Appendix 2

Appendix description:

This appendix is part of a previous feasibility study conducted for the *Inlandslänken Project*, which was carried out in 2017 and investigated an upgrade of Inlandsbanan. As this is a study from 2017, there may be differences in scope compared to what is requested in this RFI.

Note that this appendix also includes an opening of the section between Mora and Persberg and an upgrade of the connection line between Arvidsjaur and Gällivare, which is not included in the scope of this RFI.

The information in the appendix is taken from the report *Fördjupningsstudie Inlandsbanan – dragkraften som utvecklar inlandet* (2017).

1. Infrastructure measures

1.1 Limitations

Control of speed-limiting curves on Inlandsbanan and the connection lines only include the size of the radius. There is no data for the Arvidsjaur-Jörn and Mora-Daglösen sections, which means a geometric analysis has not been able to be carried out. Level crossings are assumed to be easy to move and have, therefore, not been marked as difficult to fix. The current signalling shortcomings are assumed to be remedied in connection with the replacement of the manual traffic system to the ERTMS level 3 signalling system.

1.2 Traffic management system

The European traffic management system (ETCS) monitors the line and operating locations on a section. For Inlandsbanan and the current connection lines, Traffic System E3 with the ERTMS level 3 signalling system is recommended. System E3 works so that the radio block control (RBC) bases the trains' position on information from the trains' on-board computers. Based on data sent from the ground system (the Eurobalises and/or RBCs), continuous messages are given to the trains' on-board computers that calculate the permissible speed and obstacle clearance on the track, where the train itself and a section behind it make up the block section. The switchgear along the line secures traffic by only allowing secured train routes, and the signaller directs traffic according to the train schedule. All the information necessary for the train driver is presented on a computer screen in the driver's cab. ERTMS level 3 provides opportunities for more optimised driving and that more trains can be on a route between meeting points. ERTMS Regional is a simplified variant in Sweden on low-traffic volume lines with long fixed block stretches and lower speeds.

With the E3 traffic system, operating locations that have train meeting points or train turnarounds are required to have the signalling function, simultaneous entry and exit, and enough track and length. Larger operating sites with heavy traffic, many train movements, and several tracks need to be monitored by a long-distance signaller from an operations control centre. Some smaller operating sites with only train meeting points can be technically controlled by train routes being pre-programmed or by loading places on the line being manually controlled by the driver via the control panel in the train, which sends a radio signal to the switchgear to change gears. This requires the Swedish Transport Agency gives approval that these functions can be implemented into the traffic safety system E3 for traffic safety reasons.

1.3 Operating locations

The graphical timetable illustrates where trains meet roughly and in which places meeting point tracks need to be located. However, it should be mentioned that each train route is supply-controlled for both freight and passenger trains. To determine actual demand, a real application for track capacity is needed. Because of this and for traffic safety reasons, it has not been possible in this investigation to determine which locations do not need a long-distance signaller, which is why all operating locations are assumed to be remotely controlled from an operations control centre.

1.4 Standard of track

Load-bearing capacity and speed

An inventory of the conditions of the ground has been made on the sections Sveg-Brunflo and Jokkmokk-Arvidsjaur12. The inventory constitutes the prerequisites for the measures required to increase the bearing capacity to STAX 22.5 tonnes and 6.4 tonnes/m. The conclusions of this inventory are that "the naturally stored soil in combination with backfill can handle 22.5 tons of axle load in normal cases". On some sections with "low bank height above bogland", there may be some "bearing capacity and stability problems" and in-depth investigations are recommended for increasing traffic in the future. The inventory has not considered the need for measures regarding sleepers, rails, aggregates, and bank widening.

IBAB has a reinvestment programme to replace poor rails, sleepers and fastening, sleeper densification and macadam construction on the above-mentioned sections to be able to increase the axle load. In addition, the plan includes carrying out measures at level crossings and on rust on steel bridges that extend their service life.

Once the above measures have been taken, Inlandsbanan is assumed to meet the requirements for STAX 22.5 tonnes and 6.4 tonnes/m where certain speed restrictions may occur on curves, at level crossings, and over certain geotechnically unsafe areas. The exception is the section Jokkmokk-Gällivare, where a similar inventory as mentioned above needs to be carried out.

IBAB's plan to upgrade the entire route to STAX 22.5 tonnes and 6.4 tonnes/m is based on forecasted traffic volumes. There is a great deal of uncertainty about whether the number of freight trains will increase sharply, whereby the facility will not be able to cope with the load, which will generate new traffic restrictions and dramatically increase operating and maintenance costs. To cope with a sharp increase in traffic, our assessment is that a renewal of the entire route is required to increase its standard, i.e. track replacement where sleepers are replaced, new

fastening, replacing old rails with modern rails of type UIC 60 (at least BV50) and carry out macadam construction. This also facilitates the transition from STAX 22.5 to 25 tons.

The track is to be changed to fully welded 60 kg rails with concrete sleepers and grade 1 aggregate. The standard of the line will be raised so that it meets the load-bearing requirements (STAX 22.5 tonnes and STVM 6.4 tonnes/m) and higher speeds for both freight and passenger trains. Gear changes are to be carried out on the entire stretch to switches with an angle of at least 1:14 to provide the opportunity to drive 80 km/h on the connection line.

1.5 Curve straightening

The cant on most curves will need to be raised to cope with higher speeds. A higher cant requires longer transition curves, which means that several transition curves will need to be extended. Curve straightening is to be carried out on those curves where the radius is estimated to be too small for freight trains to cope with 100 km/h and where a general assessment of the track has shown that it is possible. Many stretches have a winding geometry with small radius. This can be due to several reasons, but most likely the ground is poor or that there are large height differences, which can make curve straightening difficult.

1.6 Triangle tracks

To facilitate traffic in different directions where lines connect to each other, there are no plans, apart from Storuman municipality's project, for expanded triangular tracks because demand is very low. In a first step and dependent on market developments and the need for re-routing trains.

- Triangle tracks should be built in Arvidsjaur to handle through trains on Inlandsbanan on the Jokkmokk-Sorsele route (new construction 1500 m of track, 2 switches and possibly a new bridge over road 95).
- Triangle tracks should be built in Orsa to handle freight trains heading northwards from the Orsa-Bollnäs connection line (new construction 1500 m of track, 2 switches and a new bridge over watercourses).
- Triangle tracks at Mora Noret should be upgraded and opened for traffic to/from Borlänge (2 switches and 500 m of tracks, review track and bridge quality).

The next step should be to streamline traffic and consider whether triangular tracks should be built to eliminate locomotive turnarounds.

- Gällivare for trains north of Gällivare to/from Kiruna/Narvik towards Inlandsbanan traffic.
- Jörn on the route north to Luleå.
- Daglösen for a direct connection west towards Kil for traffic to/from Gothenburg/Oslo.

Additional triangular tracks can be considered in Storuman, Hällnäs, Hoting, Brunflo or Bräcke depending on how the market and traffic develop over time. In Kristinehamn, it would be appropriate to have a triangular track for direct traffic between Inlandsbanan and Hallsberg, although the construction is difficult to manage. The constructability in Forsmo is also uncertain, while demand is considered to be low for a northern link. A station that could be relevant for triangular tracks is Bollnäs on the Orsa-Bollnäs route and south towards Kilafors/Gävle. Here, however, the problem is to join the Northern Main Line due to high-capacity utilisation, while demand may be uncertain.