

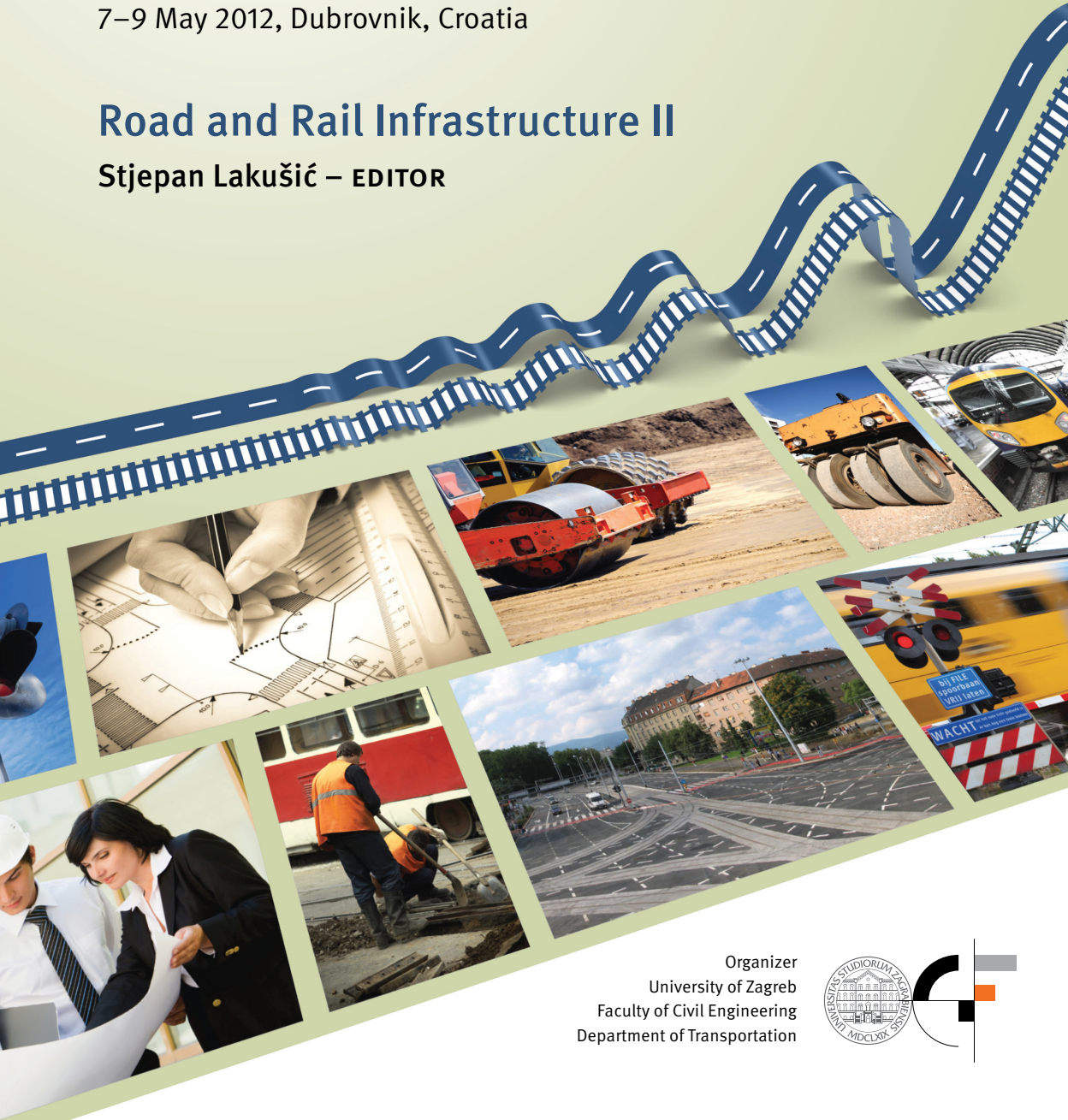


**CETRA**<sup>2012</sup>

2<sup>nd</sup> International Conference on Road and Rail Infrastructure  
7–9 May 2012, Dubrovnik, Croatia

## Road and Rail Infrastructure II

Stjepan Lakušić – EDITOR



Organizer  
University of Zagreb  
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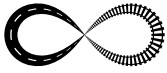
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## RAILWAY AS THE SOLUTION FOR ROAD CONGESTIONS

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### Abstract

The goal of this paper is to present rail as a sustainable means of transport and to point out the factors influencing passengers to change the modal split from car to train. The changes in modal split can be achieved by offering attractive timetables, obstacle-free access to railway stations and trains, high train frequency, well-performing information systems, comfortable and secure rolling stock and stations, and public awareness of rail and road passenger transport environmental impacts. Rail transport is a good solution for the reduction of road congestion at peak hours, reduction of external costs, increase of mobility (seniors, students, people with reduced mobility, etc.). In this paper, the economic, financial and social benefits are listed as well as the impact on the environment.

*Keywords: passenger rail transport, congestion, external costs*

### 1 Introduction

Our society and especially today's business life is structured by tight time-schedules. Time is a valuable good; therefore, passengers make destination-, route- or mode-choice decisions by taking into account both the travelling time and its value. Passengers calculate benefits for each alternative and choose the one which shows the highest usefulness. But what is the usefulness of a car stuck in a traffic jam? When choosing transport mode not only normal trip duration, but also the reliability of the arrival time is taken into account. Because time is a valuable good, the reliability of the transportation system is a decisive factor. If there is congestion on the road without additional lane for buses, even buses cannot keep their timetables because they are in congestion, too. In contrast, rail is independent of road traffic and congestion, so the train can keep its timetable and arrives on time. Public transport users consider a fair number of attributes of a trip, not only travelling time, when making their modal decisions: station access time, in-vehicle-time, reliability, number of transfers, time required for the transfers, headway, comfort (type of train set), quality of the station, in-train services, general cleanliness of the system, etc.

The challenge of the EU is to reduce the emissions and the energy consumption due to transport activities, in order to avoid or to reduce the related environmental impacts (mainly the air and noise pollution in urban areas, with the consequent effects on human health and on local and regional environment, and the production of greenhouse gases), without affecting the economic growth.

In the period 1994–2010 Slovenia was building the motorways network; therefore the investments in local roads and railway maintenance were poor. After the highway network had been built, a priority should have been the increasing of rural mobility. There are approximately 120,000 daily commuters in the Ljubljana urban area (OD home to work, and OD home to edu-

cation). The road congestion in peak hours occur daily on the main roads towards Ljubljana. The drivers on most routes have only one alternative, the bus, which cannot compete with personal transport due to long travel times (often there are no bus lines) and high fares. Additional roads could be built or the existing rail infrastructure could be used for the passenger transport. Modest but vital improvements in rail capacity can provide a viable alternative for commuters who face increasing congestion on the existing road network.

## 2 Parameters to increase the attractiveness of rail travel

Rail transport experienced a rapid decline in the second half of the 20th century, mainly due to the developments of roads and a change life style. There are several reasons for this. The EU goal is to achieve sustainable transport system and it is evident that a change is necessary so that travellers will again prefer to use a train instead of a car.. The success of railway public transport depends on three elements: the level and quality of the rail service, the level and quality of the access to the rail service and the characteristics of the area and population served. In a short term, rail operators have little influence on the characteristics of the population served, but they can control the level of service provided and the access to it. Therefore, efforts should be made to improve the level of rail service offered; mainly in terms of improved network coverage, shorter travel times, higher train frequency and higher service reliability. Such efforts focus on the actual train trip. Another option to increase rail use is to make rail services more accessible by wider geographical coverage of access services, shorter travel times to the railway station and better quality of service of travel to and from the station and at the interchange points between the modes of transport used to get to/from the station and the rail.

Efforts to increase rail use usually focus on the rail service itself while the accessibility of the rail network receives less attention, but the results of studies [4] shows that the satisfaction with the level and quality of the access to the station is an important parameter of the rail trip which influences the overall satisfaction. Good quality of access facilities to passengers will likely result in increased rail use. The quality of access facilities was found to be even more important for infrequent rail passengers, indicating that improving the access to the rail network has the potential to increase their use of rail and can attract new passengers.

Public passenger transport service requirements, target, and measure quality of service and guidance for the selection of related measurement methods are specified in European Standard SIST EN 13816:2003 [3]. Its use promotes the translation of customer expectations and perceptions of quality into viable, measurable, and manageable quality parameters and therefore this standard should be used by service providers in the presentation and monitoring of their services.

Standard SIST EN 13816:2003 sets out the comprehensive list of quality criteria and deals with aspects of performance measurement. Quality criteria are structured in three levels, where each successive level is more detailed. Level 1 contains eight criteria:

- 1 availability (criteria related to the geographical coverage of public transport services, public transport frequency, transport mode and distance to public transport),
- 2 accessibility (criteria related to the connection of public transport and other transport modes and physical access to public transport services – obstacle free access for public transport users, safe and appropriate parking area for cars and bicycles at public transport stations, etc.),
- 3 information (criteria related to data provided for trip planning and data provided during trip – information available to the user regarding the availability, accessibility, travel time, directing signs, etc.),
- 4 time (criteria related to time spent on planning and realization of travel – duration of trip, public transport punctuality and reliability, etc.),
- 5 care for customer (criterion related to the elements that makes easier and more enjoyable passenger trip – user orientated service, staff availability and attitude, providing help and

- information in case of unexpected event, providing help to disabled/young/senior passengers, etc.),
- 6 comfort (criteria related to the functionality of the equipment at railway stations and on rolling stock and the appearance of the station surroundings – stations and vehicles equipped with seats and space for passengers, comfort during trip, cleanliness, lighting and additional accessories and services like toilets, baggage space, accessibility to communications (Wi-Fi) at the station and on board, etc.),
  - 7 security (criteria related to the actual level of safety from crime or accident and the consequent sense of safety – lighting, video surveillance, presence of staff/police, emergency rescue, etc.),
  - 8 environmental impact (criteria related to the different effects that the public transport has on the environment – green house and noise emission, vibrations, energy consumption, etc.).

### 3 Benefits of modal split from road to rail

When comparing road and rail transport system, several benefits of rail passenger transport can be identified:

- economic benefits (employment, time and external cost effects, local development impact),
- financial benefits (costs of the trip by train and car)
- social benefits from the increased mobility (increase of access to education and medical care, personal independence),
- impact on the environment.
- .

#### 3.1 Economic benefit

There are several economic impacts of modal split change, namely the impact on the employment, time consumption, external costs and local development.

As employment is a primary means of income and self-sufficiency in society, access to employment is vital to achieving a number of social goals. Therefore, a lack of transportation can be a serious barrier to employment. The use of public transport to increase incomes and reduce dependency on welfare applies especially to persons without a car or persons unable to drive because of disabilities or other reasons. If these 'transportation disadvantaged' persons can be moved from a position of dependence on welfare funding to one of supporting themselves (and paying taxes), the benefits of this change are obviously substantial for the individual and society as a whole. Those transit systems that focused on trips to work generally had very large economic impacts.

There is a great amount of time losses caused by congestion. According to Handbook [2] the value of time is €24 for business passenger hour, €8 for commuting passenger hour and €3 for freight ton hour (average of €30 for HGV hour). Taking into account 1000 vehicles per hour losing 30 minutes in congestion in the morning and afternoon peak hour, such congestion causes the loss of 1,000 hours a day. Multiplied by values from the Handbook only time cost per hour amount to approx. € 12,000 per workday peak hour and to approx. € 3.1 million per year. If peak hours last longer than one hour the time cost is substantially higher.

There have been several studies on external costs on EU-level prepared (CAPRI, 1999; UNITE, 2003; INFRAS/IWW, 2004; CAFÉ, 2005; HEATCO, 2006; GRACE, 2007). In order to uniform conclusions and unit external costs of transport the Handbook was prepared. This Handbook provides unit costs for several external cost drivers in order to internalize external costs and include them in the cost-benefit analysis. In accordance with the Handbook the average unit values of external cost in are approx. 8 times higher on road (petrol cars) than on rail (electric trains) in urban areas and approx. 5 times higher in suburban/interurban areas (4.11€ct/pkm vs. 0.56€ct/pkm in urban area and 2.06€ct/pkm vs. 0.46€ct/pkm in interurban area). In the unit value of external costs noise, accidents, air pollution and climate change costs are included. Congestion costs are excluded. In case of 500 passengers they would cause €20 external

cost per kilometer on road and only €2.5 external cost per kilometre on rail. If there is 40 km trip, the total difference between road and rail users is €700 per trip. In other words, there would be benefit of passengers using rail instead of road in amount of €1,400, taking morning and afternoon peak hour into account. In one year (250 working days) the total difference between road and rail external costs amount to €350,000.

Transport infrastructure also impacts local development. The more developed infrastructure influences accessibility of an area, which becomes more interesting for investors. Good connections usually lead to growth of industrial and residential investments, and consequently to the development of the area. Similarly, congestion play an important role in the attractiveness of certain area.. Regular daily congestion, especially at peak hours, discourages both, potential investors and residents. Therefore, reducing congestion is an important indicator in the investor/resident decision process. With rural public transport system, areas that depend on tourism can experience greater levels of economic activity than they would otherwise. They can offer more attractive, less crowded environment to visitors. These tourist areas can also offer higher levels of personal service in restaurants, hotels or other business establishments. Consequently, such businesses increase employment opportunities for locals.

### 3.2 Financial benefit

Also financial aspect for passengers needs to be considered. The only cost for the passenger using railway is the price of a monthly ticket. The road user has to consider at least the following costs: fuel consumption, parking fee, vehicle amortization, registration fee and insurance. The following table is an example of the ratio between financial costs of rail and road trip, taking into account the prices in Slovenia for 2012.

**Table 1** Financial benefit of rail transport.

length [km]	costs [€]		ratio [%]
	road	rail	
20	8,16	3,90	48
55	14,04	7,68	55
70	14,54	8,77	60

### 3.3 Social benefits

Access to education enables travellers to increase their long-term chances of employment at a decent wage. Even when considering that not all persons will graduate and obtain full-time employment, the benefits of such trips are large.

Access to medical care and other social services enables the travellers to use services that increase their health and quality of life. Health centres are located in urban areas; therefore, rural rail connection is particularly vital for those persons without cars or those persons unable to drive because of disabilities, poverty, or other reasons. Trips to health centres are beneficial to those who are unable to drive home safely due to the consequences of their treatment.

For seniors, living in their own homes is often much more cost-effective than other alternatives, nursing home care being one of the most costly. Rural transit systems assist in enabling the continuation of independent living by providing persons without a car or those persons unable to drive because of disabilities the possibility of continuing live in their own homes rather than having to live in nursing homes. Benefits like these are especially relevant in the areas with large elderly populations. Such areas can obtain substantial benefits from



providing accessibility to medical treatment, shopping, social services, and personal needs, without which seniors would not be able to stay in their own homes.

### 3.4 Impacts on the environment

In EU, almost one third of all energy is used for transport, moreover; the use of energy for transport is increasing while other uses are relatively stable. In accordance with Energy balance sheets 2007–2008 [5] there was an increase in energy consumption in transport sector in Slovenia by 17% between 2007 and 2008. The energy consumption remained the same in rail sector but increased by 17% in road sector. In the same period in EU27 energy consumption in transport sector remained almost the same; in the road sector decreased by 1% while increased by 1% in rail sector. Higher energy consumption in road sector leads to higher environment pollution. As explained in the Chapter 3.1 the external cost (monetized environmental impacts) are higher in the road sector than in the rail sector.

## 4 Conclusions

Although the above mentioned public transport system benefits (economic, financial, social, and environmental) appear to be obvious, they are far from universal. Most rural transportation systems were not established with specific economic objectives. In fact, many of their objectives are social in nature, such as access to work, education and health care services. This does not preclude economic benefits; it simply means that the economic benefits, where they occur, may be hard to find and to separate from social benefits.

To conclude, the effect of railway versus road, its requirements and its impact on several areas have been discussed. The success of rail public transport depends on three elements: the level and quality of the rail service, the level and quality of the access to the rail service, and the characteristics of the area and population served. The benefits of modal split from road to rail were introduced. Comparing the costs of rail trips and road trip, the former is almost half of price of the latter. Finally the effects of time and external costs were presented.

Transport demand is closely related to economic development. Transport is a very valuable and necessary part of modern society but widespread and increased traffic is recognized as a major contributor to an extensive range of undesirable side-effects. Traffic congestion makes cities less friendly and reduces the efficiency of the road transport system by increasing travelling time, fuel consumption and drivers' stress. Therefore, the transport mode is chosen not only according to normal trip duration, but also by the availability, accessibility, comfort and safety aspects. From this point of view, passenger rail transport is a good alternative to passenger road transport. Railway operators should promote activities to increase the attractiveness of rail transport mentioned above.

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