



Together
we move



Case study Sweden

INTERFLO 450 ERTMS Level 2

Equipped with ERTMS Level 2 technology the Swedish Bothnia and Ådal lines enables reduced travel times and better freight transport.

ERTMS for effective rail traffic management

Bothnia line was the first European Rail Traffic Management System (ERTMS) Level 2 commissioned in Sweden in August 2010 for operation of up to 250km/h.

Ådal line which is directly connected to Bothnia line was commissioned in August 2012. The seamless connection between the two lines is fully electronic according to standard enhancing connectivity and significantly reducing passenger journey times.

Together the Ådal and Bothnia lines form a 320 km, single track transport corridor with 35 stations; eight for passengers and the remainder for train meetings or freight traffic. The *BOMBARDIER* INTERFLO* 450* solution controls signalling at 14 stations and 35 crossings on the Ådal line and connects ERTMS to the main Swedish rail network.

Following extensive testing regional passenger services commenced on the 1 August 2012 and the line was officially inaugurated on 14 September 2012.

320

km track corridor.

Equipped with Bombardier ERTMS technology on Bothnia/Ådal line.

99.99%

overall availability.

Connecting large towns in the north to the rest of Sweden.

Bothnia line

As part of a commitment to further improve railway services across the country, Bombardier was awarded a contract in 2004 to provide its *INTERFLO 450* ERTMS Level 2 solution for the newly-built Bothnia high speed railway line. The new 190 km single track line with 21 stations, 143 bridges and 25 km of tunnel, is the highest-speed track in the country which runs along the north-east coast of Sweden from Nyland to Gimonäs.

It is the first line in the Nordic region to be operating with ERTMS/European Train Control System (ETCS) Level 2 functionality and the success of this project has led to the upgrade of the existing 130 km Ådal line (Ådalsbanan) which has also been equipped with *INTERFLO 450* ERTMS Level 2.

Ådal line

The Ådal line links the town of Sundsvall in northeastern Sweden with the high speed Bothnia Line creating two out of three sections of a new high-speed mainline along the east coast from Stockholm to Umeå.

Providing increased functionality, the total scope of the projects for Trafikverket included:

- An *BOMBARDIER* EBI* Screen 900* control centre located in Ånge, it is fully capable of handling different types of traffic environments and serves to monitor and manage traffic on both lines.
- Four *EBI Lock 950 R4* computer-based interlocking (CBI) systems which have the capacity to control up to 12,000 wayside objects such as signals, point machines, balises and level crossing protection.
- Two *EBI Com* radio block centres (RBC) are used to control and supervise the ETCS Level 2-equipped trains, sending movement authorities to the relevant trains according to the ERTMS/ETCS Class 1 specifications. Each *EBI Com* RBC comprises a radio block processing unit, a safe transmission unit and a service MMI - software to monitor, control, troubleshoot and test the radio block processing unit.





The *EBI* Cab onboard equipment supports the driver and continuously supervises the speed of the train providing both visual and audible warnings of changes of status and movement authority.

No wayside optical signals are required and train movement is based on an authority up to the end of the locked route. Train integrity is monitored through the *EBI* Lock CBI system by either track circuits or axle counters.

Higher line speeds and increased capacity are possible on the new areas of track due to very high levels of operational safety. This approach means the elimination of the need to install and maintain wayside equipment and a reduction in civil works and cabling supply and works.

The lines have also seen installation of a new centralised traffic control centre with *EBI* Screen 900 which is specifically designed to continuously control trains through one easy-to-use interface.

Assured maintenance and increased flexibility

INTERFLO 450 has been developed in Sweden and benefits from highly skilled engineers based locally in Stockholm, Hässleholm and Gothenburg. As a result the system has been designed to cope with the harsh environmental conditions in Sweden and support is always at hand.

The remote control of wayside equipment ensures better visibility for operators and the central control room offers more flexibility to manage traffic with fewer employees.



- Automatic train protection (ATP) (ERTMS/ETCS Level 2) and *EBI* Cab systems have been installed on the 110+ trains operating on the route. The ATP ensures that drivers are aware of the target speed indication with audible warnings to warn the train driver if they are likely to exceed a speed profile that will cause the train to pass a red (danger) signal or exceed a speed restriction. The system takes into account the speed and position of the train relative to the end of its movement authority and if no action has been taken by the driver after warnings have been issued the brakes will be applied.
- Pioneering control of level crossings triggered by ERTMS position reports from the train, which minimises the time the barriers need to be closed.

With the building of the new Bothnia line, Trafikverket elected to implement an ERTMS/ETCS Level 2 solution due to the increased functionality this new technology offered.

At the core of ERTMS is the ETCS system. ERTMS solutions use ETCS onboard and wayside equipment to manage rail traffic more effectively – improving safety, maintaining high availability, providing shorter headways between high-speed trains and reducing maintenance costs for railway operators.

The onboard equipment uses radio-based signalling for ERTMS Level 2 with the wayside system providing continuously updated information to the train to increase performance and further improve safe operation. Information regarding movement authority, gradients, permitted speeds and status of the train is communicated via a GSM-R radio system from the *EBI* Com RBC. Train positioning information is ensured by the use of Eurobalises.

Reduced travel times and better freight transport

The region, which includes a number of significant industrial locations, now benefits from efficient freight transport and a reduction by up to 50% of passenger travel times. Passengers in the region were accustomed to travelling by bus or private car as rail was simply not an option.

Örnsköldsvik and Umeå (at the Northern end) which could take up to two hours is now possible in just 55 minutes and Umeå to Stockholm takes 6hrs 23 minutes representing a time saving of one and a half hours.

Strong partnership

With a history spanning more than a century, and as market leader in Sweden, Bombardier has become a long term partner for the Swedish railways, this time applying its expertise in the field of ERTMS technology which is renowned for enabling vehicles to transit across borders and rail systems. At Västeråsby, the Ådal line ERTMS system connects to the Bothnia line ERTMS system - an automated handover according to the standardised interface.

Looking to the future

Today the system has 99.99% overall availability and passengers are reaping the benefits of the new line and the reduced travel times between the rest of Sweden and the larger towns in the north. Trafikverket has ordered further upgrades to the Bothnia and Ådal lines to the latest ERTMS standard ERTMS Level 2, Baseline 3, R2. These upgrades will be commissioned during 2020.

The Bombardier *INTERFLO* 450 ERTMS Level 2 solution will provide the basis for further roll-out throughout Sweden, meaning that more passengers can benefit from shortened travel times and industry can benefit from the rapid and efficient transport of goods.



Bombardier Transportation

Marieviksgatan 29
PO Box 470 36
100 74 Stockholm, Sweden

Tel +46 10 852 0000

www.bombardier.com

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