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**Conference Paper**

## Road Infrastructure and Regional Development: An Evidence From Croatia

46th Congress of the European Regional Science Association: "Enlargement, Southern Europe and the Mediterranean", August 30th - September 3rd, 2006, Volos, Greece

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Botric, Valerija; Sisinacki, Jelena; Skuflic, Lorena (2006) : Road Infrastructure and Regional Development: An Evidence From Croatia, 46th Congress of the European Regional Science Association: "Enlargement, Southern Europe and the Mediterranean", August 30th - September 3rd, 2006, Volos, Greece, European Regional Science Association (ERSA), Louvain-la-Neuve

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**ROAD INFRASTRUCTURE AND REGIONAL DEVELOPMENT:  
SOME EVIDENCE FROM CROATIA**

Paper prepared for the  
46<sup>th</sup> Congress of the European Regional Science Association  
Volos, Greece, August 30<sup>th</sup> - September 3<sup>rd</sup>, 2006

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**ABSTRACT:** It is a common belief that investment in transport infrastructure has a positive impact on regional development. Theories related to the interaction between infrastructure and regional development can be classified as: 1. Theory which suggests that infrastructure follows regional development, 2. Theory which underlines the importance of infrastructure development as a factor behind inducing regional development and 3. Balanced development that equally emphasizes the role of infrastructure and economic growth in the region. While it is quite easy to determine direct benefits of transport infrastructure development in term of reduced travel time, reduced vehicle operating costs as well as increased transport safety, the contributions to societal (regional) development as a whole i.e. evaluation methods, are subject to certain debates.

When analyzing recent development strategies, it can be argued that the Republic of Croatia is supporting the thesis that well-built infrastructure network is a prerequisite of regional development. In that context, intensive government investments in the highway programme are elaborated with expected positive effects on regional development. In this paper the case study of the so-called “Istrian Y”, highway that will improve transport connections within the County of Istria is selected to determine whether or not there is a justification for such a belief. Therefore, in this paper we aim to analyze the impact of the “Istrian Y” on selected indicators of County development. We expect that the positive effects of infrastructure development will be proven by the selected indicators, confirming that infrastructure can be considered to exert positive influence on regional development in the Croatian case.

JEL Classification: H4, R4

Key words: transport infrastructure, motorways, regional development, Croatia

## Introduction

The provision of good quality infrastructure<sup>1</sup> is often cited as the most important factor of local and regional development, through which the adequate conditions for the growth of new business and attraction of firms to less developed areas are provided. At the same time, the impact of infrastructure development on local and regional development is the subject of various discussions. For a long time, in a relevant literature there was a generally accepted belief that this relationship has a positive direction, i.e. "*post hoc, ergo propter hoc*" ("it happened after it was built so it must be because of it") (Judge, 1998). But recent studies, such as Goodwin's (2000) demonstrate that this argument is questionable and that, especially in the context of the European Union's (EU) regional policy, a revision of this assertion is needed. The aim of this paper is to present a theoretical approach to the link between transport infrastructure and regional development, followed by empirical evidence based on the Croatian example. In the first part we focus on the relationship between regional development and infrastructure. The second part is devoted to a narrower description of transport infrastructure and its potential effects on the encompassing area. The example of the interaction between transport infrastructure and regional development in the case of motorway building and the Istria region is provided in the third part. The paper ends with concluding remarks.

### 1. Infrastructure and Regional Development

Regional inequalities with diversified regional development are foreseen as a reality of all national as well as European Union policies<sup>2</sup>. Traditionally, regional economics has explained income differences on the basis of differences between regions in their endowments of natural resources, factors of production, infrastructure and technology. In that context, the removal of obstacles to the movement of goods and factors would itself cause convergence of factor returns and living standards. Underdeveloped infrastructure can be considered as important

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<sup>1</sup> Infrastructure in a *narrow definition* refers to the transport infrastructure, IT, energy sector and public utilities while *broader definition* of infrastructure also includes health system, science and education, culture and police. (Ladavac, 1999) In the paper we are considering narrow definition of infrastructure.

<sup>2</sup> Nearly one quarter of the EU citizens live in regions eligible to receive assistance under Objective 1 of the Structural Funds, the main instrument of the EU regional policy. Recent analyses demonstrate that convergence

obstacle to the regional development, and its improvements should spur the economic growth in the region. This notion is well recognized in the relevant theoretical literature.

Richardson and Jensen (2000) indicate that spatial differences in the EU cannot be reduced without a fundamental improvement of transport infrastructure and services to and within the regions where a lack of access to transport and communications infrastructure restricts economic development. Improvements of accessibility are seen as a critical priority in the development of the polycentric urban systems<sup>3</sup> and precondition for inclusion of economic development within an overall spatial strategy of harmonization.

These theoretical considerations have also been integrated in the concrete political measures designed to improve chances of depressed regions' catching up. Even at the EU level infrastructure and in particular transport infrastructure through Trans European Transportation Networks (TENs) was used as a regional policy instrument that would foster the territorial cohesion of Member States.

At the beginning of the 1980s a scientific approach to infrastructure in the frame of economic development was initiated<sup>4</sup>. The reason for this is that standard cost benefit analysis (CBA), as an evaluation tool, considered only the direct benefits of infrastructure investments omitting a whole set of externalities. Additionally, many initiatives undertaken by the World Bank and similar organizations and institutions that promote economic development by investing into infrastructure projects have not fulfilled their goals; i.e. those investments did not achieve the foreseen results.

Many project-oriented studies were undertaken to investigate the role of economic and social impacts of transport infrastructure on the monitored area. To mention some of them, Harris (1974) performed a study on the impact of alternative motorway routes in regional development. Delayque (1969) conducted a study on the impact of motorway building on the

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on the national level has increased, while at the same time, within national economies, regional disparities have deepened. (Botrić, Rašić, Šišinački, 2004)

<sup>3</sup> The European Spatial Development Perspective (ESDP) has found polycentricity as an answer to the more balanced development. The ESDP promotes polycentricity at the EU level, firstly, to ensure a more regionally balanced development and, secondly, to enhance the EU competitiveness in the world market.

<sup>4</sup> An overview of research dedicated on the effectiveness of public infrastructure *versus* private initiatives and its impact on regional development through production function can be found in a paper written by Rovolis and Spence (1998). See also Biehl (1986), Batten and Karlsson (1996), Banister and Berechman (2000) and Rietveld and Bruinsma (1998).

development of the Rhone valley and Simmons (1991) on the impact of the Channel Tunnel on regions in France and England.

A study by Goodwin (2000) is among the first that thoroughly investigated the role of investment in transport infrastructure and the benefits accruing from them. Goodwin has analyzed reports from The Standing Advisory Committee on Trunk Road Assessment (SACTRA) and concluded the following:

- There are no automatic economic or employment benefits from new transport projects. Actually, some projects may even be harmful;
- For projects that produce economic benefits, the more economically deprived end of the link may still experience greater economic costs than benefits;
- Cost benefit analysis as currently undertaken fails to elaborate the true economic impacts;
- The link between transport growth and economic growth can be broken and especially in the cases when charges (tools) are levied to correct market distortions.

Based on Goodwin's research it can be generally concluded that while taking an infrastructure investment it is incorrect to intuitive assume positive interaction with regional development. For the future of the EU infrastructure projects, the EU (2002) has issued a revised edition of its guidance on the application of CBA to infrastructure projects that is more thoroughly requesting analysis, among other, upon impacts on regional development.

### **1.1. Complexity of Infrastructure and Development**

As it was stated in the previous part, it is unequivocal that infrastructure has an impact on economic development. According to Padjen (1996) there are three theories that explore the relationship between infrastructure and development:

- Development through a surplus of infrastructure;
- Development through a deficit of infrastructure;
- Balanced development.

When infrastructure capacity is higher than production, it is assumed that infrastructure will have an initial and inductive role in economic development. The rationale behind this

approach is that the existence of infrastructure is a prerequisite for the development of other activities. This concept is still used in less developed countries, as well as in Croatia, which will be elaborated in the forthcoming parts. However, experience has shown that physical infrastructure, i.e. objects *per se* cannot guarantee economic development.

If economic growth is based on development and growth of production, as a logical link a pressure to invest into new infrastructure will be created. The idea is that production will speed up investments into infrastructure and create growth potentials. Of course, a minimum of existing infrastructure is requested. This approach is usually applied in developed countries.

Balanced development is focused on the idea that only the simultaneous development of infrastructure and production is sustainable, explaining that infrastructure is an integral part of production chain and its function is economic growth.

These theories also provide the framework for analyzing the link between the transport infrastructure development and regional development. We thereby proceed with reviewing the literature on indicators of transport infrastructure.

## **2. Transport Infrastructure**

Transport infrastructure has a specific role in regional development. For a long time it was assumed that transport infrastructure has only a positive impact on regional development. However, the role of transport infrastructure on regional development is evaluated through direct but also indirect effects, albeit whether they are positive or negative ones. (Padjen, 1996) Here, we only briefly discuss direct and indirect effects.

## 2.1. Direct Effects

Building of transport infrastructure directly influences transport costs<sup>5</sup>. These changes are followed by a decrease in fuel consumption, capital consumption as well as a decrease of the related compensations for employees. Changes are followed by changes in transport mode, transport route, time horizon and accessibility of movements within the region. (Ladavac, 1999)

Reduction of transport costs combined with migration changes of households and business location leads to the increased productivity of the regions. Within households, decrease in travel times leads to the achievement of the same level of productivity but also consumption in a shorter time. It also stimulates elasticity relating to the migration process. Within the business sector, transport improvements lead to the effectiveness of production and positive impact on the 'just in time' principle. In the labour market, commuting time is significantly reduced.

Reduction of transport costs also leads to the increased accessibility of the region. Increased productivity and increased regional accessibility could impose an increase of economic activity. Vickerman (1991) summarizes such effects into two groups: 1. Objectively measured effects, reflecting changes in inputs and outputs of industries due to the changes in transport and 2. Subjective effects referring to changes in the perception of a region.

## 2.2. Indirect Effects

Indirect impact of building of transport infrastructure can be analyzed through changes of attractiveness of the monitored region, size of movement of goods and services and changes in the size of transport costs, i.e. changes in relative competitiveness of the regions. In addition to these changes, indirect effects also refer to changes in the environment, i.e. noise, air pollution, changes in the landscape, etc.

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<sup>5</sup> The traditional approach to the evaluation of the building of a new motorway usually focuses on reductions in journey times, increased safety and reduction in vehicle operating costs.



If the region is less developed, under indirect effects another two categories of impacts are considered; impacts on income and impacts on capacity.

*Impacts on income* are impacts derived from the time travel savings and reductions in vehicle operating costs, which directly influences the size of transportation costs. Within this category alone indirect benefits from the development changes within the region are considered, such as improvements from the building of new or improved existing infrastructure.

*Impacts on capacity* refer to the increase of regional production capacities. For example, increased transport capacity can increase the export potential of the monitored regions.

Within developed regions, changes in transport may bring only marginal benefits so transport improvements have the greatest impact when they remove a former bottleneck. (EC, 1996)

Nijkamp et al (2002) have summarized the basic effects of motorway building as shown in the following Table 1:

**Table 1 Impacts of motorway building**

<b>Transport economics</b>	<b>Effects on environment and landscape</b>	<b>Effects on regional development</b>
<ul style="list-style-type: none"> <li>- increased travel safety</li> <li>- reduction in journey time</li> <li>- increased travel comfort</li> <li>- reduced operating costs</li> <li>- lower maintenance costs</li> <li>- user benefits</li> </ul>	<ul style="list-style-type: none"> <li>- noise</li> <li>- air pollution</li> <li>- water pollution</li> <li>- vibrations</li> <li>- change of landscape</li> <li>- conservation of nature</li> <li>- land development</li> </ul>	<ul style="list-style-type: none"> <li>- regional economic growth</li> <li>- employment increase</li> <li>- effects on trade, industry and tourism</li> </ul>

Source: Nijkamp, P., Ubbels, B., Verhoef, E. (2002): "Transport Investment Appraisal and the Environment", [Tinbergen Institute Discussion Paper TI 2002-104/3](#).

In 1996, the European Commission Directorate General for Transport issued a manual on methodologies for transport impact assessment that also includes impact on regional development (EC, 1996). According to this, APAS methodology (Action de Promotion, d'Accompagnement et Suivi et autres activites), impacts of transport infrastructure on regional development can be seen through:

- direct effects - analyzed through changes in employment,
- induced effects - changes in the accessibility character of a region, and
- catalyst effects - impact on other policy instruments.

All three effects are analyzed on different spatial levels, time framework and sectors (see Table 2-4).

**Table 2 Socio-economic impacts of new motorway on different spatial levels**

	Local level	Regional level	National level
<b>Direct Effects</b>	Increased Employment in Construction Sector	Wide service sector employment due to multiplier effect	
<b>Induced Effects</b>	Increased office rents close to new interchanges	Decentralization of households into areas with enhanced accessibility	Increased competitiveness of firms because of reduced travel costs
<b>Catalyst Effects</b>	Increased business employment due to enhanced perception of area		

Source: European Commission (1996): "APAS - Methodologies for transport impact assessment". Luxembourg: Office for Official Publications of the European Communities.

**Table 3 Socio-economic impacts of new motorway at different temporal levels**

	Short term	Medium term	Long term
<b>Direct Effects</b>	Increased Employment in Construction Sector		
<b>Induced Effects</b>	Some anticipatory relocation of households into improved corridors	Some agglomeration of firms close to interchanges	Further movements of firms and households, away from area due to congestion and high rents
<b>Catalyst Effects</b>	Additional employment in landscaping projects		

Source: European Commission (1996): "APAS - Methodologies for transport impact assessment". Luxembourg: Office for Official Publications of the European Communities.

**Table 4 Socio-economic impacts of new motorway on different sectors**

	Low income households	High income households	Manufacturing	Service
<b>Direct Effects</b>	Increased casual employment in the construction sector			Spin-off business for service sector due to increased local construction expenditure
<b>Induced Effects</b>		Reallocation into affected corridors by car owning households	Increased profits due to reduced transport costs	Reallocation to newly accessible nodes
<b>Catalyst Effects</b>	Some increased employment			Some relocation due to improved perception of area

Source: European Commission (1996): "APAS - Methodologies for transport impact assessment". Luxembourg: Office for Official Publications of the European Communities.

Based on the APAS methodology, in the following part of the paper we will analyze the impact of the motorway construction on the regional development in the case of Croatia.

### 3. A Croatian Case Study

During the late 1960s Croatia also used appraisal techniques to assess the impacts of transport infrastructure on development. In 1969, the first study on the social and economic impacts of motorway building in Croatia was produced, while two years later methods of capital budgeting for road building were systematized and obligatory applied in a project analysis. In 1970 a study called "Motorway Rijeka – tunnel – Buzet – Trst" was the first study that also included indirect benefits assessment of its building, and it also investigated demographic and economic factors. Another important year is 1972 when a handbook on economic evaluation of toll roads in Croatia was produced in co-operation with the company Dorsch – Berger, and with the approval of the IBRD. In the following years, studies on the direct and indirect impacts of road building have become an integral part of technical documentation.

In 2000 the Croatian Civic Institute and the Institute of Economics in Zagreb have produced a study on cost benefit analysis of 10 Croatian highways, which also set up a framework for the implementation of the SASI model in Croatia. Today, a revision of the CBA study has being made. Additionally, a whole set of individual studies were made: to mention some of them in 1994 PROGROS (1994) did a study on the Istrian Y, Louis Berger on the motorways Zagreb - Goričan (1999a) and Zagreb - Rijeka (1999b). (Šišinački, 2005)

On gaining its independence, the Croatian transport system could be described as full of missing links and badly maintained infrastructure, which only worsened with the war damages during the Homeland war from 1991-1995.

However, by defining Paneuropean transport corridors in Crete in 1994 and later on in Helsinki in 1997<sup>6</sup> and by adoption of the Croatian spatial as well as transport development

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<sup>6</sup> Transeuropean corridors that goes through Croatian territory are:

- *V. Corridor* Venice –Trieste – Ljubljana – Uzgorod – Lvov (Section B: Rijeka – Zagreb – Budapest; Section B1: Zagreb – Oštarije – Knin - Split and Section B2: Rijeka - Trieste as well as Section C: Sarajevo – Ploče – Osijek - Budapest)
- *VII. Corridor* Danube river corridor

strategies attitude towards the role of transport infrastructure, and in particular road infrastructure in the context of regional development, has significantly changed. Today, building of road infrastructure and transport policy in general is seen as a main factor for the cohesion of Croatian territory and furthermore with European space. As an example, the mid-term action plan for motorway building and maintenance (Vlada Republike Hrvatske, 2004) is explicitly proclaiming that intensive investments in building of motorway network are seen as the main factor that will improve territorial cohesion of Croatia.

### 3.1. Croatian Road Infrastructure

Croatian roads are classified into state roads, regional roads and local roads.<sup>7</sup> The following Table 5 presents the current system of public roads in Croatia:

**Table 5 Public Road Network in Croatia, 2004**

	<b>Croatia</b>	<b>Structure, in %</b>
(1)	(2)	(3)
<b>Road network, in km</b>	<b>27,840</b>	<b>100.00 %</b>
<b>State roads, in km</b>	6,934	24.91 %
<b>County roads, in km</b>	10,604	38.09 %
<b>Local roads, in km</b>	10,535	37.84 %

Data source: Vlada Republike Hrvatske (2004): "Program građenja i održavanja javnih cesta za razdoblje od 2005. do 2008. godine". Zagreb: Vlada Republike Hrvatske.

*Motorways* are treated as state roads and currently 1,020.5 km or 14.71% of the state roads are in operation, out of which 98% are tolled. In a four-year period from 2001 till 2004 another 341 km of motorways have been built and put into operation while for the next mid-term period from 2005 to 2008 building of a further 1,000 km is planned.

- *X. Corridor* Salzburg – Ljubljana – Zagreb – Beograd – Niš – Skopje – Veles – Thessalonica (Section A: Graz – Maribor – Zagreb)

<sup>7</sup> According to the definition, *state roads* are those that connect the Croatian territory with European space. *County roads* connect county centers with towns and municipalities, roads that mutually connect towns and municipalities and access roads to the motorways. *Local roads* are those that connect towns and municipalities and roads that connect transport, historical, economic and tourist sights of local significance with the public road network. (Official Gazette, 98/25)

**Table 6 Motorway network in Croatia, 2005**

<b>Motorways</b>	<b>2005</b>
(1)	(2)
<b>Motorway network, in km</b>	1,020.5
<b>No. of km under construction</b>	116.4
<b>New motorways, forecast for 2006 in km</b>	53.4
<b>AADT (light vehicles)</b>	14,080
<b>AADT (heavy vehicles)</b>	1,945
<b>AADT</b>	16.025
<b>Number of employees</b>	3,214

Data source: HUKA (2006): Monthly bulletin of the Croatian Association of Toll Motorways Concessionaires, No. 7/2006. Zagreb: HUKA.

Management over public roads is organized through several companies:

- company Hrvatske ceste (HC) is responsible for management over state roads and coordination over county and local roads;
- Company Hrvatske autoceste (HAC) manages Croatian motorways;
- County road departments are responsible for county and local roads.

Additionally, three concession companies are responsible for the operation of the motorways: Autocesta Rijeka-Zagreb, BINA-ISTRA and Autocesta Zagreb-Macelj.

Being aware of the importance of the motorway network and its socio-economic benefits, the Croatian Government has issued a study on socio economic impacts of motorways in Croatia in 2000 (Bendeković, 2000) and its revised edition in 2005. The importance of both studies is that through the implementation of the benefit-cost analysis effects of the whole motorway network on regions that it encompasses has been analyzed. The results of the analysis are presented in Table 7.

**Table 7 Development effects of the motorway network in Croatia**

Motorway section	Forecasted period	GDP, cumulative, in mil. USD			GDP growths, in %	
		Scenario without motorway	Scenario with motorway	Indirect effect	Scenario without motorway	Scenario with motorway
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Bosiljevo-Sveti Rok</b>	2005-2034	42,6	47,1	<b>4,486</b>	5,486	5,969
<b>Sveti Rok-Split</b>	2005-2034	184,0	213,9	<b>29,847</b>	4,992	5,699
<b>Zagreb-Macelj</b>	2005-2034	96,7	105,9	<b>9,211</b>	4,657	5,093
<b>Zagreb-Goričan</b>	2004-2033	86,2	94,4	<b>8,240</b>	4,767	5,201
<b>Rijeka-Karlovac</b>	2004-2033	137,0	154,6	<b>17,555</b>	4,964	5,545
<b>Istrian Y</b>	<b>2004-2033</b>	<b>96,4</b>	<b>105,7</b>	<b>9,216</b>	<b>4,962</b>	<b>5,389</b>
<b>Bregana-Bajakovo</b>	2004-2033	141,4	148,8	<b>7,424</b>	4,627	4,885
<b>Rupa-Rijeka-Otočac</b>	2007-2036	133,0	145,2	<b>12,151</b>	4,848	5,270
<b>Split-Metković-Ploče</b>	2007-2036	172,5	193,1	<b>20,662</b>	4,970	5,503
<b>B. Manastir-border RH/BIH-Ploče</b>	2007-2036	145,6	161,8	<b>16,267</b>	4,648	5,158

Source: Bendeković, J. (ed.) (2000.): "Svodna studija financijsko-tržišne opravdanosti autocesta u Republici Hrvatskoj." Zagreb: EIZ, IGH i HUC

As expected, indirect effect will be the most viable on the motorway section Sveti Rok-Split, motorway that is connecting tourist resorts Zadar, Šibenik and Split in Dalmatia. Previously, these two nodes were connected by a regional road, coastal road that especially during the summer was constantly confronting excessive traffic volumes. For the purpose of this paper we have chosen to further analyze the effects of construction of the motorway Istrian Y on the region that is encompasses and that is the County of Istria.

### 3.2. The Istrian Y motorway

In 1995 a BOT concession was awarded for the building of the so-called Istrian Y - motorway that will connect the northern part of the County of Istria<sup>8</sup> (Slovenian border and Tunnel Učka) with the south of the County of Istria (airport and port of the City of Pula).<sup>9</sup>

<sup>8</sup> The County of Istria is situated in the north-west part of the Croatian territory and it represents, apart from the City of Zagreb as the capital city, the most developed region in Croatia. It covers an area of 2,813 sq. km or 4.98% of the Croatian territory, with a total population of 206,334 or 4,65% of the total population of Croatia. It is a peninsula, a tourist resort, so a high quality transport network is a major priority.

The construction of the motorway has started in 1996. Its realization is divided into three phases:

- Phase 1A, that includes construction of the eastern branch of the motorway (Tunnel of Učka-Pazin-Pula, 65 km)
- Phase 1B, that includes construction of the western branch of the motorway (Slovenian border-Pula, 80 km)
- Phase 2 that comprises the expansion of the motorway from the single –carriageway road network into a two line dual – carriageway motorway network, when predefined traffic levels have been reached.

By the end of 2005, a total of 130 km of motorway (out of 145 km) has been built. Construction of the Phase 1A was completed and put into operation in 1999. Regarding Phase 1B, by the end of 2006 construction will be completed and the whole section will be put into operation.

Besides the motorway Istrian Y, two European road routes go by the Istrian peninsula:

- E-65 Gdansk – Budapest – Goričan – Zagreb – Rijeka – Pasjak – Trieste and
- E-80 Trieste – Rijeka – Split – Dubrovnik – Athens.

Through the Stability pact another important route is the Mediterranean-Ionic route going from Italy through Slovenia, Croatia, Montenegro, Serbia and Albania up to Greece, where more than half of the planned kilometers of motorways go through Croatia (Istria included).

In Table 8 the latest available data on road transport network in the County of Istria are presented while Figure 1 is presenting dynamics in road network building from 1995 till 2004 in the County of Istria.

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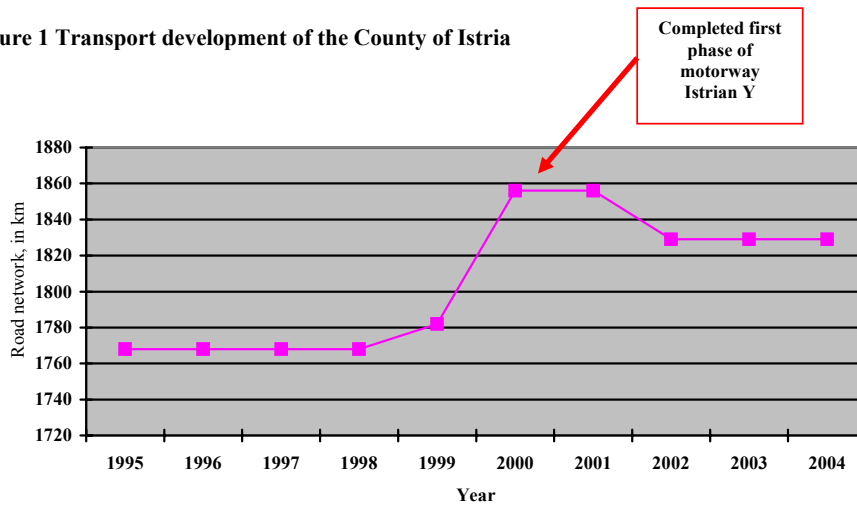
<sup>9</sup> BOT concession agreement for "Istrian Y" was the first example of public-private partnership (PPP) in Croatia. Agreement was signed between the Croatian Government and concession company BINA-Istra with majority ownership of the French Company Bouygues.

**Table 8 Road Network Development Indicators, County of Istria, 2004**

	Road network, in km	State roads, in km	County roads, in km	Local roads, in km	No. of km/1,000 inhabitants	No. of km /1,000 sq.km of surface
	(1)	(2)	(3)	(4)	(5)	(6)
<b>County of Istria</b>	<b>1.812</b>	<b>387</b>	<b>699</b>	<b>733</b>	<b>8.65</b>	<b>628.51</b>
<b>Structure, in %</b>	<b>6.40%</b>	5.12%	6.63%	7.07%	-	-
<b>Croatia</b>	<b>28,334</b>	7.378	10.193	10.269	5.82	492.38

Data source: Županijska uprava za ceste Pazin (2004): "Osnove plana razvitka županijskih i lokalnih cesta Istarske županije za period 2004.-2008. godine". Pazin: Županijska uprava za ceste.

**Figure 1 Transport development of the County of Istria**



Data source: Central Bureau of Statistics of the Republic of Croatia: "Statistical Yearbook", issues from 1995 till 2005. Zagreb: CBS.

As can be seen from the presented data, the case study we are interested in – the Istrian Y – has a significant impact on the overall road infrastructure in the region.

### 3.3. Effects of the motorway "Istrian Y" on regional development

Building of the motorway "Istrian Y" has as a goal to replace the inadequate connections between the County tourist resorts and to improve high quality connections with other Croatian counties and Slovenia.



Following the traditional approach in analysis of the effects of transport building, we are first analyzing direct effects of the motorway construction in the form of reduction in the journey times, reduction in the fuel consumption and vehicle operating costs and increased safety through the reduction of numbers of accidents.

### 3.3.1. Direct effects

The implementing of the connection between the Tunnel of Učka and the City of Pula and furthermore with Slovenian border have significantly affected journey times, as shown in the following table:

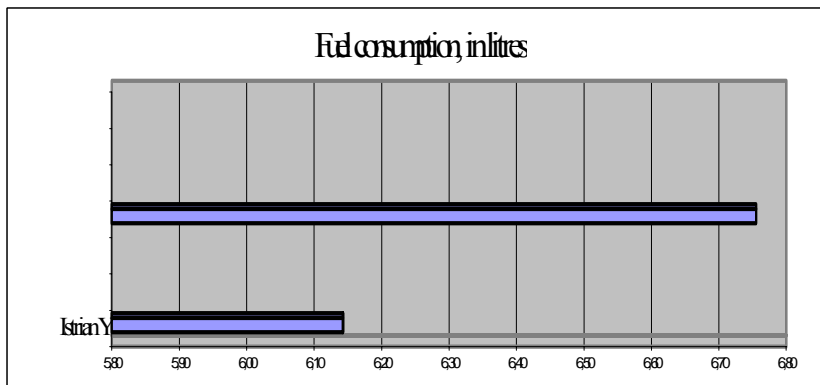
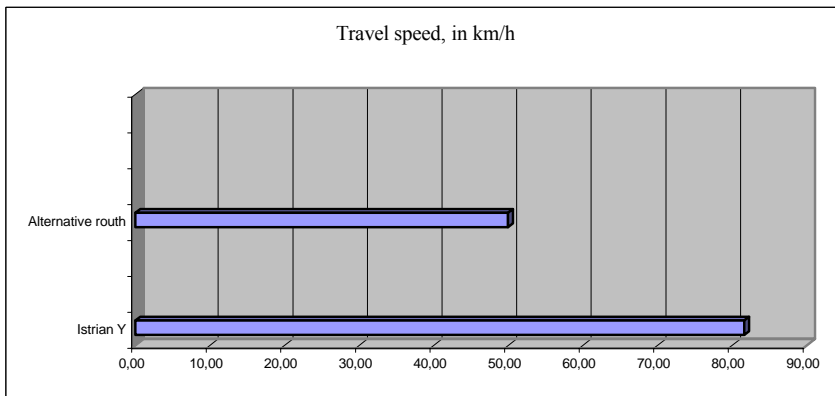
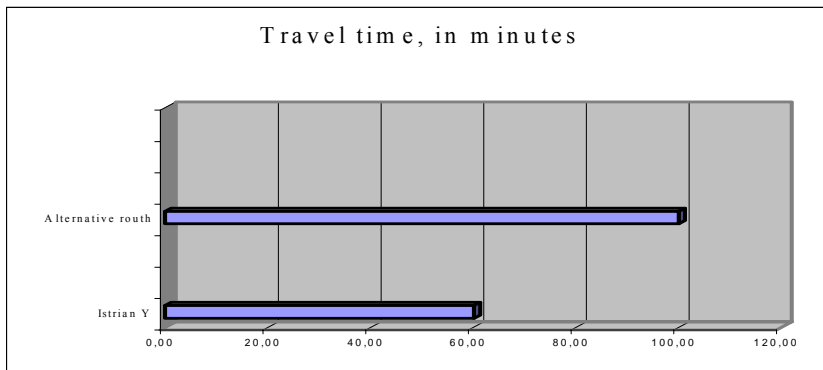
**Table 9 Comparison of journey times on alternative routes, in minutes**

	Category I & II	Category III	Category IV
<b>Route Tunnel of Učka – Pula</b>			
<b>1. Motorway Phase IA</b>	55	71	71
<b>2. Alternative route - Coast Road via Labin</b>	121	162	N/A
<b>3. Alternative route - Mountain route</b>	232	327	330
<b>Route Mirna (Slovenian border)</b>			
<b>1. Mirna Bridge - Phase 1B</b>	26	34	34
<b>2. Alternative route - Coast road via Poreč</b>	98	149	149
<b>3. Alternative route - Inland road via Buje</b>	53	70	70

Category I & II, cars with and without trailers; Category III, light commercial vehicles and buses; Category IV, heavy vehicles  
 Data source: 6. BINA-Istra (2003): "Bina-Istra, d.d. Offering Circular". Pula: BINA-Istra in cooperation with Zagrebačka banka, Alpha Bank, UBS Warburg, DePfa Group.

It can be seen that there are significant savings in journey times that will directly lead to a reduction in vehicle operating costs and fuel consumption. Following Figure 2 is demonstrating a comparison of Istrian Y and alternative route on a section the Tunnel Učka - Žminj:

Figure 2 Comparison of selected indicators of the motorway Istrian Y and alternative routes



Data source: BINA-Istra (2006): "Prometne nesreće na Istarskom Y - Analiza 2004. i 2005 godina (od siječnja do lipnja)".  
Pula: BINA-Istra.

Furthermore, a significant reduction in a number of accidents should be expected<sup>10</sup> (Table 10).

**Table 10 Number of accidents and registered cars in Istria, 1995-2005**

Year	Registered cars	Estimated foreign cars	Number of accidents	No. of accidents/No. of registered cars, in %
1995	70335	N.A	4079	5.80
1996	74263	N.A	3742	5.04
1997	81628	534748	4506	5.52
1998	87800	560201	4825	5.50
1999	92463	528283	5261	5.69
2000	98906	682494	5772	5.84
2001	99952	735710	6604	6.61
2002	105582	734334	6506	6.16
2003	110561	780137	6876	6.22
2004	117096	786696	5641	4.82
2005	123062	793226	4119	3.35

Data source: Police Administration of Istria and authors' estimations (Police Department of Istria)

The data in Table 10 do not provide evidence that the motorway improves traffic safety because the share of the accidents in total registered cars fluctuated above average in the period 1995-2000, and then increased to 6.61%. But, the presented data did not display the real situation on Istrian road because in column 2 of Table 10 we use only the registered cars in Istria, and did not analyze the foreign cars. In many situations during summer, tourists caused car accidents. They are not very familiar with the motorway, as well as they sometimes drive at inappropriate speeds, causing accidents.

Namely, during 2000 we estimate that there were an additional 682,5 thousands cars on the motorway and that number has been increasing in recent years. We calculate the number of foreign cars as total tourist arrivals by car divided by 3, but in our estimations we cannot include the other domestic traffic (cars not registered in Istria) which is also very high. As the data in table show, the share of accidents increased during the period 1997-2005 but not faster than the total traffic on the Istrian road according to our estimations.

To further elaborate upon relationship between improved road network and reduction in the number of accidents, data in the Table 11 are showing comparison of the number of accidents on the state roads, including the Istrian Y.

<sup>10</sup> One of the comments made by the European Union Road Federation on road infrastructure within the South-Eastern Europe (2006) is that "road safety needs urgent attention: Serbia and Croatia's road casualties per

**Table 11 The number of accidents on the state and county roads and Istrian Y, in 2004**

	No. of accidents	No. of accidents on each 1,000,000 km of drive
<b>1. Traffic accidents, County of Istria</b>	<b>5,640</b>	-
1.1. Traffic accidents, with material damage	4,346	-
1.2. Traffic accidents, with persons killed	34	-
1.3. Traffic accidents, with persons injured	1,260	-
<b>2. Sections of the state roads</b>		
2.1. Požane - Buzet	22	2.43
2.2. Vodnjan - Pula	112	2.02
2.3. Buje - Umag	45	2.00
2.4. D64 - Tunnel of Učka	26	1.79
2.5. Rovinj - D3	57	1.66
2.6. Plovanija - Buje	30	1.54
2.7. Kaštel - Medaki	153	1.37
2.8. Ponte Porton -Lupoglav	80	1.25
2.9. Pula - Brestova	151	1.16
2.10. Poreč - Pazin	24	0.90
2.11. Poreč - Baderna	21	0.54
<b>2.12. Matulji - Vodnjan (Istrian Y)</b>	<b>124</b>	<b>0.56</b>
<b>3. Traffic accidents, Istrian Y</b>	<b>124</b>	-
3.1. Traffic accidents, with material damage	101	-
3.2. Traffic accidents, with persons killed	3	-
3.3. Traffic accidents, with persons injured	20	-
3.4. Traffic accidents on Istrian Y / Accidents in the County	2.19%	-

Data source: Central Bureau of Statistics of the Republic of Croatia: "Statistical Yearbook", issues from 1995 till 2005. Zagreb: The CBS; BINA-Istra (2006): "Prometne nesreće na Istarskom Y - Analiza 2004. i 2005 godina (od siječnja do lipnja)". Pula: BINA-Istra.

We conclude that available data can indicate that there are some positive direct effects of the Istrian Y. However, more detailed analysis is needed in order to fully disclose the different impacts of specific effects. In addition to the direct effects, we were more interested in effects that building of the motorway Istrian Y has imposed on the County of Istria.

### 3.3.2. Indirect effects

If we look at the APAS methodology, indirect effects are mostly demonstrated through increased employment in construction sector. Therefore, we present the data on employment

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1,000 population are up to four times the rates found in the UK, a performance gap which is increasing every year".

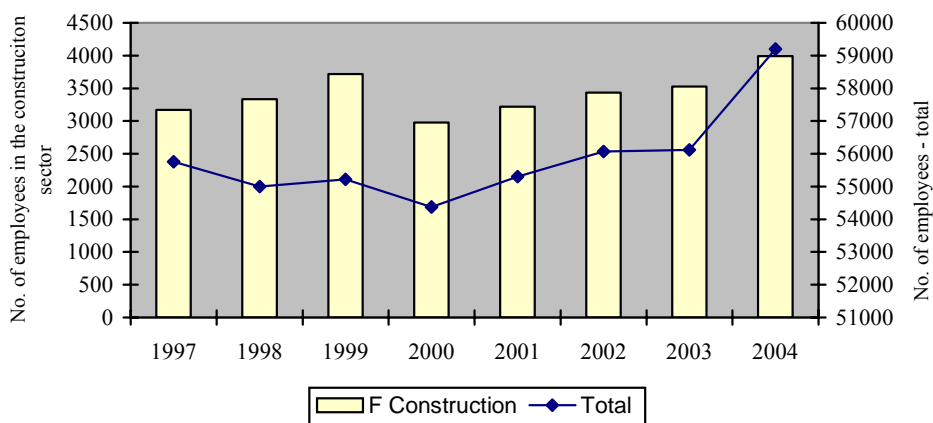
effects connected with the company responsible for building the Istrian Y, as well as employment developments during the construction period in the region.

The concession company BINA-Istra currently employs 148 employees, out of which 138 are working in the County of Istria while management board with ten employees is situated in the city of Zagreb. Furthermore, there is significant impact on seasonal employment since the concession company BINA-Istra during the tourist season (June-July-August) additionally employs 15 employees.

The Tunnel of Učka, which is an integral part of the motorway Istrian Y was constructed and opened in 1980. Before BINA-Istra took it under concession agreement, the Tunnel itself employed 64 employees. When looked in terms of jobs per kilometer, the ratio is 0.9 that is below the average ratio of 1.210 jobs directly related to motorway construction per kilometer. (The European Union Road Federation, 2006b) We can assume that additional phases of the construction of the Istrian Y will consequently increase the positive effects on the employment.

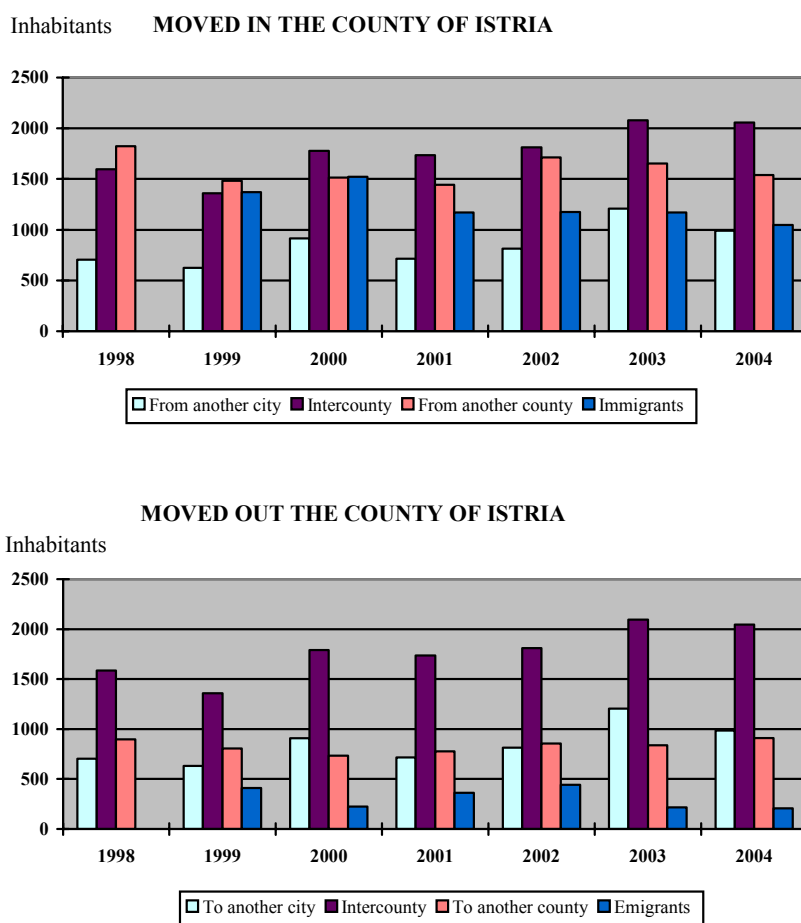
Regarding employment on the County level, following Figure 3 is showing employment trends for the period 1995-2004. As expected, during the construction period 1996-1999 there is a significant increase in the employment, especially within the construction sector, and again with the second construction phase starting from year 2003 onwards there is a trend of employment increase.

**Figure 3 Persons in Employment in Business Entities by the NCEA, County of Istria, 1997-2004**



Another indicator specified in the APAS methodology is related to the increased attractiveness of the region in terms of households' migration. Even though the analyzed period is relatively short, and migration preferences are usually revealed in the longer time spans, we are presenting some regional migration data. If we consider intercounty migration statistics (expected household movements because of improved accessibility) it was very difficult to isolate net impact of the motorway building on the migrations. However, as Figure 4 is demonstrating there is a slight increase in the intercounty migrations in years 1999 and 2000 can be noticed.

Figure 4 Migration statistics for the County of Istria, 1998-2004



## Tourism

Following Table 12 summarizes effects on tourism. Because tourists must use the motorway Istrian Y for reaching all destinations in Istria with the exception of the tourists that land in the Pula airport, we have calculated the total number of arrivals by car as approximately the number of tourist arrivals minus the total number of foreign passengers divided by two (arrivals and departures) and we have supposed that there were not arrivals by bus.

**Table 12 Index of the tourist arrivals in Istria, 1997-2004**

Country	1998/97	1999/98	2000/01	2001/00	2002/01	2003/02	2004/03	2005/04
<b>Austria</b>	108.0	92.7	122.5	106.5	100.1	104.3	99.8	97.6
<b>Bosnia and Herzegovina</b>	112.2	102.1	115.1	86.8	104.5	102.2	91.4	96.8
<b>Belgium</b>	87.3	63.0	190.7	106.4	154.6	125.6	102.1	116.9
<b>Switzerland</b>	100.6	82.4	148.6	146.5	130.5	137.1	113.9	103.8
<b>Czech Republic</b>	80.3	88.6	139.3	98.0	79.9	96.3	88.8	84.0
<b>Germany</b>	114.1	82.0	149.3	122.7	108.6	101.6	100.4	94.2
<b>Denmark</b>	161.2	90.1	188.5	106.4	136.4	187.7	142.0	139.4
<b>Spain</b>	111.7	73.9	237.1	96.9	1002.8	153.7	21.9	117.0
<b>France</b>	115.3	81.7	163.8	138.0	178.2	153.7	144.6	148.2
<b>Hungary</b>	103.6	109.4	143.2	102.7	97.6	111.9	103.2	100.0
<b>Italy</b>	106.0	94.6	128.9	100.5	98.9	111.7	98.6	99.1
<b>FYR Macedonia</b>	126.2	90.0	109.9	200.3	74.1	85.8	108.2	110.3
<b>Netherlands</b>	108.4	91.8	143.1	115.1	118.2	133.0	113.6	112.0
<b>Poland</b>	114.2	84.6	178.3	120.3	73.9	61.7	100.0	89.7
<b>Portugal</b>	103.8	88.1	211.8	103.6	142.1	98.1	142.1	132.6
<b>Sweden</b>	134.1	97.2	147.2	163.0	104.4	191.3	176.1	135.0
<b>Slovenia</b>	106.0	118.4	104.6	98.9	97.1	96.1	95.8	100.2
<b>Slovakia</b>	87.9	64.5	128.2	100.3	62.5	101.0	87.9	85.6
<b>Others</b>	125.4	75.4	155.1	99.7	29.9	556.0	134.7	124.0
<b>TOTAL BY CAR</b>	104.8	94.5	129.2	107.0	99.1	106.5	100.4	100.0
<b>ISTRIA</b>	<b>104.8</b>	<b>94.3</b>	<b>129.2</b>	<b>107.8</b>	<b>99.8</b>	<b>106.2</b>	<b>100.8</b>	<b>100.8</b>
<b>No. of arrivals Pula airport</b>	100.0	78.3	127.8	176.1	138.3	94.6	118.9	132.2

Source: Istrian Tourist Offices and Statistical Review no. 1266/2005; 1230/2004; 1197/2003; 1164/2002; 1136/2001; 1106/2000; 1080/1999; 1057/1999.

As the data in Table 12 show, we cannot draw a strong tie between the building of the motorway and the number of tourist arrivals by car. Namely, it cannot be argued that a new, faster, and better as well as safer road would significantly contribute to the attractiveness of the Istrian tourist destinations during summer because the presented data do not show the

rapid increase of the index of the tourist arrivals after the building of a better transport infrastructure. In fact, the mentioned increase of the index we can explain in the light of the raising world tourist traffic, but also as a good Croatian respond on growing foreign demand.

According to the data in Table 12, in some years, the number of arrivals from countries such as Denmark, France, and Poland rose faster than the total arrivals in Istria, but that was sporadic and we cannot make solid and all-encompassing conclusions.

Generally, the motorway Istrian Y reduces the distance from many European towns, and many of them become more close to Istria. As the presented data reveal tourist did not come more to the region just because of the infrastructure improvement. In addition, when tourists make decisions about destinations, there are many different factors that might have impact on their choice. Furthermore, during the 1990s, the Croatian tourist sector underwent a turbulent period; with war conditions in its neighbourhood and an internal transition process. Because of this the tourist traffic was concentrated in Istria, and that county participated nearly 50% in total the overnights. If we analyze only the recent years, the index of tourist arrivals from Belgium, Denmark, France, the Netherlands, countries that are quite far away from Croatia, were higher than average; thereby we can conclude that the motorway had a positive impact on the tourism sector, particularly for tourists from distant countries. New roads also augment attractiveness of an Istrian coast for neighbours primarily, Italian and Slovenian, tourists who come for one day.<sup>11</sup> Due to that situation we performed a small research on terrain and found that some restaurants in Umag, Poreč, and in some villages inside Istria triplicate their turnovers after the building of the motorway. However, since those data are not officially published and substantiated by the longer research studies, we consider them only as a preliminary confirmation of our assumptions, and not as firm evidence.

In our opinion, new infrastructure also increases the attractiveness of the entire county, because the prices of real estate on the coast have been growing approximately 10% per year, while inside the region, the mentioned index was increased by 300% and more during last fifteen years. Although, many data which can prove the statement of the positive impact of the motorway on the Istrian tourism sector are not official, we consider that there is an intensive and favourable relationship.

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<sup>11</sup> For the more detailed research we need additional data that are not available at the moment.



#### **4. Concluding Remarks**

With a general assumption that building of motorway network has an impact on the region that it encompasses, the aim of this paper was to envisage to what extent this assumption can be validated in the Croatian case.

We have chosen to analyze the case of motorway Istrian Y because effects of its construction are dominantly distributed on one region – the County of Istria. Before motorway building, existing road network was such that there was a good connection between cities in the County. However, during the summer there were severe congestion problems and, even more, problems regarding security of pedestrians since the main regional road was going along the coast and through the centers of tourist resorts. In that context it was justified to build a new road – motorway, with the two main goals: the first to take out traffic from the tourist resorts and the second one to increase accessibility of central part of the County with the coastal zone.

Construction of the motorway has started in 1996 and after ten years 130 out of 148 kilometers have been built and put into operation. After a decade a general conclusion is that the building of the motorway Istrian Y has directly contributed to the reduction in the journey time and in that sense reduction in the vehicle operating costs. Regarding number of accidents it is also notable that building of the new motorway has contributed to the significant reduction in the number of accidents.

As our analysis has confirmed, and based on the APAS methodology, building of motorway has an impact on the employment and especially within the construction sector. Furthermore, a positive interaction related to better accessibility through motorway network and tourism is verified. There are also particular trends, such as a huge increase of real estate prices but it is very difficult to extract to which extent it is due to the perception of better transport accessibility or to the exceptional increase in demand.



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