CETRA2022 11-13 May 2022, Pula, Croatia
7th International Conferenceon Road and Rail Infrastructure

VISION 2050+ (LONGTERM CONCEPT FOR SLOVENIAN RAIL NETWORK)

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Abstract

Vision 2050+ upgrades the current Transport Development Strategy (2015) for the period until 2030. Vision 2050+ serves as a framework for further railway planning activities, as it represents a possible, but not final, set of measures. The set of measures does not constrain any additional measures, spatial, organisational, administrative, or multimodal, that will be needed in the coming decades. For the period through 2035, the set of measures for the rail network is more or less final. It includes the implementation of ongoing projects, the modernization of the TEN-T network, the implementation of measures to introduce a clockface timetable in the areas of Ljubljana in Maribor and other immediate measures. The time until 2035 must be used to develop new connections and define the concept of the Ljubljana railway node. In addition, appropriate transport policy support measures must be adapted (e.g. the inclusion of bus public transport, discouraging the use of cars). When planning the measures, passenger demand, phased implementation, construction under traffic, spatial and economic feasibility, and social acceptability were considered. The article describes the process, criteria and tools for analysis, modelling and design.

Keywords: vision, railway, planning

1 Introduction

Vision 2050+ is a clear vision of the kind of railway we want to see as a society in the future. The Vision sets out what we want to achieve with rail and with individual development projects. It encompasses a wide range of measures, brings stakeholders together, supports international environmental commitments and Slovenia's desired spatial development, and enables further economic development. The Vision is intended to be robust yet adaptable to spatial constraints and future conditions, sustainable, independent of day-to-day politics, and acceptable to all segments of society. It is ambitious and at the same time realistic enough to be achievable within the set time frame, and to this end sets the conditions for its realisation.

Inadequate condition of railroad lines and demand to use more sustainable modes of transport, forces Slovenia to accelerate the preparation of planning and project design documentation for the modernization of its rail network.

Vision 2050+ should be used as a framework for further activities in the field of long-term planning of railroads, as it represents a possible, but not final, set of measures. The proposed infrastructure measures (alignments of new railway lines) were analysed on a very rough level for their spatial and functional feasibility. However, more detailed solutions, their evaluation and comparison in terms of functional, spatial, environmental, economic and social acceptability need to be done in further planning phases. The list of measures

also does not limit the consideration of additional measures, both spatial solutions and organisational, administrative, and multimodal measures, for which the need may arise in the coming decades.
For the period up to 2035, the list of measures is relatively clearly defined. These include the implementation of projects already underway (e.g. the new Divača-Koper track, the second track of the Ljubljana-Kranj-Jesenice-state border railroad line), the modernization of the TEN-T network (axle load, stations for 740 m long trains) and measures to establish clockface timetable in the Ljubljana area (e.g. the second track of the Kamnik and Novo mesto lines) and in Maribor (e.g. the second track of the Maribor-Ruše railroad line), as well as other urgent measures.
The time until 2035 should be used to define the new connections and the concept of the Ljubljana railroad junction, a project that is crucial for the development of the national railway network and represents one of the greatest challenges from the spatial planning, environment, investment and construction point of view. Only by fulfilling these tasks - with an appropriate scope and regular funding - will Slovenia be able to achieve carbon neutrality. This also requires appropriate accompanying transport policy measures (e.g. integration of public passenger transport, destimulation of private car traffic). Vision 2050+ builds on the existing National Transport Strategy (2015) for the period up to 2030.

2 Objectives

2.1 Connecting Slovenia and Europe

Transport is one of the most important indicators of the quality of life of modern society. It facilitates and enables development through the movement of people, goods, and services, while disorderly traffic conditions cause economic costs, pollute the environment, and hinder sustainable urban development.
Slovenia must be interconnected and connected. In particular, national and regional centres must be well connected to allow for commuters and educational mobility. It needs to be connected to the international network, especially to the TEN-T network. This will enable us to transport goods in a sustainable manner. The good connectivity and interconnectivity provided by efficient rail transport also supports and promotes sustainable tourism.
Between national centres of international importance (Ljubljana, Maribor, Koper), rail transport must be as fast or faster than cars. The high speed rail corridor Koper (Divača)-Ljubljana-Celje-Maribor will also provide adequate connections to most major international corridors.
Between centres of national importance (Celje, Kranj, Murska Sobota, Nova Gorica, Novo mesto, Postojna, Ptuj and Velenje and other metropolitan areas), rail must be able to compete with car and provide adequate frequency, especially during peak hours, with trains departing not more than every 30 minutes.
Between nearby centres of regional and inter-municipal importance, a 15-minute interval should be offered by train or bus during peak hours.
Another important aspect of public transportation planning is the efficiency of the “last kilometre” - the trip from the train station to the destination. Parking management, public transport, cycling, walking and other new forms of mobility (on-demand services, mobility as a service, sharing services) need to be addressed in an integrated way.

2.2 Reduction of environmental impact

The National Transport Strategy until 2030 (2015) will need to be updated in the near future, as it will be necessary to include the emission reduction targets required for the transport sector in the recently adopted Climate Strategy, in National Energy and Climate Plan of the Republic of Slovenia and EU goals "Fit for 55". The new transport strategy will need to address emissions differently than the current strategy. The new strategy will need to include measures that lead to ambitious targets. It is expected that these measures will be much more demanding in economic, environmental, spatial and social terms than the current framework and will require a broader consensus.

2.3 Sustainable mobility

In addition to an efficient transportation network, balanced spatial development must be planned to develop sustainable mobility. As many services as possible should be accessible to as many people as possible within 15 minutes. In city centres, so-called 15-minute districts should be planned, where all services are accessible to residents, while in other areas at least basic services should be provided. This will only be possible through coordinated spatial and transport planning at national, regional and municipal level.

3 Goals

3.1 Competitive travel times

Travel time is the most important criterion when deciding on a destination, a mode of transport and a route. The competitiveness of public transport depends, among other factors (price, reliability, comfort), mainly on the ratio of travel time compared to individual transport. Travel time by public transport has the advantage over driving a car that the time in the vehicle can be better used (rest, work) and one is less exposed to accidents and stress. But the travel time is increased by the access to the starting point and the journey to the destination (the so-called door-to-door or 'last mile'). The beginning and end of the trip are also critical to competitive travel times. This is the responsibility of local authorities, public transport providers and other stakeholders in transport management and transport-related services. The vision aims to achieve a competitive ratio between travel time in public transport and travel time in private cars of 1, i.e. the same travel time. However, taking into account spatial, environmental and economic constraints (ensuring high speeds in public transport), a margin of tolerance must be provided for lower order connections (e.g. between centres of inter-municipal importance), but this should not exceed 1.5.

3.2 Analysis of demand and supply

National transport model of Slovenia, including all population trips (walking, cycling, train, bus, car) and goods transport (road freight vehicles, freight trains) was used to quantitatively evaluate proposals for measures and to verify the effectiveness of the measures in achieving their objectives. The model was used to analyse the competitiveness of train travel times compared to car. The results of the analysis were the basis for identifying the need for measures to improve travel times between centres of national importance. As part of the planning of the measures, new rail lines were designed and verified in the traffic model. The passenger potential of the new connections was calculated and served as one of the key criteria for the final definition of the set of measures and their implementation timetable.

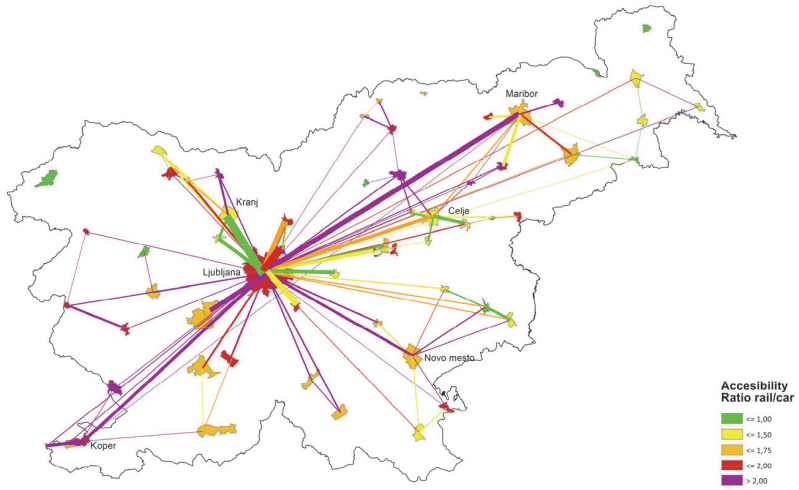

Figure 1 Current travel time ratios [rail/car]

3.3 Network capacity

Providing sufficient network capacity for freight is key to maintaining and increasing the share of freight transported by rail. The measures being implemented and planned will ensure that most of the TEN-T standards (electrification, ERTMS, loading capacity, 740 m long trains in full and with exceptions speed at 100 km/h) are met by 2030 and that sufficient capacity is available until 2050. This will allow further development of the port of Koper and other logistics-related activities. After 2030, further increases in network capacity will need to be planned if required by the European and global economic situation.

3.4 Modern trains

Modern trains must run on a modern rail network to further promote the use of passenger rail service and take advantage of the expanded rail network. In the short term, 52 new modern trains will be put into service, followed by more trains to replace the remaining older trains and accommodate the planned increased number of trips. It is estimated that about 100 additional passenger trains will be needed. High-speed trains will also have to be provided for the high-speed lines (high-speed lines according to TSI).

3.5 Timetable

The vision is to provide a clock-face (cyclical) schedule every 30 minutes. Passengers are attracted by an increase in frequency, similar to the reduction of travel times. The basic unit of the schedule is 1 hour, which can be reduced to 15 or 30 minutes for higher ridership potential and increased to two hours for lower potential and at longer distances. It is important that the time differences are a multiple of 15 minutes, as this also allows a combination of different departures and facilitates the coordination of individual schedules. A similar planning principle (planning the timetable first, then planning the corresponding infrastructure) is used in Austria, Germany and Switzerland.

4 Measures

4.1 Upgrade of the rail network

Upgrade of the main railroad lines will ensure compliance with TEN-T standards and sufficient capacity for freight traffic (e.g. double-tracking of the Ljubljana-Jesenice line). Upgrade of the regional r lines will increase the attractiveness for passenger traffic and enable the operation of the Ljubljana railway node until 2050 (depending on the development of freight traffic).
Upgrade of the main regional lines (such as the Kamnik, Dolenjska and Koroška lines), including electrification, is to be carried out over the next 15 years. In the meantime, smaller measures necessary to maintain passenger traffic will be carried out on other regional lines. The upgrading of a line usually includes the renewal or extension of the existing tracks, double tracks on sections where this is necessary to ensure clock-face rail traffic, electrification, the upgrade of stations, stops, the construction of suitable (grade-separated or at-grade) crossings over the line, and the modernization of signalling, safety and telecommunications equipment.

4.2 Integrated transport

The integration of public passenger transport should be continued and accelerated, including:
- the creation of a single national public passenger transport manager;
- the linking of all public passenger transport providers and other mobility services, including multimodal points, the reorganisation of urban passenger transport lines, the bicycle rental systems, satellite P+R systems and other measures;
- the development of integrated timetables that include rail transport as a supporting element.

4.3 Separation of passenger and freight transport

Passenger and freight traffic should be separated to increase speed and network capacity and reduce environmental (especially noise) and spatial impacts. An important measure at the national level is the development of the Ljubljana Railway Node.

4.4 New lines

A much more ambitious development should be planned for the period after 2035 - the expansion of the railroad network, which will connect Slovenia internally and externally and support the concept of a polycentric urban system and regional spatial development outlined in the Spatial Development Strategy of Slovenia and the emerging Spatial Development Strategy 2050.
At the international level, we need to connect Slovenian centres with nearby international hubs and direct them in various European directions: Zagreb (Belgrade, Athens, Istanbul, Southeast Europe), Trieste/Gorizia (Venice, Milan, Southwest Europe), Villach/Klagenfurt (Munich, North-western Europe), Graz (Vienna, Prague, North-East Europe), Nagykanizsa, Zalaegerszeg (Budapest, Eastern Europe),

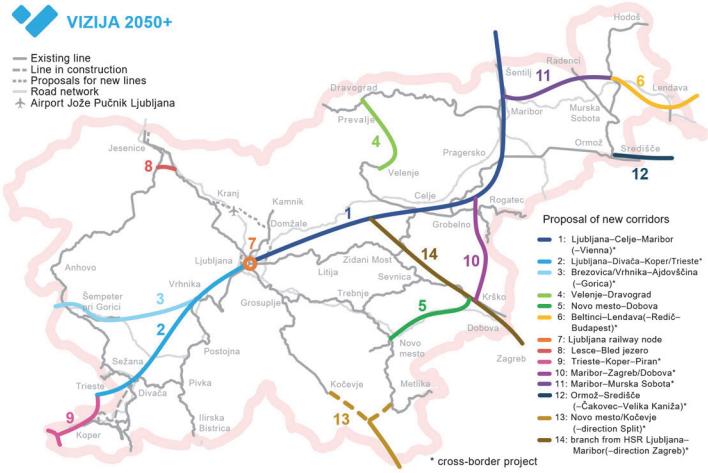

Figure 2 Proposal of new rail corridors (for consideration only)

The starting point is the travel time by train, which must be as long as by car. The biggest challenge will be the establishment of a high-speed connection between Divača (Koper/Trieste/Italy)-Ljubljana-Celje-Maribor-(Austria/Hungary). In further planning phases, cross-border connections must also be discussed in cooperation with neighbouring countries. Based on the decision on the National Transport Development Programme and similar documents of other countries, other connections may also be considered at a later stage.

5 Project design

In the following, we present the workflow for the design of new lines using the example of the new Velenje-Dravograd line. The line was designed with a design speed of V=100 km/h and in some places follows the corridor of the former Velenje-Dravograd line. The basis for the design of the line was:

- geodetic base maps at a scale of 1:50,000, corresponding to the processing status of the task, and
- a map of environmental and spatial constraints prepared for the entire country.

The projected length of the new line is 39 km. Along the route, 4 new stations and 6 new stops were established. During the planning process, each route was categorised into two levels of difficulty (difficult and easy terrain) and a tunnel route, depending on the topography and the amount of existing infrastructure near the new route. This category was then directly linked to the lengths of the individual lines and the different prices per linear metre for single-track and double-track lines. For time efficient designing we used Google Earth as well, mainly to measure approx. lengths of the tunnels.

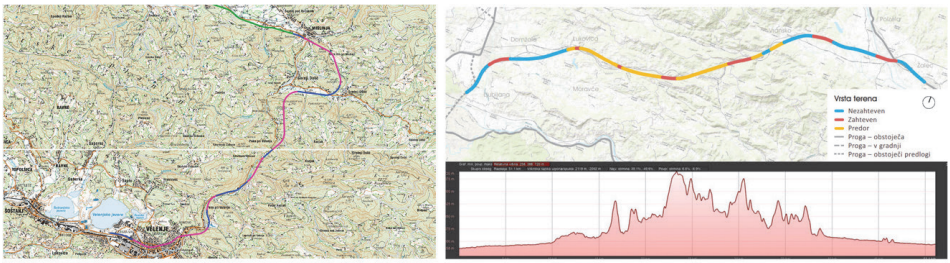

Figure 3 Example of a sections of the new Velenje-Dravograd and Ljubljana-Celje line, showing the different terrain complexities by colour

6 Implementation

Effective implementation of rail infrastructure measures requires coordinated planning between spatial/landuse and transportation planning, coordinated and effective actions by all stakeholders (ministries, development agencies, local authorities, large companies) and changes to legal regulations to ensure the efficiency of project preparation.
The areas of all attractive transport corridors considered are characterised by numerous protection, preservation, and hazard areas, a dispersed settlement pattern, a finely structured landscape, and an extensive network of public utilities and infrastructure. Spatial-ecological conflicts and objections from local communities are unavoidable and will require a serious evaluation of the feasibility and viability of each line and alternative and, most importantly, a completely different project-based approach that includes constructive stakeholder participation.
Vision 2050+ envisions a sustained increase in annual investments. All relevant stakeholders will have to provide additional staff. An analysis of investments in the rail network over the past period shows that they averaged almost 200 million euros per year. Achieving the goals is only possible by ensuring much higher and stable funding, estimated at 450 million euros per year. If investments were to average 300 million euros per year, this goal and other mobility development goals would be delayed by 10-20 years.

7 Conclusion

The planned measures will/are:
- Achieve a change in transportation mode choice:
- The goal is that by 2050, only half of all person-kilometres will be travelled by car (today 83 %), 25 % by public transportation (today 8 %), and 25 % by walking or bicycling (today 9 %)
- 30 % more jobs accessible within 30 minutes by public transport,
- Reducing emissions from passenger transport to zero in 2050 (in line with climate strategy targets).

Evaluation of measures include passenger potential, implementation phases, construction under traffic, environmental, spatial and economic feasibility, and acceptance in the wider and individual social environment.

References

[1] Ministry for Infrastructure of Republic Slovenia.: Vision 2050+ Development of Slovenian Railway Network, 2021.