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TRANSPORT DEMAND FORECAST ON PAN-EUROPEAN ROAD CORRIDOR X. METHODOLOGY, RESULTS AND THEIR ASSESSMENT THROUGH COMPARISONS WITH ACTUAL DEMAND

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Abstract

Transport demand forecast is a crucial parameter for transport planning. It defines the infrastructure dimensioning for a required level of service in a planning period, but moreover, it is determinative in the socioeconomic and financial feasibility study of transport projects. This paper presents the methodology and the results of the traffic flows forecasting exercise for the Pan-European Corridor X, which was elaborated to serve as a sound basis for documentation of the transport investments priorities, and the assessment of the results of the forecasted demand through comparisons with actual demand.

Key words: Traffic flows forecasting, modelling, Pan-European Corridor X

1. GENERAL INTRODUCTION

The multimodal Pan-European Transport Corridor X, Salzburg – Ljubljana – Zagreb – Beograd – Nis – Skopje – Veles – Thessaloniki, including its branches [A: Graz – Maribor – Zagreb, B: Budapest – Novi Sad – Beograd, C: Nis – Sofia and D: Veles – Bitola – Florina, refers to the road, rail and interconnection points for inland waterways, air, maritime, intermodal and in particular combined transport infrastructure, including ancillary installations along the route of the Corridor. This Corridor is the traditional axis linking South-Eastern Europe with Central Europe, which had served transportation in the area for many decades. Before the year 1990 it was fully operational and more or less developed in terms of road and rail infrastructure, but the turbulence period in former Yugoslavia caused a significant drop in traffic and also influenced the status of infrastructures and facilities.

For the development of the Corridor, a Technical Secretariat was established, in order to support the respective Steering Committee acting on the basis of a Memorandum of Understanding (MoU) signed in 2001 between the concerned countries and the European Commission. Extensive research has been carried out in this framework, in order to fulfil the provisions of the MoU, one of them being to define priorities and investment needs.

The research was elaborated at the Aristotle University of Thessaloniki [1], [2], and in this paper the methodology and results of this research dedicated to Road Corridor X are presented, but moreover an assessment of this forecast is attempted, through comparison of the results for the short and mid-term horizons with the actual traffic data.

2. METHODOLOGICAL FRAMEWORK AND CONSTUCTION OF THE BASE YEAR DATABASE

The review of the relevant international bibliography was the first step of the approach, in order to qualify the most appropriate methodology for the traffic forecast, identifying at the same time the best way to incorporate the particularities of Corridor X, such as the data availability, the network and the zones (areas) of influence. Therefore, the relevant studies were examined with emphasis on methodological issues (constraints, assumptions, scenarios).

It was concluded that a more simplified methodological approach, compared to those used for the traffic forecast on the ten Pan-European Corridors of Helsinki [3] and in the Regional Balkans Infrastructure Study (REBIS) [4], close to that used in the Transport Infrastructure Regional Study (TIRS) [5] was more appropriate, since it consisted a realistic model, not only because it referred to the Balkan region, but also because it attempted to optimise the relation between necessary data and respective processing tools. Both TIRS and REBIS experiences offered interesting examples of exploitation of relatively simple models, which had been satisfactory adapted in an uncertain environment, characterised by data unavailability and unreliability.

Data unavailability and unreliability were indeed the main problems to define the methodology and perform the forecast. They did not concern only the transport data, but also demographic data, macroeconomic indicators, industrial production and external trade.

In any case, the data collection process exploited every available source in order to build the base year and to define the scenarios of the forecast: national authorities, international organizations, relative transport or economic development studies etc., having as price the heterogeneity of the collected data and the resulting difficulty of uniform processing.

The construction of the Database for the base year of the forecast (year 2000) was achieved through extensive questionnaire based-surveys, followed by on-site visits of expertise along the entire Corridor X network. The necessary information, collected via the questionnaires and via various National and International Organizations (National Statistic Services, Eurostat, World Bank, United Nations, World Trade Organization, World Tourism Organization, Organization for the Economic Cooperation and Development etc.), concerned physical and operational characteristics of the network (e.g. traffic flows, operational speed, road category, duration of trips, delays at cross-borders etc.) and various demand parameters (e.g., socioeconomic characteristics, population, Gross Domestic Product, imports and exports of goods, tourism etc.).

3. DEVELOPMENT SCENARIOS

The scenarios definition comprise transport demand evolutions, depending on demographic, socioeconomic and economic (external trade) assumptions. Apart from their typical conclusions they would include transport demand projections, using forecasting techniques, where the necessary data were sufficient and reliable.

The demand parameters and the traffic volumes are the basic reference for the estimation of future demand. Obviously, the transport demand parameters depend on the existing obstacles, limitations and impedances in passengers and goods mobility. Therefore, the estimation of future demand should be based on realistic assumptions, concerning macroeconomic and related parameters, which consist basic trip generation factors, and also concerning resistance factors. Any change at the transport times and cost burdens regime due to custom and other cross border controls and procedures could bring change in demand.

Three scenarios of development were formulated: the basic-medium (realistic) and two scenarios of low and high development, namely the pessimistic and optimistic scenario, respectively. The scenarios were established by defining annual change rates of variables affecting directly the passenger and goods flows. These change rates are the growth factors and therefore, the factors for the projection of traffic in the various target years. The annual change rates of the socioeconomic, demographic and other (arrivals of visitors/ tourists at borders) characteristics used, had been extracted from relevant studies carried out by the OECD, the World Bank and other international organizations.

The reference network is inscribed in an area separated in zones, for the needs of trip generation and spatial distribution. The available, from national and international organisations, demographic and macroeconomic data referred at country level and not to smaller geographic – administrative divisions. This is moreover the reason why each Corridor X's country consisted a zone. **Table 1** provides the used forecasts of key economic indicators for the traffic zones.

Table 1: Annual growth rates of demand parameters per zone and scenario

Zone	International Trade (%)			Arrivals at borders (%)	Population (%)			Gross Domestic Product (%)		
	Low	Med	High	All scenarios	Low	Med	High	Low	Med	High
Albania	2,50	5,00	7,50	8,00	1,00	1,00	1,00	5,00	6,50	8,00
Bulgaria	2,50	5,00	7,50	5,00	0,50	0,50	0,50	3,00	4,00	5,00
Czech Rep.	2,50	5,00	7,50	4,00	0,50	0,50	0,50	3,00	4,00	5,00
Hungary	2,50	5,00	7,50	4,00	0,50	0,50	0,50	3,00	4,00	5,00
Poland	2,50	5,00	7,50	4,00	0,50	0,50	0,50	3,00	4,00	5,00
Romania	2,50	5,00	7,50	4,00	0,50	0,50	0,50	3,00	4,00	5,00
Slovakia	2,50	5,00	7,50	4,00	0,50	0,50	0,50	3,00	4,00	5,00
Slovenia	2,50	5,00	7,50	4,00	0,50	0,50	0,50	3,00	4,00	5,00
Greece	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
France	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Italy	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Austria	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Baltic States	2,50	5,00	7,50	5,00	0,30	0,30	0,30	3,00	4,00	5,00
Spain – Portugal	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Germany, Belgium, Luxemburg, Holland	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
United Kingdom – Ireland	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Scandinavia	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Switzerland	1,25	2,50	3,75	1,00	0,30	0,30	0,30	2,00	2,00	2,00
Turkey	2,50	5,00	750	8,00	1,50	1,50	1,50	3,00	4,00	5,00
Serbia/ Montenegro	2,50	5,00	7,50	5,00	0,50	0,50	0,50	3,50	4,30	6,00
Bosnia/ Herzegovina	2,50	5,00	7,50	5,00	0,50	0,50	0,50	3,50	4,40	5,50
Croatia	2,50	5,00	7,50	4,00	1,00	1,00	1,00	4,00	4,40	5,00
F.Y.R.O.M.	2,50	5,00	7,50	5,00	0,50	0,50	0,50	3,00	3,70	5,00
Russia and former Russian States	1,25	2,50	3,75	4,00	0,30	0,30	0,30	3,50	3,50	3,50

It is obvious in the above table that some countries were grouped according to their common characteristics that affect the scenarios' definition (e.g. EU member states, countries of the EU enlargement, and countries of the Stability Pact, with EU accession perspective in the long-term horizon). The accession perspectives was considered that affect the scenarios because external trade, and therefore the freight transport, in relation to the accession, would tend to liberization and the same would happen with the free movement of persons.

Concerning population, the growth rates applied reflected the different cultural, religion and other factors, which had been determined during the last decades and were expected to continue to determine intra-European population growth rates, which vary from a near to stagnation rate of 0,30% for mature, mostly developed nations, to 0,50% for the less developed ones and 1-1,50% for the least developed ones.

Concerning the GDP, its growth rates forecasts actually referred to three groups of countries: The first one with anticipated growth rates in the area of 2% were the mature EU members, for which the high level of development would allow only a modest GDP growth in the following decade. The second group included the Eastern European countries whose performance in the process of transition had been quite remarkable (Hungary, Poland). This had brought them in the EU enlargement, but it also meant that the GDP growth rates they were expected to achieve were higher than those of the mature EU economies. Finally the third group, which included the less developed countries, was expected to experience relatively higher (Serbia) to impressive (Albania) GDP growth, mainly because of their low starting point and the fact that political stability would enable them to make up for the losses during the periods of turbulence.

The trade trends also follow the pattern of GDP, in the sense that the relatively closed economies, as their integration to the EU progresses, had much greater potential for trade expansion than the open EU economies. This argument was supported by the fact that most of the eastern European economies rely on imports in order to promote their exports and also by the fact that the anticipated high GDP and income growth would allow more imports of consumer goods. However, trade expansion would not necessarily mean an increase in the arrivals of goods at the borders. This depends on the nature of the products traded. If the patterns of the trade favour high value-low bulk goods the arrivals may have a very modest increase (this mainly applies to the mature EU economies). If trade refers to bulk (relatively low value) goods then the arrivals are expected to grow even faster than the value of trade itself.

The annual change rates applied on the arrivals at the borders, resulted from the potential of the tourism industry of each zone: 4% for zones close to saturation, 5% for those who move to diversification of their tourist product, 8% for those who start from low level and now have big potentials, and finally 1% for the countries with existing low potential.

Additionally to the basic socioeconomic variables, on the various target years and scenarios, reduction coefficients were used to simulate the running times caused by the development (even in limited scale) of the infrastructure, but mainly by the development of the installations and procedures at cross borders, representing the smoothing out of the bilateral relations between the Balkan countries (and therefore between Corridor X countries).

4. PASSENGER AND FREIGHT FLOWS FORECASTING

Given the different development and the different values of the change parameters of domestic and international flows, the international flows were distinguished from the total traffic. In such a way, the four stages of the classic procedure of transport planning concerned the international transport, which does not experience the limitation of data heterogeneity for the areas and zones, like domestic flows. Therefore, the models developed concerned only the road international transport, separately for passenger and freight.

The estimation of domestic transport flows was made by growth factors application. For the various target years and scenarios the local traffic was calculated by applying an annual growth rate of 1,25 on the annual growth rate of the GDP of each country. Hence, the total assignment for the each of the target years and scenarios was achieved by the distribution/assignment of the international traffic and the addition of the each time projected local traffic.

4.1 International passenger transport

For the estimation of the generation of passenger transport an exponential equation was created (equation 1), produced by linear regression, on the basis of least squares method. In this equation the independent variable is the GDP and the dependent variable is the number of trips per person per year.

The journeys per person per year, which were used for the creation of the equation, were obtained by pilot studies of Eurostat and DG VII (today's DG MOVE) in Austria, Denmark, France, Italy, Portugal, Spain and Sweden during the period 1996 – 1997, which examined the passengers travelling various distances using all modes and their behaviour. A journey was considered to be a series of trips starting end ending at home or a temporary residence. The journeys that include a destination more than one hundred kilometres from the person's residence were regarded as long distance journeys [5].

Using linear regression analysis and the data for the countries of the pilot studies, various equations were produced (linear, 2^{nd} degree, logarithmic, hyperbolic and exponential), and after logical and statistical tests it was proved that the most appropriate form of equation was:

$$\boldsymbol{y = 0{,}4428e^{0{,}0001x}} \quad (R^2 = 0{,}796) \qquad (1)$$

where: ***y*** **=** Trips/ person/ year.; ***x*** **=** GDP/ capita.

This equation was used for the estimation of the produced passenger flows, using the GDP of each country in the year 2000. By multiplying the results with the respective population, the total number of journeys was estimated. Those numbers were for all distances travelled using all modes of transport and therefore, for the estimation of the long distance journeys and the persons travelling long distance, the road share was assumed to be 78%, the existing modal split, which was considered to remain stable, due to the low potential of the railways. Finally, considering the low expected number of long distance journeys in less developed countries, with rather weak economies, percentages analogous to those of Spain and Portugal were assumed and the following equation was produced:

$$\boldsymbol{y = 3{,}125\,x + 4{,}875} \qquad (2)$$

where: ***y*** **=** Percentage of persons travelling long distance.
x **=** Journeys per person per year.

The respective percentages were calculated for the countries of the study area, and also the road long distance trips annually (Table 2).

Table 2: Road long distance trips per year in Corridor X countries

Country	GDP/ capita (2000)	Trips/ person/ year	Population	Trips/ year	Road trips/ year	% persons travelling long distance	Road long distance trips/ year
F.Y.R.O.M.	4.400	0,69	2.031.100	1.396.459,97	1.089.238,78	7,024	**76.504**
Bulgaria	6.300	0,83	8.149.500	6.775.542,91	5.284.923,47	7,473	**394.950**
Serbia/Montenegro	2.300	0,56	10.645.200	5.932.656,02	4.627.471,70	6,617	**306.181**
Croatia	5.800	0,79	4.381.400	3.465.064,44	2.702.750,26	7,346	**198.556**
Hungary	11.500	1,40	10.005.300	13.991.889,98	10.913.674,18	9,245	**1.008.986**
Slovenia	15.600	2,11	1.990.100	4.193.550,76	3.270.969,59	11,460	**374.854**
Greece	15.460	2,08	10.565.000	21.953.126,64	17.123.438,78	11,368	**1.946.673**
Austria	24.570	5,17	8.121.000	41.964.172,61	32.732.054,64	21,023	**6.881.265**

The attractions were calculated in respect to the arrivals of visitors and tourists at the borders of each zone - country. A visitor is defined as a person travelling to a place other than his/ her usual environment for less than 12 months and whose main purpose of visit is other than the exercise of an activity remunerated from within the place visited. Visitors (domestic/ international) comprise tourists, defined as the visitors staying at least one night in a collective or private accommodation in the place or country visited [5]. The necessary data (1994-2000) were obtained by Eurostat and the World Tourism Organization.

The Eurostat data concerned total arrivals at borders, e.g. entrances in the country, so they included arrivals by all modes of transport. For this reason, the arrivals at road cross border stations were obtained from the World Tourism Organization, where the arrivals at the borders were discriminated per mode according to the national statistic services.

Finally, from these data the arrivals of the visitors of the same date were identified, which mainly consist of transit visitors, in order to avoid overestimation of international transport. For the countries grouped to a zone, the trips between them were estimated and they were abstracted. Also, for the zones bordering with countries out of the study area (Turkey, Russia – former socialistic republics) the passenger flows were adjusted to the observed traffic volumes at borders within the study area. The data used in the model as trip ends for attractions are presented in Table 3 for the Corridor X countries.

Table 3: Zone attractions used in the model

Zone	Arrivals at borders	Percentage of road arrivals	Annual number of road arrivals
Bulgaria	2.785.000	63,85%	1.778.223
Hungary	15.571.000	87,74%	13.661.995
Slovenia	1.090.000	88,70%	966.830
Greece	12.606.000	10,84%	1.366.490
Austria	17.982.000	94,42%	16.978.604
Serbia/ Montenegro	448.000	85,00%	380.800
Croatia	5.831.000	96,56%	5.630.414
F.Y.R.O.M.	224.000	88,75%	198.800

4.2 International freight transport

The produced freight flows were considered, based on TIRS experience, by the total tonnage of the transported goods by road. The calculation was made possible under the assumption that the goods transported by road are at a high percentage commodities of categories 6 (construction and raw materials and minerals) and 9 (machinery, manufactured products, transport equipment etc.) of NSTR (Nomenclature uniforme des marchandises pour les Statistiques de Transport, Révisée in use by E.U. since 1st January 1967).

Those categories are directly related to the GDP, but could not be reliably distributed between the zones of the study area with GDP criteria, not with the

GDP of the destination country but also not with the GDP of the origin country. Due to the existence of a complete origin–destination matrix of road transport in tonnage between EU countries and countries of the PHARE zone, it was preferred to extend and complete this O-D with data for the extra zones of the study area, so that the calibration and trip distribution preserve the existing bilateral trade relations. Therefore, the danger of producing trade flows that did not correspond to reality, and could came up if the GDP was used for the distribution, has been avoided. The attractions were automatically calculated through the use of the complete O-D matrix.

As for the case of passenger transport, for the countries grouped to a zone, the trips between them were estimated and they were abstracted. Also, for the zones bordering with countries out of the study area (Turkey, Russia – former socialistic republics) the freight flows were adjusted to the observed traffic volumes at borders within the study area.

5. TRANSPORT MODEL

The forecast of international traffic flows on the various road sections of Corridor X was based on the creation of models with the use of TRIPS (**TR**ansport **I**mprovement **P**lanning **S**ystem) software for transport planning. Two models were constructed for the separate simulation of passenger and freight transport. The simulations concerned the stages of trip distribution to zones and trip assignment on the network.

5.1 Traffic zones and road network

Due to the fact that Corridor X crosses and serves a big part of the Balkan Peninsula, the study area was set to be the Balkan countries and their main road network. Each Balkan country was considered as a unique traffic zone with trip productions and attractions, with the capital as centroid. Several external zones were used, in order to include the trips from and to the rest of the European countries in the simulation of international traffic on Corridor X. The definition of the external zones was based on the socioeconomic characteristics of the various countries, on their geographic position and the road network connecting them with the Balkans. In total 24 traffic zones were defined (see Table 1).

The codification of the road network was performed with the use of TRIPS MVNET application, based exclusively on the road sections characteristics (Link Based Network). Primarily the nodes were defined and then the connections between them. Then, for each road section the capacity, the distance, the road category, the running time and other indicators were defined.

The hierarchy of the road network and therefore the calculation of the capacity of traffic lanes per hour were based on the Great Britain's standings (Department of Transport, DOE Advice Note 1A, 1971), compatible with the TRIPS structure.

The examination of the digitised network (Figure 1) and the calibration was performed with MVGRAF application with visual representation of the network in combination with the application AVROAD for the definition of best routes and traffic assignment. Using AVROAD, for each pair of traffic zones the best routes were defined with "all or nothing" method and then tested.

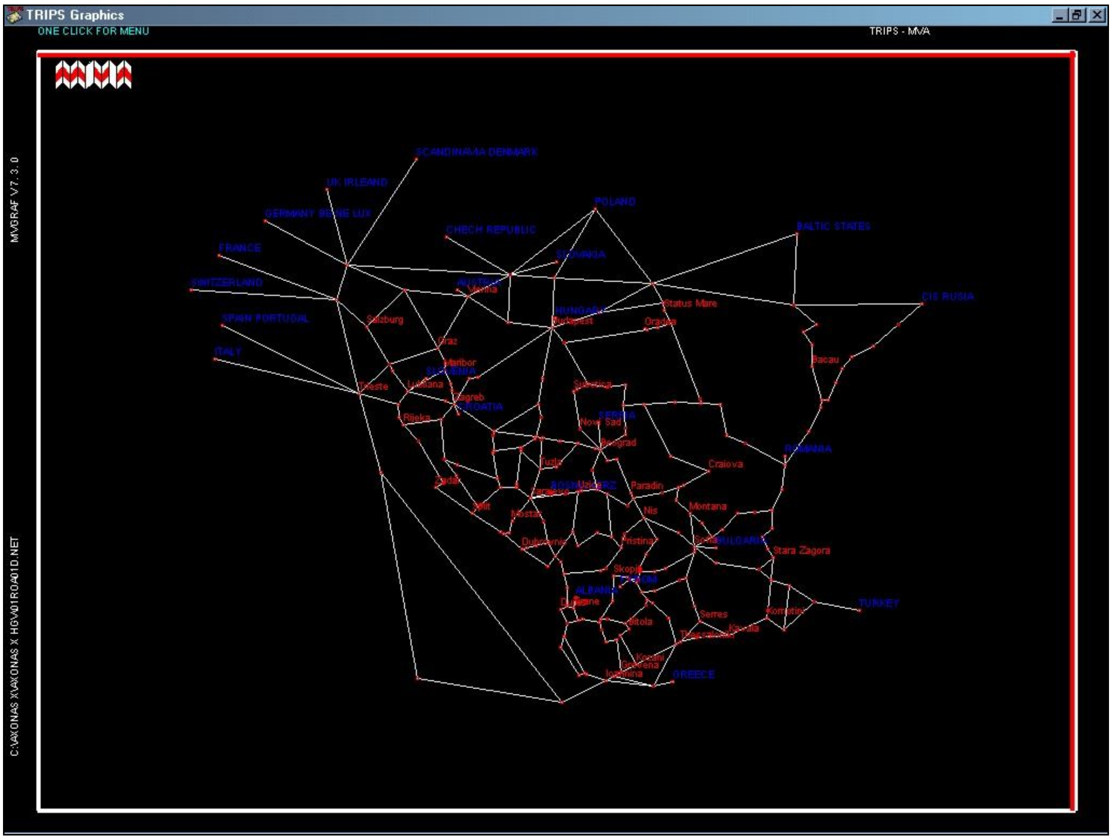

Figure 1: Digitised road network

After the network calibration a cost matrix was calculated using the AVROAD, based on the generalised cost function used in TRIPS. The calculation of the optimum routes and generally of the travel cost per pair of zones, was performed based on the relation of generalized cost. A marginal expression of generalized time was used, which was extracted by real data and comprises trip durations and delays for various reasons, of which (and mainly) the delays at border crossings. The expression of generalised cost (***GC***) has the following simple form:

$$GC = T + TL \quad (3)$$

where: ***T =*** Time.

TL = Toll costs (representing delays at cross borders)

5.2 Model for trip distribution to zones

The trip distribution was based on the methodology of gravity models, and was executed with the use of the MVGRAM. The general form of the gravity model used in TRIPS is:

$$T_{ij} = a_i b_j P_i A_j F(C_{ij}) K_{ij} \quad (4)$$

where: T_{ij} = Trips estimated from zone i to zone j

P_i = Productions from zone i

A_j = Attractions to zone j

$F(C_{ij})$ = Cost deterrence from zone i to zone j

α_i b_j = Row/ column balancing factors

K_{ij} = Correction factor

For the model calibration two matrices were used: an O-D of freight transport for the year 2000, and cost matrix (time-distances) between the zones. Having the gravity model calibrated and using the results of the trip generation stage (trip ends) the O-D matrices for each scenario and target year were estimated. The matrices estimation was performed using the MVGRAM.

5.3 Traffic assignment

The trip assignment was performed using the AVROAD, with the simple “all or nothing” method. For each pair of origin-destination one and only optimum route (depending on generalized time) was calculated. No issues of capacity limitations were examined, because the assignment referred only to international traffic and obviously no volumes close to capacity were expected.

Each origin-destination matrix of the scenarios was distributed to the road network and the international traffic assignment of the various sections of Corridor X occurred. As previously mentioned, the total assignment for the various target years and scenarios was achieved by the addition of the assigned international traffic with the projected local traffic for the respective scenario.

6. RESULTS OF THE TRAFFIC FORECAST

The most important result arising from the forecasting process was that international traffic flows, despite the increasing trends, would not be, at least in the short-term, the main component of traffic volumes [6].

In the medium-realistic scenario, by the year 2005 the road international transport in Corridor X's countries – at national level – of commercial vehicles will increase by 13-28% and of passenger vehicles by 18-28%. By 2010 – compared to 2000 – the international flows of commercial vehicles will increase by 28-63% and of passenger vehicles by 18-69%. Finally by 2015, the international flows of commercial vehicles will increase by 45-108% and of passenger vehicles by 31-235%. The lowest values refer to Austria, whilst the highest ones refer to the Balkan countries.

In the low scenario, the international freight transport flows will increase by 6-13% by 2005, by 13-28% by 2010 and by 20-45% by 2015. Respectively, the international passenger transport flows will increase by 8-24% by 2005, by 18-57% by 2010 and by 31-102% by 2015.

Finally, in the high scenario, the international freight transport flows will increase by 20-44% by 2005, by 45-106% by 2010 and by 74-196% by 2015. Respectively, the international passenger transport flows will increase by 8-32% by 2005, by 18-85% by 2010 and by 31-192% by 2015.

Bottlenecks was estimated that will appear near big cities or the capitals of the countries (e.g. near Belgrade), only in the case that bypasses' construction plans won't be implemented, and at some links, for which also motorways construction plans existed.

7. ACTUAL TRAFFIC EVOLUTION

The evolution of AADT in the period 2000-2010 is presented in Figure 2. Traffic data for 2005 come from the Corridor X database and the traffic data for 2010 from other sources: the SEETIS for the Western Balkan countries, the information system of the Southeast Europe Transport Observatory (SEETO) and the National Motorway Company (DARS) for Slovenia. Both sources use different segmentation of the Corridor, and therefore, in order to make possible the direct comparison, the method used for the calculation of the traffic data submitted by the participating countries. Namely, it had to be clarified whether the data submitted was the simple or the weighted AADT of road subsections, or represent the maximum traffic on a section.

Therefore, for the comparison for the year 2010, a reference to the data originally submitted for the base year (2000), in order to draw a conclusion on how the submitted traffic data emerged. It was concluded that data for Slovenia concerned the traffic on specific subsections of the various Slovenian sections of Corridor X, i.e. these data didn't come from the calculation of weighted AADT according to subsections' length that of each Corridor X section that the countries segmented the Corridor during the database development process.

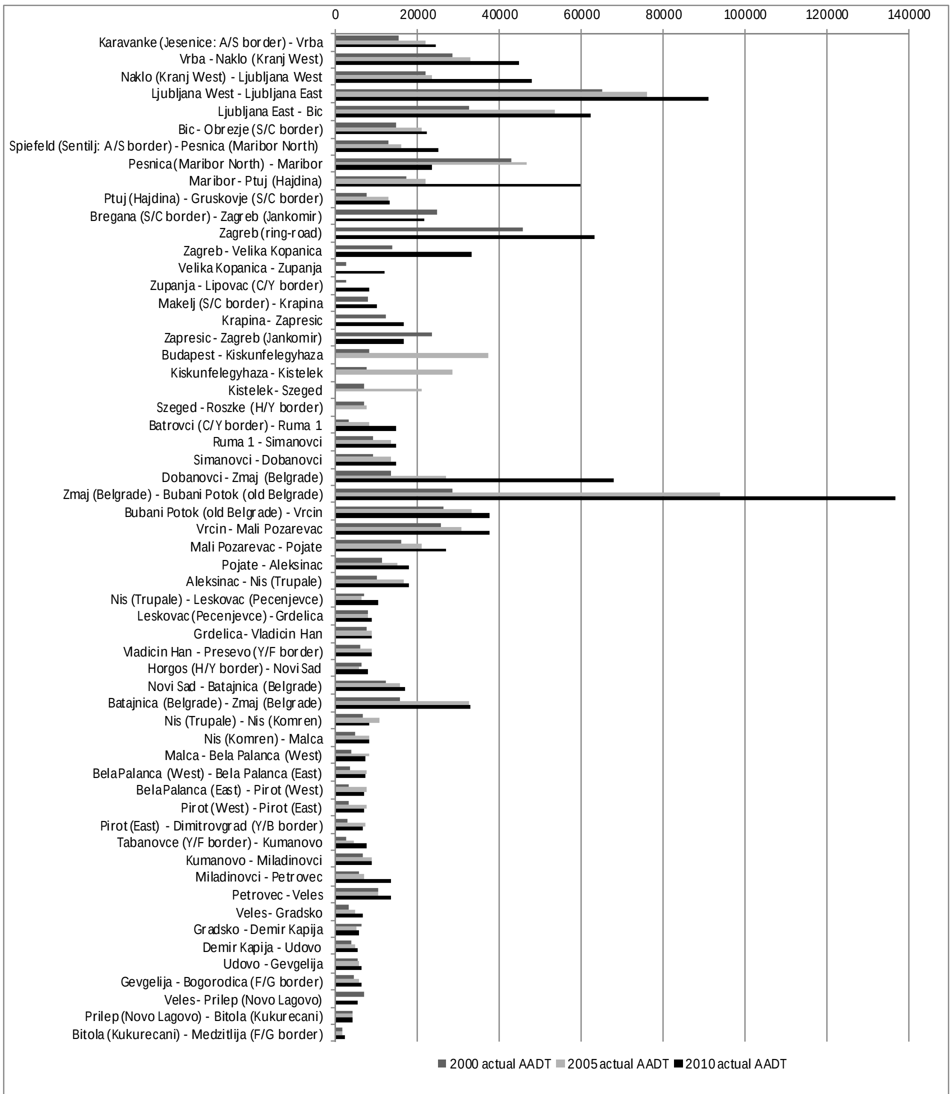

Figure 2: AADT evolution per section in 2000, 2005 and 2010 (PCUs/ day)

From the analysis of the available (and compatible for comparisons) data, it emerges that the AADT expressed in veh/day increased by 52,2% in the period 2000-2005 and increased by 35,5% in the period 2005-2010. Expressed in PCUs/day the respective increases were by 63,1% and 50,3%.

8. ASSESSMENT OF THE RESULTS

For the assessment of the traffic forecast results on Road Corridor X, several comparisons were made and diagrams of deviation of the forecasted and the recorded traffic were prepared. These diagrams concern the comparison of the forecasted (in the medium scenario) and the recorded Annual Average Daily Traffic (AADT) for 2005 and 2010, expressed in vehicles and passenger cars units (PCUs) per day (sections with not available data appear with null values).

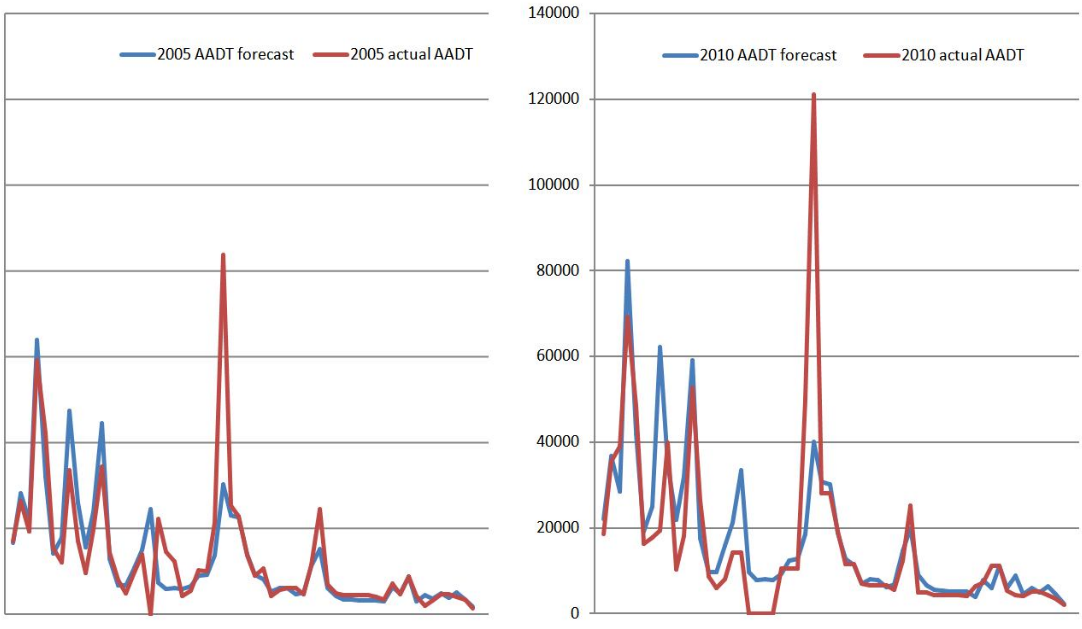

Figure 3: Deviation of values of the forecasted and recorded traffic in 2005 and 2010 per section (veh/day)

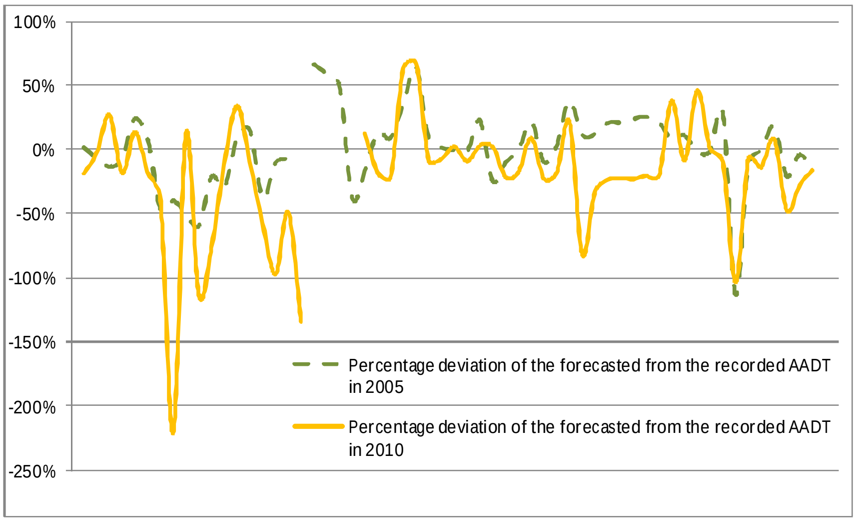

Figure 4: Percentages of deviation of the forecast values for the target years 2005 and 2010 from the respective recorded traffic per section (veh/day)

Examining these diagrams and more specifically the range of deviation of forecasted and recorded AADT for each section of Road Corridor X, satisfactory estimations are noticed (especially on sections with low traffic in the base year), but also some failures: a) on the sections Batajnica – Zmaj and Zmaj – Bubanj Potok through the city of Belgrade, and where it is obvious that the demand has sharply increased; b) on the Corridor X sections in Hungary, where from investigation to historic data on demand in the period 1997-2009 it emerges that AADT data submitted for the base year of the forecast were not reliable, as happened also for Corridor X sections in Greece; and c) on the section Pesnica – Maribor in Slovenia, due to traffic diversion to the Maribor bypass.

Excluding the sections for which the forecast failed or for which no data was available to perform the comparison, the standard deviation of the estimations per section compared to the actual demand is 2.003veh./day for 2005 forecast and 3.212veh./day for the 2010 forecast, excluding from the calculations for 2010 sections for which there were no data concerning traffic composition. The variation coefficients were calculated at 1,9% and 2,2% for the forecasts of the target years 2005 and 2010 respectively. From the calculation of the standard deviation expressed in PCUs/day even more sections have been excluded, and hence the results are rather indicative: 2.773PCUs/day for 2005 forecast and 4.596PCUs/day for 2010 forecast. The respective variation coefficients were 2,3% and 2,2% [1].

9. CONCLUSIONS

The forecast of the future demand is based on several assumptions, limitations and scenarios. In the case of Corridor X it was important to investigate the trends, the political evolutions – like the EU enlargement – and the improvements of infrastructure. Any other assumption would have been arbitrary, due to the particularity and instability in the Corridor X study area, from political point of view. This is the reason why the forecast was considered for a time horizon defined in relation to the stabilization process in the area, a decade from the date of the forecast elaboration.

Objectively, it was difficult to obtain rigid estimations of future transport demand and respective realistic volumes' assignment on the transport network because of the high uncertainty of the socioeconomic status of the countries composing the study area. The representation of the status of the base year was insufficient, due to the lack of data, the incompatibility of data from country to ountry and from period to period, because of the creation of new countries in the Western Balkan region.

The followed procedure was par excellance of experical character. It was based on the very good knowledge of the particularities of the Corridor. This realistic aspect led to the rejection of complicated models, which are ineffective in cases of insufficient and unreliable data, and the adoption of more compatible techniques for planning out scenarios and forecast techniques.

Given the constraints and limitations met, the attempt to estimate the future traffic flows along Corridor X can be considered successful. Some failures are noticed, but these were due to unreliable data for the base year, due to urbanisation/ suburbanisation and increase of mobility around major cities and due to diversion to new infrastructure developed after the forecast.

In any case, this forecast avoided successfully overestimations, which is a usual phenomenon in this type of exercises. Therefore, the modest demand forecast served the purpose for which it was elaborated for, namely the provision of sound basis for priority projects definition, as well as the provision of a basis for extension of the forecasts for longer periods for specific projects, as requested in the elaboration of feasibility, socioeconomic and financial studies for project documentation, that reach 25 even 30 years ahead.

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