TRAFFIC CONNECTION AS A KEY FACTOR OF ECONOMIC DEVELOPMENT

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Abstract: *Traffic connection and modern transport infrastructure are one of the key factors of economic development. The need for everyday travel to citizens of different business goals, as well as ordinary daily or occasional migration of the population, have a significant impact on the mobility system. Creating a network of modern roads and developing smart traffic infrastructure is a precondition for a sustainable transport system. At the same time, developing a network of modern roads and smart infrastructure has a crucial impact on the development of an efficient and well-connected sustainable mobility system. Good traffic connectivity and multimodal transportation are key to a sustainable mobility system. Such a mobility system will provide greater comfort, flexibility, faster travel, reliability and traffic safety. For a sustainable transport system in the future, it is crucial to meet the needs for smart sustainable mobility solutions. It is therefore necessary to develop new solutions that increase the accessibility of the infrastructure, optimize bandwidth and improve the quality of transport services. Traffic connectivity with smart traffic infrastructure that needs to be digitized and automated should provide future conditions for connected and automated mobility. A sustainable transport system with such a concept of smart mobility will ensure economic growth and development and improved traffic safety.*

Key words*: traffic connection, sustainable traffic system, smart mobility.*

1. INTRODUCTION

Transport and infrastructure are one of the key factors for economic and economic development as well as the ability to attract investors for new investments. The daily journeys of citizens with different business goals, as well as the usual daily or occasional migration of the population, significantly affect the mobility system. Creating a network of modern roads and developing smart transport infrastructure has a key impact on the development of an efficient and well-connected mobility system. The interconnection of different transport modules (airport, rail, road) is crucial for a sustainable mobility system. Such a system should provide maximum comfort, shorter travel from destination to destination and safe and reliable travel. Addressing the transport needs of the 500 million citizens of the European Union (EU) for travel as well as the needs of the transport economy, while considering resource and environmental constraints, is a priority for the future mobility system. As a key problem, and as the analysis shows, in the transport sector, a significant and still growing source of greenhouse gases, a reduction of at least 60% of greenhouse gas emissions is required by 2050 compared to 1990 [1]. By 2030, the target will be a reduction to about 20% below their 2008 level.

Taking into account the fact that transport has become cleaner and more energy efficient, fossil fuels are still used for 96% of transport energy needs in the EU. Its increased volume implies that it remains a major source of noise and local air pollution. New technologies for vehicles and traffic management will be key in reducing emissions in the European Economic Area (EEA). However, without the support of an adequate network of modern roads and its smart use, no qualitative changes in the transport system are possible. In general, investments in transport infrastructure and transport connectivity have a positive effect on economic growth, create prosperity and new jobs, and enhance trade, accessibility and mobility of people.

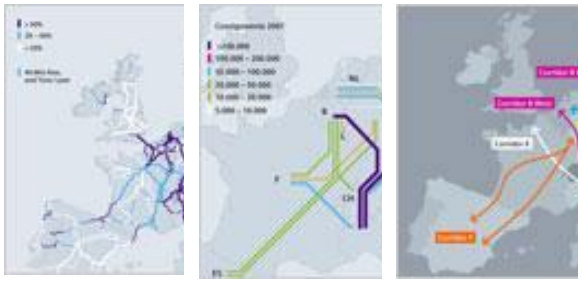
2. TRAFFIC CONNECTION AND ECONOMIC GROWTH

Transport as a condition of economic growth and development requires the construction of the necessary modern roads and the integration of national road networks into a single network of roads in a particular economic area. In concrete terms, an important prerequisite for the economic development and development of all its members is the linking of the basic transport infrastructure network with the trans-European networks and corridors as one of the basic objectives. Efforts are therefore constantly being made to enable the necessary roads to be built and to integrate national road networks into a single Trans-European Network-Transport (TEN-T).

2.1. Trans-European Road Network

The creation of such a European network results in the removal of bottlenecks and the integration of certain areas into a common road system, which would be a basic prerequisite for a sustainable transport system and economic development. This approach allows the 500 million EU population to be distributed evenly, as some countries and regions are more populated than others, such as the Benelux countries, the German border area, as well as England and northern Italy. Traffic flows are closely related to population density. Some key sources of transport are industrial enterprises, such as the automotive, mining, and marine and airports for the import and export of goods. The main destinations are cities and metropolitan areas, energy companies, ports and other transshipment points. The main features of such transport interconnections are: cross-border traffic,

transport volume, causes of economic development, consequences for rail development, trans-European road network and degree of completion of the TEN-T corridor. Figure 1 shows the great importance of cross-border (international) traffic in Central Europe and through the South-East Corridor.



The most important traffic flows | Volume of transport | Causes of development

Figure 1. Overview of basic traffic connection features, Source: [4]

The main routes with an international traffic share of more than 50% are:

- The hinterland serving the ports of Amsterdam, Rotterdam and Antwerp and traffic through the Benelux countries, Trans-Alpine traffic, West-east traffic through the Baltic States, North-south traffic through Poland and West-east traffic on the Czech Republic-Slovakia-Hungary corridor and further east .

The leading demand routes based on the annual shipment are:

- Germany - Italy, with almost 300,000 shipments in each direction,
- Belgium - Italy, with more than 100,000 shipments in each direction,
- Austria - Germany (about 75,000 / 56,000 shipments),
- Germany - Poland (about 67,000 / 46,000 shipments),
- Austria - Italy (about 47,000 / 44,000 shipments).

Combined traffic on the European South East Corridor continues to grow in importance. This growth is fueled by economic relations between Europe and Turkey, such as important ports on the Black Sea and the economic development of new EU Member States. That is why the EU-funded Trend Project defines the main freight corridors according to the main material goods flows. Freight rail is also gaining importance far beyond the EU. As international rail transport becomes more and more important, national rail transport is also more important, especially because of the increasing need for environmental awareness.

The idea of the Trans-European Network (TEN) emerged in the late 1980s as a precondition for creating an integrated European market. The basic idea was that flexible passenger and freight traffic is difficult to achieve without adequate network infrastructure for energy, telecommunications and transport. Therefore, the objective of the Trans-European Transport Network (TEN-T) is to ensure an efficient and reliable transport system by creating a standardized multimodal network in terms of infrastructure, vehicles and traffic management. The network includes air, water, rail and road transport. The European Commission has defined 30 priority projects for completion by 2020. Priority projects include 18 projects in the field of rail links, three mixed projects in the area of rail-roads and two projects in inland waterways.

These projects have sent clear signals towards the development of environmentally sustainable transport systems. The Trans-European Corridor Network, in line with the proposal for a Regulation on the EU Guidelines for the development of the Trans-European

Transport Network and the Connecting Europe Facility for Transport, Energy and Information and Communication Infrastructures, would be developed on the basis of a two-tier approach, consisting of a comprehensive and core network, Figure 2.

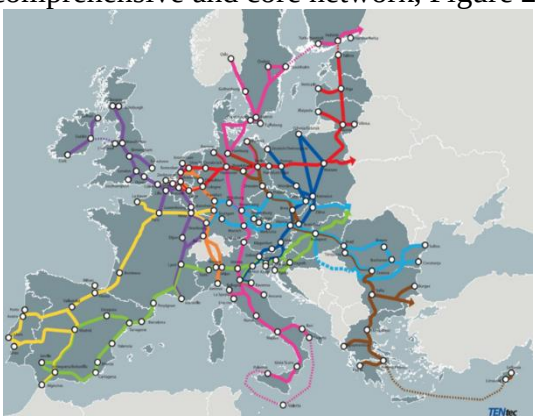


Figure 2. View of TEN corridor network, Source [4]

The comprehensive network includes all existing and planned infrastructure that meets the requirements of the Guidelines and should be in place by 31 December 2050 at the latest.
The core network includes only those parts of the comprehensive network that are strategically most significant and should be established by 31 December 2030 at the latest. The European Commission Decision on 18 October 2013 defined nine corridors of the EU Basic Transport Network as the backbone for the connection of 94 major European ports and 38 key airports with rail and roads in the capitals of European countries, and the development of 15 thousand kilometers of railway infrastructure capable of achieving satisfactory speed for passenger and freight trains, as well as 35 border crossings. These nine corridors are a priority for European Union transport policy, which is why an additional € 26 billion financial facility called CEF (Connecting Europe Facility-CEF) has been set up, from which Member States can also finance projects in addition to existing structural and cohesion funds. these corridors on the basis of calls for proposals by the European Commission. The network of nine corridors consists of corridors: Baltic-Adriatic, North Sea-Baltic, Mediterranean, Middle East-Eastern Mediterranean, Scandinavian-Mediterranean, Rhine-Alpine, Atlantic, North Sea-Mediterranean, Rhine-Danube. Each must include three types of transport infrastructure, passing through three Member States and two border crossings.

2.2. Economic effects of transport connectivity

At the meeting held in the first half of this year in Ljubljana, there were no changes in the previously established plans of the European Network of nine key corridors, related to the EU's strategic transport routes. Investments in all trans-European corridors were considered. The most valuable investments in all the trans-European corridors are currently the construction of a waterway between France and Belgium worth around one billion euros, the extension of the Brenner tunnel worth 879 million euros and the construction of the 814 million euro high-speed Lyon-Turin railway [b]. Of the investments made in the new EU member states, the largest amount was provided by Romania, in the reconstruction of the Brasov-Simeria line of close to EUR 800 million [6].

The EU expects that by the completion of all nine corridors by 2030, 13 million new jobs will be created and new economic activity of 8% of EU GDP will be achieved. Of the Western Balkan countries, Croatia is the only EU Member State on two of the nine corridors mentioned, the Baltic-Adriatic and the Rhine-Danube direction. Within these two corridors, there are two major strategic transport projects in Croatia that the Union is ready to co-finance in a high percentage, the railway from the Hungarian border across Zagreb to Rijeka and the Zagreb-Ljubljana railway line.

2.3. Transport connection of B&H

B&H Transport Connectivity is based on the Framework Transport Strategy developed in accordance with the B&H Framework Transport Policy 2015-2030. This document is a framework and basic document on the basis of which the development strategy, laws, plans, programs, regulations and decisions on the process of development of the transport sector will be created. Horizontal Goal in the B&H Transport Framework Policy 2015-2030. is set for the country's integration into the EU, following the Land Transport Protocol incorporated into the Stabilization and Association Agreement. Consequently, the transport sector must contribute to sustainable and stable economic development through four general objectives: to ensure institutional efficiency, to ensure financial sustainability, to stimulate economic development, to address environmental and social impacts, and to comply with EU standards and regulation.

Part of the B&H road network has international strategic importance in the Western Balkans region due to its inclusion in the SEETO comprehensive network.[51] In this regard, the comprehensive network identified by the SEETO Memorandum of Understanding should be seen as a multimodal regional transport network, which is the basis for the implementation of transport investment programs. In addition, on 27 August 2015, during the Western Balkans Summit 6 (WB6) held in Vienna, representatives of WB6 and the European Union reached an agreement on an indicative extension of the Trans-European Transport Network in the Balkans. As a result of this agreement, the entire SEETO comprehensive network is now integrated into the TEN-T network. In this regard, the map shows all road sections that are part of Europe's TEN-T core and comprehensive network, Figure 3.

WB6 Annex 1 includes a list of "pre-identified projects", ie. identification of priority works and studies to improve the quality of infrastructure at the extension of the TEN-T corridor and core network in the Western Balkans. As regards the B&H road network, the projects in Annex 1 WB6 are clearly identified. The list of pre-identified projects highlights the importance of cross-border projects (B&H-Croatia) for the implementation of the Mediterranean Corridor and the TEN-T extension of the core network. Figure 3 shows the connection between the TEN-T and the SEETO comprehensive network. In this respect, the map clearly states that the SEETO comprehensive routes and corridors (R1, R2a, R2b, R3 and Vc) form part of the Trans-European Transport Network. It is important to note that the indicative extension of the Western Balkans TEN-T network is grouped into SEETO "routes" and "corridors": the existing ones are coded according to the adopted "traditional" codification previously used by the "Pan-European Corridors". Thus, "Corridor Vc" stands for the southern extension of the former "Pan-European Corridor V".

[51]SEETO (South East Europe Transport Observatory) is a regional transport organization established by the Memorandum of Understanding for the Development of a Regional Transport Network (MoU) signed on June 11, 2004 by the Governments of Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Montenegro and Serbia and the United Nations Mission in Kosovo and the European Commission.

Figure 3. SEETO comprehensive routes and corridors, Source: [7]

At the Ljubljana meeting, a meeting was held on the Union's transport connection with the Western Balkan countries, transport routes that would go to B&H, Serbia and Macedonia, and further to Turkey, and that would place Croatia more significantly in the Union's transport plans, not included in strategic trans-European projects . The possibility of further consideration could come in 2021.

3. SUSTAINABLE MOBILITY SYSTEM

People today expect and need solutions that make their daily mobility easier, more flexible, faster, more reliable and more affordable. Cities and national economies, on the other hand, face the challenge of reducing transport costs, space requirements, noise and CO2 emissions. The pressure on mobility providers and policy makers to meet these mobility and transport requirements is not only high, but growing. It is estimated that by 2050 the urban population will exceed 70%. Faced with these growing demands, the transportation industry is looking for solutions that will take existing transportation infrastructure to the next level. Therefore, mobility needs to be made safer, faster, more convenient and more fun. People want to travel easier, easier and more comfortable and therefore need timely information and data. With this approach, digitalisation and mobility automation give a new role and importance, as they enable fast data flow, better accessibility, information and quality of service delivery.

3.1. Smart mobility

In an increasingly urban world, ensuring efficient transportation is a key challenge for both the city and the mobility providers. Smart solutions not only allow mobility providers to respond quickly to any situation, they also allow them to anticipate. In this context, digital solutions provide an enhanced and modern travel experience with constant internet access and customized services. Therefore, the development of smart urban mobility through digital solutions is a roadmap for improving urban multimodal transport and mobility management. The digital planning and operations of mobility providers in order to increase their efficiency in managing intelligent and integrated software solutions makes full sense. Applying innovative technologies in road or rail transport and helping to assess the impact on their business is another important challenge within the smart mobility solution. New trends in Europe show the introduction of free public transport. Free transport in Europe five years ago introduced the city of Tallinn, the capital of Estonia. In the first half of this year, the French city of Dunkirk became the largest European city with free public transport. This is a trend showing that the idea of introducing free public transport is expanding, with free public transport already introduced in 60 cities in Europe.
By 2021, a single road, rail and air transport ticket should be operational within the European Union as one of the measures on the EU's transport future. The prerequisite for the introduction of a single ticket is the ongoing digitalisation of transport infrastructure throughout the EU. The new vision is an easy, fast and cheap transportation for EU citizens. Expansion

of the use of electric vehicles in the Union is expected from 2021, which will depend on the forthcoming decision by the European Commission to maximize the use of electric cars in the work of public institutions and agencies of EU Member States.

3.2. Green mobility and energy efficiency

Some solutions show how green carbon-free mobility can become established and become a reality in transport by coordinating a number of energy efficiency measures, such as: electric buses on public transport, multimodal transport management, adaptive street lighting, adaptive traffic management, LED signaling systems, environmental protection through traffic management, etc. The use of electric buses in public transport shows that operating costs (energy and services) are about 25% lower than buses powered by internal combustion engines. The benefits of eBUS are the reduction of CO2 emissions, noise reduction and energy savings due to its excellent efficiency and optimized renewable energy. The concept of multimodal traffic management and the information system informs drivers of the current traffic situation and free parking and the timing of the arrival of the next tram, which shows that smart networking of the transport system module optimizes traffic and makes public transport more attractive to citizens, such as the city of Halle in Germany. Traffic and street lighting management require close coordination, with street lights automatically adjusting to the current traffic situation. At other times, such as late at night, lighting intensity can be reduced significantly, resulting in energy savings of up to 60%. Research has shown that adaptive traffic management or the Green Wave research has shown helping the city reduce CO2 emissions by a thousand tonnes a year, reducing congestion, noise and emissions. At the same time, it speeds up traffic by up to 15%, such as in Muenster, Germany.

LED-based signaling systems reduce energy costs by up to 90%. LED signal systems consume only a tenth of the energy of standard incandescent bulbs, but this is not the only reason more operators are adopting this new technology. LEDs also last ten times longer than conventional incandescent bulbs and are twice as cost effective.

3.3. Connected and automated mobility

Mobility under the current conditions is crossing a new, digital border by increasing automation and connectivity, allowing vehicles to "communicate" with each other, with road infrastructure and with other road users. These developments, driven by advances in artificial intelligence [2], are opening a whole new level of cooperation among road users. Connected mobility implies the integration and connectivity of vehicles with mobile technology, and above all internet connectivity. This will mean less accidents, less fuel consumption and less stress. Connected vehicles have a networked wireless communication between the vehicle, the infrastructure and the personal communication devices of the passengers. Electric cars that were once thought to be real only on film are now present in reality, on the road. They think ahead of us, they are safer, find free parking spaces, etc. Today's vehicles are already connected in many respects. However, in the very near future it will interact directly with and interact with the road infrastructure. Automated driving encompasses a wide range of technologies and infrastructures, opportunities and applications in different service cases, Figure 4. It should also be seen in the broader context of new developments in automation and connectivity enabled by new technologies and systems in mobility and other areas.

Figure 4. Automated driving and networking, Source: [8]

The implementation of a high level of automation and related mobility includes:

- connecting vehicles to a traffic situation (V2X): V2X technologies include the use of wireless technologies to achieve real-time two-way communication and how to adapt the ride to the road conditions in advance.
- vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) connectivity, with technology that enables cars to communicate with one another.

In the near future by 2020, coupled mobility and automated driving will take effect on highways, such as tractor-trailer traffic, and in cities at lower speeds such as garbage collection by lorries, full autonomous mobility should be achieved by 2030. Automated low-speed mobility in gardens, such as urban transport and urban small-vehicle delivery, should take place by 2020 for public transport. Travel to cities should be covered by up to 25% shared automated vehicles. All new vehicles should be connected to the Internet by 2022, and many of them can communicate directly with each other in their environment starting in 2019. New vehicles will be supported by free high-precision digital mapping services thanks to Galileo satellite data from 2019. How Europe does 23 % of world motor vehicle production, therefore, the vision is to be the world leader in fully autonomous safe mobility. Automated and connected vehicles will generate large amounts of data that can be shared through communication devices. This information has enormous potential to create new and personalized services and products that could radically alter existing business models, such as roadside assistance, vehicle insurance, vehicle repair, vehicle rental or the development of new ones.

4. CONCLUSION

Transport will have a key impact on the economic development of a particular area in the future. Requirements for a sustainable transport system and a smart sustainable mobility system will affect the creation of new solutions that will significantly change the way business and economic processes are managed. Smart, connected and automated mobility is likely to change the way we move and the way we use, sell and own vehicles. It will open new areas for business development and enable new mobility services. A comprehensive strategy can harness the potential of automated mobility while anticipating and mitigating new societal challenges.

In a rapidly changing world, B&H must take this opportunity to establish standards that will allow for better transport connectivity and quality improvement in providing safe, efficient, socially responsible and environmentally friendly mobility to its citizens.

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