SECOND TRACK OF THE DIVAČA-KOPER RAILWAY LINE

REPUBLIC OF SLOVENIA
MINISTRY OF INFRASTRUCTURE
SLOVENE INFRASTRUCTURE AGENCY
SECOND TRACK OF THE DIVAČA–KOPER RAILWAY LINE
Second track of the Divača–Koper railway line

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**ACRONYMS USED**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating current</td>
</tr>
<tr>
<td>CEF</td>
<td>Connecting Europe Facility</td>
</tr>
<tr>
<td>CETRA</td>
<td>Central European Transport Model</td>
</tr>
<tr>
<td>DC</td>
<td>Direct current</td>
</tr>
<tr>
<td>EIA</td>
<td>Ecologically important area</td>
</tr>
<tr>
<td>ERTMS</td>
<td>European Railway Traffic Management System</td>
</tr>
<tr>
<td>ETCS</td>
<td>European Train Control System</td>
</tr>
<tr>
<td>GSM-R</td>
<td>Global System for Mobile Communications - Railway</td>
</tr>
<tr>
<td>NATM</td>
<td>New Austrian Tunnelling Method</td>
</tr>
<tr>
<td>NB</td>
<td>Noise barrier</td>
</tr>
<tr>
<td>NSP</td>
<td>National Site Plan</td>
</tr>
<tr>
<td>TBM</td>
<td>Tunnel-boring machine</td>
</tr>
<tr>
<td>TEN-T</td>
<td>Trans-European Transport Networks</td>
</tr>
</tbody>
</table>
Introduction
Slovenia is situated at the crossroads of the Alps, Dinaric Alps, the Pannonian Plain and the Adriatic Sea. Due to its geographical position, it is an important traffic hub in this part of Europe with crossings of traffic flows between North and South, and East and West. Two trans-European transport corridors pass through the country: the Baltic-Adriatic and the Mediterranean corridor.

The main transport branches in Slovenia are road and rail transport which run on a densely branched nearly 45,200-kilometre network of public roads and 1,200-kilometre network of railways, which together with airports for international passenger and freight transport and a port for the international transportation of goods form an integrated and developed transport system with more than 75 million passengers and almost 100 million tonnes of diverse cargo transported a year.

It was the estimates of future trade flows through the port of Koper that some time ago encouraged ideas on the new railway infrastructure that would ensure better links to the interior of the country as well as to the wider European area.

The existing Divača–Koper single-track line was built in 1967 as an industrial track and any possible increase in its capacity merely by modernisation of infrastructure is severely limited.

The first research of the possibility of the new railway link, supported with studies, was carried out in the late nineties. It was followed by the procedure of the spatial placement of the line and the determination of the variant for which the Government of the Republic of Slovenia adopted the Decree on the National Site Plan in 2005, and the Amendments to the Decree in 2014.

On the initiative of the Ministry of Infrastructure, the spatial placement procedure was led by the Ministry of the Environment and Spatial Planning, while professional support and expertise were provided by the investor, the Slovenian Infrastructure Agency, which is a body within the Ministry of Infrastructure. In 2011, project management and the implementation of other professional consulting services included DRI upravljanje investicij (Družba za razvoj infrastrukture, d.o.o.) as an internal consulting engineer.

At the time of issuing this publication (June 2015), project designs for a building permit for the project of the second track between Divača and Koper were prepared and reviewed; the majority of approvals for the project to proceed had been obtained and most of the land required for construction had been acquired.
The Government of the Republic of Slovenia notes that the establishment of the TEN-T standard in the Mediterranean and the Baltic-Adriatic rail corridor is in accordance with the draft of the Transport Development Strategy in the Republic of Slovenia, and that the implementation of the new Divača–Koper railway connection (hereinafter referred to as the second track) is important.

2. The last point of the conclusion cited above has indeed been realised, and for the realisation of other points, at the 27th regular session on 18 March 2015, the Government of the Republic of Slovenia appointed an inter-ministerial working group to prepare a set of public-private partnership forms for the construction of the second track of the Divača–Koper railway line.

3. This publication presents the key starting points for planning, purpose, the history of spatial placement and the technical elements of the new line. Due to the placement of the line in a sensitive karst area, a special section is devoted to the requirements regarding the impacts on the environment which will need to be strictly adhered to during the construction.

4. The Government of the Republic of Slovenia instructed the Ministry of Infrastructure, the Ministry of Finance and the Ministry of Economic Development and Technology to propose to the Government of the Republic of Slovenia possible forms of public-private partnership in accordance with the Public-Private Partnership Act (Official Gazette of the Republic of Slovenia No. 127/L6) for implementing the investment of the second track, and to do so in the shortest possible time.

5. The Government of the Republic of Slovenia instructed the Ministry of Infrastructure to apply to the first CEF call to tender, which ended on 26 February 2015, in the context of the so-called national envelope with the project of upgrading the Poljčane–Slovenska Bistrica rail link and the project of a side track from the Koper freight station, including the execution of all activities for selecting a private partner to build a second track. The project of the second track in the context of CEF is applied to an open call to tender. With other projects, Slovenia will also participate in the following CEF calls to tender. With other projects, Slovenia will also participate in the following CEF calls to tender. The execution of the project cannot start prior to the conclusion of a public-private partnership.
Bases for the planning and the purpose of the second track of the Divača–Koper railway line
The Divača–Koper section is an integral part of the Trans-European Transport Network (TEN-T network). In accordance with EU Regulation No. 1316/2013, the territory of the Republic of Slovenia is crossed by two corridors of the core network, an integral part of which is also the Divača–Koper line. These are:

- the Baltic-Adriatic corridor in the direction (Graz)–Šentilj–Maribor–Ljubljana–Koper/Trieste, and
- the Mediterranean corridor in the direction (Venice)–Trieste/Koper–Ljubljana–Pragersko–Hodoš–(Budapest).

The importance of the Divača–Koper line is most evident in international railway freight transport, which is understandable given the role of the cargo port of Koper in linking the hinterland Slovenian and European economies with countries overseas.

The existing line on the section in question does not meet the standards for the core network which were adopted by the Council of the EU in 2012 and are expected to be implemented by 2030. The standards are not met in the ensured speed and the length of trains.
THE PURPOSE OF THE SECOND TRACK OF THE DIVAČA–KOPER RAILWAY LINE

- To provide modern and efficient railway link between the cargo port of Koper and the rail network in the Republic of Slovenia, and consequently also the wider European rail network;
- To finally abolish all limitations of throughput and transport capacity of the railway line from Koper to the junction in Divača;
- To increase reliability of the operation of the railway line from Koper to Divača;
- To increase the level of traffic safety;
- To shorten travel times;
- To reduce environmental impacts and risks to the environment;
- To additionally increase the proportion of cargo transported by rail;
- To enable and to increase the use of environmentally friendly modes of transport.

CARGO PORT OF KOPER

OVERVIEW OF THROUGHPUT IN THE PAST

The cargo port of Koper is almost the only generator of cargo transport on the Koper–Divača section of the line. The port of Koper and other important Northern Adriatic ports (Venice, Trieste, Ravenna, Naples) are attractive for transoceanic cargo, especially for cargo coming from Asia via Suez. Cargo en route from Asia arrives at these ports about a week earlier than it would at rival north European ports (Rotterdam, Antwerp etc.).

In 2008, the company Luka Koper, d.d., signed a concession contract with the Republic of Slovenia for a period of 35 years for the provision of port services, the management, development and regular maintenance of port infrastructure in the Koper cargo port.

According to the data of Luka Koper, d.d., a total of 18,965,351 tonnes of cargo was loaded/unloaded in Koper in 2014. Of the total cargo handled, approximately 65% was transported by rail.

<table>
<thead>
<tr>
<th>Year</th>
<th>Loaded</th>
<th>Unloaded</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>2.0</td>
<td>2.3</td>
<td>4.3</td>
</tr>
<tr>
<td>2003</td>
<td>3.0</td>
<td>2.3</td>
<td>5.3</td>
</tr>
<tr>
<td>2004</td>
<td>3.6</td>
<td>2.3</td>
<td>5.9</td>
</tr>
<tr>
<td>2005</td>
<td>3.5</td>
<td>2.2</td>
<td>5.7</td>
</tr>
<tr>
<td>2006</td>
<td>3.4</td>
<td>2.1</td>
<td>5.5</td>
</tr>
<tr>
<td>2007</td>
<td>3.3</td>
<td>2.0</td>
<td>5.3</td>
</tr>
<tr>
<td>2008</td>
<td>3.2</td>
<td>1.9</td>
<td>5.1</td>
</tr>
<tr>
<td>2009</td>
<td>3.1</td>
<td>1.8</td>
<td>4.9</td>
</tr>
<tr>
<td>2010</td>
<td>3.0</td>
<td>1.7</td>
<td>4.7</td>
</tr>
<tr>
<td>2011</td>
<td>2.9</td>
<td>1.6</td>
<td>4.5</td>
</tr>
<tr>
<td>2012</td>
<td>2.8</td>
<td>1.5</td>
<td>4.3</td>
</tr>
<tr>
<td>2013</td>
<td>2.7</td>
<td>1.4</td>
<td>4.1</td>
</tr>
<tr>
<td>2014</td>
<td>2.6</td>
<td>1.3</td>
<td>3.9</td>
</tr>
</tbody>
</table>
### Throughput by Groups of Goods 2009–2014

<table>
<thead>
<tr>
<th>Year</th>
<th>CARS</th>
<th>GENERAL CARGO</th>
<th>LIQUID CARGO</th>
<th>BULK CARGO</th>
<th>CONTAINERS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>3,073,620 t</td>
<td>1,643,552 t</td>
<td>6,724,354 t</td>
<td>763,621 t</td>
<td>6,760,204 t</td>
<td>18,965,351 t</td>
</tr>
</tbody>
</table>

### Countries

- **Other Countries**: 2%
- **Austria**: 32%
- **Slovenia**: 29%
- **Slovakia**: 8%
- **Poland**: 1%
- **Germany**: 2%
- **Italy**: 14%
- **Hungary**: 9%
- **Czech Republic**: 3%

## Throughput by Groups of Goods for 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>763,621 t</td>
</tr>
<tr>
<td>General cargo</td>
<td>1,643,552 t</td>
</tr>
<tr>
<td>Liquid cargo</td>
<td>3,073,620 t</td>
</tr>
<tr>
<td>Bulk cargo</td>
<td>6,724,354 t</td>
</tr>
<tr>
<td>Containers</td>
<td>6,760,204 t</td>
</tr>
<tr>
<td>Total</td>
<td>18,965,351 t</td>
</tr>
</tbody>
</table>

### Comparison by Groups of Goods for 2014

- **518,900** vehicles
- **674,033** TEU

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**Estimate of Throughput by Markets**

- **Austria**: 32%
- **Other Countries**: 2%
- **Slovenia**: 29%
- **Slovakia**: 8%
- **Poland**: 1%
- **Germany**: 2%
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- **Hungary**: 9%
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**Bases for the planning and the purposes of the second track of the Divača–Koper railway line**
For the concessionaire, Luka Koper, d.d., to be able to increase its capacity and market share, it plans to implement numerous investments of its own in the coming years, mainly the following:

- The maximum possible extension of the first pier and upgrading the existing coastline infrastructure;
- Increasing the number of moorings:
  - basin II: arranging the south coast of the second pier, livestock, oil tankers;
  - basin III: Ro-Ro and the start of arranging the third pier;
- Internal linking infrastructure and transport routes (in parallel with new entrances);
- New storage capacities: tanks, warehouses;
- Expanding the port into the hinterland (the area of disposal sites in consolidation);
- Infrastructure and a passenger terminal facility.

**FORECAST OF THROUGHPUT AT THE CARGO PORT OF KOPER**

Regarding the given space constraints in accordance with the National Site Plan, it is envisaged that with the implementation of all planned measures, the concessionaire will be able to load/unload approximately 40 million tonnes per year.

**LONG-TERM FORECAST (FOR 2030) OF THE THROUGHPUT AT THE CARGO PORT OF KOPER BY GROUPS OF GOODS**

<table>
<thead>
<tr>
<th>Group of Goods</th>
<th>Throughput 2030 (in thousand tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>1,081,276 t</td>
</tr>
<tr>
<td>General cargo</td>
<td>3,007,757 t</td>
</tr>
<tr>
<td>Liquid cargo</td>
<td>3,813,721 t</td>
</tr>
<tr>
<td>Bulk cargo</td>
<td>10,147,776 t</td>
</tr>
<tr>
<td>Containers</td>
<td>17,239,593 t</td>
</tr>
<tr>
<td>Total</td>
<td>35,290,123 t</td>
</tr>
</tbody>
</table>

RELIABILITY OF THE EXISTING TRACK

In the 1960s, the track between Divača and Koper (or between Koper and the connection to the line in Prešnica) was built as an industrial track. An important reason for this decision was the fact that in the former Yugoslavia the central port was Rijeka and not Koper.

MAIN CHARACTERISTICS

The existing Divača–Koper line is the main single-track electrified railway line. It is made up of the following sections:

- Divača–Prešnica junction: 16.5 km;
- Prešnica junction–Boje junction: 28.1 km;
- Boje junction–Koper: 3.5 km;
- Boje junction–Koper freight station: 0.9 km.

The route has a great longitudinal gradient, up to 26 ‰ between Prešnica and Boje. Examination of route elevation shows that the highest point Rodik is 107 m higher than the destination in Divača. Therefore, there is a significant altitude loss of some 107 m.

MAIN RISKS

The existing single-track line between Koper and Divača is the only rail link between the port of Koper and the hinterland. The capacity and transportability of the line are strongly influenced by unexpected events as well as measures that must be implemented on the line (maintenance works, modernisation etc.). Summer forest fires that can disrupt or totally put a halt to any traffic present an extremely high risk. Rock falls, which are common due to the nature of the terrain, also present a risk.
TRAFFIC ON THE DIVAČA–KOPER RAIL LINK

The Divača–Koper line is characterised by an uneven structure of freight transport by directions, as 70% of freight transport is in the direction from Koper to Divača and 30% in the direction from Divača to Koper. This non-uniformity in directions is not noticed in passenger transport. In passenger transport, a slightly higher offer has been noticed during the summer months (holiday trains), while in freight transport, the scope of the transport part, expressed in the number of freight trains, changes monthly and is usually the highest at the end of the year.

On the Divača–Koper section, the number of freight trains has been increasing, with the exception of a drop in 2009, and transported net weight increased from 8.1 million tonnes in 2007 to 11 million tonnes in 2014. The average for 2012 was 83 trains per day, of which 10 were passenger, 13 locomotive and 54 freight trains.

## Transported Net Weight on the Divača–Koper Section

<table>
<thead>
<tr>
<th>Year</th>
<th>Divača–Koper</th>
<th>Koper–Divača</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>8.1</td>
<td>8.6</td>
<td>16.7</td>
</tr>
<tr>
<td>2008</td>
<td>8.8</td>
<td>8.7</td>
<td>17.5</td>
</tr>
<tr>
<td>2009</td>
<td>9.2</td>
<td>8.7</td>
<td>17.9</td>
</tr>
<tr>
<td>2010</td>
<td>8.9</td>
<td>7.7</td>
<td>16.6</td>
</tr>
<tr>
<td>2011</td>
<td>7.1</td>
<td>8.8</td>
<td>15.9</td>
</tr>
<tr>
<td>2012</td>
<td>8.8</td>
<td>8.8</td>
<td>17.6</td>
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<tr>
<td>2013</td>
<td>8.8</td>
<td>8.9</td>
<td>17.7</td>
</tr>
<tr>
<td>2014</td>
<td>10.4</td>
<td>7.7</td>
<td>18.1</td>
</tr>
<tr>
<td>2015</td>
<td>11.0</td>
<td>8.7</td>
<td>19.7</td>
</tr>
</tbody>
</table>

## Number of Trains per Day in 2012

- Divača–Koper
- Koper–Divača
- Total

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Trains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger</td>
<td>10</td>
</tr>
<tr>
<td>Locomotive</td>
<td>13</td>
</tr>
<tr>
<td>Freight</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
</tr>
</tbody>
</table>
The capacity of a railway line is determined on the basis of throughput capacity and transport capacity.

- **Throughput capacity** is the ability of a line to let through a certain number of trains in a specified time period with the existing technical equipment of the line, a certain series and type of traction vehicles and the organisation of train traffic. The throughput capacity of a line is expressed in the number of trains per day which can run on an individual section at a specified time, taking into account the actual technical equipment and transport technology and the necessary quality of service.

- **Transport capacity** is a line of information that defines how many net tonnes of goods can be transported on a line in a specified time period. The transport capacity is expressed in the unit of net tonnes per year.

### Throughput and Transport Capacity of the Divača–Koper Single-Track Railway Line

<table>
<thead>
<tr>
<th>Description</th>
<th>Throughput</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Modernisation</td>
<td>72 trains/day</td>
<td>9.2 million net tonnes</td>
</tr>
<tr>
<td>After Modernisation</td>
<td>82 trains/day</td>
<td>14.3 million net tonnes</td>
</tr>
<tr>
<td>Modernised Line with the Second Track Between the Dekani Power Sub-station and Koper</td>
<td>85 trains/day</td>
<td>15.2 million net tonnes</td>
</tr>
</tbody>
</table>

The throughput capacity of the existing Divača–Koper line in the case of mixed traffic and taking into account that locomotive trains do not operate is 72 trains per day. The transport capacity of the line before modernisation was 9.2 million net tonnes per year. The throughput capacity of the existing and modernised Divača–Koper line in the case of mixed traffic and taking into account that locomotive trains do not operate is 82 trains per day in both directions. The increase in the capacity is mainly due to the introduction of the block section on the whole line and an increase in the power of power sub-stations, which leads to the reduction of the train-tracking interval, resulting in the increased capacity of the line. It is clear from the data on the average number of trains per day in 2012 that the throughput capacity of the existing modernised line has already been exceeded.

The transport capacity of the existing modernised line is estimated at 14.5 million net tonnes per year, assuming that the entire planned modernisation of the existing line is implemented and taking into account the particular configuration of freight trains - the curtailment of locomotive trains which are driven as push-pull trains for freight trains.

In addition to the construction of the second track on the Divača–Koper section of the railway line, the construction of the second track between the Dekani power sub-station and Koper is also part of the global project and will be carried out prior to the construction of the second track on the Divača–Koper section. Therefore, line capacity is also defined with regard to the construction of the aforementioned parallel track. With the construction of 1.2 km of track between the Dekani power sub-station and Koper, the implementation of additional measures and the assumption that locomotive trains do not operate on this section, the throughput capacity of the existing modernised Divača–Koper line will be 85 trains per day in both directions. The transport capacity of the existing modernised Divača–Koper line with 1.2 km of track built, one power sub-station and the optimisation of traffic management (including locomotive trains or driving with an attached push-pull train on the whole route) and the maximum load of freight trains (1,600 gross tonnes) will be 15.2 million net tonnes per year in both directions combined.

The capacity of the existing Divača–Koper line before modernisation in the case of mixed traffic and taking into account the operation of locomotive trains was 72 trains per day. The transport capacity of the line before modernisation was 9.2 million net tonnes per year. The increase in the capacity is mainly due to the introduction of the block section on the whole line and an increase in the power of power sub-stations, which leads to the reduction of the train-tracking interval, resulting in the increased capacity of the line. It is clear from the data on the average number of trains per day in 2012 that the throughput capacity of the existing modernised line has already been exceeded.

The throughput capacity of the existing line is information that defines how many trains in a specified time period with the existing technical equipment of the line, certain series and type of traction vehicles and the organisation of train traffic. The throughput capacity of a line is expressed in the number of trains per day which can run on an individual section at a specified time, taking into account the actual technical equipment and transport technology and the necessary quality of service.

### Throughput and Transport Capacity of the Divača–Koper Railway Line

- **Throughput** - the transport capacity of a line is information that defines how many trains in a specified time period with the existing technical equipment of the line, certain series and type of traction vehicles and the organisation of train traffic. The throughput capacity of a line is expressed in the number of trains per day which can run on an individual section at a specified time, taking into account the actual technical equipment and transport technology and the necessary quality of service.

- **Transport** - the transport capacity of the existing and modernised Divača–Koper line in the case of mixed traffic and taking into account that locomotive trains do not operate is 82 trains per day in both directions. The increase in the capacity is mainly due to the introduction of the block section on the whole line and an increase in the power of power sub-stations, which leads to the reduction of the train-tracking interval, resulting in the increased capacity of the line. It is clear from the data on the average number of trains per day in 2012 that the throughput capacity of the existing modernised line has already been exceeded.

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### Figures for Traffic Load Levels on the Divača–Koper Line

The figures for traffic load levels on the Divača–Koper line are derived from the upgraded national transport model, which consists of the basic CETRA model and its upgraded version with the model of maritime transport, allowing the evaluation of the effects of individual measures on the quantity of throughput in individual North Adriatic ports.
Both passenger transport and the transport of goods were modelled. The goods model was broken down into categories of goods (a total of 56 categories), and their generation, distribution and the selection of the means of transport were calculated. The maritime transport model is based on the assumption that in the Northern Adriatic area, there is one generator of maritime transport from where ships choose the North Adriatic ports depending on the destination of goods and the generalised cost of transport. The generalised price of transport includes the cost depending on the distance travelled by sea, rail and road, the cost of transport, loading and unloading depending on the transport time for maritime, rail and road route, the direct costs of loading and unloading at terminals, the cost of throughput depending on time, and the loss in value of goods depending on time.

In 2040, 40 to 42 million net tonnes of cargo is expected according to forecasts, of which 60% on rail. In the concept of the train operating model, it was assumed that the existing line will be intended for freight trains travelling in the Divača–Koper direction, while the new line will be intended for freight trains travelling in the opposite direction, i.e. the Koper–Divača direction. The table below shows the results of the redistribution of net tonnes to the existing and new line in the Divača–Koper direction and the Koper–Divača direction.

### Distribution of the Expected Volumes of Freight Transport Between the Existing and New Line (Million Net Tonnes)

<table>
<thead>
<tr>
<th>Year</th>
<th>Existing line</th>
<th>New line</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KP–DI</td>
<td>DI–KP</td>
<td>Total</td>
</tr>
<tr>
<td>2020</td>
<td>0.000</td>
<td>5.611</td>
<td>5.611</td>
</tr>
<tr>
<td>2030</td>
<td>0.000</td>
<td>10.135</td>
<td>10.135</td>
</tr>
<tr>
<td>2040</td>
<td>0.000</td>
<td>10.630</td>
<td>10.630</td>
</tr>
</tbody>
</table>

10 local passenger trains (5 pairs in both directions), which will operate on the existing line, and 4 regional or international passenger trains (2 pairs in both directions), which will operate on the new line between Divača and Koper, are envisaged for the needs of passenger transport. In 2040, a total of 120 to 150 trains are expected between Divača and Koper, depending on the organization of traffic. It is important to emphasise that after the construction of the second track, the organisation of traffic flow will change, as well as the capacity of the existing line between Divača and Koper.

In particular, the operation of the new line changes the organisation of traffic flow of freight trains, because they will use the new line for runs in the Koper freight station–Divača direction, while the existing line will be used for runs in the opposite direction, which will significantly reduce the number of crossings on the existing line and contribute to increasing the throughput capacity.

The representation of the capacity of the lines between Divača and Koper in case of conditions with the investment, i.e. the operation of the new and the existing line, and in case of conditions without the investment, i.e. the operation of only the existing modernised line with the constructed second track between the Dekani power sub-station and Koper.

<table>
<thead>
<tr>
<th>THROUGHPUT CAPACITY OF LINES BETWEEN DIVAČA AND KOPER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Without Investment</strong></td>
</tr>
<tr>
<td><strong>Modernised existing line</strong></td>
</tr>
<tr>
<td>Throughput capacity</td>
</tr>
<tr>
<td>Trains/day</td>
</tr>
</tbody>
</table>

* Including the constructed second track between the Dekani power sub-station and Koper

According to forecasts, 120 to 150 trains a day on average will run on the line from the direction of Koper. Potential connection between Trieste and Koper could result in even greater total volume of trains and freight traffic. Thus the link between the port of Trieste and Koper would represent an additional cross-border impact of this project.
MEASURES ON THE EXISTING TRACK

The most important measures intended to increase the capacity of the existing line are the following:
- The modernisation of the existing track, which is in the final stage of implementation, and
- The construction of the second track between the Dekani power sub-station and Koper (1.2 km), which will be implemented prior to the construction of the second track between Divača and Koper.

MODERNISATION OF THE EXISTING TRACK

The modernisation of the existing track is divided into two phases, and the second phase into four stages.

FIRST PHASE

In the first phase of the modernisation of the existing Divača-Koper line, the modernisation of the signalling and safety devices was implemented with new electronic devices that enable remote automatic traffic management from the traffic management centre in Postojna, rearrangement of electrical installations at stations due to changes on the return line, adaptation of signalling and safety devices.

SECOND PHASE

Stage A, which was concluded in October 2014 included measures in the context of the reconstruction of the Hrpelje–Kozina railway station and transport power substation, the reconstruction of the Koper freight station and the construction of the new power sub-station of Dekani, and all the work on the Divača–Koper open line (adaptation of the traffic management centre in Postojna, rearrangement of electrical installations at stations due to changes on the return line, adaptation of signalling and safety devices). Stages B and C which include the reconstruction of the Divača railway station and the Divača power sub-station on the abolition of the five level crossings of road and rail and the construction of an underpass, are in their final stage. In the context of stage D, which is currently in progress, it is planned to complete the works on track devices, catenary, return line, outdoor lighting and signalling and safety devices on the part of the main post station and marshalling group of the Koper height station. In the context of stage D, an underpass in Divača and two underpasses in the municipality of Sežana and in Prešnica will be constructed.

THE SECOND TRACK BETWEEN THE DEKANI POWER SUB-STATION AND KOPER

The project will succeed in eliminating a bottleneck on part of the joint route of the existing and planned line. This measure was separated from the overall project of the second track and will be implemented separately in order to increase the capacity of the existing line until the construction of the second track on the entire section between Divača and Koper (or the Dekani power sub-station).

The measures included in this investment are the following:
- Construction of a 1.2 km-track on the section between the Koper freight station and the area of the Dekani power sub-station,
- Measures to increase the power supply of the electrical catenary, and
- Optimisation of rail transport technology, thereby enabling the maximum possible capacity of the existing track.

Such an investment will additionally increase the transport and throughput capacities of the existing line after the modernisation, which will be completed in 2015, but it represents only a temporary solution. Further actions are necessary for a lasting increase in the capacity of the rail link between Divača and Koper.

The investment in question has been applied to the tender and is expected to be co-financed by the CEF funds – cohesion (national envelope).

On the existing line, prior to the construction of the second track between Divača and Koper, additional technological, organisational and construction measures are planned in accordance with the professional findings and new technologies, to increase the throughput and transport capacity of the line.
History of the spatial placement of the second track between Divača and Koper

For the final spatial placement of the section of the line, i.e. before the National Site Plan was adopted in 2005, two rounds of evaluation and assessment of variants were carried out.
The first round of evaluation

Activities to increase the capacity of the Divača–Koper line date back to 1996, when the then Ministry of Transport and Communications commissioned eligibility study increasing the capacity of the Divača–Koper single-track line (the study »Povečanje kapacitet enotirne proge Divača–Koper«; ZT – Projektprinzip Ljubljana d.d. and Austria Rail Engineering (ARE), January 1999).

The study included surveys of technical, ecological, economic and financial feasibility of two single-track lines between Koper and Divača. The basic findings of the eligibility study were that with merely technological reorganisation of the existing line and interventions in the existing infrastructure, it is not possible to handle anticipated traffic and create reserve capacities on the rail which are necessary for the development of the port of Koper, and that the only permanent solution to the problem of capacities is the construction of a new railway line.

As part of processing the construction of the second track of the line, the study presented three groups of variants of the route of the new track:

- The route of the second track completely parallel to the existing line,
- Partly a parallel route and partly a new route,
- A completely new route of the line, which would spatially result in two single-track lines.

Due to the high concentration of natural value, protected ecologically important areas through which the line is planned to run, variant 4.1 proved to be unacceptable from the environmental point of view mainly for two reasons:

- This variant passes through the first zone of water protection area, which supplies the whole coast with drinking water,
- This variant passes the Karst edge twice, an area which is part of Karst Regional Park, where any development would mean the degradation of the landscape and areas of natural beauty.

Six discussed variants for the route for the second track - with different speeds:

<table>
<thead>
<tr>
<th>Variant</th>
<th>Route Description</th>
<th>Vmax (km/h)</th>
<th>Im (‰)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variant 1</td>
<td>Parallel route of the second track for Vmax = 70 km/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variant 2</td>
<td>Partly a parallel route and partly a new route for Vmax = 80 km/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variant 3</td>
<td>A new route of the line for Vmax = 120 km/h (first variant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variant 4</td>
<td>A new route of the line for Vmax = 120 km/h (second variant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variant 4.1</td>
<td>A new route of the line for Vmax = 120 km/h (second variant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variant 5</td>
<td>A new route of the line for Vmax = 160 km/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variant 6</td>
<td>Link to the Trieste-Ljubljana line (new route of the line for Vmax = 250 km/h [high-speed line])</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECOND ROUND OF EVALUATION

Due to the unacceptability of the proposed variant from the first round, the second round of variants dealt only with the so-called tunnel variants, including an analysis of possible connections in the direction of Trieste.

On the basis of obtained guidelines and taking into account points of view expressed at public presentations and discussions of variant I/2, a modified variant was created – variant I/3, supported by all local communities and competent ministries.

THE SELECTED VARIANT

The second round of evaluation led to the selection of the variant for which the Government of the Republic of Slovenia later adopted the Decree on the National Site Plan (Official Gazette of the Republic of Slovenia, No. 43/2005) and then the Decree amending the Decree on the National Site Plan (Official Gazette of the Republic of Slovenia, No. 59/14).

Second track of the Divača–Koper railway line
Second track of the Divača–Koper railway line

Description of the selected variant
The elements used in the design

On the basis of the decrees adopted by the Government of the Republic of Slovenia, which refer to the spatial placement of the section in question, the project design for a building permit was prepared using the following elements, which represent the main characteristics of the new line:

- Following the adoption of the National Site Plan in 2005, some additional checks were implemented, in particular with regard to double tracks on the entire Divača–Koper route. The possibility of additional connections to Trieste at the height of Črni Kal was studied, which would result in a junction of two directions (from Divača to Trieste or to Koper). The possibility of implementing a double-track line to the intended junction in Črni Kal and then a single-track line towards Koper was also studied.
- In 2010, the Republic of Italy withdrew from the intention to link the second track with the port of Trieste.

Activities after the adoption of the National Site Plan

In addition, all approvals required to acquire a building permit were obtained, except the consent of the Slovenian Public Agency for Railway Transport regarding interoperability. A complex Environmental Consent was obtained, which includes the process of cross-border impacts due to the proximity of the Republic of Italy. The report of the impacts on the environment was also presented in Italy, comments and opinions were collected and appropriate answers were prepared.

In accordance with the adopted National Site Plan and the prepared project design for a building permit, almost all the land for obtaining a building permit has been acquired. A small proportion of the land referred to in the amendments to the National Site Plan, adopted in August 2014, still needs to be acquired.

THE ELEMENTS USED IN THE DESIGN

<table>
<thead>
<tr>
<th>Line type:</th>
<th>Single-track</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length:</td>
<td>27.1 km</td>
</tr>
<tr>
<td>Maximum longitudinal gradient:</td>
<td>17 ‰</td>
</tr>
<tr>
<td>Maximum speed:</td>
<td>160 km/h</td>
</tr>
<tr>
<td>Clearance:</td>
<td>GC</td>
</tr>
<tr>
<td>Load:</td>
<td>2000 kN/m or 60 KN/m (category D4)</td>
</tr>
<tr>
<td>Rail:</td>
<td>60 E1</td>
</tr>
<tr>
<td>Track superstructure:</td>
<td>Mostly ballastless</td>
</tr>
<tr>
<td>Haulage system:</td>
<td>Electrical (3 kV DC)</td>
</tr>
<tr>
<td>Traffic management system:</td>
<td>ERTMS (SIGM–RIETCS level 2)</td>
</tr>
</tbody>
</table>

Legenda

- MEJA POSEGA
- Izvlecni tir -PGD (parcele)
- DKN
- MEJA OSNOVNEGA DPN
- KO
After the Divača station, the route runs the first 830 m on the terrain or a slight embankment, and then the following 1,350 m in cut, the height of which increases with change. At a length of 230 m before the portal of the first tunnel, the cut widens to 40 m, so that the front of the cut is wide enough even for the entry into a service (security) tunnel. The service road (connected to the Divača–Lukes road) will also be widened in front of the entry into the tunnel, while after the construction of the tunnel the platform will be used primarily for the access of maintenance staff and for the needs of safety and rescue.

At km 2+980, the route runs into the first tunnel T1 where it is straight, with the exception of one gentle curve. South of the Mihele village, in the upper part of the Glinščica valley (km 9+680), the route comes to the surface and bridges the Glinščica valley with two bridges, and there is a gallery between them. A service road will also run to this area (partly also over the route of the abandoned Kozina–Trieste line). Service or safety platforms are planned in front of both portals.

The entry into the second tunnel T2 is defined with the portal at km 9+052. At the beginning of the tunnel, the route runs in a curve with a radius of 1,500 m, and then in a straight line through most of the tunnel. A passing point is planned in the last part of the straight line, thus a widening of the tunnel profile is also planned at this area. A passing track will be placed to the right from the main track, with the distance between the two axes of 4,75 m. In the last part of the tunnel where it passes from the area of the Karst plateau, the route of the new line runs in a sharp right curve, which will enable a speed of 120 km/h. In the homestead of Dvoro, the line passes to a widened pre-cut beyond the main road. Service roads will lead to both platforms at the beginning and end of tunnel T8. The route continues along the valley of the Ribčev pond, where the gradient of 17‰ reduces.

The envisaged speed on the part of the second track between Dekani and the Alpine junction gradually reduces from 120 km/h to 100 km/h and finishes at 80 km/h, which represents the maximum allowed speed in the deviation at the existing junction point for thekop passenger station.

In the final section, the line crosses a local road and a bicycle path. The line bridges the Ribčev River with a new bridge which will be built next to the existing one. The installation of the point connection with the existing track is planned at the last part of the common course. At the Alpine junction, the route of the new second track is completed. The second track connects to the loper height station.
46 | Second track of the Divača–Koper railway line

Description of the selected variant

Main elements and characteristics:

- **Route length**: 27.1 km
- **vmax**: 160 km/h
- **rmin**: 1,404 m (600 m)
- **imax**: 17‰
- **Number of viaducts**: 2
- **Number of tunnels**: 8
- **Total length of railway tunnels**: 20.5 km
- **Total length of railway viaducts**: 1,039 m
- **Percentage of tunnels**: 75%
- **Percentage of viaducts**: 4%
- **Clearance**: GC

Longitudinal profile of the second track of the Divača–Koper line:

- **Route length**: 27.1 km
- **vmax**: 160 km/h
- **rmin**: 1,404 m (600 m)
- **imax**: 17‰
- **Number of viaducts**: 2
- **Number of tunnels**: 8
- **Total length of railway tunnels**: 20.5 km
- **Total length of railway viaducts**: 1,039 m
- **Percentage of tunnels**: 75%
- **Percentage of viaducts**: 4%
- **Clearance**: GC

Legend:

- **OPEN TRACK DIVAČA–KOOPER**
- **DIVAČA–KOOPER SECTION**
- **SPLIT–KOOPER SECTION**
- **VIADUCT 1**
- **VIADUCT 1, L = 452 m**
- **VIADUCT 2**
- **VIADUCT 2, L = 647 m**
- **TUNNEL 1**, **L = 6,714 m**
- **TUNNEL 2**, **L = 6,017 m**
- **TUNNEL 3**, **L = 3,808 m**
- **TUNNEL 4**, **L = 330 m**
- **TUNNEL 5**, **L = 1,954 m**
- **TUNNEL 6**, **L = 128 m**
- **TUNNEL 7**, **L = 359 m**
- **TUNNEL 8**, **L = 1,163 m**
- **P1 UNDERPASS, km 26+840**
- **RIŽANA BRIDGE, L = 32.0 m, km 27+253**
- **P2 UNDERPASS IN A CAISSON, m 27+368**
- **END OF SECTION DIVAČA–KOOPER (BIVJE JUNCTION)**
- **km 28+056.187 (Existing chainage 28+044.78)**

Tunnels:

- **T1**, **L = 6,714 m**
- **T2**, **L = 6,017 m**
- **T3**, **L = 3,808 m**
- **T4**, **L = 330 m**
- **T5**, **L = 1,954 m**
- **T6**, **L = 128 m**
- **T7**, **L = 359 m**
- **T8**, **L = 1,163 m**

Viaducts:

- **V1**, **L = 452 m**
- **V2**, **L = 647 m**

Viaducts and gallery:

- **Glinščica bridge 1**, **L = 70 m**
- **Glinščica gallery**, **L = 45 m**
- **Glinščica bridge 2**, **L = 100 m**

Primary positions:

- **ČRNÍ KAL–KOPER SECTION**
- **DIVAČA–ČRNÍ KAL SECTION**
- **ČRNÍ KAL–KOPER SECTION**

Second track between the Dekani power sub-station and Koper, approx. 1.2 km

Relocation of the existing track

Tunnels: T3, 310 m; T4, 1,054 m; T5, 310 m; T6, 180 m; T7, 1,163 m.

Viaducts: Viaduct VS-Škofije, 542 m; Viaduct VS-Galliriva, 452 m; Viaduct VS-Galliriva, 452 m.

Second track of the Divača–Koper railway line
BASIC GEOLOGICAL DATA

On the section between Divača and Črni Kal, the route of the second track runs on different formations of carbonate rocks characterised by numerous karst features (sinkholes, cracks, caverns, underground caves, chasms etc.). The degree of karstification of individual areas is high, crushed zones appear in the area of fault zones between individual formations. Groundwater levels can vary significantly depending on hydrological conditions as well as local differences in porosity and permeability. A high risk of water ingress on karst channels and cracks appears in the area of crushed and fault zones. In the area of crossing the Glinščica valley (between the villages Mihele and Beka), flysch sedimentary rocks appear that are strongly pleated and cracked due to thrusting in the past. Sandstone strongly predominate among rocks in this area due to the permeability of flysch and limestone is such that flysch rocks represent barrier layers over which groundwater from limestone flows (karst spring). Due to the concentration of water, the probability of the occurrence of the karst formations is greatly in the area of the Glinščica valley.

Basic rocks on the section between Črni Kal and Dekani consist of flysch rocks, characterised by the alternation of layers of clay stones, siltstones, marl and sandstones. Because of the thrusting of the carbonate massif on the flysch base, flysch rocks are pleated and tectonically cracked in the area of the hinterland of Črni Kal. Under the Črni Kal Plateau, limestone nodule is placed in a fan shape on the flysch base. Almost the entire surface of flysch is covered by weathered flysch stone. There are almost no weathered stones on the steep slopes of erosion ravines, but they accumulate in great quantities at the foot of the slopes and in beds of occasional watercourses.  

On the section between Dekani and the Bivje Junction, the route of the second track runs through the valley of the Rižana River where alluviums of the Rižana appear 10 to 13 m thick on the flysch base. It is the alternation of layers of clayey silt with frequent organic remains, while sandy gravel soils appear deeper on the flysch base. A groundwater level is located at the depth of 1.5 m below the surface. Surface layers are more and also suddenly due to poorly permeable clays.

ACCESS ROADS AND PLATFORMS AT TUNNEL PORTALS

The route of the second track descends from Divača on the Črni Kal Plateau to the coastal area with an altitude of a few meters above sea level. It crosses the Črni Kal Edge in a number of tunnels. Most tunnel portals are located in the steep, narrow, difficult to access areas on an up-sag of the flysch formation with poor local road infrastructure. Local roads are mainly narrow and winding in visibility and allow only low driving speed, while their surfaces are mainly in poor condition. Local roads often pass through typical karstic villages, where they run among densely placed houses and commercial buildings. It is practically impossible for large, heavy trucks and other construction machinery to pass through such villages.

Therefore, the implementation of appropriate access roads is a necessary condition for the start of the construction of the new track. Such roads must be implemented prior to the commencement of works for the construction of tunnels and greater bridging structures. Access roads are planned in a way that they connect to the high quality and adequately efficient national road network. During the construction, implemented access roads will be used to access the construction sites of tunnels, viaducts, bridges and the route of the track. After the second track is constructed, access roads will be adequately arranged and will be used to access tunnel portals and water storage tanks for maintenance needs, and in the event of accidents on the second track of the railway line, the roads will serve as intervention roads for rescuing from tunnels. Access roads will also be used by the local population for access to land if access was interrupted with the construction of the second track. After the construction of the second track is completed, a part of access road T-3bl will be arranged as a cycle path running on the Rižana–Trieste abandoned railway line.
### Characteristics of Access Roads

<table>
<thead>
<tr>
<th>No.</th>
<th>Road Description</th>
<th>Typical Cross Section (m)</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N1 - left</td>
<td>4.50</td>
<td>511.00</td>
</tr>
<tr>
<td>2</td>
<td>T-1a</td>
<td>5.00</td>
<td>643.46</td>
</tr>
<tr>
<td>3</td>
<td>Connection to RL-203/2028 Debelo – Lipnica</td>
<td>8.50</td>
<td>149.00</td>
</tr>
<tr>
<td>4</td>
<td>T-Jad</td>
<td>4.50</td>
<td>1,005.51</td>
</tr>
<tr>
<td>5</td>
<td>Access road to water tank V-1</td>
<td>5.50</td>
<td>149.20</td>
</tr>
<tr>
<td>6</td>
<td>Connection of access road V-1</td>
<td>5.00</td>
<td>53.90</td>
</tr>
<tr>
<td>7</td>
<td>T-1a1</td>
<td>4.50</td>
<td>2,900.00</td>
</tr>
<tr>
<td>8</td>
<td>T-1a2</td>
<td>4.50</td>
<td>1,233.62</td>
</tr>
<tr>
<td>9</td>
<td>T-2b</td>
<td>5.75</td>
<td>376.01</td>
</tr>
<tr>
<td>10</td>
<td>Access road to water tank V-2</td>
<td>2.40</td>
<td>184.3</td>
</tr>
<tr>
<td>11</td>
<td>T-3c</td>
<td>5.20</td>
<td>158.30</td>
</tr>
<tr>
<td>12</td>
<td>T-4a</td>
<td>4.50</td>
<td>1,005.10</td>
</tr>
<tr>
<td>13</td>
<td>T-4c</td>
<td>7.20</td>
<td>620.20</td>
</tr>
<tr>
<td>14</td>
<td>T-4b</td>
<td>7.20</td>
<td>501.48</td>
</tr>
<tr>
<td>15</td>
<td>Connecting service road T4-T7</td>
<td>7.20</td>
<td>2,012.14</td>
</tr>
<tr>
<td>16</td>
<td>T-5</td>
<td>7.20</td>
<td>213.00</td>
</tr>
</tbody>
</table>

Culverts and various supporting and retaining walls, necessary for the implementation of roads, are also planned with individual roads.
## Structures

### Tunnels

All tunnels are single-tube tunnels; tunnels T1, T2 and T8 are designed with service tubes, which are to be used for rescue operations, while tunnels T4 and T7 have transverse exit tubes.

Planned tunnels with lengths of the main tunnels, service tunnels and transverse exit (escape) tubes:

<table>
<thead>
<tr>
<th>No.</th>
<th>Structure</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tunnel T1</td>
<td>6,714.00</td>
</tr>
<tr>
<td>2</td>
<td>Service tube SC-T1</td>
<td>6,683.11</td>
</tr>
<tr>
<td>3</td>
<td>Tunnel T2</td>
<td>6,017.34</td>
</tr>
<tr>
<td>4</td>
<td>Service tube SC-T2</td>
<td>6,018.53</td>
</tr>
<tr>
<td>5</td>
<td>Tunnel T3</td>
<td>330.00</td>
</tr>
<tr>
<td>6</td>
<td>Tunnel T4</td>
<td>1,951.51</td>
</tr>
<tr>
<td>7</td>
<td>Exit tunnel tube IPC-T4A</td>
<td>61.48</td>
</tr>
<tr>
<td>8</td>
<td>Exit tunnel tube IPC-T4B</td>
<td>44.75</td>
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<td>9</td>
<td>Tunnel T5</td>
<td>126.00</td>
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<tr>
<td>10</td>
<td>Tunnel T6</td>
<td>518.53</td>
</tr>
<tr>
<td>11</td>
<td>Tunnel T7</td>
<td>1,652.58</td>
</tr>
<tr>
<td>12</td>
<td>Exit tunnel tube IPC-T7</td>
<td>160.20</td>
</tr>
<tr>
<td>13</td>
<td>Tunnel T8</td>
<td>3,616.20</td>
</tr>
<tr>
<td>14</td>
<td>Service tube SC-T8</td>
<td>3,818.22</td>
</tr>
<tr>
<td>15</td>
<td>Service tubes SC-TF</td>
<td>3,773.15</td>
</tr>
</tbody>
</table>

Total length of tunnels: **20.5 km**

Total length of tunnels including service and exit tubes: **37.4 km**

### Typical Cross-section of the Main Tube

- **Basic Information:**
  - Clearance Width: 5.00 m + 2 corridors of 0.75 m
  - Clearance Height: 6.50 m
  - Excavation Profile: Drained execution of 69 m² and non-drained execution of 71 m²

### Typical Cross-section of the Service Tube

- **Basic Information:**
  - Clearance Width: 3.60 m
  - Clearance Height: 2.50 m
  - Excavation Profile: Drained execution of 40 m² and non-drained execution of 44 m²

The axle distance between the tubes is 25.00 m.
Tunnel T1: 6,714.00 m

Because of the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level between the tunnel tube and the structures of a power station with transformer stations are planned.

Tunnel T2: 6,017.34 m

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level between the tunnel tube and the structures of a power station with transformer stations are planned.

Tunnel T3: 330.00 m

Due to the short length of the tunnel, the construction of service tubes or leading tubes are not planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T3. The direction of Koper.

Tunnel T4: 1,953.61 m

Because of the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T3. The direction of Koper.

Tunnel T5: 128.00 m

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T5. The direction of Koper.

Tunnel T6: 358.53 m

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T6. The direction of Koper.

Tunnel T7: 1,162.58 m

Due to the short length of the tunnel, a service tube or leading tube is not planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T7. The direction of Divača.

Tunnel T8: 3,808.00 m

Because of the length of the tunnel and the specific terrain, the construction of service tubes or leading tubes is not planned for this section. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.

The tunnel is characterised by low geotechnical and mechanical conditions. Due to the length and the specific terrain, the construction of service tubes between the tunnels of Divača and SC1 is planned for this section. Several transformer stations are planned. The tunnel will be located in the flysch rocks where a large amount of hinterland water is not expected; therefore, the drainages will be installed between the tunnel tube and the drainage system of tunnel T6. Waste water will be discharged through an oil trap and a settling basin at platform level in front of portal T8. The direction of Divača.
V1 VIADUCT
V1 viaduct, or Gabrovica viaduct, is 452 m long and bridges the Osp valley at a height of between 10 and 60 m and at an angle of approximately 30 degrees crosses the existing motorway viaduct of Črni Kal. The height difference between the two structures is 30 m at the point of crossing. The incremental launching method for the construction of the superstructure is planned, with a launching nose of 40 m. The superstructure with a static length of 424 m is a pre-stressed reinforced concrete structure over 7 fields (52 + 5 x 64 + 52) with the shape of a trough and provides a sufficient static height of the structure, while also providing adequate wind protection for trains (bora), and also adequate noise protection for the surroundings. Pillars have a polygonal box cross-section.

V2 VIADUCT
V2 viaduct, or Vinjan viaduct, is 647 m long and is designed as a continuous pre-stressed reinforced concrete superstructure over 13 fields with a static length of 630 m (40 + 11 x 50 + 40). The cross-section of the superstructure has the shape of a box with top plate consoles. The pillars also have a box-shaped cross-section, their height is up to 60 m. On the edge girder of the superstructure, a fence is attached to protect against noise, and on the other side, a fence to protect against the wind.
Other Structures

Bridging the Glinščica Valley

Due to ventilation problems in tunnels T1 and T2, the two tunnels and structures across the Glinščica valley will be connected into a single tunnel structure. Bridges Glinščica 1 and Glinščica 2 are planned to be implemented as closed box structures, connecting to T1 or T2 tunnel with the galleries in front of the tunnels. The bridges are designed as prestressed simply supported structures of a closed box-section with one clearance span each. The gallery of Glinščica will be implemented between the two bridges. The Glinščica valley is bridged by three connected structures in a shape of a closed box structure with a total length of 215 m. These three structures connect to tunnels T1 and T2 on both sides with galleries. Thus, the impact of rail transport on the sensitive environment of the protected area of the Glinščica valley is limited to the greatest possible degree.

Underpasses

Underpass P1 is designed for crossing the existing interstate bicycle path D8 and a road which provides access to individual plots in the vicinity. After the construction of the second track is completed, the road will also be used as an access road to the planned power sub-station Dekani. The underpass will be made under the new and under the existing track.

Bridge

The bridge over the Rižana River is designed similarly as the existing bridge of a single-track line at this point, that is, as a frame reinforced concrete structure over three fields, with a total length of 27.40 m. On the route in the area of crossing the Glinščica valley, there are two more bridges, which are described in the section on bridging the Glinščica valley.

Structure Length (m)
Glinščica bridge 1 70
Glinščica gallery with a retaining wall 45
Glinščica bridge 2 100
TOTAL 215

Underpass P2 is designed for crossing a categorised local road which on the north side connects to regional road RS-741 and on the south side to regional road RS-625. Due to high groundwater, the underpass is designed in the form of a caisson. The underpass will be made under the new and under the existing track.

View of the two bridges and the Glinščica gallery

Lateral section of the bridge over the Ržana river
Culverts

Most of the culverts are located on the sites where the route of the second track crosses transverse torrential ravines and smaller watercourses (edges of the Osp valley and Vrhnica valley). A part of the culverts are also used in the drainage system - for draining water from drainage ditches along the railway line through the body of the line embankment. On the lower part of the route (the valley of the Rižana river), new culverts are mostly on the locations of the existing ones, on the route of the existing track. These culverts are not lengthened but replaced by new ones under both tracks. Culverts on access roads are an integral part of the plans of individual roads.

Characteristics of culverts:

<table>
<thead>
<tr>
<th>No.</th>
<th>Structure</th>
<th>Dimension (m)</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>21.31</td>
</tr>
<tr>
<td>2</td>
<td>Flat culvert</td>
<td>1.15/1.0</td>
<td>40.84</td>
</tr>
<tr>
<td>3</td>
<td>Flat culvert</td>
<td>5.0/2.0</td>
<td>44.28</td>
</tr>
<tr>
<td>4</td>
<td>Flat culvert</td>
<td>5.5/2.0</td>
<td>32.69</td>
</tr>
<tr>
<td>5</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>32.80</td>
</tr>
<tr>
<td>6</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>44.28</td>
</tr>
<tr>
<td>7</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>63.81</td>
</tr>
<tr>
<td>8</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>30.00</td>
</tr>
<tr>
<td>9</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>44.28</td>
</tr>
<tr>
<td>10</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>32.26</td>
</tr>
<tr>
<td>11</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>38.18</td>
</tr>
<tr>
<td>12</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>57.35</td>
</tr>
<tr>
<td>13</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>24.83</td>
</tr>
<tr>
<td>14</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>22.83</td>
</tr>
<tr>
<td>15</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>34.27</td>
</tr>
<tr>
<td>16</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>11.82</td>
</tr>
<tr>
<td>17</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>7.91</td>
</tr>
<tr>
<td>18</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>57.35</td>
</tr>
<tr>
<td>19</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>6.42</td>
</tr>
<tr>
<td>20</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>21.03</td>
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<tr>
<td>21</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>24.41</td>
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<tr>
<td>22</td>
<td>Flat culvert</td>
<td>1.0/1.0</td>
<td>15.67</td>
</tr>
</tbody>
</table>

Total length of culverts: 691.51 m

Supporting and Retaining Structures

Appropriate independent supporting and retaining structures are planned by the Glinščica gallery between the bridges Glinščica 1 and 2, next to the Črni Kal power sub-station, and between portals of tunnels T2 and T4. Other supporting structures are an integral part of the portal structures of tunnels, or are located on access roads forming an integral part of the plans of individual roads.

<table>
<thead>
<tr>
<th>No. Structure</th>
<th>Length (m)</th>
<th>Max. height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anchored retaining wall between bridges Glinščica 1 and 2</td>
<td>70.00</td>
<td>13.44</td>
</tr>
<tr>
<td>2. Retaining wall at the Črni Kal power sub-station</td>
<td>85.33</td>
<td>10.00</td>
</tr>
<tr>
<td>3. Retaining wall between tunnels T3 and T4</td>
<td>104.16</td>
<td>7.70</td>
</tr>
</tbody>
</table>

Total length: 209.59 m
### Noise Prevention Measures

In accordance with the requirements of the study on noise pollution, it will be necessary to build five sets of noise barriers on the route of the second track.

<table>
<thead>
<tr>
<th>Code</th>
<th>Type/Category</th>
<th>Chainage (km)</th>
<th>Height of UER (m)</th>
<th>Length (m)</th>
<th>Surface (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB 1</td>
<td>Absorption (A2)</td>
<td>15+940.00 to 16+075.00</td>
<td>2.5</td>
<td>135.00</td>
<td>337.50</td>
</tr>
<tr>
<td>NB 2-1</td>
<td>Absorption (A2)</td>
<td>16+075.00 to 16+178.00</td>
<td>2.5</td>
<td>51.80</td>
<td>129.50</td>
</tr>
<tr>
<td>NB 2-2</td>
<td>Structure of V1 viaduct</td>
<td>16+125.00 to 16+768.00</td>
<td>2.5-5.5</td>
<td>445.20</td>
<td>2,439.20</td>
</tr>
<tr>
<td>NB 2-3</td>
<td>Absorption (A2)</td>
<td>16+176.80 to 16+623.30</td>
<td>2.5</td>
<td>148.00</td>
<td>370.00</td>
</tr>
<tr>
<td>NB 2-4</td>
<td>Structure of V2 viaduct</td>
<td>16+623.30 to 16+768.00</td>
<td>2.5-5.5</td>
<td>515.70</td>
<td>2,821.30</td>
</tr>
<tr>
<td>NB 3</td>
<td>Structure of V1 viaduct</td>
<td>16+176.80 to 16+768.00</td>
<td>2.5-5.5</td>
<td>594.70</td>
<td>2,821.30</td>
</tr>
<tr>
<td>NB 4-1</td>
<td>Absorption (A2)</td>
<td>21+530.00 to 21+593.80</td>
<td>2.5</td>
<td>64.33</td>
<td>160.83</td>
</tr>
<tr>
<td>NB 4-2</td>
<td>Transparent to V2</td>
<td>21+593.80 to 22+239.40</td>
<td>2.5</td>
<td>647.50</td>
<td>1,618.75</td>
</tr>
<tr>
<td>NB 4-3</td>
<td>Absorption (A2)</td>
<td>22+238.50 to 22+275.00</td>
<td>2.5</td>
<td>47.87</td>
<td>119.68</td>
</tr>
<tr>
<td>NB 5</td>
<td>Absorption (A2)</td>
<td>27+175.00 to 27+425.00</td>
<td>2.5</td>
<td>248.50</td>
<td>621.25</td>
</tr>
</tbody>
</table>
Superstructure

General

The construction of a slab track is planned on the greater part of the section, while a classic track on a ballast bed is planned over the smaller area outside tunnels and structures.

Ballasted track

Rails of system 60 E1 will be installed on the section, with a length of 100 m and a quality grade of at least 900. The shape and characteristics of rails are defined in SIST EN 13674-1:2004. The rails are welded and at the end of the section in question, a transition rail from system 60 E1 to system 49 E1 is installed with the length of 7.2 m.

The concrete sleepers of 260 cm of length with an axial distance of 0.6 m are planned and must comply with SIST EN 13230-1:2007.

The concrete mixture is 32/50v in accordance with SIST 13450:2003.

Tracks and points are welded into a continuous welded rail (CWR) with aluminothermic welding. Rails welded are 100 m long and the welding parts at the directional and height regulation of tracks.

Ballastless track

Slab track system

The project includes a slab track system of type OBB PORR. Train load is transmitted through the rails to fixing points, then to the load-bearing plate of the track, and through the elastic contact area to the track bed. The load-bearing plate of the track is the main load-bearing element of the structure. It is made in a concrete mixing plant as a prefabricated element from reinforced concrete. It has two rectangular openings through which it is poured with self-leveling concrete after it is installed at a suitable height and position. The lower part of load-bearing plate and the inner and outer edges are covered with an elastic contact layer. The load-bearing plate of the track is installed on the reinforced concrete slab for load-distribution, the thickness of which depends on whether the track runs in a tunnel, on a bridge structure or on an open route.

Rails and fixing material

Rails of system 60 E1 will be installed on the section, with a length of 100 m and a quality grade of at least 900. The shape and characteristics of rails are defined in SIST EN 13674-1:2004. Tracks are welded into a continuous welded rail with aluminothermic welding and by taking into account the specifics of welding in tunnels.
**ELECTRICAL CATENARY**

On the second track of the Divača–Koper railway line, the electrical catenary will be implemented with the system of direct current (DC) and voltage of 3kV. The electrical catenary will be implemented so that it is possible to later upgrade it with the system of alternating current (AC) with the voltage of 25 kV. An overhead line is planned with a cross-section of 440 mm². Steel lattice rods are planned for carrying overhead lines, adapted for fixing to the foundation with an anchor plate and screws. Minimal distance of the internal edge of an overhead line is not dependent on the position (straight, curve) and the height and the orientation of the rail heightening. This distance varies from 3.45 m to 3.85 m in the lower part of the route, by the existing track – ballasted track – the minimum distance is also 2.55 m.

**POWER SUB-STATIONS**

Powering of the electric catenary on the second track of the Divača–Koper railway line is planned from the power sub-stations Divača, Črni Kal and Dekani. The power sub-stations Divača and Dekani will be properly arranged in the context of the modernisation of the existing track, while the Črni Kal power sub-station will be built in the context of the construction of the second track. The powering of the Črni Kal power sub-station will be provided with the implementation of the connection to the 110 kV Divača–Koper power line for powering electrical traction, and with the implementation of the connection to the 2x20 kV power line of Dekani–Divača/Crnonica power sub-station for powering safety systems in tunnels and the power sub-station’s own use.

**SIGNALLING AND SAFETY DEVICES**

On the second track of the Divača–Koper line, the ERTMS/ETCS system of level 2 will be installed. In the context of the documentation of the project design for a building permit for the construction of the second track of the Divača–Koper line, detailed reports are prepared for the execution of:

- Signalling and safety devices;
- GSM-R system;
- Video surveillance and security;
- Powering.

These systems and devices will be installed on the railway line in the final stage of construction. Due to the construction of a large number of tunnels, the installation of the mentioned systems will be implemented several years after the start of the construction. Given the rapid development of professional expertise in this field, the projects of the systems discussed would already be out-dated by then. The plans of the systems and devices in question will therefore be prepared later in the context of making executive design project documentation. In the context of prepared project designs for building permit, the construction part of the installation of devices in question is adequately dealt with. These are the sewage system and trenches for wiring with the necessary shafts, standing points of individual devices, phones, GSM-R base stations, all the canals and similar.

**RELOCATION OF UTILITY LINES**

On the route of the second track, the relocation of utility power lines is planned, as well as some low-voltage lines and water supply lines. This will primarily be adjustments and connection of lines needed to build the second track, such as the connection of the power sub-station to the network, the connection of the pumping stations of the caissons of underpasses, locational removal of local water supply or telecommunication lines. There will be no significant relocations of utility lines (high voltage power lines, the main water supply lines or gas pipes) on the route.
Estimated value of the selected variant

Second track of the Divača–Koper railway line
The assessment of the investment value of the construction of the second track between Divača and Koper in the amount of EUR 1,289,878,629 (including VAT, fixed prices in April 2013) was made in the context of the preparation of the investment programme (INVp) in October 2013. The assessment was made on the basis of the designer cost estimation of the reviewed project design for a building permit, which was made by the company SŽ - Projektivno podjetje, Ljubljana d.d., with partners. The investment programme has not yet been adopted since the financing of the project has not yet been determined. Nevertheless, we estimate that the part that refers to the amount of costs is estimated sufficiently realistically and will not change, while the investment programme can be completed and confirmed only after the exact financing of the project is known.

The assessment of the investment value is divided into several main sets:

<table>
<thead>
<tr>
<th>Set Description</th>
<th>Amount (EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation works (A)</td>
<td>890,731,206</td>
</tr>
<tr>
<td>Other costs (B)</td>
<td>63,986,910</td>
</tr>
<tr>
<td>Other services (C)</td>
<td>105,037,178</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,059,755,294</strong></td>
</tr>
<tr>
<td>VAT</td>
<td>230,123,335</td>
</tr>
<tr>
<td><strong>TOTAL INCLUDING VAT</strong></td>
<td><strong>1,289,878,629</strong></td>
</tr>
</tbody>
</table>

Implementation works (A) include all works necessary for the construction of tunnels, bridging structures, access roads and pre-cuts together with works needed to carry out the route and superstructure, catenary, signalling and safety devices, as well as video surveillance and security. This set also includes the implementation of the second track between the Dekani power sub-station and Koper, and 7% of the entire budget amount is designated for unforeseen works.

The set of other costs (B) includes the cost of disposal sites and the cost of processing of excess material, costs relating to the purchase of necessary land and the purchase of two road-rail fire trucks. This set also includes the renovation of the existing track between the Dekani power sub-station and Koper, and 5% of the entire budget amount is designated for unforeseen works.

The set of other services (C) includes the costs required for the preparation of project documentation, archaeological investigation and excavation, and cost for project supervision and management.
During the construction of the second track between Divača and Koper, it will be necessary to strictly comply with the requirements related to environmental impacts. These requirements also apply to potential cross-border impacts.
GEOLOGICAL AND RELIEF CHARACTERISTICS

The regulation of the construction site and construction works will mostly cause indirect impacts on geological conditions and relief, which will only be short-term in nature. The greatest direct impacts can be expected at the area of the construction of major embankments, deeper cuts, tunnels, and at locations of the intake of excess material. Taking into account mitigation measures such as appropriate gradients of cuts and embankments, rehabilitation of temporary routes and manipulation areas, rehabilitation of exposed areas, the impact during the construction will be moderate to large.

Possible impacts of the intervention on the geological conditions and relief features in the cross-border area of the Republic of Italy are not expected.

AIR

Construction will take place mainly in a scarcely populated area, while transport needed for construction of the railway line will be carried out on construction roads and the existing public road network. During the construction, emissions of particles and exhaust gases will be increased at construction sites, construction roads and sites where excess material will be deposited. The emissions of particles from open parts of construction sites will be the highest during preparatory earthworks of soil excavation, transport of material and its depositing on temporary and permanent deposit sites. The impact during the construction will be moderate if mitigation measures are implemented: the prevention of dusting of uncovered parts of the site and manipulation areas, regular cleaning of transport surfaces and setting up construction fences near other buildings, and other mitigation measures, such as cleaning the chassis of construction machinery when leaving the site, and it will also be necessary to strictly adhere to legal restrictions and terms from approvals.

During the construction and operation, there will be no cross-border impact on air quality.

QUALITY OF SOIL AND PLANTS

During the construction, soil pollution will be caused by the increased burdening of soil with substances originating from the excavated or construction materials and with emissions from the transport of construction materials and excavated material. These effects may include the increased emissions of dust particles, the transport of material and related emissions, inappropriate handling of run-off rainwater and contamination of soil with various surface materials. During the operation, impacts are possible on the sections where the route runs in the open and on exit areas due to improper handling of run-off rainwater and accidents in the transport of dangerous or harmful substances.

By taking into account mitigation measures, the impact during the construction will be moderate. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals.

Cross-border impact of the construction of the second track of the Divača–Koper line on soil both during the construction and operation is reasonably not expected.
Hydrographical features, chemical and ecological state of surface waters and flood safety

The Karst region is characterised by a shortage of permanent surface waters. These appear on the edge karst areas of the lower Karst, where watertight flysch rocks are found. Several watercourses are on the flysch area in the lower part of the route. Impacts of limited duration are expected during the construction. These are impacts on the water regime and on naturally preserved watercourses, as well as an increase in lateral and vertical erosion in exposed areas and, consequently, higher turbidity of watercourses. Due to the abstraction of water for construction, there is a possibility of water discharge falling below the biological minimum. Impacts during the construction will be limited to the natural preservation of watercourses, which will undergo regulation because of the construction of the line.

By taking into account mitigation measures, the impact during the construction will be moderate. It will be necessary to strictly adhere to legal restrictions and terms from approvals.

There will be no cross-border impact with the implementation of all mitigation measures.
Effects on the environment Second track of the Divača–Koper railway line

Flora, fauna and habitat types

Presence of humans in the immediate surroundings of the construction site. Over the entire area of the intervention, negative impact on birds could be possible due to construction works in the nesting period when birds cannot retreat and leave their nests. During and after the intervention, there will be a highly increased possibility of the introduction of non-native plant species to the degraded areas. The operation of the railway line may result in animals getting run over. Since the majority of the railway line will run in tunnels, traffic on it will have no significant impact on birds. Birds will in particular be affected by noise, which will reduce the density of nesting directly along the track. Birds hitting electrical lines in the areas where the track exits a tunnel and birds hitting trains will be possible. Negative impacts on flora and fauna of the area will also be present because of the use of pesticides. There will be no impact on flora, fauna and habitat types at the sites of the intake of excavated material.

By taking into account all mitigation measures, the impact during the construction and operation will be moderate. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals.

There will be no cross-border impact since adequate technical solutions for preventing possible pollution have been planned.
**PROTECTED AREAS**

In the wider area (up to 500 m), there are three Natura 2000 areas— Karst Site of Community Importance, Karst Special Protection Area, and Rijana Site of Community Importance, and several protected areas. The route physically intervenes only in the protected area of Beloš–the Glinščica gorge with the valley of Gria, sinkhole caves, archaeological sites Lorenco and the castle above Botač. Impact during the construction will be manifested as permanent reduction of the habitats of qualifying and key species, increased pollution of the environment with noise, and increased presence of humans, which will mostly disturb mammals and birds. There may be negative effects on active qualifying and key nocturnal animal species in case of night lighting at construction sites and in case of chopping down woody vegetation during nesting. The operation of the railway line will disturb qualifying and key animal species primarily because of the increased pollution of the environment with noise, the possibility of birds hitting poorly visible objects and animals colliding with vehicles, and the inadequately arranged lighting of railway stations.

The impact of construction and operation will be moderate by taking into account mitigation measures such as a limited period of construction and preparatory works (chopping down woods etc.), a limited range of construction sites, and the nature conservation surveillance. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals.

There will be no cross-border impact because adequate technical solutions for preventing possible pollution of this kind have been planned.
VALUABLE NATURAL FEATURES AND ECOCLOGICALLY IMPORTANT AREAS

The route of the second track runs in the immediate vicinity of the geomorphological natural values: Belka–Qudica cave system, L-1 (Sostoj and Milčekova jama cave in Loke). It gets close to less than 20 m to the area Glinščica-gorge, Kastel Edge, Glinščica, Radovje–double stream, and Bibina, and three points of natural and natural beauty (Glinščica, Glinščica–waterfall and Črnotiče–sinkhole) of the route will be physically isolated from areas of expected valuable underground geomorphological features (caverns) and areas of Cretaceous rocks with fossil fish sites (karst), where it will be possible to discover and damage new caves and fossils during the construction. In the wider area of intervention (500 m on each side of the intervention), there are two ecologically important areas: I–Glinščica and I2–Bibina. In the area between Divača and Omisalj, the route will run with its tunnels, viaducts, surface area access and service roads across the ecologically important area of Plinsko, which will result in the physical destruction of a part of the ecologically important area and the impact on the present plant and animal species. During the construction, noise levels and the presence of humans will be increased which will primarily negatively affect large mammals and birds. Due to construction works in watercourses and their immediate vicinity, water will become increasingly contaminated and suspended substances in water, and there will also be a possibility of pollution with current effluent and hazardous substances which are toxic for aquatic organisms.

This could result in a reduction in populations of animal species in the area. During the operation of the railway track, negative impacts will be possible on the hydrology, ecotopes and valuable underground geomorphologically natural features in the area of intervention. Negative impacts due to the operation will also be possible as the ecologically important area of karst, primarily because of noise, possible collisions and the use of biocides along the railway track.

By taking into account a number of mitigation measures, the impact of the construction and operation is estimated as moderate. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals. There will be no cross-border impact.

CULTURAL HERITAGE

The second track interferes with several areas of cultural heritage. At the beginning, it intervenes in the area of the Divača–Koper railway site No. 2 (heritage No. 9023). In the area, no cross-border impact is expected. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals. The construction works may result in permanent or temporary degradation or damage to an area of habitat or cultural heritage due to excessive emission of particles from a construction site, vibrations produced by construction machinery and construction of additional access roads to construction sites or service platforms. By taking into account mitigation measures, the impact during the construction will be large. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals.

Since construction sites, transport paths and the second railway track with accompanying structures and arrangements do not indispose upon the territory of the Republic of Italy, no cross-border impacts are expected.
CULTURAL LANDSCAPE AND VISIBLE QUALITIES OF SPACE

During the construction, the visible quality of space will be impacted by the construction site, temporary depositing of surplus material, construction machinery and additional heavy traffic, primarily in the area of service platforms, viaducts and in the area of the construction of access roads. Due to the large proportion of tunnels, the visible exposure of the route of the railway line, perceived as a whole, will be low.

The impact of the construction and operation of the second track will be moderate by taking into account the proper formation of slopes, appropriate planting and the design of structures.

The only part that will be visible from Italy will be the section between tunnels T7 and T8 with viaduct V2 across the Vinjanski potok stream. The viaduct will create a widely recognisable spatial feature. The landscape image and identity of the space in this area will be changed. Since the infrastructure facilities are a part of everyday life, they are not perceived as negative; therefore, it is estimated that there will be no negative cross-border impact.

AGRICULTURAL LAND AND AGRICULTURE

Due to the prevailing underground construction, the impacts on agricultural land will be less significant than they would be in the case of surface construction. Regarding agricultural land by land use, the route with accompanying arrangements affects 27.8 ha, of which 22 ha is the best agricultural land and 5.8 ha other agricultural land. Negative impacts are expected primarily on the pedological and hydrological state of agricultural space, the established agricultural networks and the network of land amelioration canals, and the loss of produce. During the operation, a negative impact is the permanent loss of agricultural land.

Taking into account mitigation measures such as preventing the pollution of agricultural land and providing access to agricultural land, the impact of the construction will be moderate. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals.

Since the route does not run on the Italian territory, there will be no cross-border impacts on agriculture and agricultural activity during the construction and the operation of the second track of the line.
Forests and forestry

The route with its accompanying infrastructure affects 35.5 ha of forest land. The construction of the railway track will interfere with the established network of forest roads and other roads, and will also cause damage to the newly formed forest edge and trees. In addition to the permanent loss or damage to forests, the biggest impact on forested land and forestry will be caused by the construction of planned structures, which will cause damage and changes in micro-location and habitat conditions on the newly formed forest edge and degradation of the Trnovščica forest reserve. Due to the abovementioned, greater investment in the protection and cultivation of forests will be needed, as well as changes of forest management and other plans in the field.

Taking into account the mitigation measures, such as preventing soil erosion, implementing silvicultural measures for consolidating the newly-established forest edge, planting a new forest edge, recultivation etc., the impact of the construction and operation will be moderate. During the construction, it will be necessary to strictly adhere to legal restrictions and terms from approvals.

Since the route does not run on Italian territory, there will be no cross-border impacts on forestry and forested land during the construction and operation of the second track of the railway line.
During the construction of the second track of the Divača–Koper line, noise pollution will increase in the area of the construction of the uncovered part of the route, in the area of construction site platforms of tunnels and structures, at the construction roads, transport roads for the transport of excess material, and at the areas for the intake of excess material. In the area of construction site platforms, the dominant sources of noise will be construction machinery and trucks, ventilation devices for blowing air into the tunnel tubes, and at some construction site platforms also the operation of jaw crushers, drilling machines for mining and mobile concrete plants. The transport of excess excavated material will be carried out mainly on state roads. Noise pollution is expected to increase significantly along these roads. During the intake of the excavated material in the area of the Šalara marl quarry, Ankaranska Bonifika and the Bekovec location, occasional excessive noise pollution is expected at the most exposed buildings, but pollution is not expected to reach critical levels.

Taking into account the mitigation measures such as the implementation of noise barriers in the total length of approximately 1.1 km, the implementation of passive noise protection on seven structures, and taking into account the time limits on construction, the impact of construction and operation of the second track will be moderate to large, while the effect of the disposal of excess material will be moderate during the construction. It will be necessary to adhere to legal restrictions and terms from approvals.

There will be no cross-border impact with the implementation of a noise barrier on the Vinjan viaduct, which is the closest to the border with the Republic of Italy.

Effects on the environment

Noise

During the construction of the second track of the Divača–Koper railway line, noise pollution will increase in the area of the construction of the uncovered part of the route, in the area of construction site platforms of tunnels and structures, at the construction roads, transport roads for the transport of excess material, and at the areas for the intake of excess material. In the area of construction site platforms, the dominant sources of noise will be construction machinery and trucks, ventilation devices for blowing air into the tunnel tubes, and at some construction site platforms also the operation of jaw crushers, drilling machines for mining and mobile concrete plants. The transport of excess excavated material will be carried out mainly on state roads. Noise pollution is expected to increase significantly along these roads. During the intake of the excavated material in the area of the Šalara marl quarry, Ankaranska Bonifika and the Bekovec location, occasional excessive noise pollution is expected at the most exposed buildings, but pollution is not expected to reach critical levels.

Taking into account the mitigation measures such as the implementation of noise barriers in the total length of approximately 1.1 km, the implementation of passive noise protection on seven structures, and taking into account the time limits on construction, the impact of construction and operation of the second track will be moderate to large, while the effect of the disposal of excess material will be moderate during the construction. It will be necessary to adhere to legal restrictions and terms from approvals.

There will be no cross-border impact with the implementation of a noise barrier on the Vinjan viaduct, which is the closest to the border with the Republic of Italy.

Vibrations

The occasional impact of vibrations on individual buildings is expected during the construction of the second track mainly due to the drilling of tunnel tubes and construction of tunnels and cuts on the open parts with mining and blasting, while transport vehicles will be the predominant source of vibrations on access roads between construction platforms and the sites for the intake or loading and unloading of excavated material.

An increased impact on buildings due to vibrations is also expected on transport roads between construction platforms and also at the intake or loading and unloading of excavated material. Transport of excess excavated material from tunnel construction sites will mostly take place on the national road network and partly also on local roads. The area of impact along transport roads due to the transport of excavated material has been estimated up to a distance of 10 m from access roads. As the potential impact on the areas of the Osp valley and the village of Lokev has been estimated as excessive, the construction of a new construction road T4-T7 and the use of T3-Ta have been envisaged in order to divert all cargo traffic to an unpopulated area.

During the construction, it will be necessary to strictly adhere to mitigation measures such as the use of appropriate devices for work and the time limits for intensive construction works, for the impact to be moderate. It will be necessary to adhere to legal restrictions and terms from approvals.

Considering that the nearest buildings on the Italian side of the border are far away from the construction sites, there will be no cross-border impact from vibrations on the Italian side during the construction.
Effects on the environment

Second track of the Divača–Koper railway line

**Light pollution**

Environmental light pollution can increase primarily during the construction due to the lighting of construction sites and construction site platforms. The impact during the construction will be moderate; it will be necessary to consider legal restrictions and terms from approvals. There will be no cross-border impact on light pollution during the construction and operation of the second track of the Divača–Koper line.

**Electromagnetic radiation**

There will be no sources of electromagnetic radiation during the construction of the second track of the Divača–Koper line. The construction of the second track of the railway line and its operation will have no impact on the Italian side in terms of electromagnetic radiation.

**Waste**

Most common waste during the construction will be excavated material, which is not a hazardous waste. Besides excavated material, other waste will also appear during the construction (construction waste, packaging, waste oil, etc.), but in small quantities. Ankaranska Bonifika and Bekovec are locations planned for the intake of excess excavated materials into the soil, while the greater part of the excess material will be taken to the Koper freight station and then by rail for processing to the Anhovo cement factory (flysch material) and Črnotiče quarry (crushing into useful fractions), and the remainder of the material will be used for processing into building materials.

When it comes to burdening the environment with waste, the impact of the intake of excavated material on both locations of the intake will be positive during the lifespan of this intervention, as the soil at Ankaranska Bonifika and Bekovec locations will be improved to the benefit of agriculture. Also, the removal and processing in relation to environmental burden will be positive, as it will reduce interventions required to obtain raw materials for the production of cement or stone fractions.

During the construction, it will be necessary to strictly adhere to mitigation measures, such as proper collection, storage, and waste management to minimise the impact of the construction. There will be no cross-border environmental impact related to waste.
Conclusion
Second track of the Divača–Koper railway line
The second track of the rail link between Koper and Divača has been the subject of planning scrutiny and analysis since the late 1990s. The process of spatial placement determined a variant, for which the Government of the Republic of Slovenia adopted the National Site Plan in 2005. Even later, after the adoption of MSP, certain checks were implemented regarding a partial or total system of double tracks on the line, but since October 2010, the route of the line has been final. It will be a single-track line between Koper and Divača, which, together with the existing modernised line, will represent a double-track connection between Koper and Divača. The route of the line and its characteristics are described in this document.

The construction of the line will represent a challenge for those engaged in the construction profession. It is a complex engineering project with eight tunnels of different lengths, two viaducts, a bridge and a demanding crossing of the Glinščica valley. Certainly, the construction of tunnels in the karst region represents a certain risk, which cannot be entirely avoided despite the geological and geomechanical research that has been conducted. During the construction, special emphasis will need to be given to following the terms and conditions which must be met in a sensitive area of the karst underground and underground waters, in particular in the construction of tunnels and in crossing the Glinščica valley.

Also, from the environmental point of view, it will be demanding to execute accesses to tunnel portals and to the sites of other civil engineering structures. It is necessary to comply with the time allowed for the execution of works (night work) and also comply with the conditions from approvals which at certain times even forbid construction in some areas.

The time of the construction of the entire section of the new line between Divača and Koper is estimated at six to seven years. This does not take into account the potential risk of possible complications in the procurement process and risks regarding any unforeseen events during the construction of tunnels (e.g. karst caves or alyko, water intrusion). In the karst area, such events cannot be entirely ruled out, despite high-quality geological and geomechanical research. The time of the construction is most affected by the execution time of the longest tunnels, followed by the time for equipping the entire section of the new line. The planned tunneling technology is the so-called New Austrian Tunnelling Method (NATM). The alternative implementation technology using a tunnel-boring machine (TBM) to bore the entire profile of the tunnel was, considering the above-mentioned findings, deemed as too risky to be used in the karst region.