

THE IMPACT OF EXISTING AND PLANNED TRANSPORT INFRASTRUCTURE ON THE SPATIAL DEVELOPMENT OF SLOVENIA: THE CONCEPT OF THE SPATIAL PLAN OF SLOVENIA

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Abstract: Transport infrastructure is a key driver of spatial development, settlement patterns, and regional economic dynamics. By determining levels of accessibility and connectivity, transport systems influence the spatial distribution of population, economic activities, and services. This paper examines the impacts of existing and planned transport infrastructure on the future spatial development of Slovenia, with particular attention to settlement structure and regional accessibility. The analysis combines theoretical perspectives from regional development theory, accessibility theory, and land-use transport interaction models with the strategic objectives of the Concept of the Spatial Plan of Slovenia. The study demonstrates how transport infrastructure contributes to the development of a polycentric settlement system, reduces regional disparities in accessibility, and strengthens functional linkages between urban centres. Special attention is devoted to planning concepts such as "60-minute Slovenia," "30-minute regions," and "15-minute local centres," which aim to ensure equitable access to services and employment across the national territory. The results indicate that coordinated spatial and transport planning plays a critical role in achieving balanced territorial development, improving economic competitiveness, and supporting sustainable mobility in Slovenia. This paper aims to examine how existing and planned transport infrastructure will influence Slovenia's spatial development under the new Concept of the Spatial Plan of Slovenia.

Key words: Project The Concept of the Spatial Plan of Slovenia, transport planning, spatial planning, Slovenia.

UTICAJ POSTOJEĆE I PLANIRANE SAOBRAĆAJNE INFRASTRUKTURE NA PROSTORNI RAZVOJ SLOVENIJE: KONCEPT PROSTORNOG PLANA SLOVENIJE

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Rezime: Transportna infrastruktura je ključni pokretač prostornog razvoja, obrazaca naseljenosti i regionalne ekonomske dinamike. Određivanjem nivoa pristupačnosti i povezanosti, saobraćajni sistemi utiču na prostornu raspodelu stanovništva, privrednih aktivnosti i usluga. Ovaj rad analizira uticaje postojeće i planirane saobraćajne infrastrukture na budući prostorni razvoj Slovenije, sa posebnim osvrtom na strukturu naselja i regionalnu pristupačnost. Analiza kombinuje teorijske perspektive iz teorije regionalnog razvoja, teorije pristupačnosti i modela interakcije korišćenja zemljišta i saobraćaja sa strateškim ciljevima Koncepta prostornog plana Slovenije. Studija pokazuje kako saobraćajna infrastruktura doprinosi razvoju policentričnog sistema naselja, smanjenju regionalnih razlika u pristupačnosti i jačanju funkcionalnih veza između urbanih centara. Posebna pažnja posvećena je planerskim konceptima kao što su „60-minutna Slovenija“, „30-minutni regioni“ i „15-minutni lokalni centri“, koji imaju za cilj obezbeđivanje ravnopravnog pristupa uslugama i zaposlenju na čitavoj teritoriji države. Rezultati ukazuju na to da usklađeno prostorno i saobraćajno planiranje ima ključnu ulogu u postizanju uravnoteženog teritorijalnog razvoja, unapređenju ekonomske konkurentnosti i podršci održivoj mobilnosti u Sloveniji. Ovaj rad ima za cilj da ispita kako će postojeća i planirana transportna infrastruktura uticati na prostorni razvoj Slovenije u okviru novog Koncepta prostornog plana Slovenije.

Ključne reči: Projekat Koncept Prostornog plana Slovenije, planiranje saobraćaja, prostorno planiranje, Slovenija.

1. INTRODUCTORY THEORETICAL AND CONCEPTUAL FRAMEWORK

1.1 Context: transport infrastructure and spatial development

Transport infrastructure is widely recognized as a fundamental driver of spatial development patterns. By determining how easily people, goods, and information move between locations, transport networks shape the geography of economic activity and human settlement (Rodrigue, Comtois, & Slack, 2020). Improved connectivity alters accessibility - the ease or cost of reaching different places - and thereby influences the location decisions of households and firms. Infrastructure investments such as motorways, railways, or ports that reduce travel times increase the accessibility and attractiveness of certain areas relative to others, often

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triggering changes in spatial development and regional growth. Consequently, the relationship between transport infrastructure and spatial development has long been a central topic in spatial planning and regional science. Transport infrastructure not only shapes mobility patterns but also influences environmental sustainability and the long-term organization of urban and regional systems (Banister, 2008).

To frame the discussion, it is important to clarify several key concepts used throughout this paper. **Transport** refers to the movement of people, goods, and information across geographic space through interconnected networks, modes, and infrastructure that reduce the friction of distance and enable spatial, economic, and social interaction. A **transport system** is an integrated socio-technical system of infrastructure, networks, vehicles, services, and institutional arrangements that enable and regulate this movement. **Transport infrastructure** consists of the fixed physical networks, transit corridors, terminals, and intermodal nodes that form the material basis for transport systems. Finally, **spatial development** can be understood as a policy-guided process that shapes spatial structures and land use in order to balance development and protection interests and ensure sustainable territorial development.

Over the past several decades, regional development theories have offered different perspectives on how transport investments influence growth and spatial change (Śladkowski, 2019). Early development economists debated balanced versus unbalanced growth strategies, questioning whether broad infrastructure investment across regions or targeted investment in key locations would generate greater economic benefits and spillovers. Relatedly, polarization or core-periphery theories suggested that improved transport links might initially benefit already advantaged “core” regions, concentrating investment and widening disparities with peripheral areas (Myrdal, 1957; Hirschman, 1958). In contrast, convergence theories proposed that infrastructure could help lagging regions catch up by supporting a more even distribution of development. The new economic geography further explained how declining transport costs, combined with agglomeration economies, may lead either to concentration or dispersion of economic activity, producing different spatial equilibria such as a dominant core or a polycentric network of cities depending on contextual conditions (Krugman, 1991; Fujita, Krugman & Venables, 1999). Macroeconomic perspectives have also diverged: while some neoclassical approaches argue that public infrastructure may “crowd out” private investment, Keynesian and endogenous growth theories view infrastructure as a key driver of demand, productivity, and positive externalities. Overall, these perspectives show that the spatial impacts of transport infrastructure are not uniform but depend on the location of investments and their interaction with regional economic structures.

A central concept for understanding these effects is accessibility. Accessibility refers to the opportunities (jobs, services, markets, etc.) reachable from a given location within a certain travel cost or time, and it represents a key theoretical link between transport supply and land-use outcomes. Classic studies show that areas with greater accessibility tend to attract more development, confirming that “accessibility is a fundamental determinant of urban-regional growth” (Hansen, 1959, as cited in Wegener, 2004a). Conversely, poorly connected regions, often described as “peripheral,” frequently face economic disadvantages due to their relative remoteness. Improvements in national transport infrastructure (e.g., new inter-city motorways or rail corridors) modify the accessibility landscape by effectively “shrinking” distance: previously peripheral areas may become better integrated into national markets, while central locations often gain additional interaction opportunities (Vickerman, 2017). Researchers analyse these processes using measures such as potential accessibility, a gravity-based indicator that estimates the spatial opportunities created by new or upgraded transport links (Rosik et al., 2022). Such models are used to evaluate how infrastructure investments, such as high-speed rail lines or motorways, may redistribute economic activity. Results often show complex spatial effects: connectivity improvements can accelerate growth in leading regions while providing more limited benefits to distant lagging areas (Rosik et al., 2022). Consequently, debate continues over whether major transport investments promote spatial convergence or reinforce existing regional disparities. Empirical evidence remains mixed, suggesting that improved connectivity alone does not necessarily guarantee balanced regional development (Rosik et al., 2022).

To capture the bidirectional relationship between transportation and land use, planners and researchers have developed various integrated frameworks. Land Use-Transport Interaction (LUTI) models, for example, simulate how changes in transport infrastructure affect the location of population and employment over time, while land-use changes in turn influence travel demand and network performance (Wegener, 2004a). These models - ranging from spatial economic equilibrium approaches to agent-based simulations - explicitly represent this feedback loop between accessibility, development, and mobility. Early contributions such as Lowry’s model (Lowry, 1964) provided the conceptual foundation, and more advanced operational tools have since been developed to support national and regional planning, including the SASI model in Europe, which evaluates the socio-economic and spatial effects of infrastructure investments. In parallel, economists have

developed multi-region general equilibrium models to analyse how reductions in transport costs influence the spatial distribution of economic activity and welfare across regions (Redding & Sturm, 2008; Allen & Arkolakis, 2014). As noted in a comprehensive review by Redding and Turner (2014), contemporary theoretical and empirical research increasingly seeks to distinguish between the genuine growth effects of transport infrastructure and the spatial redistribution of existing economic activity. In practice, improved transport infrastructure can generate new growth while simultaneously redistributing economic activity between regions, an important consideration for policy analysis.

The impacts of transport infrastructure can be categorized as direct versus indirect and generative versus distributive. Direct effects are experienced immediately by users and producers, including reduced travel time, lower vehicle operating costs, and improved mobility or market access resulting from new road or rail infrastructure (Rosik et al., 2022). These benefits often translate into higher productivity and greater convenience for businesses and travelers. Indirect effects arise through second-order adjustments in the spatial economy, as firms reorganize supply chains, households relocate, land values change, and new investments concentrate in more accessible locations. Some investments generate additional economic activity that would not have occurred otherwise - for example by enabling new logistics services or tourism in previously isolated regions. At the same time, distributive effects may occur when growth is spatially redistributed without a net increase; improved connectivity can allow production or employment to shift from one city to another (Rosik et al., 2022). Research shows that such indirect and redistributive effects can be substantial relative to direct benefits, often leading to significant spatial reorganization (Śladkowski, 2021). Empirical evidence across different countries indicates that a large share of the economic impact of new motorways or railways results from the relocation of population and economic activity rather than from overall national growth (Redding & Turner, 2014). This underscores the need for policymakers to consider not only aggregate benefits but also the spatial redistribution of gains and losses associated with transport infrastructure investments.

Another important theoretical insight is that transport infrastructure investments trigger both agglomeration and dispersion forces in the economy (Rodríguez-Pose, 2020). By lowering transport costs and travel times, infrastructure can reinforce agglomeration: firms and people may cluster in large nodes or corridors to benefit from scale economies and dense labor markets, as commuting and goods movement become easier (Redding and Turner, 2014). This aligns with classical location theories and modern economic geography models, where reduced transport friction enhances the competitiveness of larger markets, reinforcing urban hierarchies. Conversely, improved transport can also enable dispersion: activities once concentrated in central areas may relocate to peripheral regions due to better connectivity, lower land costs, or available labor. For example, 19th-century railroads fostered hub cities, while 20th-century motorways and automobiles supported suburbanization and smaller city growth through finer-grained access (Redding and Turner, 2014). The spatial outcome of infrastructure depends on which forces dominate. Motorways may promote dispersion by enabling rural industry and commuting, while high-speed rail or air links often bypass intermediate areas, reinforcing ties between major hubs and potentially deepening core-periphery divides. Transport-induced gains are typically uneven: well-connected areas capture more benefits, while remote regions may see limited improvement. This spatial inequality can be mitigated - but not eliminated - by infrastructure alone. However, targeted investments in peripheral regions that reduce internal barriers and improve market access can foster convergence. New economic geography models suggest that intraregional transport upgrades can attract firms and boost productivity in lagging areas. In sum, the spatial effects of transport infrastructure are context-dependent: the same investment may concentrate or disperse development, depending on economic structure, land-use policies, and supporting networks.

Given these complex dynamics, the implications for spatial planning and policy are substantial. Planners and policymakers increasingly recognize that transport infrastructure is not just an engineering or economic concern, but also a spatial policy tool that must align with spatial planning (Cervero and Kockelman, 1997). National-level decisions - such as where to build a new expressway or how to prioritize rail over road - have long-term effects on urban systems, regional economies, and environmental sustainability. As a result, integrated planning approaches are widely advocated, with transport and spatial development plans developed in tandem to guide the direction and distribution of growth. Some governments now embed spatial-development objectives into transport project appraisals, evaluating impacts on regional connectivity, equity, and urban form alongside traditional cost-benefit analysis. There is also growing use of multi-criteria analysis in transport planning, assessing not only economic efficiency but also social and environmental factors such as accessibility, ecological impact, and equity. This reflects a theoretical understanding that the "wider spatial impacts" (Rosik & Wójcik, 2023) - including land use changes, migration patterns, and regional productivity shifts - must be anticipated and managed, even if they are harder to quantify than direct user benefits.

In conclusion, the relationship between transport infrastructure and national spatial development is reciprocal and multifaceted (Wegener & Fürst, 2004b). Transport investments can reshape a country's spatial economy and settlement structure, benefiting some regions more than others and creating both opportunities and planning challenges. Theoretical models explain these dynamics by showing how infrastructure alters accessibility, location advantages, and transport costs while interacting with agglomeration economies and land markets to produce new spatial configurations. Such insights highlight the need for coordinated planning that aligns transport infrastructure with land-use regulation and regional policy objectives. A key lesson from the literature is that infrastructure alone cannot ensure balanced development; its effects depend on how it is integrated into the broader spatial system. When strategically coordinated with spatial planning, transport investments can support balanced regional development, strengthen polycentric urban networks, and enhance national cohesion. Without such coordination, however, large infrastructure projects may contribute to unintended outcomes such as urban sprawl or widening regional disparities. Therefore, a strong understanding of transport-space interactions, grounded in theory and empirical research, is essential for effective spatial policy-making and the pursuit of sustainable and equitable national development.

These theoretical perspectives highlight the importance of integrating transport and spatial planning. Transport infrastructure investments must be coordinated with land-use policies to ensure that improved accessibility produces desirable spatial outcomes. Without such coordination, transport investments may reinforce spatial inequalities or contribute to urban sprawl.

The theoretical insights outlined above provide an important framework for understanding spatial development strategies in Slovenia. The Slovenian spatial planning system explicitly recognizes the strong relationship between transport infrastructure and settlement structure. The Comprehensive Spatial Plan of Slovenia (henceforth CSPS) (Jankovič et al., 2026) incorporates these principles by linking transport investments with broader spatial objectives such as territorial cohesion, polycentric development, and sustainable mobility.

These perspectives therefore form the analytical framework for this study, guiding the evaluation of Slovenia's spatial development strategy. Key concepts such as accessibility, polycentric development, and core-periphery dynamics serve as the main criteria for assessing the spatial implications of existing and planned transport infrastructure. Following accessibility theory, the analysis assumes that improved travel times – such as those targeted by the “60-minute Slovenia” concept - increase development attractiveness and functional integration. Although no formal LUTI model is applied, the study is conceptually informed by land use-transport interaction frameworks (e.g., Wegener, 2004), which emphasize feedback loops between infrastructure investment, accessibility, and spatial development. This analytical perspective enables a structured interpretation of Slovenia's spatial planning objectives in light of established theoretical insights.

Building on this framework, the following section examines how these dynamics manifest in the Slovenian context. It applies the discussed theories to explore how transport infrastructure development and the CSPS influence spatial development. This transition from theory to practice illustrates how principles such as accessibility, polycentric development, and core-periphery dynamics are reflected in Slovenia's spatial planning strategies, thereby linking the conceptual framework with a concrete case study.

1.2 Importance of the topic for Slovenia

The objective of this study is to examine how existing and planned transport infrastructure will influence the spatial development of Slovenia, with particular attention to the strategic goals outlined in the CSPS. The analysis adopts a case study approach, drawing on national planning documents and theoretical frameworks in spatial and transport planning. The analysis draws on official planning documents, including the CSPS and the Resolution on the Spatial Development Strategy of Slovenia 2050 (henceforth ReSPR50), as well as supporting theoretical literature and national policy data. These sources provide the basis for evaluating the spatial implications of transport infrastructure development in Slovenia.

The theoretical insights outlined above provide an essential framework for understanding the spatial development strategies implemented in Slovenia. Slovenia's spatial planning system explicitly recognizes the strong relationship between transport infrastructure and settlement structure. CSPS incorporates many of these theoretical principles by linking transport infrastructure investments with broader spatial development objectives such as territorial cohesion, polycentric development, and sustainable mobility.

1.3 Aim of the paper

By analysing the interaction between transport infrastructure development, accessibility concepts, and spatial planning policies, this paper provides new insights into how transport investments can influence settlement structure and territorial cohesion within the polycentric spatial system of Slovenia.

1.4 Research questions

In order to address these objectives, the paper focuses on three key research questions. First, how does the existing transport infrastructure influence the spatial organization of settlements in Slovenia? Second, what spatial effects can be expected from planned transport infrastructure investments? Third, how do accessibility concepts embedded in the CSPS contribute to balanced territorial development? By addressing these questions, the paper aims to clarify the relationship between transport infrastructure development and the long-term spatial structure of the Slovenian territory. The analysis combines theoretical perspectives on transport infrastructure and spatial development with an examination of the Slovenian spatial planning framework and major infrastructure projects.

1.5 Paper structure

The paper is structured as follows: Chapter 2 presents a qualitative case study of Slovenia, analysing the impacts of existing and planned transport infrastructure on spatial development and settlement structure. Chapter 3 provides the main conclusions and policy implications, highlighting the importance of integrated spatial and transport planning and emphasizing the role of accessibility-based concepts such as “60-minute Slovenia,” “30-minute regions,” and “15-minute local centres” in promoting balanced territorial development. The literature section presents the theoretical and empirical sources that inform the conceptual framework and support the analysis presented in the paper.

2. IMPACTS OF TRANSPORT INFRASTRUCTURE ON SLOVENIA’S FUTURE SPATIAL DEVELOPMENT

The analysis presented in this paper is based on a qualitative case study approach focusing on Slovenia. It combines the review of national spatial planning documents, transport development strategies, and relevant policy frameworks with conceptual analysis of accessibility and spatial development patterns. Particular attention is given to the CSPS as the central strategic document guiding the relationship between transport infrastructure and spatial development. The study interprets the spatial implications of existing and planned transport infrastructure through the theoretical perspectives of accessibility theory and polycentric spatial development.

This chapter presents a qualitative case study analysis of Slovenia’s spatial development in relation to existing and planned transport infrastructure. We conduct a document and data analysis using the CSPS (Jankovič et al., 2026) as the primary source. From this, we extract data on planned infrastructure projects and accessibility targets. We compare the current transport network with planned developments, identifying regions that do not meet the ‘60-minute Slovenia’ accessibility criterion based on travel-time GIS analysis presented in the Spatial Plan. This evaluation is guided by the theoretical criteria outlined in Chapter 1 - particularly accessibility, polycentric development, and core–periphery dynamics - to assess whether the proposed infrastructure supports balanced spatial development and regional cohesion.

Transport infrastructure is one of the most influential drivers of spatial development and settlement patterns. The location of roads, railways, and transport hubs shapes accessibility, economic activity, and the distribution of population. In Slovenia, spatial planning strongly integrates transport infrastructure development with the broader goals of sustainable spatial development, regional cohesion, and economic competitiveness.

Slovenia’s spatial planning framework emphasizes the need for a balanced settlement system supported by efficient transport networks. CSPS aims to strengthen connections between urban centres, ensure accessibility to essential services, and reduce spatial inequalities between regions (Jankovič et al., 2026). Transport infrastructure is therefore considered a fundamental structural element that influences both national spatial organization and regional / local settlement development.

Existing transport networks have historically played a major role in shaping Slovenia’s settlement structure. Major urban centres such as Ljubljana, Maribor, and Koper have developed as important transport nodes

located along key national and international corridors. At the same time, peripheral and mountainous regions often experience weaker connectivity, which affects economic opportunities and demographic development.

2.1 Transport infrastructure as a driver of spatial development

Transport infrastructure significantly influences spatial structure by determining the accessibility of settlements and regions. Areas with better connectivity typically attract economic investment, population growth, and urban development. Conversely, regions with limited transport access often experience slower development and demographic decline.

In Slovenia, spatial planning strategies emphasize the importance of transport infrastructure for maintaining a balanced and polycentric settlement system. CSPA supports the development of multiple regional centres rather than concentrating development solely in the capital region. Efficient transport networks are essential for connecting these centres and enabling functional relationships between them (Jankovič et al., 2026).

CSPA identifies several key objectives related to transport infrastructure:

- strengthening connections between urban centres,
- improving accessibility to services and employment,
- supporting sustainable mobility,
- reducing regional disparities in accessibility.

These objectives highlight the dual role of transport infrastructure as both a mobility system and a spatial planning instrument.

2.2 The polycentric settlement system of Slovenia

ReSPR50 is based on a polycentric settlement structure, in which several urban centres perform important regional functions. Instead of concentrating development exclusively in one metropolitan area, the strategy promotes a network of cities and towns that provide services, employment opportunities, and administrative functions. Transport infrastructure is essential for maintaining this polycentric structure. Efficient connections between urban centres allow smaller cities to remain economically competitive and accessible. Without adequate transport infrastructure, the settlement system would likely become more centralized, leading to increased spatial inequalities.

Major urban centres such as Ljubljana, Maribor, and Koper function as first-level centres within the national settlement hierarchy. These cities act as key transport nodes and serve as primary hubs for economic and administrative activities. At the same time, regional centres such as Celje, Novo mesto, Kranj, and Murska Sobota play an important role in providing services to surrounding areas. The integration of transport and spatial planning ensures that infrastructure investments support the development of these centres and maintain balanced territorial development. The development of a polycentric system of settlements and business zones in connection with the existing transport infrastructure is graphically presented in the Figure 1.

2.3 Existing transport infrastructure and settlement patterns

2.3.1 National Transport Corridors

Slovenia occupies a strategic geographical position at the intersection of major European transport routes connecting Central Europe, the Balkans, and the Mediterranean region. These corridors form part of the Trans-European Transport Network (TEN-T), which connects Slovenia to international transport systems. The national motorway network and railway system form the backbone of Slovenia's transport infrastructure. These networks connect the main urban centres and provide access to neighbouring countries. The concentration of infrastructure along these corridors has historically influenced the spatial distribution of economic activities and settlements. The embeddedness in international transport infrastructure networks is presented in Figure 2.

Urban centres located along major corridors tend to experience stronger economic growth and population increase. Transport accessibility encourages the development of business zones, logistics centres, and commercial activities near major infrastructure nodes.

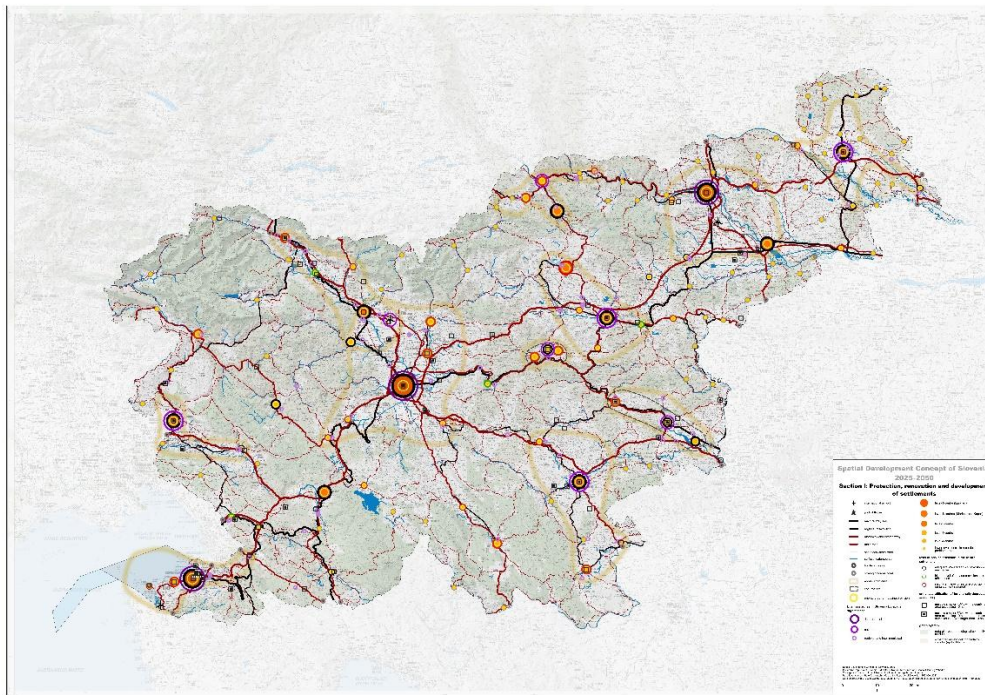


Figure 1. The development of a polycentric system of settlements and business zones in connection with the existing transport infrastructure
Source: (Jankovič et al., 2026)

2.3.2 Accessibility and Regional Disparities

Despite Slovenia's relatively dense transport network, significant differences in accessibility still exist between regions. Some peripheral areas remain poorly connected to major urban centres, which limits their economic potential and affects settlement development. Certain regions such as Koroška, Bela krajina, Posočje, and parts of the Primorsko-notranjska region experience travel times exceeding the desired accessibility thresholds (Jankovič et al., 2026). Poor transport connectivity in these areas increases transportation costs, limits access to services, and discourages economic investment.

These accessibility disparities can lead to several spatial consequences, including:

- population decline in remote regions,
- limited economic diversification,
- reduced accessibility to public services.

Addressing these inequalities is therefore a key objective of Slovenia's future transport and spatial planning policies.

2.4 Planned transport infrastructure and accessibility concepts

To address accessibility challenges and support balanced spatial development, the spatial plan introduces several key planning concepts related to transport accessibility.

2.4.1 The Concept of "60-Minute Slovenia"

One of the central concepts of Slovenia's spatial planning strategy is the "60-minute Slovenia" model. The goal of this concept is to ensure that the majority of the population can reach a first-level urban centre within 60 minutes by road transport. Although many areas already meet this accessibility criterion, several regions remain outside the 60-minute threshold due to inadequate infrastructure (Jankovič et al., 2026). Improving transport connections to these areas is therefore an important planning priority. The implementation of the 60-minute accessibility concept is expected to strengthen functional connections between regions, improve access to employment and services, and support balanced settlement development.

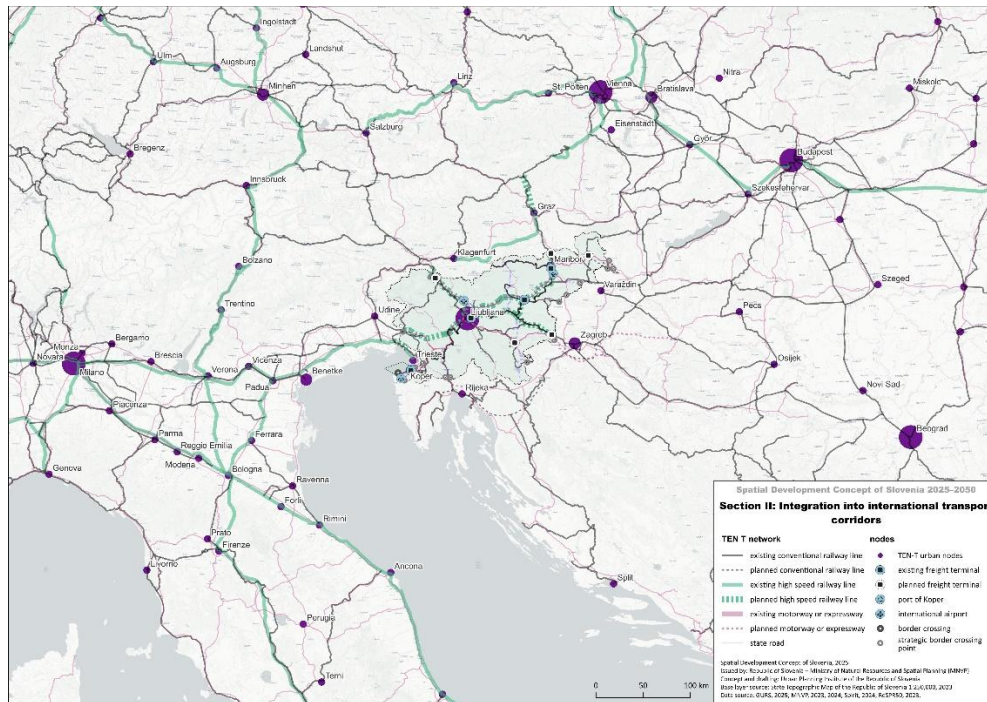


Figure 2. Integration into international transport infrastructure networks
Source: (Jankovič et al., 2026)

2.4.2 The “30-Minute Regions” Concept

Another important planning principle is the development of *30-minute regional accessibility*, which ensures that residents can reach regional centres within approximately half an hour. However, several areas still lack adequate accessibility to regional centres, including Bela Krajina, Posočje, the Cerkljansko-Ildrijska region, and parts of the Primorsko-notranjska region (Jankovič et al., 2026). Improving accessibility within regions is expected to strengthen the role of regional centres and enhance the distribution of economic activities. It also supports the development of smaller towns and reduces pressure on major metropolitan areas.

2.4.3 The “15-Minute Local Centres” Concept

At the local scale, spatial planning promotes the concept of *15-minute local centres*, where essential services such as schools, healthcare facilities, public transport stops, and recreational areas can be reached within a short travel time. This approach aims to create more compact and livable settlements by reducing the need for long daily commutes and encouraging sustainable mobility patterns. According to the spatial plan, particular attention should be given to connecting residential areas with educational institutions, healthcare facilities, and public transport nodes (Jankovič et al., 2026).

2.5 Railway infrastructure and spatial development

Railway infrastructure plays a central role in the future development of Slovenia's transport system. Current railway travel times between major cities remain relatively long compared to road transport, which reduces the competitiveness of rail transport for passengers (Jankovič et al., 2026).

To address this issue, several major railway modernization projects are planned. These include:

- completion of the Divača–Koper railway connection with a parallel track,
- upgrading the Ljubljana–Jesenice railway line,
- upgrading the Dobova–Zidani Most–Ljubljana corridor,
- modernization of the Ljubljana railway hub (Jankovič et al., 2026).

Additional projects include new railway connections such as Bled–Lesce and Beltinci–Lendava, as well as a light railway system connecting Trieste, Koper, and Izola. These infrastructure improvements are expected to significantly reduce travel times, improve reliability, and increase the attractiveness of rail transport. Refer to Figure 3.

From a spatial development perspective, faster railway connections could encourage commuting-based settlement patterns, where residents live in smaller towns while working in larger urban centres. This may contribute to a more balanced distribution of population and reduce pressure on major cities.

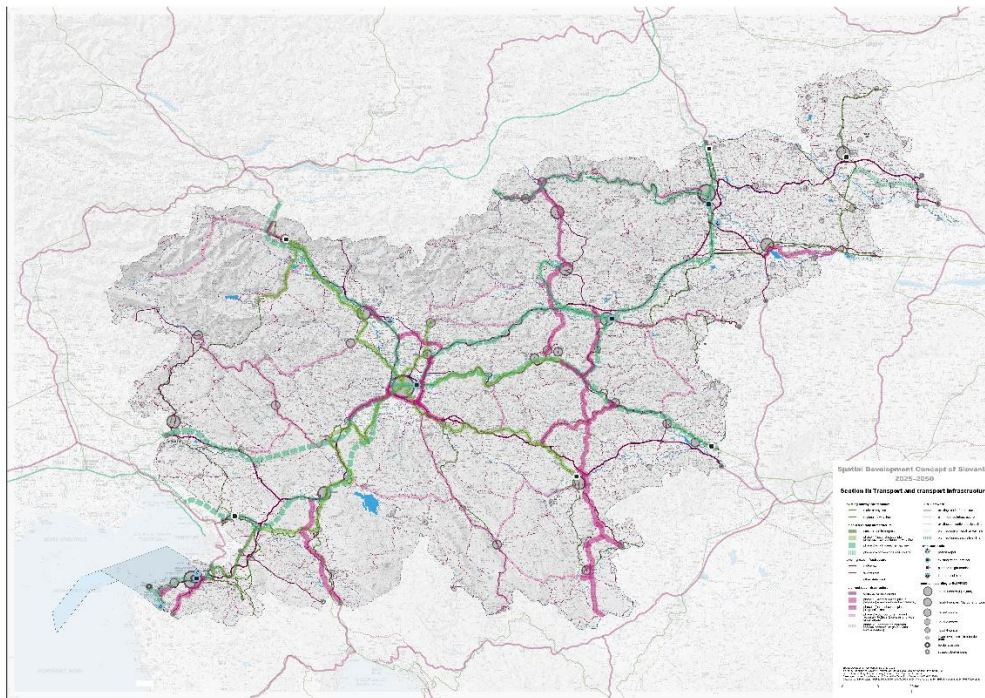


Figure 3. Current and planned transport infrastructure and the settlement system
Source: (Jankovič et al., 2026)

2.6 Road infrastructure and regional development

In addition to railway modernization, several major road infrastructure projects are planned to improve regional connectivity. These include the development of the Third Development Axis, which aims to improve connections between northern and southern regions of Slovenia, particularly between Šentrupert, Slovenj Gradec, Novo mesto, and Črnomelj (Jankovič et al., 2026). Other projects include improvements to the motorway network and the construction of bypass roads around urban areas to reduce congestion. The Ljubljana transport node is identified as one of the most critical points in the national transport network due to the intersection of major road and railway corridors. Improving road infrastructure will reduce travel times, improve safety, and enhance accessibility for both passengers and freight transport.

2.7 Intermodal transport and economic development

CSPS also emphasizes the development of **intermodal transport systems**, which integrate different modes of transport such as rail, road, and maritime transport. Major intermodal freight terminals are planned in Ljubljana, Maribor, and Koper, as well as at Ljubljana Airport (Jankovič et al., 2026). Secondary-level logistics terminals may be developed in locations such as Novo mesto, Sežana, Dobova, Murska Sobota, Celje, and Jesenice where sufficient transport demand exists. These logistics hubs will play an important role in regional economic development by supporting freight transport, logistics activities, and industrial development.

2.8 Sustainable mobility and settlement structure

In addition to major infrastructure investments, the spatial plan promotes sustainable mobility solutions such as improved public transport, cycling infrastructure, and pedestrian networks. Cycling infrastructure will connect numerous settlements and urban centres through regional cycling corridors. These connections will support sustainable commuting patterns and encourage environmentally friendly mobility options. Public transport systems will also be strengthened through the integration of rail and bus services. Fast bus connections will complement railway lines, while demand-responsive transport services will improve

accessibility in sparsely populated rural areas (Jankovič et al., 2026). These measures aim to create more sustainable settlement structures and reduce reliance on private car transport.

2.9. Implications for future settlement development

The combined effects of existing and planned transport infrastructure will significantly influence the future spatial development of Slovenia.

Several key trends can be expected:

1. Strengthening of major urban centres due to improved transport connectivity.
2. Growth of regional centres, supported by improved accessibility.
3. Reduced regional disparities through targeted infrastructure investments.
4. More sustainable settlement patterns through improved public transport and cycling networks.
5. Greater functional integration between regions, enabling stronger economic cooperation.

Transport infrastructure will therefore continue to play a decisive role in shaping Slovenia's spatial development.

The Slovenian case illustrates how transport infrastructure functions as a key instrument of spatial policy rather than merely a technical mobility system. The interaction between infrastructure development and accessibility concepts demonstrates the importance of integrating transport planning with spatial development strategies in order to maintain a polycentric settlement structure and avoid excessive spatial concentration.

3. CONCLUSION

Transport infrastructure is a key structural element shaping spatial development. Through its influence on accessibility, mobility patterns, and the spatial organization of economic activities, it affects the distribution of population, employment, and services across a territory. The analysis presented in this paper shows that the relationship between transport infrastructure and spatial development is complex and multidimensional, involving both direct improvements in connectivity and indirect structural transformations within settlement systems. Previous research demonstrates that transport planning decisions generate long-term spatial impacts extending beyond the transport sector, influencing land-use development, settlement patterns, and economic activity through changes in accessibility and development opportunities (Litman, 2023).

The theoretical framework indicates that infrastructure investments generate a dynamic interaction between agglomeration and dispersion processes. Improved connectivity often strengthens major urban centres where economic activities, services, and institutions are concentrated. These centres benefit from economies of scale, stronger labour markets, and better connections to national and international transport networks. At the same time, improved accessibility can stimulate development in smaller towns and peripheral regions by facilitating the mobility of labour, services, and economic activities. The balance between these processes largely determines the spatial outcomes of transport investments.

Slovenia illustrates this dynamic particularly clearly. Due to its small territory, varied topography, and historically polycentric settlement structure, transport infrastructure plays an important integrative role in the national spatial system. The country's spatial development strategy reflects this relationship by aligning transport planning with broader territorial objectives. Infrastructure is therefore understood not only as a mobility system but also as an instrument for strengthening cohesion, competitiveness, and sustainable spatial organization. Slovenia already possesses a dense road and railway network connecting major urban centres and linking the country to European transport systems. Its strategic position at the intersection of key European corridors further enhances the national and international significance of this infrastructure, particularly through logistics and freight flows associated with the Port of Koper.

Despite this relatively well-developed network, significant accessibility disparities remain between regions. Peripheral and mountainous areas such as Koroška, Bela krajina, and parts of the Posočje region still experience longer travel times to major urban centres. These limitations affect demographic and economic processes by reducing the attractiveness of these regions for investment, employment, and residential development. Over time, such disparities may contribute to spatial polarization, with stronger growth in highly accessible regions and stagnation in more remote areas.

To address these challenges, the CSPS introduces accessibility-based planning principles aimed at strengthening territorial cohesion and improving functional integration across the national territory. The concepts of “60-minute Slovenia,” “30-minute regions,” and “15-minute local centres” represent key elements of this strategic framework. These principles establish accessibility targets and guide infrastructure investments toward areas where improved connectivity can most effectively support balanced development.

The “60-minute Slovenia” concept aims to ensure that most of the population can reach a first-level urban centre within approximately one hour, emphasizing the importance of national accessibility for economic and social integration. By strengthening connections between major cities and surrounding regions, this principle supports functional urban areas and labour mobility. Similarly, the “30-minute regions” concept focuses on regional accessibility by enabling residents to reach regional centres within reasonable travel times, strengthening regional labour markets and improving access to services such as education, healthcare, and administration.

At the local scale, the “15-minute local centres” concept reflects contemporary planning approaches promoting compact development and sustainable mobility. By encouraging settlements where essential services are accessible within short travel distances, this approach contributes to improved quality of life, reduced dependence on private car use, and more efficient land-use patterns. Together, these accessibility principles illustrate how transport infrastructure planning can be integrated with spatial planning strategies to guide settlement development in a more balanced and sustainable way.

The planned modernization of Slovenia’s transport infrastructure will play an important role in achieving these spatial objectives. Railway modernization projects, including the second track between Divača and Koper and upgrades of key rail corridors, are expected to improve the competitiveness of rail transport. Faster and more reliable connections between major cities could reshape commuting patterns and strengthen functional integration between urban regions. Improved rail accessibility may also support the development of smaller towns as residential locations while maintaining strong economic links with larger urban centres.

At the same time, road projects such as the Third Development Axis aim to improve connectivity in regions with weaker accessibility. By strengthening north–south connections, these projects may stimulate economic development in peripheral areas and reduce regional disparities. Improved road connectivity may also support the development of regional economic clusters by facilitating more efficient movement of goods and labour.

Freight transport and logistics infrastructure also play a central role in Slovenia’s spatial development strategy. The development of intermodal hubs and logistics centres in cities such as Ljubljana, Maribor, and Koper is expected to strengthen Slovenia’s role as a transport gateway between Central Europe and the Adriatic region. The Port of Koper is particularly significant as a maritime hub linking European markets with global trade networks, and improved rail and road connections to the port will further enhance its strategic importance.

Nevertheless, infrastructure expansion also presents planning challenges. Without careful coordination with land-use and regional development strategies, new investments may contribute to urban sprawl or excessive concentration in dominant urban centres. Infrastructure development may also increase land consumption, fragment natural habitats, and contribute to transport-related emissions.

For these reasons, integrated spatial and transport planning remains essential for achieving sustainable spatial development. Transport infrastructure should not be planned solely according to mobility needs but must also consider broader territorial, environmental, and social objectives. The Slovenian spatial planning framework recognizes this requirement by emphasizing coordinated planning across sectors and governance levels.

Looking ahead, the continued development of Slovenia’s transport infrastructure will likely have significant implications for the country’s spatial organization. Improved connectivity between urban centres may strengthen the existing polycentric settlement structure by reinforcing functional relationships between cities and regions. At the same time, improved accessibility may encourage new patterns of residential development and commuting, reshaping the spatial distribution of population and economic activities.

Ultimately, the success of these developments will depend on the ability of spatial planning institutions to guide infrastructure investments in ways that support balanced territorial development. By integrating transport planning with spatial development strategies, Slovenia has the opportunity to strengthen its polycentric settlement system, improve accessibility across regions, and enhance its role within European transport networks. Transport infrastructure should therefore be understood not only as a technical system facilitating

mobility but also as a key instrument shaping the long-term spatial structure, economic competitiveness, and sustainability of the national territory.

The integrative case-study approach used in this paper—combining theoretical insights with policy document analysis—proved effective for evaluating how national planning goals align with established spatial development theories. This framework enabled a qualitative assessment of infrastructure impacts, particularly regarding accessibility, polycentric development, and regional cohesion. However, the approach relies on planned scenarios and policy assumptions; therefore, the findings should be interpreted as analytical insights rather than predictive outcomes. Future research could expand this work through comparative case studies in other national contexts or by incorporating quantitative modelling techniques such as LUTI or spatial equilibrium models. Previous research also indicates that transport infrastructure can generate spatial spillover effects influencing regional economic development beyond the immediate investment area (Yin et al., 2024).

Future spatial planning priorities in Slovenia should therefore focus on continued railway modernization and the development of integrated multimodal transport systems to support sustainable mobility and strengthen national and international connectivity. At the same time, transport investments should prioritize improving accessibility in structurally weaker and peripheral regions while reinforcing the polycentric settlement structure, thereby contributing to balanced territorial development and the broader objectives of European territorial cohesion.

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