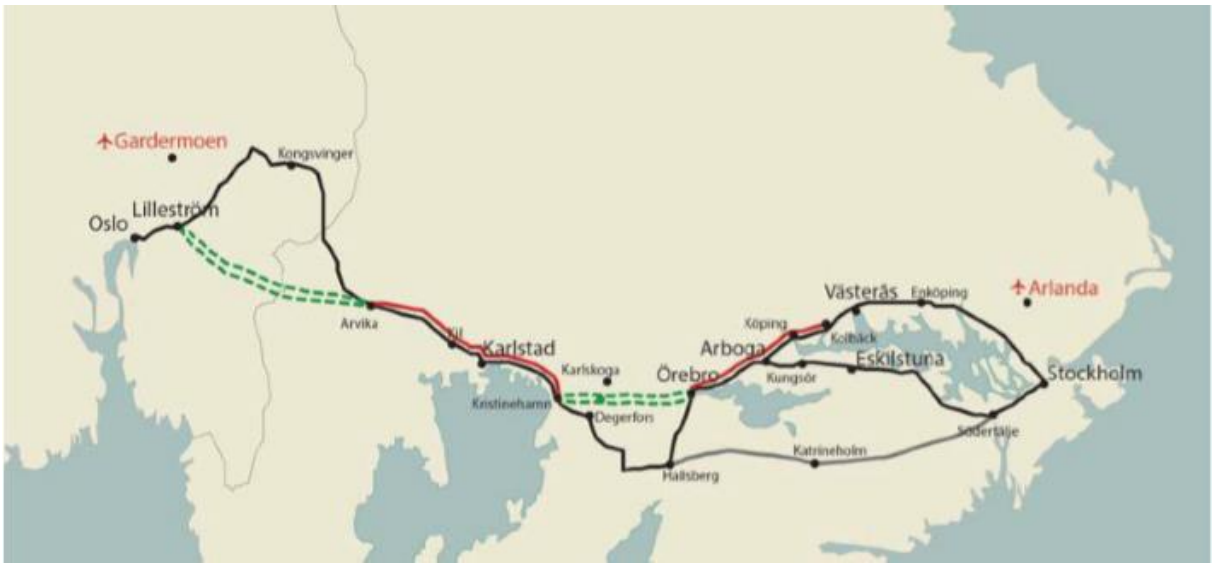

Figure 6 Possible expansion after 2035, source: The Swedish Transport Administration, 2019.

The expansions of the new links and their importance is highlighted in Sweco's report from 2019. Sweco has developed recommended travel time goals for the Värmland rail line to enable the achievement of the travel time target of 3 hours. These travel time goals describe a scenario where the Nobel rail line's 65 km of railway is built for 250 km/h speeds for B-trains, as wells as sections of the Ski-Arvika (108 km) or Lilleström-Arvika (97) km) on the Border rail line is built for 250 km/h speeds for B-trains. The Nobel rail line and the Border rail line have been studied in more detail and the conditions for feasibility, as presented above, have been described (Ramboll, 2019a and 2018/2019b). The Nobel rail line has an assessed investment cost at about 12.7

billion Swedish kronor and the Border rail line at 34.5 billion Swedish kronor or 27 billion Swedish kronor, depending on the section chosen for development (step 3 and 4 measures) (Ramboll 2018; 2019b). For the Mälaren rail line, three scenarios have been tested (Sweco, 2019). The conclusion is that if the goal for travel time at 3 hours is to be reached, the trains need to maintain an average speed of about 170 km/h on the Värmland rail line and Mälaren rail line, which would mean a reduction of travel times of about 20 minutes on the Värmland rail line and about 15 minutes on the Mälaren rail line. The options suggested to achieve the goal are:

- Upgraded speeds through Kil from 40 km/h to 80 km/h, which would reduce travel times by 2 minutes.
- New section that goes past Kil (250 km/h) reduces travel time by about 5 minutes.
- If a connection is made via Lilleström-Oslo, instead of via Ski-Oslo, travel times are reduced by 3 minutes (step 1 and 2 measure).
- With direct trains between Stockholm-Ski would the daily travel time be reduced by 12-15 minutes (step 1 and 2 measure).

The difference between the driving the S-train compared to the B-train between Stockholm and Ski (with the condition that tracks are built for 250 km/h for B-trains) is 9 minutes (Sweco, 2019).

Capacity 2040

In 2018, Sweco conducted a capacity study where possible traffic routes for the year 2040 were investigated, with the condition that new links and double track expansions were built.

For passenger traffic, the analysis was based on a high-traffic scenario (06-09, 15-18) and a low traffic scenario (09-15, 18-00).

- Traffic routes during high traffic hours: Oslo-Hovsta, 1 regional train per hour; Hovsta-Stockholm 2 regional trains per hour; and Oslo-Stockholm, 3 express trains.
- Traffic routes during low traffic hours: Oslo-Hovsta, 1 regional train every other hour; Hovsta-Örebro, 1 regional train per hour; Örebro Valskog, 2 regional trains per hour; Kolbäck-Stockholm, 1 regional train per hour; and between Oslo-Stockholm, 2 express trains per hour.

The capacity study also looked at conditions for freight traffic for the year 2040.

According to the forecast for freight traffic volumes (kTon), freight traffic might double by the year 2040. The capacity study indicates that the expected amount of trains traveling and passing the Oslo-Stockholm corridor will be accommodated if the train traffic is spread out throughout the day. However, capacity constraints arise during high traffic hours in four specific congested sectors in the Stockholm and Oslo areas, Örebro-Hövsta, and Arvika-Kristinehamn. One assessment is that it will be particularly problematic along the Hovsta-Örebro section, see Figure 7 below.

For freight traffic, the study points out that a bypass is generally needed for freight traffic to be able to pass passenger traffic, and that the location of the bypass stretches should be further investigated (Sweco, 2018).

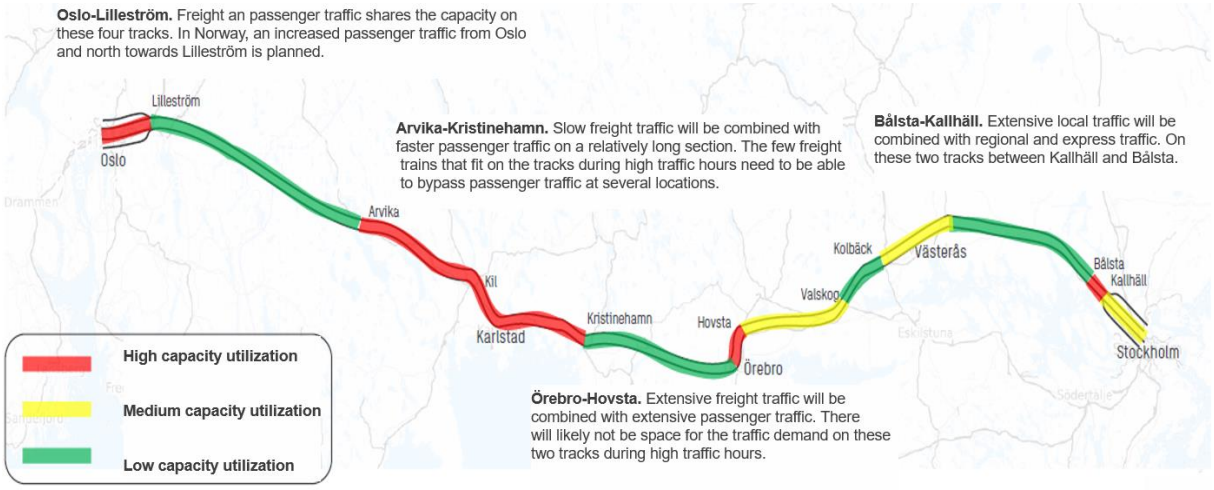

Figure 7 Capacity during high traffic hours, four traffic section, source: Sweco, 2018.

Trivector's analysis, reflections, and conclusions

In both establishing goals and describing the impacts of proposed measures, the regional and sub-regional perspective needs to be highlighted more clearly. It is important to clarify what is of the highest priority and what is most urgent; whether it is fast destination travel or improved regional travel opportunities. There are largely different measures that need to be highlighted depending on what is prioritized.

Today's fastest travel time by train from Oslo to Stockholm is 5 hours and 32 minutes due to ongoing railway work along the Kongsvinger rail line, but before the railway work started in 2017, the fastest travel time was nevertheless about 10 minutes longer than in the early 2000s. [3] Most connections today take over 6 hours, whereas in 2017 it would take just over 5 hours. The frequency of train traffic is low, only two direct trains in each direction per day. The long-term goal is about 3 hours travel time with about three express trains and two regional trains per hour. Thus, it is far between the present-day situation and the set goals. The long-term goals for 2030 and 2040 appear broadly plausible and beneficial, but a plan is needed for how steps can be taken in the short-term to approach the long-term goals.

The proposed measures in the long-term are mainly step 3 and step 4 measures, out of the 4-step principle. These measures are necessary to achieve the long-term goals. Steps 1 and 2 are discussed to a small extent but are especially needed in for the short-term perspective.

An important step 1 measure would be a plan to regain the travel times that were in effect at the beginning of the millennium and to take into account measures

[3] Before railway work started (2017) the fastest travel time with 4 stops was 4 hours and 50 minutes. In 2002, the fastest travel time with 5 stops was 4 hours and 43 minutes.

implemented during the 2000s, in that way additional time gains should become possible.

In the process so far, the measures seemed to have focused more on the planning for an improved and expanded infrastructure. Infrastructure is not a goal itself but rather it is the means to creating the conditions for better train traffic. Therefore, the starting point should be to develop competitive and cost-efficient traffic arrangements and only in the next step asses which infrastructure is required to enable the proposed traffic situation.[4] This does not diminish the significance of infrastructure's role, but it is important that the work is carried out in the proper order. Developing a well-worked baseline timetable for various target years (for example, 2030, 2040, and 2050) should form the basis for infrastructure planning. This process was carried out, for example, in Skåne, where Skånetrafiken (the regional transport authority in Skåne) developed a new train strategy that led to the country's highest increase in train travel. The model, "Bahn und Bus 2000," in Switzerland led to Europe's highest public transport use. [5]

To begin development of train traffic in the near future, it is important not to set sub-goals too high. For example, being able to run a fast train every hour (compared to Stockholm-Malmö service) or at least a strict every two-hour traffic, would mean a big shift compared to the current situation, and should be able to start with our first completing a total double track extension. It is only at higher service frequency that the double tracks are required.

[4] Timetables have been developed in the Measurement study, for example, but they appear to be mainly aimed at illustrating which train services are possible with the proposed infrastructure – not to lay the basis for infrastructure investments. The ongoing work for the development of "En bättre sits," the regional strategy for the Mälaren region, has a shorter time perspective.

[5] In" Bahn und Bus 2000," detailed train timetables have been developed for 10-15 years in the future, which lays the basis for what infrastructure investments will be carried out. Therefore, can the measures that give the greatest benefits be conducted.

The Border rail line is a key investment in achieving attractive traffic between Oslo and Stockholm, as Oslo-Arvika is by far the slowest rail line. Something that should be considered in order to reduce investment costs and enable early planning is to aim for a single track at the speed of 250 km/h with densely placed meeting stations as a first stage ("Norrbotnia rail line standard").

To run service through the Mälaren region requires the Nobel rail line, which is a costly project. The time gain will not be as large as the time gains achieved with the Border rail line. In the short and medium term, the focus should be to continue service through the Western Railway (Västra Stambanan, Hallsberg). Traffic via Västerås and Örebro is important for regional development but is not as important as short-term measures to reduce travel times between Oslo and Stockholm.

The reason for continuing to use today's railway through the Western Railway, in the short-term, is that it can quickly, and without the need of large infrastructure investments, achieve improved travel times along the corridor. By reducing the travel times between Oslo and Stockholm in the short-term, can the conditions for increased service be developed. In the short-term, an increase in travel along the corridor can, in turn, strengthen the arguments for a longer-term expansion of the Nobel rail line (an object that is not currently included in the national investment plan).

Furthermore, there are no barriers to the continued operation of efficient regional service between Stockholm, Västerås, and Örebro along the Mälaren rail line. That service is not dependent on the Nobel rail line.

References

The Swedish Transport Administration (2019) 250 km/h with Mixed Traffic (*250 km/h med blandad trafik*)

The Swedish Transport Administration (2017a) Improved accessibility along the Stockholm-Oslo corridor, Part 1 (*Förbättrad tillgänglighet inom stråket Stockholm-Oslo, del 1*)

The Swedish Transport Administration (2017b) Improved accessibility along the Stockholm-Oslo corridor, Part 2 (*Förbättrad tillgänglighet inom stråket Stockholm-Oslo, del 2*)

Ramböll (2019a) Track study for the Nobel rail line between Örebro and Kristinehamn (*Spårstudie för Nobelbanan mellan Örebro och Kristinehamn)*

Ramböll (2019b) Track study for the Border rail line's two studied alternatives between Arvika and Oslo (*Spårstudier för Gränsbanans två studerade alternativ mellan Arvika och Oslo*)

Ramböll (2018) Track study for the Border rail line's two studied alternatives between Arvika and Oslo (*Spårstudier för Gränsbanans två studerade alternativ mellan Arvika och Oslo)*

Sweco (2019) Development of travel time goals for the Värmland rail line (*Framtagande av restidsmål Värmlandsbanan*)

Sweco (2018) Capacity analysis Oslo-Stockholm (*Kapacitetsanalys Oslo-Stockholm*)

Sweco (2017) Trafik Audit (*Trafikrevision*)

Appendix

Attatchment 1

Summary of measurement proposals:

Dokumenttitel	Utgivare och år	Förslag till åtgärder 2030	Förslag till åtgärder 2040
Förbättrad tillgänglighet inom stråket Stockholm-Oslo, del 1 och 2	Trafikverket 2017	**Steg 1,2**: Utveckling av befintliga resecentrum, Parkeringsplatser vid vissa stationer och stora hållplatser, Gemensamma biljettsystem för persontrafiken, Utveckla nodfunktioner för godstransporter, prognosmodell för samhällsnytta över nationsgräns, digitalisering **Steg 3,4**: Dubbelspår från Hovsta och 17 kilometer österut, Dubbelspår Jädersbruk – Arboga, Ombyggnation av kopplingspunkten Mälarbanan – Godsstråket genom Bergslagen, Mötesspår Munktorps station, Dubbelspår Björke – Kolbäck, Dubbelspår Ökna – Jädersbruk, Dubbelspår Från Alväng till anslutningspunkten för dubbelspåret från Hovsta och österut, mötesstation Välsviken, Förlängt mötesspår vid Väse station/driftplats, Dubbelspår mellan Karlstad och Skåre, Dubbelspår Kristinehamn och tio kilometer västerut, Dubbelspår Skattkärr-Välsviken, dubbelspår Skåre och fyra kilometer mot Kil	**Steg 3,4:** Dubbelspår Köping-Valskog, 3,5 km dubbelspår Björke-Köping, 6 km dubbelspår från Väse och österut, ca 9,5 km dubbelspår från Skattkärr och österut, 4,5 km dubbelspår Välsviken-Karlstad, 4 km dubbelspår från Stenåsen österut, Gränsbanan, Nobelbanan
250 km/h med blandad trafik	Trafikverket 2019		Sträckan tänkbar för utbyggnad efter 2035, förutsätter ERTMS, störst tidsvinster Arvika-Lilleström, ytterligare utbyggnad av 250 km/tim Kristinehamn-Karlstad-Kil minskar restiden till 3:30, för minskning nedåt 3 tim leds trafiken via Mälarbanan och Nobelbanan, dubbelspår Kolbäck-Örebro samt Kristinehamn-Arvika
Spårstudier för Gränsbanans två studerade alternativ mellan Arvika och Oslo.	Ramböll 2019 på uppdrag av bolaget Oslo-Stockholm 2.55		Maxhastigheten 250 km/tim, endast persontrafik, dubbelspår hela sträckan, inga stationer mellan Ski och Arvika, anslutning i plan till befintlig järnväg i Arvika respektive Ski

Spårstudier för Gränsbanans två studerade alternativ mellan Arvika och Oslo.	Ramböll 2018 på uppdrag av bolaget Oslo-Stockholm 2.55		Maxhastighet 250 km/tim, endast persontrafik, dubbelspår hela sträckan, inga stationer mellan Lilleström och Arvika, anslutning till befintlig järnväg i Arvika och Lilleström
Spårstudie för Nobelbanan mellan Örebro och Kristinehamn	Ramböll 2018		Maxhastighet 250 km/tim, sträcka 67,4 km, endast persontrafik, dubbelspår hela sträckan, ny station Karlskoga, planskilda anslutningar till befintlig järnväg i Kristinehamn respektive Örebro, kräver 10 tunnlar och 9 broar
Trafikrevision	Sweco 2017	Kapacitetsökning på sträckan (Arvika)-Kil-Karlstad-Kristinehamn, samt kapacitetsökning på Karlstad central/bangård, kapacitetsökningar mellan Örebro-Arboga, på Örebro central samt Västerås central	Ny bana Lilleström-Arvika, hastighetsökning Arvika-Kil (200 km/h), ny bana Kristinehamn-Örebro, ny station i Karlskoga, kapacitetsökningar på sträckan Arboga-Kolbäck
Kapacitetsanalys Oslo-Stockholm	Sweco 2018		Den förväntade mängden tåg som trafikerar och passerar stråket Stockholm-Oslo år 2040 ryms om tågtrafiken sprids ut över hela dygnet, uppstår kapacitetsbegränsningar i högtrafik, Det är av stor vikt att det skapas utrymme för att kunna bedriva ett proaktivt underhåll av järnvägen, förbigångsspår för att godstrafiken ska kunna bli förbigången av persontågstrafiken
Restidsmål Värmlandsbanan	Sweco 2019		Förslag för kortade restider: Nobelbanan med 250 km/tim för B-tåg, Gränsbanan Ski-Arvika 250 km/tim för B-tåg, uppgraderad hastighet Kil-Karlstad till 80 km/tim/ny dragning förbi Kil, Uppgradera Vämlandsbanan och Mälarbanan till 250 km/tim med 4 uppehåll, koppling mellan Lilleström-Oslo istället för Ski-Oslo, direkttåg Ski-Oslo, direkttåg Sthlm-Oslo, S-tåg istället för B-tåg Sthlm-Ski