

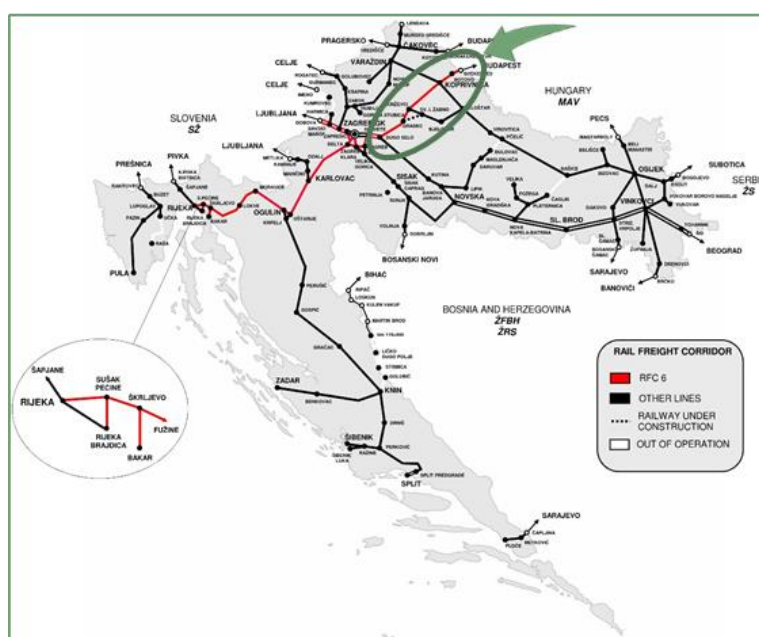
MODERNISATION OF THE RAILWAY LINE DUGO SELO–HUNGARIAN BORDER (SECTIONS DUGO SELO–Križevci and Križevci–state border)

General information

The project regards the **modernisation of the cross-border railway sections Dugo Selo-Križevci and Križevci-state border with Hungary**. The railway line connecting Dugo Selo with the Hungarian border is part of the Mediterranean CNC and, more in detail, it is part of the link connecting Zagreb with Budapest. The line is also part of the Rail Freight Corridor 6.

The localisation of the line is presented in Figure 5-1.

Figure 5-1: Localisation of the railway line Dugo Selo-Hungarian border



Source: Network Statement for year 2018, HŽ Infrastruktura (2016)

The existing line from Dugo Selo to the border with Hungary is single-track and has a total length of 79,1 km. The section between Dugo Selo and Križevci has a length of 35,75 km, while the remaining section between Križevci and the border with Hungary has length of 43,2 km. The line is coded as M201 inside the internal classification of HŽ Infrastruktura. The existing characteristics are summarised in Table 5-1.

Table 5-1: Existing characteristics of the railway line Dugo Selo-Hungarian border

Item	Technical characteristic
Electrification	25kV AC single-phase
Weight limits	Category D4 (22,5 tons for axleload, 8,0 tons/m)
Loading gauge	GC
Speed	Maximum value of 140 km/h for very short sections, but with many restrictions up to 50 km/h at different points
Maximum permitted train length	Variable from a minimum of 515 m to maximum of 800 m
Signalling	Automatic protection (autostop) based on INDUSI standard from Dugo Selo to Botovo

Source: HŽ Infrastruktura (2016)

The rail line modernisation is a part of a larger project for setting up a high-efficiency, double-track railway line for mixed transport along the entire Mediterranean CNC, which will connect the Iberian Peninsula through the Port of Rijeka, Zagreb and Budapest with the Hungarian–Ukrainian border and TEN-T European network. The rail line modernisation will increase in traffic volumes towards central European countries by connecting Rijeka and Zagreb to the Hungarian rail network. The project will satisfy the following TEN-T priorities:

- **Ensuring optimal integration of the transport modes and interoperability within transport modes:** the project will improve passenger intermodality, with new parking areas and access roads in order to connect the populated areas with the stations and stops, both the railway station and the regional bus station will be located together, allowing the intermodality between them.
- **Bridging missing links and removing bottlenecks, particularly in cross-border sections:** the Mediterranean CNC Study issued by the European Commission in December 2014 includes some features of the Dugo Selo-Botovo (HR/HU Border) section in the list of railway critical issues in Croatia: single rail track, train speed limitations for freight (<100 km/h), train length limitations (400-500 m). This bottleneck will be removed with the designed upgrade and duplication of the railway line.
- **Promoting the efficient and sustainable use of the infrastructure and, where necessary, increasing capacity:** the project provides the reorganisation of the technological scheme of the line and significant increase of capacity due to the doubling of the existing track and to the renovation of stations and signalling systems.
- **Improving or maintaining the quality of infrastructure in terms of safety, security, efficiency, climate and, where appropriate, disaster resilience, environmental performance, social conditions, accessibility for all users, including elderly people, persons with reduced mobility and disabled passengers, and the quality of services and continuity of traffic flows:** the renewal of the signalling and telecommunication systems and the de-levelling of the road level crossings, together with the disposition of audio and visual signals and barriers in the ones that are kept, will improve the levels of safety and security. The project will include the implementation of noise barriers according to EIA and Noise study in the surroundings of populated areas. The renovation of the permanent way will enable the reduction of vibrations. Measures will be adopted in order to minimise the environmental impact, as well as the adaptation to climate changes for the identified risks: flooding, bridge scouring, landslides and extreme temperature effect.
- **Implementing and deploying telematic applications and promoting innovative technological development:** the installation of the ETCS level 1 will allow the improvement of the operation of the railway line, increasing both its capacity and security. The overall objective of the project is to significantly increase the existing line capacity and, in particular, to meet technical requirements for interoperability in accordance with Directive 2008/57/EC and TSI's for conventional railway system of Trans-European railway network.

In the end, the line will meet the requirements of corridor traffic and will also receive interoperable freight trains, as well as enable the increase of line capacity and the quality of life for people living next to railway lines. It will also attract investment in noise protection according to European standards.

The **promoter of the project** is HŽ Infrastruktura, the national rail infrastructure manager of Croatia. The project is divided into two parts:

- upgrade and construction of the second track between Dugo Selo and Križevci;

- upgrade and construction of the second track between Križevci, Koprivnica and the border with Hungary.

Technical description

The technical description of the project can be provided separately for the section Dugo Selo -Križevci and for the section Križevci-state border.

Section Dugo Selo-Križevci. The project as a whole comprises the design, construction and putting into service of the Dugo Selo-Križevci rail section, which includes upgrading of the existing 35,75 km single-track, and electrified section with some minor track re-alignments plus the addition of a second track and station improvements. With the inclusion of Dugo Selo Station in the project, the total length of the section is 38,23 km.

According to the documents made available, the project includes:

- The re-alignment of 9,3 km of the existing single-track in 4 locations in order to increase the radius from a minimum of 1.000 m to at least 1.700 m.
- The construction of a second track adjacent to the re-aligned existing track with the same specifications (i.e., crushed stone ballast, pre-tensioned reinforced concrete sleepers, continuously welded type 60 E1 rails, elastic fittings and structural gauge GC).
- The upgrading of the existing single track power supply, telecommunication and signalling systems with systems suitable for double track operations, speed up to 160 km/hour and 25-ton axle loads.
- The project also includes the elimination of 19 level crossings, the construction of 12 road over/under-bridges, 6 pedestrian subways and the reconstruction of the existing 6 bridges (4 railway and 2 road bridges), reconstruction of 7 other railway bridges and the upgrading of 2 halts and 4 stations (including the substantial reconstruction of Dugo Selo station).
- The upgrading works include the extension of the platforms and station (halt) buildings, redoing the track layouts, constructing subways and improving passenger facilities (i.e., canopy protection to platforms, public information and address systems, facilities for disabled, car parking, etc.).
- A 41-km service road adjacent to the track and the access to the road overpass is included in the project (approximately 15 km as a whole).
- The stations involved in the project are Dugo Selo, Vrbovec, Gradec and Križevci and the halts improved are Božjakovina and Repinec.
- Signalling systems equipment includes optical fibre cables, GSM-R, ETCS level 1.
- The electrification system encompasses a power supply rehabilitation of 2 substations and approximately 40 km of new catenary and the overhead contact line (OCL) and the poles and/or portals alongside the line.

The total **estimated implementation cost** (including expropriation, supervision and contingencies) is exactly € 194.623.502,50 or € 5,1 million per km. Maintenance costs without the project have been estimated at an amount of € 2,53 million per annum, while maintenance costs in the with-project scenario have been estimated at an amount € 4,29 million per annum.

Section Križevci-Koprivnica-state border. The planned works for the section Križevci-Koprivnica-state border include the upgrade and reconstruction of the existing track as well as the construction of a second track parallel to the existing one. At the subsection Carevdar-Lepavina, due to the difficult

technical characteristics of the land in this area, the existing route is to be abandoned in the length of 4,3 km and a completely new double track railway line is planned.

Reconstruction of railway stations and modernisation of traffic control and signalling and interlocking infrastructural subsystem, as well as energy subsystem are also part of the project.

The **total estimated cost** is € 297,11 million (of which € 283,94 million are eligible costs). Traffic operation cost (from 2012) is approx. € 52.000 per km, i.e. € 2,2 million per year. The average maintenance cost (from 2012) is approx. € 69.000 per km, i.e. € 2,9 million per year. Due to the doubling of the track, it is estimated that maintenance cost will increase by 25%, while the operating costs will increase by 50% after the year 2031.

Project implementation

Section Dugo Selo-Križevci: the construction works started in July 2016 and the opening of the second track is forecasted by 2020. Even if the construction works are ongoing, the representatives of HŽ Infrastruktura during the meeting held with the Consultant pointed out how that further financing sources could guarantee the national budget commitment of 15% of the total investment.

The companies that are involved in the construction and supervision are:

- A construction contract for the amount of € 163,1 million was signed with a consortium involving the Croatian companies DIV d.o.o., Dalekovod d.d. and Zagreb-Montaža d.o.o.
- A contract for the supervision of works for the amount of €1,9 million was signed with the consortium composed by SGS Adriatica d.o.o. and Investiinženjering d.o.o.

Section Križevci-Koprivnica-state border: the contract for the preparation of the design and other project documents for the upgrade and construction of the second track was signed on 10 December 2012 by HŽ Infrastruktura d.o.o. as Contracting Authority and URS Polska Sp. z.o.o. in consortium with URS Infrastructure and Environment UK Limited and IDOM Ingenieria y Consultoria S.A. In the meantime, during the implementation of the contract, URS Polska Sp. z.o.o and URS Infrastructure and Environment UK Limited changed their names into AECOM Polska Sp. z.o.o. and AECOM Infrastructure and Environment UK Limited, respectively.

The total value of the design contract is € 5,3 million, of which 85% is provided by the European Union (IPA) and 15% by the Croatian Government. The deadline for the completion of the design is 42 months from the contract signature date.

No details about further procurement plans (for construction) were made available to the Consultant.

Transport demand

Only limited information about the transport demand was made available to the Consultant. The only information available that can be reported regards the Dugo Selo-Križevci section forecasts, developed on a model based on the GDP growth and a convergence of Croatia towards EU trends, with a GDP growth rate equal to 3% from 2025 onwards was assumed. The elasticity of transport demand is indicated in Table 5-2.

Table 5-2: Transport demand elasticity assumed for the Dugo Selo-Križevci project

Transport type	Present - 2025	2025 & beyond
Rail passenger transport	0,95	1
Rail freight transport	1,09	1
Private car transport	1,18	1

Source: HŽ Infrastruktura (2016)

No generated traffic is derived in this demand analysis. The increase in traffic is assumed to be solely the effect of economic growth, regardless the transport network development.

The Consultant’s observation is that if the assumption of a GDP trend of 3% is confirmed, such value should be then taken with care. As a comparison, in Table 5-3 are reported the forecasted GDP growth rates both for Croatia, the EU and Europe as a whole.

Table 5-3: Forecasted GDP annual growth rate [%]

Year	Croatia	Europe	European Union
2016	1,9	1,5	1,9
2017	2,1	1,6	1,7
2018	2,2	1,7	1,8
2019	2,3	1,8	1,8
2020	2,3	1,8	1,8
2021	2,0	1,8	1,7

Source: International Monetary Fund

Financial analysis

As regards the **project financing**, due to the complexity of the planned activities, the two sections followed two separate paths.

- Section **Dugo Selo-Križevci**: due to the complexity of the project and the relatively late planned start of construction, in the development of the funding application, this section was planned as a project to be carried out in two phases and included in the Operational Programme Transport for the period 2007-2013 (OPT) and in the Operational Programme Competitiveness and Cohesion for the period 2014-2020 (OPCC). The total eligible cost is about € 200 million. An amount of 15% of the total investment will be financed with national funds.
- Section **Križevci-state border**: the project obtained a CEF financing of 85%. The Grant Agreement no. INEA/CEF/TRAN/M2015/1126931 was signed on 6 October 2016 between INEA and HŽ Infrastruktura, providing for a € 241,35 million financing (the total estimated cost amounts to € 283,94 million).

With respect to the **financial analysis**, the performance indicators are summarised in Table 5-4.

Table 5-4: Financial performance indicators

Section	Discount rate	Financial rate of return on investment	Financial rate of return on national capital
Dugo Selo-Križevci	5,0%	FNPV(C): € -167.970.559 FIRR(C): -6,08%	FNPV(K): € -23.263.718 FIRR(K): -0,18%
Križevci-state border	n.a.	FNPV(C): € -251.958.925,59 FIRR(C): -5,75%	FNPV(K): € -35.553.214,63 FIRR(K): -0,06%

Source: Feasibility Study

As regards the **financial sustainability analysis**, the results for the section **Dugo Selo-Križevci** show that the project will not run out of cash, as the cumulative cash flow is always equal to zero or positive. However, the precondition is of course that the Croatian Government continues to support the rail passenger transport at the current level. On the other hand, for the section **Križevci-state border** the cumulated cash flow shows values below zero during the first years. This is because all annual net operating expenses will not be covered at the beginning by HŽ Infrastruktura revenues. It is being

assumed that these amounts will be paid by operating subsidies until the project achieve a sustainable financial regime, with a positive cumulated generated cash flow.

Economic analysis

Only general results are available at the moment, reported in Table 5-5.

Table 5-5: Economic performance indicators

Section	Discount rate	ENPV [€ million]	EIRR	B/C ratio
Dugo Selo-Križevci	5,5%	189,1	10,91%	2,47
Križevci-state border	5,0%	14,53	5,37%	n. a.

Source: Feasibility Study

As regards the section Križevci-state border, the adopted discount rate is 5,0%, consistently with the implementing Regulation on the funding application form and the CBA methodology for the programming of period 2014-2020 and therefore it is slightly different from the 5,5% adopted for the section Dugo Selo-Križevci. The result appears to be just above the economic feasibility, with an EIRR of 5,37%. Nevertheless, the full social feasibility of the investment should be also evaluated considering the investment as a whole and not divided into two parts, since both sub-sections are functionally the same line as part of an international corridor.

Environmental analysis

As regards the section **Dugo Selo-Križevci**, the EIA has been prepared and a positive opinion from the relevant authority (Ministry of Environment and Nature Protection) has been issued in November 2005. An additional study of possible impact of the project on the Natura 2000 Ecological Network was performed during 2012. Based on the study, the Declaration was issued in November 2012 by Ministry of Culture, Nature Protection Directorate upon which it can be concluded that the planned project will not have any significant adverse effects on the area of National Ecological Network and possible future Natura 2000 sites.

With respect to the section **Križevci-Koprivnica-state border**, the EIA has been prepared and positive opinion from the relevant authority (Ministry of Environment and Nature Protection) has been issued.

Safety levels

A general improvement of the safety levels for both sections will be obtained by:

- the development of a more advanced signalling system that will further increase rail safety (that is already high also with the existing line);
- the improvement and reshape of the existing stations (stations have been designed with higher safety levels and in compliance with current standards);
- the de-leveling of the most critical road level crossings, together with the disposition of audio and visual signals and barriers in the ones that are kept.

There is no other specific information on safety issues and black spots, before and after project implementation.