

# Capacity requirements

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# 1 Engineering works

## 1.1 Planned major engineering works

See Annex 3 B - Planned major engineering works.

# 2 Pre-arranged paths for international corridors

Pre-arranged paths for international “Rail Freight Corridors” are published in mid-January on each freight corridors website.

Link to freight corridor ScanMed RFC [www.scanmedfreight.eu](http://www.scanmedfreight.eu)

# 3 Bottleneck Plans

## 3.1 Background

Rail traffic in the metropolitan areas is extremely intensive, with a high level of capacity utilisation. This means that the traffic system is sensitive to disruption – small delays propagate rapidly and the possibilities for recovery are restricted, at the same time as the demand for train paths has increased.

Capacity restrictions occur on those parts of the railway network where the demand for train paths is higher than the available capacity; applications for train paths cannot then be fully satisfied. On lines with a high capacity utilisation, it is especially important to establish the preconditions for the rail traffic that can be supplied with a high standard of transport quality. In order to be able to use the capacity in an efficient way in traffic-intensive areas, the Swedish Transport Administration draws up congested sector plans with pre-planned train path channels.

Bottleneck plans are part of a four-stage model which shows that a combination of running plan changes and adjustment measures in the infrastructure is extremely cost-effective. A system with pre-planned train-path channels leads to the existing facilities being used more efficiently. However, it is with a combination of improvements in the infrastructure that the best effect can be achieved.

## 3.2 Purpose

The bottleneck plans shall be used in the capacity allocation process for the purpose of:

- achieving an efficient capacity utilisation in traffic-intensive areas through finished train path channels
- guaranteeing punctuality by means of robust running timetables

- serving as planning support for applications for train paths and the construction of timetables.

The pre-planned train path channels shall serve as the basis for the applications made by railway undertakings for train paths and the Swedish Transport Administration's timetable construction.

### 3.3 Scope

The bottleneck plans cover the three metropolitan areas of Stockholm, Göteborg (Gothenburg) and Malmö

The bottleneck plan Stockholm includes the following stretches:

- Stockholm Central/Stockholm City – Arlanda/Märsta – Uppsala
- Stockholm Central/Stockholm City – Bålsta
- Stockholm Central/Stockholm City – Nynäshamn
- Stockholm Central/Stockholm City – Södertälje hamn/Södertälje syd – Gnesta
- Södertälje hamn – Södertälje centrum
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The bottleneck plan for Göteborg (Gothenburg) includes the following stretches:

- Göteborg – Stenungsund
- Göteborg – Öxnered
- Göteborg – Alingsås
- Göteborg – Almedal, (- Borås)
- Göteborg – Kungsbacka

The bottleneck plan for Malmö includes the following stretches:

- Malmö central/Godsbangården – Hässleholm
- Lund – Landskrona östra – Helsingborgs Central
- Malmö – Peberholm
- Malmö godsbangård – Fosieby – Lernacken

### 3.4 Infrastructure

The bottleneck plans are based on the fact that the infrastructure specified in the Network Statement is complete and fully operational. In the case of engineering works that have a major impact on the traffic, a special bottleneck plan may be drawn up.

### 3.5 Traffic structure

By means of timetable analyses within the areas concerned, train path channels have been developed. With these as a basis, models have been created with the aim of facilitating the allocation of capacity. Minor deviations can be made from these on condition that no further train paths are required. The division of the train path channels cannot therefore be regarded as determined in advance.

### 3.5.1 Bottleneck plan train types

**Fast (S):** trains with a high mean speed. It shall be possible for the vehicles to be driven at a speed of 160 km/h. In practice, only passenger and mail trains fulfil these requirements.

**Slow (L):** trains with a lower mean speed, normally freight trains or regional trains with stops at most of the intermediate stations. There is nothing to stop vehicles that meet the requirements for fast train paths being driven in a slower path if no faster train path is available. A certain train can use a slow train path on one line sub-section and a fast train path on another line sub-section.

### 3.5.2 Stockholm area

#### 3.5.2.1 General

On the multiple track stretches of line Årstaber<sup>1</sup>g - Flemingsberg<sup>1</sup> and Stockholm Central - Skavstaby, strict channel operation shall be employed. This means that no planned crossing between inner and outer tracks is normally allowed. The point connections between tracks should be primarily regarded as redundant in operational disruptions.

In order to make optimal use of the train path channels on the multiple track stretches, it is assumed that the trains are driven at a homogeneous speed and on inner and outer tracks. Generally speaking, inner tracks shall be used by slow trains (commuter and freight trains) and outer tracks by fast trains (regional and inter-regional trains, and by fast trains and mail trains).

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<sup>1</sup> The multiple track at the stretch Stockholm-Årstaber<sup>1</sup>g is considered to be two separate double track



Figure 1. Bottleneck Plan Stockholm, geographic demarcation

### 3.5.2.2 Special conditions

A-Trains traffic along the route Stockholm Central – Arlanda norra is governed by an agreement with the State. The agreement guarantees the operation of either four trains per hour in 15 minute intervals or six trains per hour in 8 to 12 minute intervals. A-Train trains operates track 1 and 2 at Stockholm Central.

The stretch of line from Stockholms södra - Stockholm City - Tomtebodavästra (Citybanan) is reserved for commuter train. The trough-tracks at Stockholm Central (track 10-19) are scheduled to be shut down in stages for re-building, but at least eight tracks will be available to regional and interregional trains and freight trains.

### 3.5.2.3 North of Stockholm Central

The capacity on the multiple tracks stretch Stockholm Central/Stockholm City–Skavstaby is theoretically 20 train paths per hour and direction, however the differences in speed between different types of trains, limits the number of train paths.

Trains operating on Stockholm Central, shall normally be driven on outer track on the four-track stretch of line Tomtebodavästra – Skavstaby (via Arlanda) – Myrbacken and Tomtebodavästra – Huvudsta. Crossing points<sup>2</sup> however, are located at the branch station Skavstaby. In order to avoid capacity losses, trains that are driven on different tracks, but which lack contact points with each other, make joint use of train path channels where this is possible.

<sup>2</sup> Crossing points in this context are understood to be points/switch connections where trains are allowed according to plan to be led over from an inner track to an outer track, and vice versa.

The four-track stretch of line Stockholm Central – Tomtebodavästra (track U1, U3 and N1, N3) enables trains to/from Ostkustbanan and Mälardalen to operate independently. North of Huvudsta the number of trains is limited by the capacity situation on the stretch of line Stockholm Central/Stockholm City – Tomtebodavästra and how the partial four-track stretch of line Barkarby-Kallhäll is used.

In total, a maximum of 20 train paths are allowed per hour and direction on the four-track stretch north of Stockholm Central.

The double track Citybanan connects at Tomtebodavästra (tracks U2, N2). It is a part of the inner track system within the Stockholm area and allows a maximum of 20 train paths per hour and direction.

#### 3.5.2.4 South of Stockholm Central

The capacity on the double track stretch of line Stockholm Central – Flemingsberg is theoretically 20 train paths per hour and direction on each track, however the differences in speed between different types of trains, limits the number of train paths.

The double track Citybanan connects at Stockholms södra (track 1-2). Trains operating on Stockholm Central shall normally be operated on outer track on the stretch Årstaberget – Flemingsberg (via Södertälje syd) – Järna. Crossing points however, are located at the branch stations Flemingsberg and Järna. In order to avoid capacity losses, trains that are driven on different tracks, but which lack contact points with each other, make joint use of train path channels where this is possible.

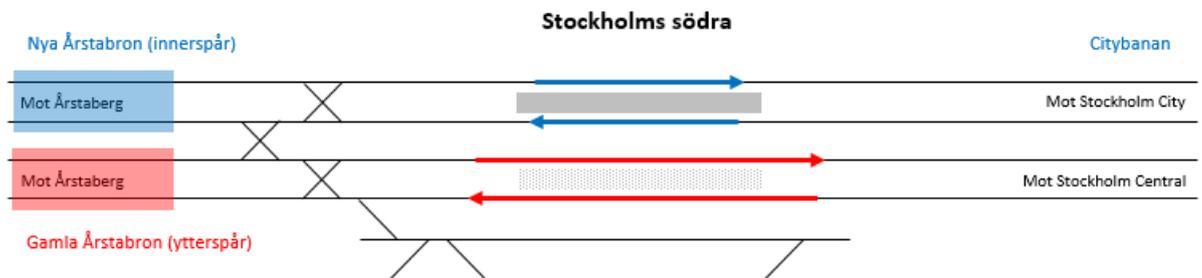


Figure 2: Schematic track plan Stockholms södra. South of Årstaberget the two double tracks changes to one four-track

In total, a maximum of 35 train paths are allowed per hour and direction on the four-track stretch of line south of Årstaberget, based on the following distribution:

- 15 train paths on the four-track stretch's outer track (track U1, N1)
- 20 train paths on the four-track stretch's inner track (track U2, N2).

#### 3.5.2.5 Citybanan

Citybanan is reserved for commuter train. The capacity on the double track stretch of line Stockholms södra – Stockholm City – Tomtebodavästra is theoretically 24 train paths per hour and direction, but since Citybanan is a part of the inner track system within the Stockholm area, a maximum of 20 train paths per hour and direction is allowed

The stopping times at Stockholm City are restricted in length to two minutes. During off-peak traffic, exceptions can be made for fulfilling special wishes, for example equip trains and train set changes. On these occasions changing of direction can be done on tracks 1-4.

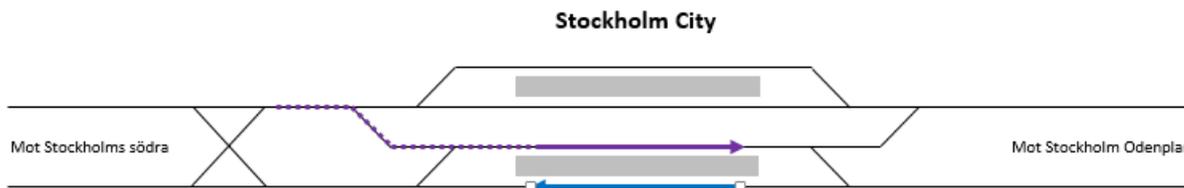


Figure 3: Stockholm City Station: examples of train set replacement to the south due to vehicle faults. The purple line illustrates the new train set coming from the depot in Älvsjö; the blue line shows the train set to be replaced

Trains operating on Citybanan must normally remain on the inner tracks on the four-track stretches of line Tomtebodavägen övre – Skavstaby (via Märsta) – Myrbacken and Tomtebodavägen övre – Huvudsta, Barkarby-Kallhäll and the stretch of line Årstaberget-Flemmingsberg (via Södertälje hamn) – Järna. Crossing points however, are located at the branch stations Skavstaby, Flemmingsberg and Järna.

### 3.5.2.6 Stockholm Central

In order to achieve better utilisation of the track capacity at platforms, special planning conditions apply for Stockholm Central. These concern primarily passenger traffic, but the capacity available on the platform tracks is also an important precondition in order for the flow of goods trains and other movements to be able to function efficiently without stopping.

The traffic at Stockholm Central is divided into three groups, with in part different preconditions:

- through-trains
- turning trains from the south
- turning trains from the north.

The planning assumptions apply during peak traffic; at other times, exceptions can be made from them in order to meet specific wishes.

#### **Through-trains**

Through-trains from the south shall normally operate on tracks 15-19 and through-trains from the north shall operate on tracks 10-14. Freight trains operate on all through-tracks (10-19) unless they include wagons with special transport conditions

Since platform capacity is limited during peak traffic shall long stops be avoided. The stopping times are restricted in length to ten minutes. During off-peak traffic, exceptions can be made for fulfilling special wishes, for example night trains with lay-overs, equip delayed trains and at events.

***Coupling and uncoupling of railcar trains***

The coupling together of railcar trains shall be avoided during peak traffic. The changing of train parts between different tracks may only be performed during off-peak traffic since shunting movements consume more capacity.

***Turning trains from the south***

Turning trains from the south should normally operate on tracks 15–19<sup>3</sup>. After the stop at Stockholm Central the trains continues directly to the C-group where turning takes place, Some of the trains continues via E-Group to Karlberg where turning takes place on Track M, V1, D1 or D2 (at least one of the tracks should be available for through-trains). After turning, the trains are driven from C-Group to tracks 10-14.

Turning that requires right-hand track use (referred to as crossing) when approaching or departing from Stockholm Central is only allowed if no train path channels in the opposite direction of operation are put into use.

***Railcar train and loco-hauled train with driving trailer/two locomotives / (SMS train)***

Activity	Time frame
Stop at Stockholm Central (Arrival Tracks 15–19)	10 minutes
Stop at Norra Bantorget (Service Tracks E6–E7)	20 minutes
Holding/turning at Karlberg (Track M, V1, D1 or D2)	20 minutes <sup>4</sup>
Stop at Norra Bantorget (Service Tracks C2–C4)	30 minutes
Stop at Stockholm Central (Departure Tracks 10–14)	10 minutes

***Loco-hauled train***

Locomotive terminal looping is allowed given that no train path channel may be utilized.

***Turning trains from the north***

Turning trains from the north which operates on track N1 shall normally operate on tracks 1-8 and trains which operates on track N3 shall normally operate on tracks 13-16.

Operation of tracks 1-8 is restricted by a number of factors:

- Tracks 1–2 are only available for Arlanda Express airport shuttle services.
- Track- and platform length varies from track to track.
- The possibility for looping on Track 3 is lacking.
- The possibility for simultaneous entry and exit varies between tracks.

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<sup>3</sup> If necessary, trains from the south can turn on track 14

<sup>4</sup> When Tracks M, D1 and D2 are occupied at the same time

- Movements to and from Track 8 (north side) is dependent on the traffic on Tracks 10–11. Operations on Track 8 shall therefore be limited and must be coordinated with the traffic to Tracks 10–11.

In order to make it possible for sufficient track capacity to be offered, the following time frames shall be applied for turning trains coming from the north.

***Railcar train and loco-hauled train with driving trailer/two locomotives / (SMS train)***

Activity	Time frame
Stop at Stockholm Central without reprovisioning (Tracks 1–8)	45 minutes
Stop at Stockholm Central with reprovisioning (Tracks 1–8)	60 minutes

***Loco-hauled train***

The stopping time for loco-hauled trains with terminal looping is max. 60 minutes at Stockholm Central. Locomotive loop turning, however, cannot always be performed according to wishes for example during peak traffic.

### 3.5.2.7 Getingmidjan

While Getingmidjan is shut down in summer 2019, a special bottleneck plan will be drawn up for the Stockholm area.



### Hamnbanan

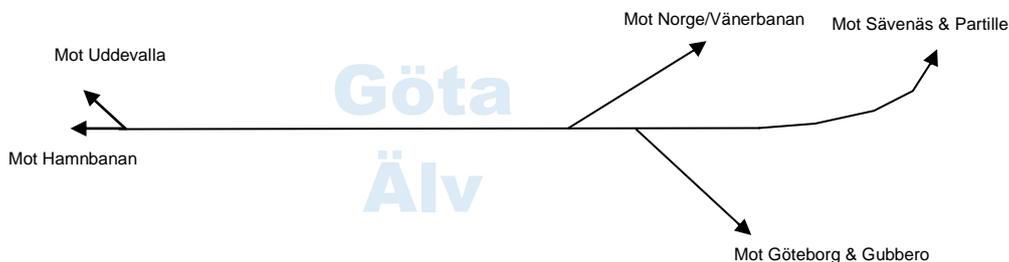
Göteborgs hamnbana, which is included in the bottleneck plans, even though this in its entirety is considered to be located within the operational sites Göteborg Kville, Pölsebo and Göteborg Skandiahamnen, is in practice a single-track line with densely positioned signals in order to provide ample capacity for trains that are driven in the same direction, but not for oncoming traffic. There are two tracks on the stretch Pölsebo-Skandiahamnen but one track is expected to be used primarily for shunting. Göteborgs hamnbana has sufficient capacity to cope with five trains per hour and direction.

### Marieholmsbroarna

In connection with the allocation process, a balance must be achieved between the need for bridge openings and the capacity of the railway. The bridges need to be opened 18 times per day. This means one bridge opening per hour, excluding the period between 06:00-09:00 and 15:00-18:00. The opening time for the Marieholmsbroarna is 15 minutes.

The stretch of line from Göteborg Kville over the Göta älv at Marieholmsbroarna has three different destination points:

- Göteborg Marieholm for trains to Norway /Vänerbanan
- Gustavsplatsen for trains to Sävenäs and Västra stambanan
- Olskrokskrysset for trains to Göteborgs central and Gubbero (Väst kustbanan and Kust till kust-banan).

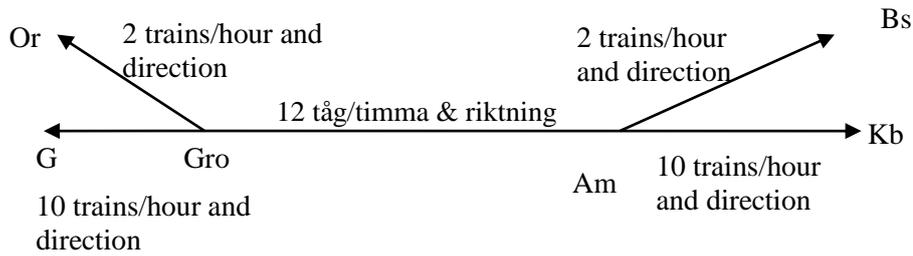


On the stretch Göteborg Kville–Olskroken/Göteborg Marieholm, there is room for five freight trains and two passenger trains per hour and direction. This makes it possible to operate half-hourly services on Bohusbanan and that the freight traffic on Göteborgs hamnbana can be offered at least one train path per hour and direction via Olskroken to/from each route and to Sävenäs Marshalling Yard.

Marieholmsbroarna are openable for shipping along Göta älv. In general, rail traffic has precedence over boat traffic.

### Gårdatunneln (Gubbero–Almedal)

On the sub-section Gubbero–Almedal, there are 12 bookable train paths per hour and direction. These divide up in Gubbero towards Göteborg C and towards Olskroken. In Almedal, the train paths are divided up towards Kungsbacka and Borås, respectively (see figure).



### 3.5.3.3 Göteborgs central

#### General

Göteborgs central is a terminus with three double-track connections. These are:

- Olskroken-Västra stambanan (tracks 71 and 72)
- Olskroken-Norge/Vänerbanan (tracks 73 and 74)
- Gubbero (tracks 85 and 86).

Adjacent to the platform tracks there is a holding rail yard and a depot with a cleaning hall and two different service halls for vehicles. The rail yard has low-speed operations. The capacity is determined in the first place by the number of crossing trains and shunting routes.

#### Subdivision of platform tracks

In order to create the highest possible capacity, the platform tracks must be used on the basis of a certain pattern in order to avoid crossing train paths between the different lines. Trains that arrive from a certain line may not for the same reason depart towards another line unless the situation is studied in each individual case. The best flow is achieved by using the track groups in accordance with the following table, which was also a precondition when drawing up the bottleneck plans.

Track group	Comprises tracks	Used to/from
A	1–7	Västra stambanan
B	8–10	Norway/Vänerbanan, Bohusbanan
C	11–16	Västkustbanan, Kust till kust-banan

#### Time at platforms

It is allowed to be at the platform 15 minutes before departure or after arrival. In some cases, longer times at the platforms can be offered.

#### Intervals between trains on platform tracks

The trains have predetermined departure and arrival times at Göteborgs central every fifth minute. This interval is determined by the fact that it takes about 4.5

minutes from the departure of a train until the next train can arrive as a consequence of intersecting train paths at the terminus rail yard. Tracks 11 and 12 can be used both in track groups B and C, depending on the needs.

### Shunting

During the peak traffic periods (06.00–08.00 hours and 16.00–18.00 hours), shunting can only take place after special consideration in each individual case. Each shunting movement shall then be placed on an equal footing with a train movement in a corresponding track section. In order for shunting to be possible, a train path shall thus be unused so that the shunting movement can use the interval in time that will thereby be made available.

### Locomotive terminal looping

Loco-hauled trains that arrive and that will then depart with the same hauling locomotive shall have at least 45 minutes between the time of arrival and the time of departure. During this time it must be possible to switch the train to the O-group for locomotive terminal looping and then switch it back to a platform track

## 3.5.4 Malmö area



### 3.5.4.1 Coordination with Danish stretch of line

For Öresundsförbindelsen (the Öresund link), the selected train path channels are coordinated so that they also serve on the connecting Danish section from Peberholm to København H (passenger traffic) and the border station Padborg (freight traffic).

#### 3.5.4.2 Character of trains on different sub-sections, stopping scenario, etc.

The fast trains on Södra Stambanan normally make stops in Hässleholm, Lund, Malmö central, Triangeln and Hyllie. Between Hässleholm and Lund, trains can make stops at one or two intermediate stations if the performance of the train is sufficient to meet the stipulated time in Hässleholm, or *alternatively* (whenever possible) leave earlier from Hässleholm (odd trains) or arrive later (even trains). On Västkustbanan, in the same way trains normally make stops at Helsingborg and Landskrona.

On the stretch of line Hässleholm–Malmö Marshalling Yard, the slower trains are divided into trains that are assembled for 100 km/h, 90 km/h and 80 km/h, respectively. On the stretch Malmö Marshalling Yard–Peberholm, all paths can be used by train sets that have been assembled for 80 km/h.

For the stretch Malmö central–Hyllie (Citytunneln)–Lernacken only a small number of vehicle types are driven owing to the tunnel restrictions. Since all these vehicles are of the “fast” category, there are no slow train paths on this stretch of line.

For the stretch of line Malmö Marshalling Yard–Fosieby–Lernacken, there are only slow train paths. The plan will be extended with suitable train paths channels for the new passenger traffic called Malmöringen, which is expected to start Timetable 2019.

#### 3.5.4.3 Train paths for restoration

For the stretch of line Lund–Malmö–Hyllie, there are 1–2 restoration paths per hour and direction. These shall in the normal case be vacant or *alternatively* time for them is created in some other way and then in the first instance that one train path is left vacant, for example because no-one has applied for it.

#### 3.5.4.4 Malmö central

In order to achieve better utilisation of the track capacity at platform tracks, special planning conditions apply for the through-tracks 1–4 at Malmö central. These tracks shall be used on the basis of the following principles:

- Trains shall be through-trains, i.e. not have Malmö central as their final or outgoing station.
- The composition of the train shall not be changed, for example in the form of the coupling on or uncoupling of a trainset(s)
- The stopping time shall be between two and four minutes.

These planning conditions apply for the larger part of the traffic day. Certain exceptions can be made, in the first place during off-peak traffic (approximately 19.00–06.00 hours), to fulfil special wishes.

Switching between train track and depot means in most cases crossing movements, and shall be minimised in peak traffic.

#### 3.5.4.5 Helsingborg Central

Platform tracks are optimised for train lengths of up to 160 m. Train paths that are included in the bottleneck plan do not permit general operation with trains that are longer than 160 m. The possibilities to conduct operations using long trains is handled in the timetable process in each individual case.