

Pre-Qualify for the Design-Build of Israel Railway's ETCS L2 Onboard Project

General Technical Description

5 January 2016

Chapter I- Project Background

Facing a continuously growing demand in passenger and freight traffic, Israel Railways has to cope with an increasing number of trains. In the core network, there is the need to raise capacity significantly. In addition, the existing ATP system is subject to safety shortcomings, which can be mitigated by means of a Full Supervision ATC approach. Both reasons have led to the intention to introduce ETCS Level 2 on the Israeli network. In this chapter, details on the current situation and the motivation are provided.

The current line length of Israel's Railway Network is about 625 km. The total track length is about 1,175 km. This number includes the tracks of both directions and some station tracks. The signalling system is based on electronic and relay interlocking, using axle counters as well as isolated track circuits as a train detection system. A variant of INDUSI I60R is applied as an automatic train detection system and the signalling scheme is close to German H/V signalling.

Nowadays, Israel's Railway Network is within a development process. There are several new lines which are already under construction:

- Fast Track to Jerusalem: Tzomet Daniel – Jerusalem Ha'Uma
- Link from Ra'anana to Coastal Line
- Ako-Carmiel Line
- Haifa- Beit Shean Line

There are also some other planned lines that will connect relevant economic areas. Such network extension and the rising volume of traffic (either freight hauling or passenger) have led to some limitations, e.g. the arising of the Ayalon corridor as a bottleneck within the railway network. As a first stage, that troublesome situation has been handled with the implementation of a new block scheme (shortening block length) and the limiting of maximum speed in that segment of the network, both measures working together with the goal of increasing traffic capacity. This way, capacity in the core of the network was raised to ten trains per peak hour and in each direction on the coastal line. There remains pending a second stage, as one of the issues to be resolved within the solution to be offered by winner of the tender, in which the traffic from the New Jerusalem line will have to be assimilated. To serve these services, up to thirteen trains per peak hour and in each direction will have to be operated.

To overcome capacity issues like the aforementioned, several works are being performed to increase the frequency of trains on some lines. Among such works are the following:

1. Rebuilding the track layout of Herzliya station.
2. Rebuilding the track layout of Tel Aviv central, Tel Aviv Hagana station, enabling middle track turn around.
3. Rebuilding the track layout of Lod station.

Alongside the network growth, several actions are being planned and/or performed with the aim of modernising the network and improving efficiency, such as the deployment of a modern railway electrification system (25 kV ac) which will cover 420 km of the network, and the procurement process for new electrified rolling stock compatible with that electrification system.

Given the current and foreseeable outlook of Israel's Railway Network, and within the framework of the development plan, the current automatic train protection system INDUSI seems insufficient in terms of both safety and capacity. Furthermore, INDUSI system is approaching to the end of its life cycle.

With a view to making the overall railway network more efficient, the need to seek an alternative to the INDUSI system is imposed, since it would not, in all the capacity issues, be possible to apply constructional solutions to meet the desired operation requirements (e.g. Ayalon corridor, on absorbing the future traffic of the Jerusalem High speed link), and to overcome the limited scope of that system on safety issues. Such a new automatic train protection system should be able to deal with the present and future shortcomings at a reasonable cost.

Current and Future Network Layout

The line length of Israel's future Network is about 880 km with electronic interlocking, with electrified lines and 1,435 mm of standard gauge. The future total track length is about 1,500 km. This number includes the tracks in both directions and some station tracks. The network is centred on Israel's densely populated coastal plain, from which lines radiate out in many directions.

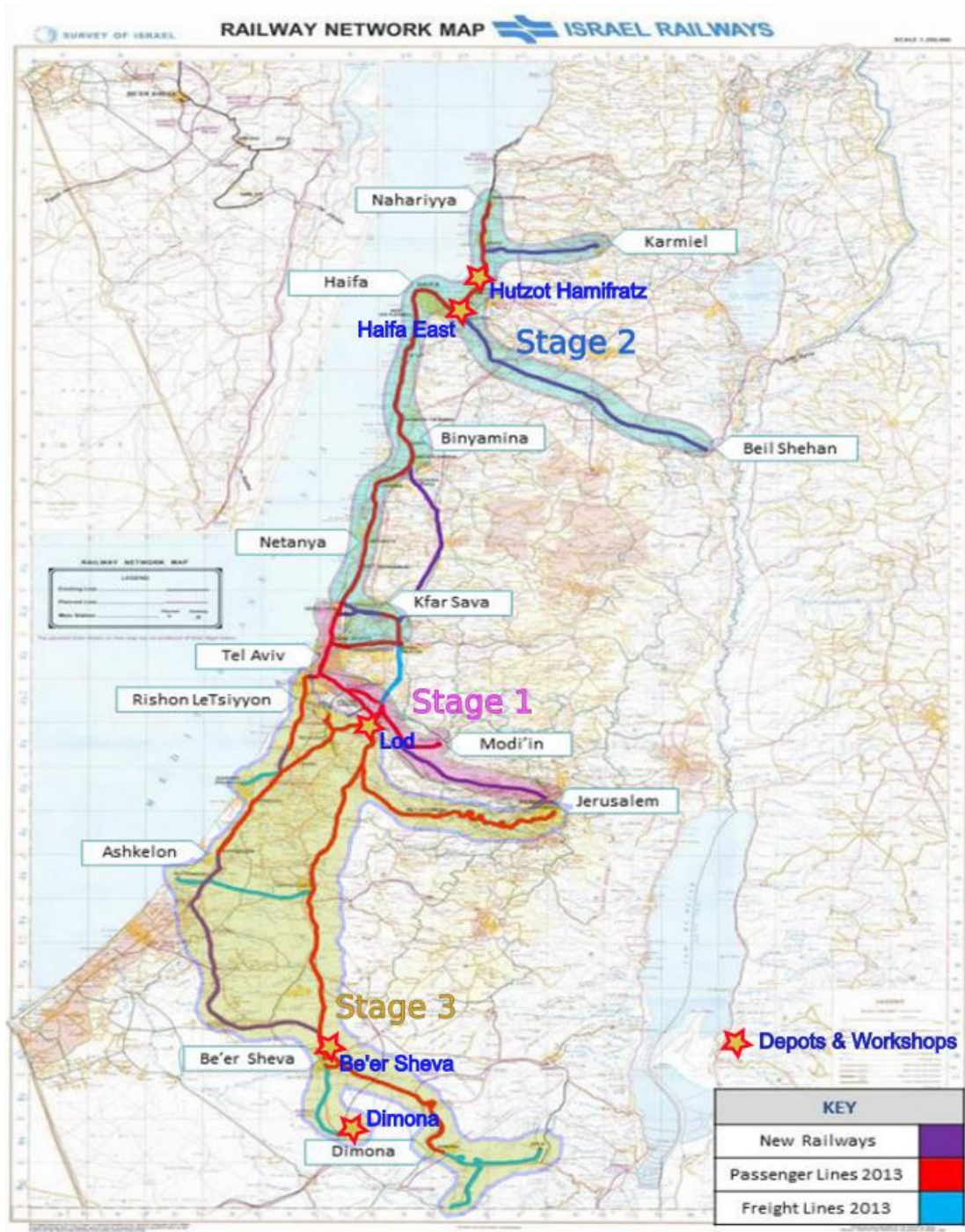


Figure 1. Outline of existing lines and under construction, Implementation Stages, Depots and Workshop

Israel's Railway Network is being updated to cope with new necessities such as transport communication between strategic areas, increasing the capacity of existing lines, safety relevant issues, energy or life cycle going to the end of some subsystems.

Israel Railway's Rolling Stock Fleet

This Design, Build and Maintenance (DBM) Tender for the implementation of the ERTMS/ETCS Level 2 on-board subsystem, relates to the on-board equipment of **228** vehicles (including locomotives) of the existing ISR's rolling stock fleet and optionally **59** more. See *Fig 2 - Summary of existing and planned ISR Fleet*.

The list of relevant rolling stock to be considered for fleet upgrades is essentially the whole ISR fleet:

Mainline Diesel Locos

- Alstom Prima JT42BW , #731-778, built 1996-2006 at Meinfesa plant
- Euro3200, #1301-1324, built 2013-2014 by Vossloh Spain at ex-Meinfesa plant, related to the RENFE 334
- Alstom Prima JT42CW, #702-709, built 1997 at Meinfesa plant
- Euro4000, #1401-1414, built 2011-2012 by Vossloh Espana at ex-Meinfesa plant, similar locomotives are in use by several European operators. Additional one unit currently under construction and will be delivered year 2016.
- EMD G12, #108-126 10 units in service, some already withdrawn from service, built 1954-1966
- EMD G26 and G26-2, 9 and 6 units respectively, all 15 units are in service, built 1971-1979 & 1982-1986
- EMD GT26CW, #701 of 1989, 6 NRE/ TVZ Gredelj Zagreb, closely related to ONCF DH401-420. 6 more units supposed to be order in future.

Diesel multiple units

- ABB Scandia IC3, #01-10, 1992-1993
- ADTRANZ Denmark IC3, #11-24, 1995-1999
- Bombardier IC3, #25-41, 2002-2003
- #ABB Scandia (ex Swedish Statens Järnvägar) IC3, #42-50, 1990-1991

Note: Related units also in use in Denmark Push-Pull Power Cars

- GEC Alstom SDPP, #301-305, assembled at Haargaz Israel, 1996-1997
- Siemens Viaggio Light SDPP, #801-814, built 2009-2011,
- Bombardier DDPP, #402-424, built 2001-2004

- Bombardier DDPP, #501-507, built 2005-2006
- Bombardier DDPP140, #2001-2022, built 2012
- Bombardier DDPP160, #2023-2034, built 2014, first electrification ready rolling stock. Two additional units are planned to be ordered in 2016.

Note1: Siemens SDPP, Bombardier DDPP and DDPP140 are to be upgraded to be 'electrification ready', and also be 'ETCS ready' within the upgrade package to ensure similar conditions on all power cars

Note 2: DDPP160 to be upgraded to 'ETCS ready'

Note 3: GEC Alstom SDPP to be upgraded to 'ETCS ready'

Shunter

- Meinfesa GA-DE 900, #261-263, built 1997 related to SBB Am841)
- NOHAB/KVAB T44, one unit, #131 (closely related to Swedish Green Cargo Td)

Type	Manufacturer	Quantity
Passengers		
BOBO JT42BW	Vossloh	48
EURO 3200	Vossloh	24
Coach DD	Bombardier	64
Coach PP	Siemens	14
Coach PP	Alstom	5
IC3	-	45
Total Passengers		200
Freights		
COCO JT42CW	Vossloh	8
EURO 4000	Vossloh	14
GT 26CW	TZV Gredelj	6
Total Freight		28
TOTAL ISR Fleet for main retrofitting		228
Optional Existing Fleet: Freight, Yellow Machines		
Yellow Machine	-	12
GM		27
Total Optional Existing Fleet		39
Optional Future Fleet: Passengers, Freight		
Coach DD	Bombardier	14
GT 26CW	TZV Gredelj	6
Total Optional Future Fleet		20

Fig. 2 - Summary of existing and planned ISR Fleet

Israel Railway's Rolling Stock Depots and Workshops

There are 4 Depots and 1 Workshop located at:

- ✓ Beer Sheva
- ✓ Haifa East
- ✓ Lod
- ✓ Haifa Kishon Workshop
- ✓ Dimona

Automatic Train Protection

Israel Railways makes use of INDUSI (“Induktive Zugsicherung”, “inductive train protection”), which belongs to the class of ATP systems. Its application areas besides Israel are Germany, Austria, Romania, Slovenia and Canada. INDUSI facilitates inductive coupling and consists of two components, namely a track-borne and a train-borne magnet.

The train protection system uses the frequencies 1,000 Hz at the pre-signal, 500 Hz before the main signal and 2,000 Hz at the main signal. In Israel, the 500 Hz magnet is mandatory and always located 370 m before the main signal.

Figure 3 illustrates the supervised speeds as a function of the three train types.

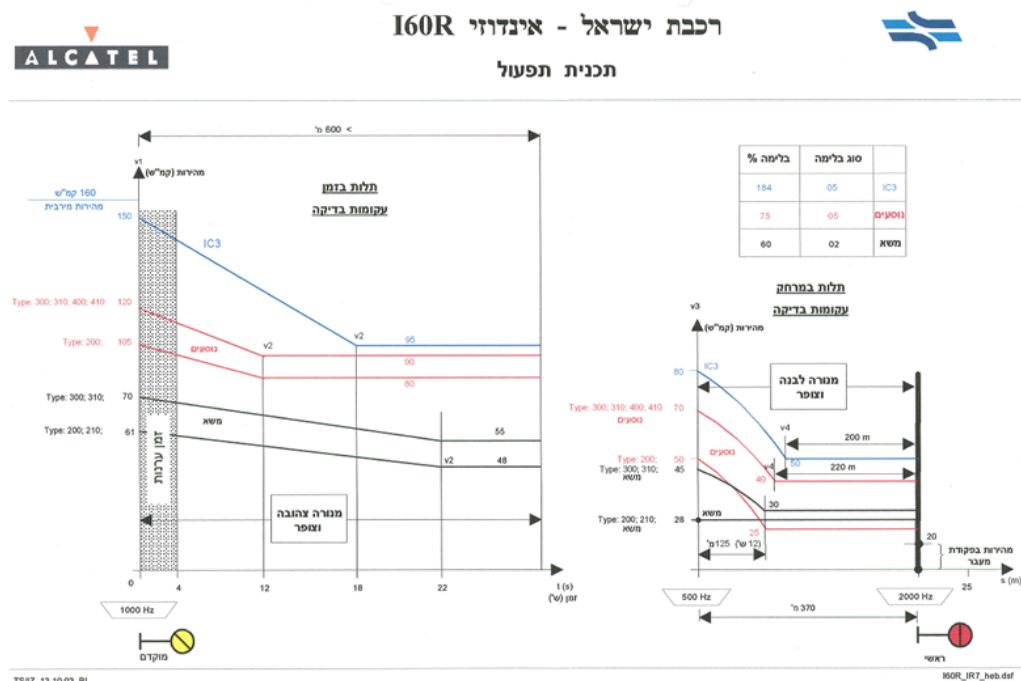


Figure 3 - I60R supervision curves in Israel

Mobile Telecommunications

There are two main mobile communication systems in operation in ISR:

- "VHF radio communication system". It is ISR own system based on about 20 based stations with full coverage of the net. ISR is planning to keep this system as a "stand-by" system for DRP cases.
- "MIRS- cellular communication system". It is a public system that is close to be after End of Life. ISR is planning to replace MIRS by GSMR.

Chapter II – Scope of the ERTMS Project

Israel Railways Ltd. (*ISR*) wishes to upgrade the signalling capacity across its network to enhance the provision of services to its customers. To this end, ISR intends to implement the European Rail Traffic Management System (*ERTMS*). ISR anticipates this to be done in two deployments – the installation and rollout of a GSM-Railway communications network (*GSM-R*) and a Level 2 European Train Control System (*ETCS L2*).

Chapter III – ISR Trackside Project Deployment

The ERTMS/ETCS L2 Trackside system will be progressively implemented across the entire Israel Network (see Figure 1). The whole Israel Railway Network includes existing and planned projects and contains about 1,500 KM track, 8 operational IXL's, 1 reserve IXL.

The ERTMS/ETCS L2 Trackside system will be implemented in three main stages:

1. **Stage 1** (see Figures 1 and 4), includes the section Herzliya- Jerusalem Binyanei Hauma- Modi'in -Lod (excluded). Stage 1 includes operation of two (2) RBC's (according to numbers of IXL areas, the number of RBC's can be changes with accordance to the "Detail Design"), 213 KM of track, and one (1) reserve RBC for the whole network.

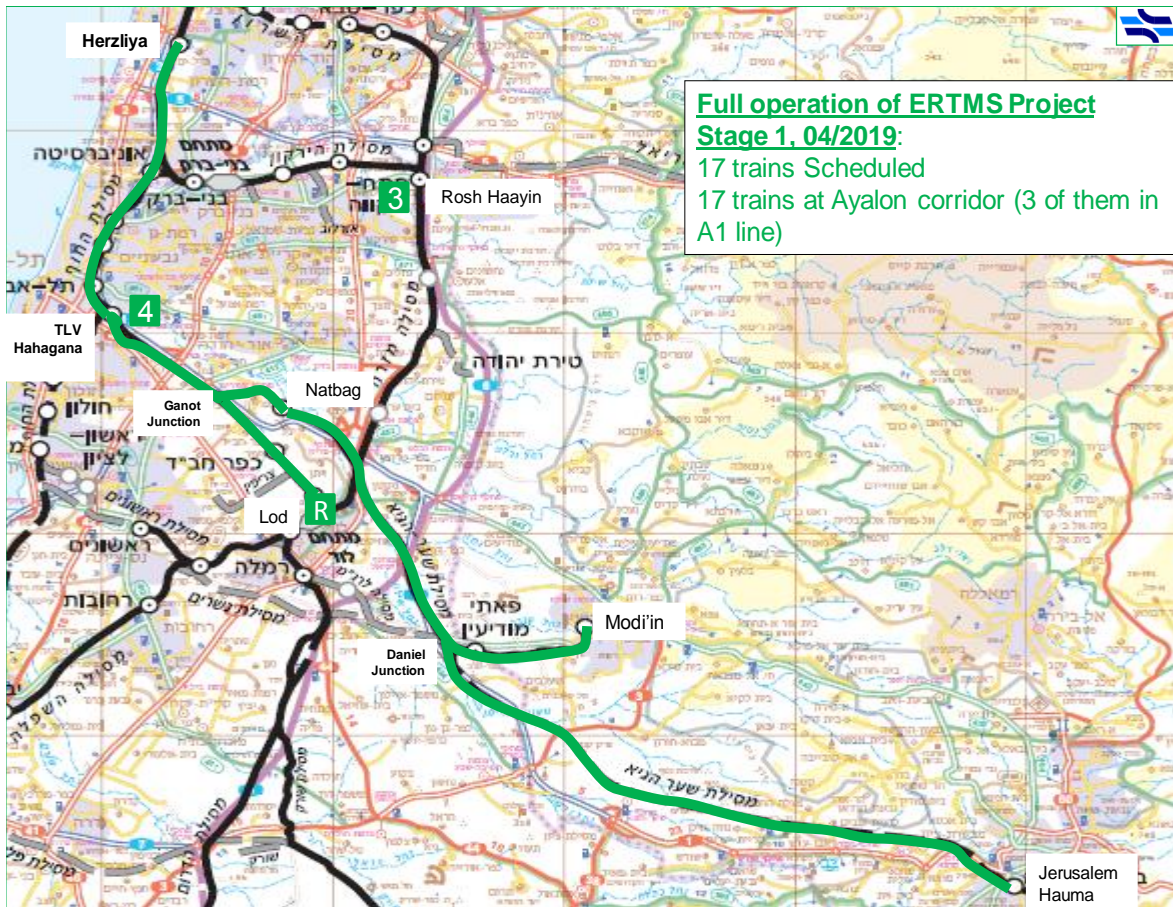


Figure 4 - ERTMS/ETCS L2 Trackside Stage 1

2. **Stage 2** (see Figure 1), includes the sections Naharia- Karmiel- Beit Shean- Kfar Saba- Herziya ,three (3) RBC's (according to numbers of IXL areas, the number of RBC's can be changes with accordance to the "Detail Design") 440 KM of track.
3. **Stage 3** (see Figure 1) includes the track sections -Lod- Rosh haain- Ashkelon-K.Gat- B.Sheva- Zefa - Zin, three (3) RBC's (according to numbers of IXL areas, the number of RBC's can be changes with accordance to the "Detail Design") 780 km track.

Chapter IV – ISR Onboard Project Deployment

Fleet Migration/Retrofitting Strategy

Both the current and the future rolling stock fleet of ISR are composed of a variety of models, uses, manufacturers, age and traction energy. Nevertheless, the current fleet operation strategy is to operate the maximum number of trains with the minimum number of constraints.

Based on the abovementioned information and the foreseen deadlines to put in service the ERTMS (ETCS L2 + GSM-R) trackside project as well as all ongoing required projects in parallel (Signalling, Fixed Communication, Electrification, Infrastructure etc.), a retrofitting priority must be considered.

The Contractor will be responsible for establishing and providing coordination with the Rolling Stock Manufacturers regarding design changes and implementation in existing vehicles.