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AADT	Annual average daily traffic
ADT	Average daily traffic
AIM	Adrian-Ionian Motorway
B&H	Bosnia and Herzegovina
B/C ratio	Benefit-cost ratio
BCP	Border crossing point
C/B	Cost – benefit
CBA	Cost - Benefit Analysis
CFCA	Central Finance and Contracting Agency
DNC	Dubrovnik Neretva County
DZS	Državni zavod za statistiku (eng. *CROATIAN BUREAU OF STATISTICS)*
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EIAS	Environmental Impact Assessments Study
EIRR	Economic Internal Rate of Return
ENE	East-northeast
EPR	Environmental performance review
EU	European Union
EUNIS	European Nature Information System
GDP	Gross Domestic Product
GP	Granični prijelaz (eng. *border crossing*)
GVA	Gross value added
HEATCO	Developing Harmonised European Approaches for Transport Costing and Project Assessment
HRK	Croatian kuna
IBA	Important Bird Areas
IGH	Institut građevinarstva Hrvatske (engl. *Civil Engineering Institute of Croatia)*
ILO	International Labour Organization
ISPA	Instrument for Structural Policies for Pre-accession
IUCN	International Union for Conservation of Nature
JASPERS	Joint Assistance to Support Projects in European Regions
JI	Jugoistočno (engl*. Southeast*)
MCA	Multicriteria assessment approach
MedPAN	The Network of Managers of Marine Protected Areas in the Mediterranean
MoUSEETO	Memorandum of Understanding South East Europe Transport Observatory
NMVOC	Non-methane volatile organic compounds
NNE	North-northeast
NW	Northwest
ODS	Origin-Destination surveys
OG	Official Gazette
PAP/RAC	Priority Actions Programme Regional Activity Centre
PFS	Prefeasibility Study
RLS	Richtlinien für den Lärmschutz an Straben
RoC	Republic of Croatia
RTDDM	Regional Traffic Demand and Distribution Model
SCI	Sites of Community Importance
SE	Southeast
SPA	Special Protection Areas
SSE	South-southeast

TEM	Trans-European Motorway
TEN-T	Trans-European Transport Network
ToR	Terms of Reference
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
VfM	Value for Money
VTTS	Value of Travel Time Savings
WB	World Bank

1 INTRODUCTION

1.1 Background

The Prefeasibility Study (PFS) has been designed to address and resolve critically important issues related to the fact that the land territory of Croatia is separated into two parts by the City of Neum at the seashore of Adriatic, by a 14 km wide territory of the Bosnia and Herzegovina (B&H).

This is a historically based situation that originates back to the events of 1699, when the Dubrovnik Republic relinquished control of this region to the Ottoman Empire with the Treaty of Karlowitz (Sremski Karlovci), following the Great Turkish War. Dubrovnik gave the Turkish Empire access to the sea, but just as importantly, it provided them with a buffer zone separating Dubrovnik territory from the Republic of Venice.

Since the end of the 19th century until 1992, the whole region was joined under the same administration (e.g., Austro-Hungarian Empire, Kingdom of Yugoslavia, socialist Yugoslavia), thus allowing for free passage of people and exchange of goods and commodities. That had a significant impact on social and national situation in the region where various nationalities lived together and settled down in new areas.

The majority ethnic group in the Neum area today are Croats, which has significant cultural and geopolitical implications. For example, Croat children who live in Neum go to high schools in Croatia (mainly Metkovic).

The situation changed again after the dissolution of socialist Yugoslavia, when the Republic of Croatia and Bosnia and Herzegovina were internationally recognized in 1992. A relatively liberal regime of border crossings was put in place, allowing facilitated flow of goods and people. Accession of the Republic of Croatia to the European Union on July 1, 2013 brought about significant changes yet again, with the introduction of much more stringent EU rules for the flow of goods and people in the area.

As a result, currently there is a very complicated and multidimensional issue on providing continuity of the European Union land territory by joining the two separated parts of Croatia/EU. There are many aspects of this issue which must be addressed, together and separately since, they are commingling and cannot be resolved without considering all angles of the problem. The resolution of these issues has not only regional but also continental importance. Addressing these issues is consistent with the objectives and provisions of the European Union major policies and strategies, especially the Cohesion Policy[1]. The pillars of economic growth in Europe is seen in investing in new and innovative solutions with consideration and activities to achieve economic, social and territorial cohesion of the Union.

The provision of the continuity of the European Union land territory by joining the two separated parts of Croatia/EU is definitely consistent with the principles of the Cohesion Policy. This objective should by accomplished not technically, but also with an objective to maximise regional and EU-wise economic and social benefits that may occur from this activity. To provide a chance for accomplishing the above, permanent solution that will ensure unconstrained flow of goods and persons through the EU territory and Schengen area should be proposed, as clearly and rightly stipulated in the Terms of Reference for this project. The time factor is very important in addressing the objectives of this project and to contribute to EU Cohesion policy objectives. The benefits for the European Union as a whole may be provided for the time when, as ToR says, permanent solution and security of the union's borders are insured, and the Schengen provisions may be fully implemented.

[1] There are a number of EU documents addressing the issue of the Cohesion Policy. For example, they are addressed at length in the report: Investing in Europe's future European Commission, Fifth report on economic, social and territorial cohesion November 2010.

The major groups of the issues to be addressed are:

- Geopolitical aspects
- Security issues
- Social problems
- National and nationality issues
- Economic system
- Economic development differences and migration
- Transport connections
- Security of the EU borders
- EU policies: Schengen, Cohesion, Transport and Economic Development
- Other related issues

1.2 Specific Elements in this Prefeasibility Study

This prefeasibility study is titled *The Pre-feasibility study for the possible transport connection of Croatian territory.* It must be interpreted and understood correctly. The major objective is obviously to find a permanent transport solution to the issue of territorial continuity of EU. The internal waters and territorial sea connections are provided, the problem is with the land continuity, and all related to this situation implications including reduced possibilities for fully implementing EU policies and Schengen requirements. This solution cannot however be found based only on a typical comparison of cost benefit assessment of the proposed scenarios. This might lead in this case to wrong and ineffective solutions. There are a number of development options proposed for the resolution of the key issue. They approach the problem solution from different angles and with various action tools. They provide different benefits and have a various contribution to EU and regional economic, social and territorial issues. In this case, standard evaluation methods are usually no sufficient to properly address the problems and make sound long-term infrastructure decisions. In particular, simple cost and benefit comparisons may be insufficient and misleading[2]. The assessment has also been complicated by the fact that the proposed options are at a different stage of development starting from the options which are only at the conceptual design stage to the partially build projects.

Consequently, a multidimensional and interdisciplinary approach has to be implemented. This is consistent with the multiciteria assessment approach called for in ToR. In this case, there are no simple and one discipline type answers. Many aspects of each solution must be considered. Typical cost – benefit assessment of development options may be misleading and result in false advice and choices. The best C/B ratio solution may be not most advantageous socially, geopolitically or as far as economic development issues are concerned. In this case, implementing in a simplistic way just the lowest cost scenario without addressing, other merits of all other options, may be inappropriate (although the final choice of the cheapest option is possible and no prejudice should be exhibited in this matter)

As far as the time factor is concerned, this is not a simple and standard situation either. The situation in the target area changed radically since July 1, 2013, when the Republic of Croatia joined the European Union. It will change again, when Bosnia and Herzegovina will become an EU member. At the time when this project is conducted there is no specific official date which can be set for the B&H membership in the EU. It is unknown for EU, Croatia and the B&H partners themselves. This calls for flexibility in conducting analyses and makes a sensitivity approach necessary. Depending on the schedule for B&H EU membership, the assumptions for some development options may change.

[2] This opinion is often presented in literature for situations when there are significantly differing options for addressing particular issues and achieving desired effects.

In that respect, the development of assumptions for the proposed options assessment must be based on the Terms of Reference (ToR), and also subsequent continued communication with the Beneficiary, and the Advisory Committee set for the project. In this project, and approach encompassing more than just a word by word ToR reading is necessary. The specific situation calls for consideration of multidisciplinary and multidimensional aspects of the prioritization of the development options. For that purpose the multicriteria assessment approach (MCA) presented in the ToR seem to be the best and likely to provide the most educated and correct answers. The following methodological assumptions transpire from the above.

1.3 Project Objectives

Two PFS objectives are defined verbatim in the ToR:

- The global objective of this pre-feasibility study is to evaluate the possible transport connections between two land separated parts of the Croatian and EU territory and identify the most advantageous option from the economic, environmental and political point of view by assessing its legal implications, long-term feasibility and sustainability.
- Specific objective is to examine all available options to connect the EU/Croatian territory West and East of Neum.

This set of objectives is clear and unequivocal. There are however some other tasks in the ToR that may be treated as additional objectives but equally important objectives. It is important to take note of them since they delineate the entire analytical process and reasoning behind the final choice of the most promising option. They are underlying assumptions for the Multi-criteria Assessment (MCA) methodology (and CBA assessment as an important element of MCA). All these elements are critical for making the choice considering all the factors described in PFS.

These elements are:

- It is of utmost importance both for Croatia and the EU to find **a permanent solution** that will ensure unconstrained flow of goods and persons through the EU/Croatian territory and the Schengen area, avoiding any traffic bottlenecks in the future, while at the same time ensuring the security of the future external Schengen borders and keeping in mind the enlargement process of the EU.
  The permanent character of the chosen option must be considered at all stage of the assessment starting from CBA, other elements areas of analysis, MCA assessment, and all the way to the PFS final conclusions. This is a critical element in interpreting the results of the CBA and MCA. The permanency means that the development option provides a solution minimum for the assumed life cycle of the investment. All options which require changes in basic assumptions in the earlier period of time cannot be considered permanent.
- The aim of the pre-feasibility study is to allow the Commission to assess **the possible co-financing of the construction of transport infrastructure connecting the separated territory of Croatia from EU funds.** For that purpose. The CBA had to be conducted, and the costs and benefits assessed. This is an important element of the PFS, it indicates the seriousness of all the parties involved in timely and permanently resolving this problem. Since as indicated above, the geopolitical situation in the region may change due to the expected expansion of the EU, the permanency of the solution is a very important factor that needs to be considered. The developments of temporary solutions, which will lose their functions after EU expansion possibilities materialize, seem to be not desired by this ToR. The feasibility of such temporary options must give particular attention.
- The PFS study evaluates the possible transport connections between the two land separated parts of the EU/Croatian territory and identifies **the most advantageous option from the economic, environmental and political point of view**, while assessing its **legal implications, long term feasibility and sustainability.**

All possible solutions, accepted by the Beneficiary have been evaluated, including bridge, ferries, tunnels, extraterritorial roads, and continental corridors. Many other options were addressed too, but they have been rejected as not applicable to this case or not justified by various reasons[3].

- The Contractor took into account **current political (border) situation between the Republic of Croatia (RoC) and Bosnia and Herzegovina (B&H). The impact of Croatia's accession to the European Union** and likely future developments have also been considered. It was acknowledged that Croatia joining the EU is a long-term political and economic process that needs to contribute to the quality of life in the region. This is, as the history teaches us, the measure insuring social peace and stability in multinational and multicultural regions. The Neum is a multinational and multicultural region.
- The Contractor identified the problems and bottlenecks related to transport organization and transport infrastructure, economy, social aspects, environmental issues, as well as political (border) situation between RoC and B&H. The proposed solution will take this under consideration.

The EU/Croatia land territory connection has a significant EU, regional and national meaning in terms of economics, economic regional development, tourism, freedom to travel for EU nationals, geopolitical stability, security of EU borders, cultural inheritance preservation, cultural and social development, and poverty combating in the South-western Balkan region. The land discontinuity of the EU territory in this area is resulting in problems in communication, transportation, legal aspects, which adversely affects the economy, and complicates achieving long term objectives of the European Union, especially the EU Cohesion Policy.

The importance of establishing the connection has increased significantly after the Republic of Croatia joining the European Union on July 1, 2013. In fact it is a major geopolitical, economic and security issue for the entire European Union. The physical separation (land) of Croatia from the rest of the Union is the only such situation in the European Union. The solution for this awkward situation is in the interest of the entire Union, and may critically contribute to geopolitical stability, economic growth and social welfare at this strategic South-western Balkans region of the EU. The resolution of this issue will also significantly impact EU policy and possible expansion plans in the region.

The time factor has not been verbatim mentioned in the ToR, however it underlies almost all the requirements of this project. The solution is needed as soon as possible and any delays may have critical impacts not only in monetary but also political and social terms. The time factor is than, an important issue in this analysis. Based on the assessment presented in the PFS, the conclusion appears that to effectively address the problem of connecting the EU/Croatia land territory, all the necessary actions have to be initiated immediately. This concerns all possible spheres of activities from technical, engineering, through financial and political actions. The resolution of the current situation is in the interest of all the parties involved including the EU, Croatia, Bosnia and Herzegovina, regional and local governments and communities, and last but not least the citizens the targeted area.

1.4 Multi-criteria Approach

The Multi-criteria analysis (MCA) is a key element of the proposed and accepted by the Beneficiary transport options assessment methodology. The criteria for analysis took into account the financial impact (value-for-money) of the possible project, its long-term sustainability, the impact of the proposed option on economy and environment in the target area, the requirements of Schengen Acquis and in particular the Schengen Border Code (Regulation 562/2006), customs control, veterinary and phytosanitary inspection, Trans-European Transport Networks as well as the likely political impact.

[3] A list of development options presented in this report has been mutually agreed upon with the Beneficiary and the European Commission and Bosnia and Herzegovina members of the Advisory Committee. The approach involving a review of options with special attention given to the most promising alternatives has been implemented based on the Advisory Committee (EC, B&H, and Croatia members) recommendation and approval of the Beneficiary.

The opportunity costs of one option against the other has been taken into account. Special attention was given to the existing and future environmental legislation and in particular Natura 2000, the Maritime Directive and also other proposed Natura 2000 sites in the targeted area. As a principle, each proposed option has been assessed on the basis of all identified criteria, and the legal implications they may have.

The procedure required for the completion of this study calls for thorough consultations with the Beneficiary. This is fully justifiable since the Beneficiary represents here the interests of both the European Union and Republic of Croatia. In the complicated regional situation and having one of the longest EU external border – the Republic of Croatia claim for assistance of the EU in resolving this issue is strong and justified. Plus the resolution of the issue would significantly contribute to the Cohesion Policy objectives.

The PFS provides recommendations, on the basis of the multi-criteria assessment (MCA) including the CBA input. Per ToR, one transport option has been recommended. It must be reminded that based on the advice of the Advisory Committee the Contractor may consider the multiple choice solution, however the choice one option, as initially stated in the ToR would be probably the most desirable. This would contribute to the faster problem solving path, cost savings and the overall increase of the process Value for Money (VfM). The Contractor however, did not prejudge the outcome, and assessed all options on equal terms being ready to recommend more than one option if the choice of one solution were not clearly possible. It is understood that the selected development option will have to be further assessed and addressed in detail in the full feasibility study. The premise of this PFS is to make a choice of the most suitable development option. It has not been designed as a substitute for the feasibility study of any of the development options. This impacts the applied analytical and methodological approaches.

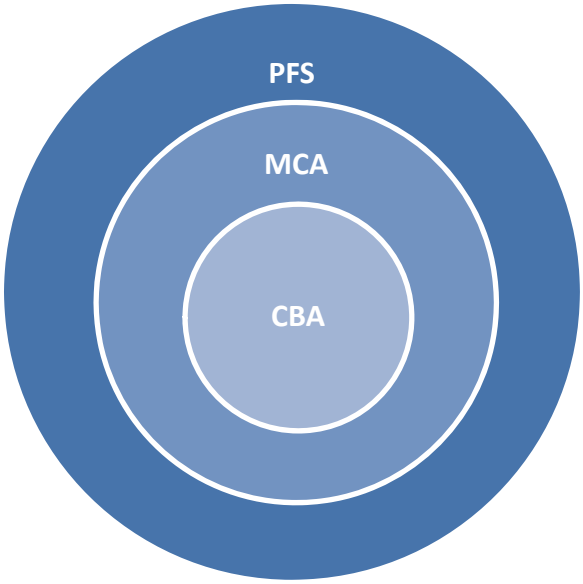
1.5 Methodological Assumptions

This study has three major elements

- Cost Benefit Assessment
- Multi-criteria Analysis (including all the input assessment)
- Multidimensional Evaluation and Interpretation of the Results

This sequence of analytical steps is consistent with the methodology requested in the Terms of Reference for the project. The scheme and interrelationship of major work elements has been presented below.

Figure 1 The Relationship Among Cost – Benefit Analysis (CBA); Multi-criteria Analysis (MCA), and Pre-feasibility Study (PFS)



1.6 Evaluation Steps Sequence

The study was conducted according to ToR, the methodology described in the proposal and in the preceding paragraphs. The Prefeasibility Study report comprises sections addressing the following issues:

- Project definition
- Socioeconomic conditions and regional development
- Existing road infrastructure
- Existing traffic conditions, including the O-D survey results and analysis
- Technical aspects
- Legal aspects
- Environmental aspects
- Economic impact
- Evaluation of alternatives – Multi-criteria Analysis (MCA)
- Summary of conclusions

1.7 Data used during the preparation of the study

The project required application of various forms of data collection techniques. Primary and secondary data were collected.

Primary data were collected by:

- By conducting a series of site visits in the targeted area with the private and public sectors. Particularly important were interviews with local and county officials and institutions that provided detailed information for the study.

- A large number of interviews were conducted with national government officials in Zagreb
- Data were collected from interviews with the government agencies and ministries
- Interviews with local governments

Secondary data were collected from many sources among them:

- Published Croatia government and government agencies data
- Published data from Bosnia and Herzegovina
- Data sources of the European Union
- Relevant data sources from other countries

A detailed list of data sources and conducted meeting has been provided in the Final report[4].

[4] The Final Report is a separate report provided to the Beneficiary and the Contracting Authority.

2 NEEDS FOR TRANSPORT SOLUTION

2.1 Background

The Prefeasibility Study (PFS), MCA and CBA have been designed to address and resolve critically important issues resulting from the fact that the territory of the Republic of Croatia (RoC) (now EU), is separated into two parts by a 14 km wide territory of the Bosnia and Herzegovina (B&H) around the City of Neum at the seashore of Adriatic. The coastal line of the B&H corridor is 23.6 km long. The stretch of the Adriatic highway passing through the corridor is 9.25 kilometres long and hand as two border crossing points; on the western side Klek – Neum I and on the eastern side Zaton Doli – Neum II.

The movement of passengers and goods between northern and southern part of Croatia takes place over the above BCPs. However, import or export of the goods into and out of Croatia and B&H doesn't take place at these two border crossing points as decided in the Agreement between the Republic of Croatia and Bosnia and Herzegovina on border crossing points.[5]

Figure 2 Border Crossing Point Klek- Neum

Figure 3 Border Crossing Point at Zaton doli – Neum II

After the accession of the Republic of Croatia to the EU on 1th July 2013, the EU legal framework and related border proceedings made an impact on the movement of passengers and goods between two discontinued parts of the Croatian territory.

The traffic of passengers and goods in the Neum corridor is controlled in line with international bilateral agreements and EU legal framework allowing for a special transit regime.[6] There are specific requirements[7] in the Accession Treaty in order to provide transit of the specific goods and appropriately equipped and staffed border crossing points at both entries shall be provided. The details are explained in other parts of the PFS, especially the legal section. Products of animal origin are **not** subjected to phyto-sanitary checks_These products are subject to the special regime, i.e. they do undergo a certain type of check, which of course is not the same as unhindered passage which would take place on EU territory.

[5] Agreement between the Republic of Croatia and Bosnia and Herzegovina on border crossing points.
[6] The Croatian Accession Treaty, Annex
[7] Transit of live animals shall be prohibited while consignments must not be transported in open vehicles via Neum and vehicles have to be properly sealed.

2.2 Needs for Permanent Solution

The Croatian EU membership makes it necessary to introduce a permanent solution that will ensure unconstrained flow of goods and persons either through the Croatian or Bosnian territory avoiding traffic bottlenecks by ensuring high level of safety at the external EU Border in line with the EU Acquis. With no doubts, the discontinuity of the territory of the Republic of Croatia results in problems in communication, transportation, legal aspects, which adversely affect the economy. It also has social, political, and economic development implications.

The current situation cannot be defined as fully stable. Based on the practices of similar corridors in the World there is always a possibility of misunderstanding and political complications in similar circumstances. The existing situation, or rather lack of permanent politically neutral solution, leaves the door open for a possibility of temporary traffic constrains due to various actions that may be undertaken at BCP. In 2013, such an occurrence took place. Based on the correspondence between the Croatian and Bosnia and Herzegovina authorities, assessed by the Consultant, it was established that there was a dispute regarding practices of the B&H customs authorities at the BCP in the Neum corridor. The correspondence indicates that the newly introduced B&H customs procedures created a significant increase of border and customs control, and caused significant traffic jams and delays at the border crossing points. According to the observations and traffic monitoring data, transit time at the Neum corridor BCPs has increased by up to 300%[8].

These problems must be needed to be addressed. Any solution that would not eliminate a possibility of similar occurrences is not permanent. The World experience indicates that the only viable and permanent solution is to eliminate contact points and provide whenever possible transport infrastructure which usage would be dependent on actions of any other state. In this case, that indicates, that transport infrastructure solution located solely within the EU territory would provide the needed full and permanent solution to the problem

2.3 Impact on European Union

The land discontinuity of the EU/ Croatia territory also directly impacts the EU interests. This impact has the following forms:

- Contrary to the earlier situation, due to the EU expansion, passenger traffic has to be controlled, at the entry to and exit of the Neum in line with EU rules.
- While passenger traffic continues in line with EU rules, the transport of goods across the Croatian-Bosnian border after Croatia's EU accession on July 1, 2013 must take place in line with the agreed special regime for corridor through Neum, as stipulated by the Croatian Accession Treaty[9]
- Products of animal origin coming from Croatia and transiting through the territory of Bosnia and Herzegovina at Neum before re-entering Croatia via Klek or Zaton Doli, may be exempted from the required veterinary checks.
- Croatia must ensure (and did) fully equipped and staffed points of entry to the north and south of the corridor in place as well as effective technical surveillance systems to ensure efficient controls.
- Consignments must not be transported in open vehicles via Neum and the vehicles have to be properly sealed.

[8] Such an increase significantly impacts evaluation assumptions of development options. The increase of border time provides additional traffic diversion from D8 route mainly to the options involving the Peljesac peninsula, which contributes to their higher competitiveness. See the traffic model and the evaluation model for BCP movements and congestion.

[9] Annex V of the Act of Accession; List referred to in Article 18 of the Act of Accession: transitional measures; Section 5, Food Safety, Veterinary and Phytosanitary policy; Subsection IV Neum.

- The transit of live animals with the exception of pet animals through Neum is prohibited.

2.4 Impact on the City of Neum

The current situation is also limiting development options for Bosnia and Herzegovina and the City of Neum. Traffic on D8 is routed though the centre of the city, and separates sea-side properties from the rest of town. The current traffic patterns negatively impact options for encouraging investments and economic development to the City of Neum. A very intense, during the summer time, traffic decreases attractiveness of the Bosnia and Herzegovina Adriatic Coast, and discourages investors and tourists. The reduction of traffic flows through this City should result in concrete economic benefits for the City and its inhabitants.

The Croatia accession to the European Union impacted the mobility of both the citizens of Croatia and Bosnia and Herzegovina. Consequently, improvements of infrastructure in both countries are needed to alleviate these circumstances.

In Croatia the improvements are needed to eliminate the negative effects of establishing the borders which are a subject to the regime of the European Union wit borders of the third party countries. In Bosnia and Herzegovina, the mobility of its citizens has been significantly reduced by eliminating the option for easy border crossing to Croatia. This is very important since there are many natural life related connections between the territories of both countries.

The situation is slightly easier in the Neum area for B&H citizens who have Croatian/EU citizenship. They can enjoy easy passage of the border. For citizens who do not have EDU citizenship the situation remains complicated. In light of the Schengen requirements this may become even complicated to all the citizens of B&H who do not have EU citizenship (single or dual) .

The transport system and infrastructure improvements must also consider the **time factor**. It has been assumed that at some point Bosnia and Herzegovina will access the European Union for that purpose infrastructure expenditures must take under consideration what will happen with these improvements after this date. It is important to know of after the accession of both countries to the European Union the committed funds will result in the expected benefits. This leads to a conclusion that special care has to be taken to the assessment of long term viability of transportation options and improvements.

The situation of the City of Neum must be also considered in terms of social and geopolitical needs. As indicated earlier in this report, the accession of Croatia to the EU limits the mobility of the citizens of the area. This is even more important because the Neum area does not have sufficient connections to the centre and north of B&H. In this situation the best, safest and most desirable way of travelling now to the north of the country for example Sarajevo is via the territory of the Republic of Croatia. In light of the Schengen requirements this starts to be complicated to all the citizens of B&H who do not have dual citizenship. Such a situation does not contribute to improvement of geopolitical situation. Perhaps, in that situation the solution of the Croatia territory joining, also the options for supporting B&H needs for improving connection with the Neum area should be considered. This may be addressed by providing assistance for the development of road connection from the City of Neum to the centre of the country solely via the B&H territory. It seems that under the current situation no infrastructure investment solutions including the creation of the free special legal status zone in the Neum area are acceptable. It is therefore that the solution of the EU/Croatian territory connection must be addressed with the consideration of all other regional aspects of the situation in that area to insure geopolitical stability in that region minimum for the period that both Croatia and Bosnia and Herzegovina are not in the European Union.

2.5 Impact on the Dubrovnik Neretva County (DNC)

The improvements of the regional transport system to the largest extend affect the Dubrovnik - Neretva County (DNC). These improvements impact the quality of life in this county by impacting such events as; the cost of leaving, attractiveness of the area for tourists (who if no needed transport infrastructure is available must travel for a much longer time to this area compared to other areas of Croatia for example the regions of Makarska and Split), economic development opportunities, cost of consumer goods and life, etc. The problems and needs for developments have been expressed in many documents in that in the Development Strategy for the Dubrovnik – Neretva County for the years 2011 – 2013 prepared in Croatia. The document indicate that:

- The County is inadequately connected by means of motorway with other parts of Croatia and parts outside Croatia.
- It is difficult to consider environmental, economical and other factors in strategic planning of the development of transport and transport infrastructure because of the separation of the county.
- A part of the County roads are in a poor condition.
- The increase in the congestion of the City transport in Dubrovnik.
- The transport infrastructure is not sufficiently adapted to suit the needs of the disabled.
- There is a lack of alternative roads which might be used in case of natural disasters, fires and so on (lack of emergency evacuation systems).
- The fact that cargo ships are overage might be the cause of environmental adversities.
- The coastal sea transport, which is of strategic importance for the development of islands, is not sufficiently developed. Furthermore, the condition of the transport links between islands is most critical, apart from the links to the Elaphiti islands.
- Sea infrastructure (island ports and peninsula Pelješac port) is not adequate, that is, it is not adapted to adverse weather conditions.
- There are insufficient development programs aimed at enhancing services and economical activities related to the further development of railway transport from Ploče to the state border.
- Potential problems in transport due to introducing of the Schengen regime at the border with Bosnia and Herzegovina (further in the text B&H).

There are also other needs for road infrastructure developments in the region. The aim of the development of transport infrastructure in Dubrovnik-Neretva County (DNC) is to ensure better links between Dubrovnik and the rest of the country (taking into consideration that the territory of Croatia is discontinued in Neum, thus making Dubrovnik detached from the centre of the country) and further to ensure better links within the DNC. The developments should also ensure the enhancement of the transport links between the DNC and other parts of Croatia and Europe.

2.6 Transit to Ploce

Free transit through Croatian territory to and from the Port of Ploce and through the territory of Bosnia and Herzegovina in Neum is very important because even after the Croatian accession to the EU these corridors are used mainly by businesses from B&H. In addition, these routes, especially the one through Neum, are gaining importance through the commitment of both countries to the Adriatic-Ionian corridor that passes through seven countries, beginning with Italy (Trieste) through Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania and Greece (Kalmata).

Anticipating this fact, the European Commission gave its recommendation during a meeting of the Interim Subcommittee for Transportation, Environment, Energy, and Regional Development to establish and intensify the bilateral dialogue with Croatia on finding solutions to disputed issues relating to transit through the Neum corridor. A joint statement by the Ministers of Transport of B&H, Croatia, Montenegro and Albania was signed in Ljubljana in 2004, while in 2009 the Council of Ministers of B&H tasked the Ministry of Communications and

Transport to carry out a study and to draft project documentation to explore the best routes for the Adriatic-Ionian Motorway from the border with Croatia to the border with Montenegro.

According to the Stabilization and Association Agreement with the EU, B&H has committed to the development of a core regional network of South East Europe (MoUSEETO) including the Adriatic-Ionian Motorway which is going to be a part of the TEN-T network in the future. Bosnia and Herzegovina and Montenegro have defined their points of contact of the Adriatic-Ionian Motorway. Additionally, an initiative for defining the points of contact between B&H and Croatia has been sent to the Croatian authorities.

The failure to resolve the issue of transit through B&H significantly complicates and slows down the entire transport network around Neum, especially after the accession of Croatia to EU, not only for goods "from Croatia to Croatia", but also for goods "from Bosnia and Herzegovina to Bosnia and Herzegovina" and to Croatia, as well as for all other goods that are in transit on the way to Croatia.

There are also other needs for road infrastructure developments in the region. The aim of the development of transport infrastructure in Dubrovnik-Neretva County is to ensure better links between Dubrovnik and the rest of the country (taking into consideration that the territory of Croatia is discontinued in Neum, thus making Dubrovnik detached from the centre of the country) and further to ensure better links within the DNC. The developments should also ensure the enhancement of the transport links between the DNC and other parts of Croatia and Europe.

2.7 PFS Approach to DNC Development

The PFS aims therefore at enhancing the transport connection of DNC to the rest of Croatian territory and thus fits the framework and goals stated above. The project is also consistent with the overall set of transport interventions planned by the DNC government:

- Continue developing the motorway to Dubrovnik.
- Start developing fast road over Pelješac and fast road between Osojnik (Dubrovnik) and Debeli brijeg.
- Solve problems related to introducing the Schengen regime at the B&H border
- Develop, reconstruct and modernize local and County roads (urgent asphalt renewal is primarily needed) and ensure that there are sufficient car parks, pedestrian zones and cycle tracks.
- Secure further development of coastal transport of passengers and significantly enhance the links between islands and the County centre, as well as the links between the islands.
- The development of alternative roads which would be used in case of natural disasters.
- Systematically solve city transport in Dubrovnik.
- Adapt the transport infrastructure according to the needs of the disabled.
- Initiate activities relevant to developing planned airports.
- Start developing emergency heliodroms foreseen by the County space planning.
- Carry out investments in the sea infrastructure so as to enhance its condition and to increase the quality of sea transport network.
- Secure the reconstruction and validity of existing overage cargo ships.
- Establish the system of intermodal transport towards the passenger port of Gruž.
- Enhance the railway transport from Ploče to the state border (provide a development plan for services and economical activities related to the further development of the railway transport).

The results of the project and other actions described above, should provide the direct road link between the DNC and the rest of the country, reduce congestion and travelling time along D8 road, increase comfort and safety when driving, increase attractiveness of the Adriatic – Ionian direction for both goods and passenger transport compared to the other European transport corridors and enhance conditions for tourist arriving by personal cars and coaches. Other assumptions and implications for this project are described in other parts of the PFS.

The results of the project and other actions described above, should provide the direct road link between the DNC and the rest of the country, reduce congestion and travelling time along D8 road, increase comfort and safety when driving, increase attractiveness of the Adriatic – Ionian direction for both goods and passenger transport compared to the other European transport corridors and enhance conditions for tourist arriving by personal cars and coaches.

3 DEFINITION OF DEVELOPMENT OPTIONS

3.1 Introduction

The Prefeasibility Study addresses 11 development options. This list has been developed in consultation and approved by the Beneficiary and the Contractor in several steps. A list of projects was also discussed frequently at the Advisory Committee meetings. The final choice of scenarios was unanimously accepted by this committee. The following is a description of steps and concerns considered when establishing and agreeing on the final list of development options, subsequently subjected for evaluation.

3.2 Development Options Identification Procedure

The final list of development options to be evaluated within PFS was developed per ToR in cooperation and with approval of the Beneficiary, and as a result of advice received from the Advisory Committee[10]. The following steps were made to agree on the list and scope of development options for final evaluation:

- First, a list of development options included in the Terms of Reference has been thoroughly discussed and evaluated. This initial indicative list of options included the following options:

    - Bridge (of different heights and pole span, floating): mainland - Peljesac peninsula with access roads to the bridge, and a new road across the Peljesac peninsula to the state road D8. Please note that the ToR does not specify any design or type of the bridge. A number of options have been considered prior to the initiation of this study, however, to be independent and fair the Contractor made calculations and assessment based on a generic construction type. The detailed design of the bridge will be a subject for the Feasibility Study[11].
    - Bridge (of different heights and pole span, floating): mainland - Peljesac peninsula with access roads to the bridge without a new road across the Peljesac peninsula to the state road D8; (see comments above for the bridge type issues)
    - Highway road Corridor through Bosnia and Herzegovina (B&H) with special traffic regime (and status) in the Neum background (city in B&H). (The special traffic regime and the EC requirements for such a fixture have been addressed in the following sections of this report)
    - Tunnel under the B&H territory; (This option was provide in the initial list of development options however it was for the beginning negatively assessed by either Croatia or B&H partners. It was addressed only because it was included in the initial list of development options)
    - Reconstruction of existing road and partial construction of new road across the Peljesac peninsula from the ferry port Trpanj to the state road D8, using existing ferry connections; It was clarified with Beneficiary and later with the city government of Trpanj that this option cannot include because of various reasons the expansion of the ferry terminal space in the city. This constituted a significant limitation for this option both technically as in terms of economic feasibility. The consultant might have addressed some other options here but based on the agreement with the Beneficiary they were abandoned as not consistent with regional economic development and spatial plans.

[10] The final list of development options has been jointly approved by the Beneficiary and Advisory Committee at the 2nd Advisory Committee meeting.

[11] There were some feasibility studies completed for some scenarios of this development options. In the opinion of the Contractor, they have to be revalidated due to lapse of time and uncertainty of some current engineering design. Plus the consultant agreed according to the ToR for this PFS that it will not prejudge any design elements of any project and therefore the assessment was conducted on the level of detail necessary for the Pre-feasibility study with objectives as set out earlier in this report.

- Use of existing piers on piles of the bridge: mainland - Peljesac peninsula and construction of access roads on the mainland side to state road D8, and on Peljesac side to state road D414;
- Use of existing piers on piles of the bridge: mainland - Peljesac peninsula and construction of access roads to the bridge, and a new road across the Peljesac peninsula to state road D8;
- Use of (original) Adriatic-Ionian motorway route through hinterland of B&H with motorway exits to Metkovic and Dubrovnik.

- Second, the Contractor was required to identify other possible transport organization and transport infrastructure options that may be used to connect the Croatian territory west and east of the Neum. The intention was that other options might be developed as a result of the analysis. For that purpose, the consultant:

  - Conducted its own research of viable options.

    - For example, similarly to other regions located in the mountain regions, various options of rail connection were addressed by the Contractor. This included a rail multipurpose shuttle and car shuttle similar to the developments used for example in Switzerland. They were however eliminated due to the cost and time of possible construction.
    - Various options for ferry service extension were contemplated, however none of them (except of those listed above) were realistic based on the restrictions of navigation channels and supply of needed ferry services.
    - A long distance cable car solution was also considered but it did not address car traffic problem. so had to be eliminated.

- Third, the Beneficiary requested that an immersed tunnel project be considered and assessed. This was to include tunnel documentation from one of the engineering firm which claimed that this is the most efficient solution. This development option has been included to the evaluation.
- Fourth, based on the discussion with the Beneficiary and Advisory Committee, the design of the floating bridge has not been included in the list of the project for future evaluation. It was concluded that this design, although engineering-wise sound, may result in significant environment, legal and the Bay of Neum access complications. This conclusion has been approved by the Beneficiary.
- Fifth, based on the advice of the Advisory Committee, a new exterritorial option called The Neum By-pass was included to the analysis by the Bosnia and Herzegovina partners. This project was another option for an exterritorial corridor solution. The difference is that it is located closer to the City of Neum than the previously indicated corridor projects. There were a number of discussions of the new option and it was finally decided that it will substitute for one of the two earlier submitted corridor options. As a result, the PFS assessment included one extraterritorial corridor solution and the Neum By-Pass. It is important to clearly differentiate these options. The extraterritorial corridor is a highway located on the territory of the third country (B&H) while the by-pass is a special type of the road which is located by the valley where the City of Neum is located and which after the B&H accession to the European Union will become a by-pass ring around the city. Because to that is has to be constructed based on different engineering solution than a regular highway – for example a larger number of ingress and egress nodes have to be designed and constructed.

3.3 A comparison of ToR Assumptions and a Final List of Evaluated Development Options

Table 1 Initial and Final Development Options for Pre-feasibility Study

ToR Option (see 2.3 of ToR)	The Consultant classification
Option 1: Bridge (of different heights and pole span, floating): mainland - Peljesac peninsula with access roads to the bridge, and a new road across the Peljesac peninsula to the state road D8 Comment: New road *from D414 (Šparagovići) to D8 (mainland), Ston bypass included.*	**Option A:** Bridge: mainland - Peljesac peninsula with access roads to the bridge, and: **A1**: with a new road across the Peljesac peninsula to the state road D8 **A2**: without a new road across the Peljesac peninsula to the state road D8
Option 2: Bridge (of different heights and pole span, floating): mainland - Peljesac peninsula with access roads to the bridge **without a new road across the Peljesac peninsula** to the state road D8	
Option 3: Highway road Corridor through Bosnia and Herzegovina (B&H) with special traffic regime (and status) in the Neum background (city in B&H);	**Option C**: Highway corridor through B&H with special traffic regime (and status) in the Neum background (city in B&H);
Option 4: Tunnel under the B&H territory;	**Option G**: Tunnel under B&H
Option 5: Reconstruction of existing road and partial construction of new road across the Peljesac peninsula from the ferry port Trpanj to the state road D8, using existing ferry connections;	**Option D:** Long distance ferries with rehabilitation of existing peninsula road (Reconstruction of existing road and partial construction of new road across the Peljesac peninsula from the ferry port Trpanj to the state road D8, using existing ferry connections)
Option 6: Use of existing piers on piles of the bridge: mainland - Peljesac peninsula and construction **of access roads on the mainland side to state road D8, and on Peljesac side to state road D414;**	**Option E:** Short distance ferry line (on position of Pelješac bridge) with connecting roads and: **E1**: with a new road across the Peljesac peninsula to the state road D8 **E2**: without a new road across the Peljesac peninsula to the state road D8
Option 7: Use of existing piers on piles of the bridge: mainland - Peljesac peninsula and construction **of access roads to the bridge, and a new road across the Peljesac peninsula to state road D8**	
Option 8: Use of (original) Adriatic-Ionian motorway route through hinterland of B&H with motorway exits to Metkovic and Dubrovnik.	**Option H**: Adrian-Ionian Motorway (AIM)
Not listed in ToR	**Option F**: Immersed tunnel to the Pelješac peninsula with access roads and: **F1**: with a new road across the Peljesac peninsula to the state road D8 **F2**: without a new road across the Peljesac peninsula to the state road D8
	Option B: Neum bypass with connecting roads – city road corridor through B&H with special traffic regime (and status) in the Neum background (city in B&H);

A detailed description of the development options selected for evaluation is provided further in this report. The major features for these solutions are addressed below.

3.3.1 OPTION A: PELJEŠAC BRIDGE WITH CONNECTING ROADS AND WITH/WITHOUT A NEW PENINSULA ROAD

The Peljesac bridge with connecting roads and with/without the new peninsula road (option A) assumes the construction of a new bridge between Komarna (mainland) – Brijesta (Pelješac), the approach roads to the bridge from the national road D8 on the location Duboka to Komarna and from Brijesta to the national road D414 on the location Zaradeže. The design speed for the link roads and the bridge will be 90km/h.

The major element of this option is the construction of new bridge between Komarna (mainland) – Brijesta (Pelješac). The bridge is partially ready, as the initial commencement of the construction works on the northern and southern termini took place in October 2007, with the sea works starting in the autumn of 2008. However, the construction contract was terminated in May 2012.

Option A comprises of two sub-options: A1 and A2.

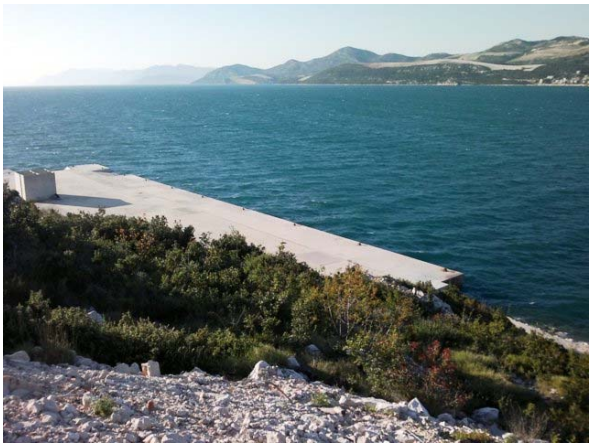
- **Option A1** assumes that additionally to the bridge and the connecting roads, a new route of the D414 Pelješac road on the section from Zaradeže to the national road D8 on the location Đonta Doli will be constructed, to improve the transport condition on the whole route on the Peljesac peninsula. The design speed for the constructed sections will be 90km/h.
- **Option A2** assumes that no additional investments will be done on the Peljesac peninsula roads. On the existing road across the peninsula the design speed is 50km/h.

Figure 4 Option A1- the existing road network and the planned interventions

The bridge has been partially completed, as the initial commencement of the construction works on the northern and southern termini took place in October 2007, with the sea works starting in the autumn of 2008. The construction works and contract were terminated in May 2012.

Figure 5 The Built Pillar of the Peljesac Bridge

Figure 6 The Built Dock of the Peljesac Bridge



Option A1: The Pelješac bridge with connecting roads and with a new peninsula road

In the option A1 the total length of the infrastructure is 32+551m including the Pelješac Bridge of 2,440m, and with the following scope of interventions:

- Construction of the link road from the D8 to the bridge;
- Construction of the Pelješac Bridge;
- Construction of the link road to the Šparagovići;
- Construction of the new road D414 from Šparagovići to Donta Doli

The following elements will be built on these sections:

- Duboka interchange (with D8);
- Pelješac Bridge (2440 m)
- Brijesta interchange;
- Kamenice tunnel (499m);
- Debeli Brijeg tunnel (2467m);
- Zaradeže interchange (with D414);
- Ponikve interchange (with D414);
- Viaduct (220m);
- Prapratno interchange (with D414);
- Polakovica tunnel (1200m);
- Bridge (485m);
- Supava tunnel (1270m); and
- Doli interchange (with D8).

The design speed for this road is 90km/h.

Option A2: Pelješac bridge without connecting roads and without a new peninsula road

In the option A2 the total length of the new infrastructure is about 14km including the Pelješac Bridge of 2,440m, and with the following scope of interventions:

- Construction of the link road from the D8 to the bridge;
- Construction of the Pelješac Bridge;
- Construction of the link road to the špargovići;

The following elements will be built on these sections:

- Duboka interchange (with D8);
- Pelješac Bridge (2440 m)
- Brijesta interchange;
- Kamenice tunnel (499m);
- Debeli Brijeg tunnel (2467m);
- Zaradeže interchange (with D414);

On the existing road across the Peljesac peninsula, the design travel speed is 50km/h.

3.3.2 OPTION B: NEUM BYPASS

The Neum Bypass option (Option B) has been established and proposed by the government of Bosnia and Herzegovina and the recommendations of the B&H team conducting negotiations with EU. This option facilitates the connection with EU Vc corridor and follows the planned bypass from the Spatial plan of Neum and partially of B&H (the eastern part of the bypass). This spatial plan has however not been accepted yet.

Due to the EU requirements, the complete project of the Neum bypass will be finished once B&H becomes EU member. Before that time, the connection of the by-pass to the planned and existing road system of B&H will not be implemented, and the Neum bypass would have special traffic regime and status, enabling the seamless flow of passengers and cargo between Ploce and Dubrovnik. This is an extraterritorial solution that needs to meet the EC requirements for Schengen regulations. Once B&H becomes the EU and Schengen member, the by-pass would be connected with the local road system. By this, it would transfer from an extraterritorial corridor to a local, typical by-pass connection[12].

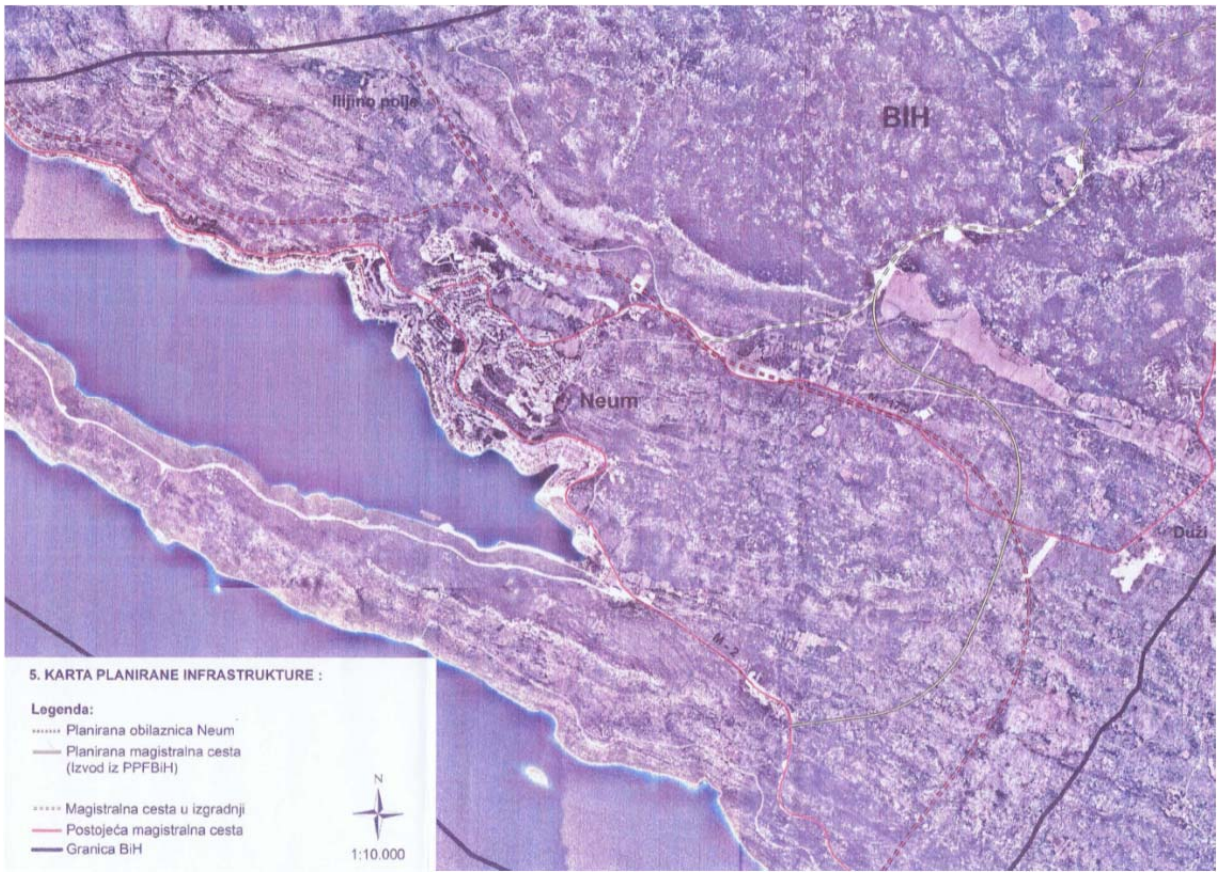
The Neum bypass on the B&H side is proposed as a 2 lanes road beginning in two points on the Croatian border:

- Near the Llijno Polje,
- On the Adriatic road (D8), about 4.15 km from the Neum intersection on the Adriatic Main road.

Both sections meet near the Prisoje hills and then the route follows the existing highway Stolac-Neum, to the Ilija's Hill, from where the route turns towards the Adriatic magistral road following and joins it after the border crossing. The length of the by-pass section through B&H is 10100 m and the total length of the by-pass is 10 800m.

[12] The connections to local road infrastructure would have to be made. To accomplish that, a significant portion of security fixtures will have to be dismantled at a significant additional cost. Some of construction will become obsolete and idle (for example security control centre, frontage (safety monitoring) roads on both side of the by-pass. They are than, by the definition, temporary and not permanent.

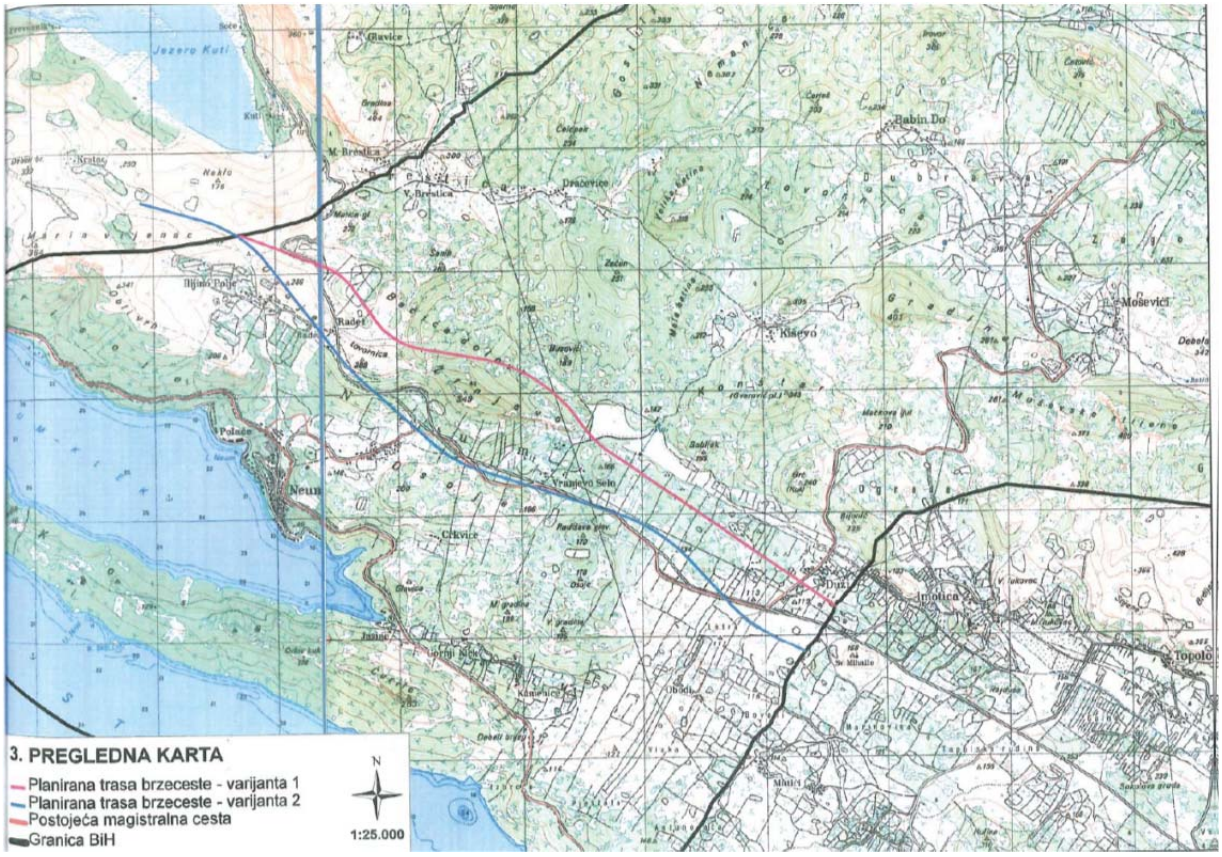
Figure 7 The Neum By-Pass



3.3.3 OPTION C: HIGHWAY THROUGH B&H

The Highway Corridor through B&H option (Option C) was established by the government of B&H. Prior to that decision, a B&H elaborated two other corridor variants, marked by “pink” and “blue” below.

Figure 8 Extraterritorial Corridor Options



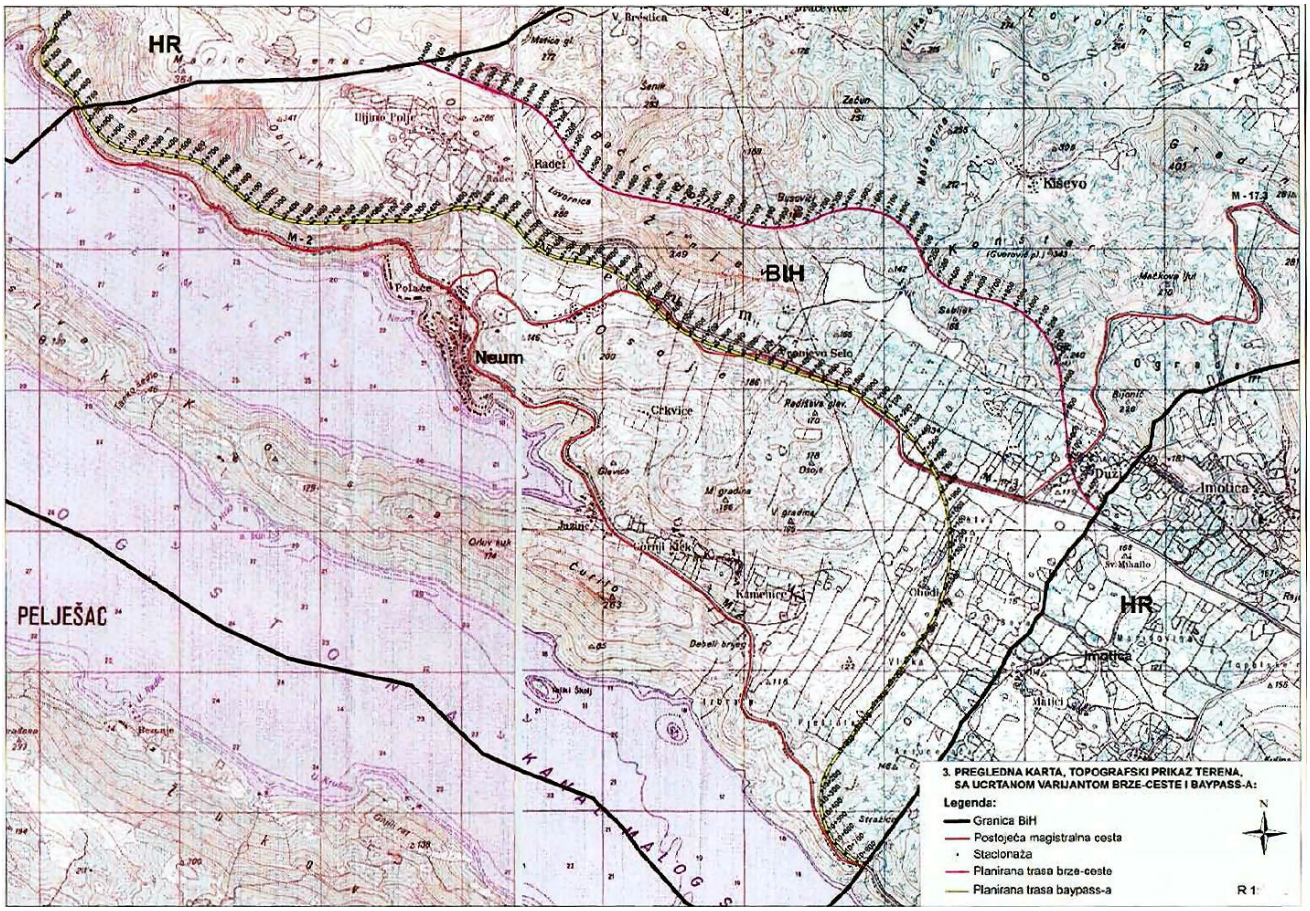
The final route for the corridor was defined. The accepted option C (option “red” on the figure below) starts at the Croatian-B&H border between the hill Marijin Vijenac and Osoja. This position of the route is based on the requirements from the representatives of the City of Neum to move the route as far as possible to the north. The route involves the stretch where the route passes through the site Vranjevo Selo it is to be displaced towards North, towards the site Konštar, i.e. it should be located on the other side of the field. The road is designed as a 4-lane expressway. However, the design speed of the road cannot be higher than 90km/h, according to the minimum horizontal radius.

The following elements will be built on these sections:

- two tunnels (2 x 0.25km);
- one viaduct (0.15km); and
- one cut over 25m high.

The total length of new infrastructure is 22,2 km.

Figure 9 Extraterritorial Corridor Options (2)



3.3.4 OPTION D: LONG DISTANCE FERRIES WITH REHABILITATION OF EXISTING PENINSULA ROAD

Long distance ferries with rehabilitation of existing peninsula road (option D) constitute a do-minimum option of the project. The option generally assumes the utilization of existing infrastructure, with selected rehabilitation activities and several new sections to bypass the dense urban areas.

The option D starts from the harbour of Ploce and going to the harbour of Trpanj, using the existing long distance ferry line. Later it continues on the existing roads across the peninsula until Donta Doli to join the road D8. The existing peninsula road from Trpanj to mainland will be partially rehabilitated and new bypasses of Janjina, Potomje, Pijavično and Ston will be constructed. The design speed varies depending on the road sections, from 50 - 60km/h on the existing road D414, to 90km/h on the newly built sections.

Concerning the scope of interventions, the option D assumes:

- Rehabilitation of the road D415;
- Periodic maintenance of the road D414 (section Košarni – Prizdrina);
- Construction of the bypass of Potomje & Pijavično;
- Periodic maintenance of the road D414 (section Pijavično – Trstenik);
- Construction of the bypass of Janjina;
- Periodic maintenance of the road D414 (section Prapratno – Ston);
- Construction of the new road of the D414 from šparagovići to Donta Doli.

The following elements will be built on these sections:

- Prapratno interchange (with D414);
- Polakovica tunnel (1200m);
- Bridge (485m);
- Supava tunnel (1270m); and
- Doli interchange (with D8).

The total length of the new infrastructure and road rehabilitation is about 37.8km.

Figure 10 Long distance ferry option

3.3.5 OPTION E: SHORT DISTANCE FERRIES WITH CONNECTING ROADS AND WITH/WITHOUT A NEW PENINSULA ROAD

Short distance ferries with harbours and connecting roads and with/without a new peninsula road (option E) provide the alternative to the Peljesac bridge in the same corridor. The option assumes that the bridge will be replaced by two new ferry ports by bridge abutments i.e. one on each abutment.

The ferry quays have to be constructed by the existing abutments, which would provide ferry connection between Komarna and Brijesta. The ferry quay on the side of Komarna shall be connected to the existing traffic network, via the existing construction site road (which would be upgraded to the level of a public road) up to the national road D8. The ferry quay on the Pelješac peninsula shall be connected to the existing road network from the Brijest settlement to the national road D414. Apart from the quays by abutments, it is required to adjust the elements of the approach road to cargo transport further towards Ston in order to provide easy transport of vehicles on the Pelješac peninsula.

Option E comprises of two sub-options: E1 and E2.

- **Option E1** assumes that additionally to the ferries and the connecting roads, a new route of the D414 Pelješac road on the section from Zaradeže to the national road D8 on the location Đonta Doli will be constructed, to improve the transport condition on the whole route on the Peljesac peninsula. The design speed for the constructed sections will be 90km/h.
- **Option E2** assumes that no additional investments will be done on the Peljesac peninsula roads. On the existing road across the peninsula the design speed is 50km/h.

Existing traffic volume in Neum at summertime peak hours is almost 900 vehicles/hour. Capacity of one ferry line with 2 ferries is about 150 vehicles/hour per ferry . Journey time for 2km distance would be 30 minutes,

boarding and disembarking included. Capacity of line depends on ferry capacity, but because of short distance of only 2 km we cannot raise ferry size and capacity too much – boarding/disembarking would last longer and that will decrease number of flows per day.

Option E1

The option E1 starts from the road D8 (Ploce – Dubrovnik) in the place called Duboka. In the option E1 the total length of the infrastructure is 32+551m with the following scope of interventions:

- Upgrade of the existing construction site road to the parameters of the public link road from the D8;
- Construction of the access road from the link road to the ferries docks;
- Construction of the ferry quays and docks;
- Construction of the link road to the špargovići and access road from ferries docks to the link road;
- Construction of the new road D414 from špargovići to Donta Doli

The following elements will be built on these sections:

- Two temporary ferries docks;
- Duboka interchange (with D8);
- Brijesta interchange;
- Kamenice tunnel (499m);
- Debeli Brijeg tunnel (2467m);
- Zaradeže interchange (with D414);
- Ponikve interchange (with D414);
- Viaduct (220m);
- Prapratno interchange (with D414);
- Polakovica tunnel (1200m);
- Bridge (485m);
- Supava tunnel (1270m); and
- Doli interchange (with D8).

The design speed on this road is 90km/h.

Option E2: Short distance ferries with connecting roads and without a new peninsula road

The option E2 starts from the road D8 (Ploce – Dubrovnik) in the place called Duboka. In the option E2 the total length of the new infrastructure is about 14km with the following scope of interventions:

- Upgrade of the existing construction site road to the parameters of the public link road from the D8;
- Construction of the access road from the link road to the ferries docks;
- Construction of the ferry quays and docks;
- Construction of the link road to the špargovići and access road from ferries docks to the link road;

The following elements will be built on these sections:

- Two temporary ferries docks;
- Duboka interchange (with D8);
- Brijesta interchange;
- Kamenice tunnel (499m);
- Debeli Brijeg tunnel (2467m);
- Zaradeže interchange (with D414);

The design speed on the existing roads at the Peljesac peninsula is 50km/h.

3.3.6 OPTION F: IMMERSED TUNNEL WITH CONNECTING ROADS AND WITH/WITHOUT A NEW PENINSULA ROAD

Immersed tunnel and connecting roads and with/without a new peninsula road (option F) provide another alternative to the Peljesac bridge in the same corridor. The option assumes that the bridge will be replaced by the immersed tunnel. Taking into consideration the existing partially build bridge infrastructure, this option would require the removal of these newly built parts of infrastructure to enable the immersed tunnel construction and access (see the pictures below). Option F comprises of two sub-options: F1 and F2.

- **Option F1** assumes that additionally to the tunnel and the connecting roads, a new route of the D414 Pelješac road on the section from Zaradeže to the national road D8 on the location Đonta Doli will be constructed, to improve the transport condition on the whole route on the Peljesac peninsula. The design speed for the constructed sections will be 90km/h.
- **Option F2** assumes that no additional investments will be done on the Peljesac peninsula roads. On the existing road across the peninsula the design speed is 50km/h.

Figure 11 Immersed Tunnel – Example

Figure 12 A Portion of Built Peljesac Bridge to be Dismantled to Build the Tunnel

The design cross section of this tunnel is as follows:

- Lanes 2 x 3.5m = 7.0m;
- Emergency lanes 2 x 2.5m = 5.0m;
- Emergency side walk 2 x 1.5 m = 3.0m;
- Total width = 15.0m.

Note that the depth of the bay is on 28m. The first layer of the bottom is mud having over 40m of thickness. The immersed tunnel cannot be lied down on the mud. In this case the technical obstacles for this construction are following:

- Excavation of the 1,440,000m3 of the mud from the depth of 28m;
- Deposing of the pre-casted elements on the level -68m; and
- Covering all elements by the stones.

Option F1

In option F1, total length of the infrastructure is over 40km, with the following scope of interventions:

- Upgrade of the existing construction site road to the parameters of the public link road from the D8;
- Deconstruction of the elements of the bridge;
- Construction of the immersed tunnel;
- Construction of the link road to the Šparagovići;
- Construction of the new road D414 from Šparagovići to Donta Doli

The following elements will be built on these sections:

- Duboka interchange (with D8);
- Immersed tunnel (unknown length)
- Brijesta interchange;
- Kamenice tunnel (499m);
- Debeli Brijeg tunnel (2467m);
- Zaradeže interchange (with D414);
- Ponikve interchange (with D414);
- Viaduct (220m);
- Prapratno interchange (with D414);
- Polakovica tunnel (1200m);
- Bridge (485m);
- Supava tunnel (1270m); and
- Doli interchange (with D8).

The design speed for the constructed sections will be 90km/h.

Option F2

In the option F2 the total length of the new infrastructure is over 20km, with the following scope of interventions:

- Upgrade of the existing construction site road to the parameters of the public link road from the D8;
- Deconstruction of the elements of the bridge;
- Construction of the immersed tunnel;
- Construction of the link road to the šparagovići;

The following elements will be built on these sections:

- Duboka interchange (with D8);
- Immersed tunnel (unknown length)
- Brijesta interchange;
- Kamenice tunnel (499m);
- Debeli Brijeg tunnel (2467m);
- Zaradeže interchange (with D414);

On the existing road across the peninsula the design speed is 50km/h.

3.3.7 OPTION G: TUNNEL UNDER BOSNIA & HERZEGOVINA

Tunnel under B&H (option G) is a new idea facilitating the seamless borderless connection between Ploce and Dubrovnik. The tunnel would provide an alternative for the highway through B&H territory. Currently there is no defined route of the tunnel, and no documentation for this option is available nor prepared. To establish a cost estimate the Consultant made the following assumptions:

The width of the tunnel: 2 x 3.50m lanes + 2 x 2.5m emergency lanes = 12.0m;

- Total length of the tunnel: 12km including two exits;
- Total length of the link roads: 5 km

The design speed for the constructed sections was assumes 90km/h.

3.3.8 OPTION H: ADRIAN-IONIAN MOTORWAY (AIM)

The Adriatic-Ionian Motorway (AIM) route through the hinterland of B&H with motorway exits to Metkovic and Dubrovnik (option H) would be the part of the motorway along the Adrian sea coast from Athens through B&H, Montenegro, Albania and Macedonia. The AIM would start from the Corridor Vc (motorway Ploce - Budapest) on the B&H territory, between Caplina and Mostar. In this case the traffic from north of Croatia and going to Dubrovnik would take this motorway and the exit to Dubrovnik would be near from the town Trebinje.

The Adriatic-Ionian transport corridor would connect all major Adriatic and Ionian ports which are the endpoints of pan-European corridors and other important transversal corridors: corridor V in Trieste with nearby town of Kopar, corridor Vb in Rijeka, of Zagreb – Split motorway on joint Lika – Dalmatia part, corridor Vc in Ploče, transversal corridor in Montenegrin port of Bar, corridor VIII in Albanian port of Durressi, corridor Via Egnatia in Igoumenitsa and the link towards Athens and the port of Patras.

The Adriatic-Ionian Motorway represents the integrated concept of the road complex with all complementary longitudinal and connection roads in the corridor, consisting of: present Adriatic and Ionian highway and new bypass roads in areas of large town agglomerations, such as Rijeka and Split, and on longer sections of southern Dubrovnik coastal region, but also in Montenegro, Albania and Greece.

Currently, there is no defined route of the AIM through the B&H territory, and no documentation for this option is available nor prepared.

To establish a cost estimate the Consultant made the following assumptions:

- construction of the Corridor Vc from Ploce to Mostar – 23km (2 x 2 lanes + 2 EML);
- construction of the Adrian – Ionian Motorway from the Corridor Vc to Trebinje – 54km (2 x 2 lanes + 2 EML);
- link road from the Trebinje to Dubrovnik – 23km (2 lanes road);

All these three sections are mountain roads.

Table 2 A Final List of Development Options for PFS Assessment

Final Development Options Considered in the Pre-Feasibility Study
Option A: Bridge: mainland - Peljesac peninsula with access roads to the bridge, and: **A1**: with a new road across the Peljesac peninsula to the state road D8 **A2**: without a new road across the Peljesac peninsula to the state road D8
Option B: Neum bypass with connecting roads – city road corridor through B&H with special traffic regime (and status) in the Neum background (city in B&H)
Option C: Highway corridor through B&H with special traffic regime (and status) in the Neum background (city in B&H);
Option D: Long distance ferries with rehabilitation of existing peninsula road (Reconstruction of existing road and partial construction of new road across the Peljesac peninsula from the ferry port Trpanj to the state road D8, using existing ferry connections)
Option E: Short distance ferry line (on position of Pelješac bridge) with connecting roads and: **E1**: with a new road across the Peljesac peninsula to the state road D8 **E2**: without a new road across the Peljesac peninsula to the state road D8
Option F: Immersed tunnel to the Pelješac peninsula with access roads and: **F1**: with a new road across the Peljesac peninsula to the state road D8 **F2**: without a new road across the Peljesac peninsula to the state road D8
Option G: Tunnel under B&H
Option H: Adrian-Ionian Motorway (AIM)

4 SOCIOECONOMIC ASSESSMENT AND ECONOMIC DEVELOPMENT ISSUES

4.1 Socioeconomic Characteristics

4.1.1 POPULATION

The Dubrovnik–Neretva County is the southern county in the Republic of Croatia and its territory is organised in 22 local self-government units, five towns (Dubrovnik, Korčula, Ploče, Metković and Opuzen) and 17 municipalities (Blato, Dubrovačko primorje, Janjina, Konavle, Kula Norinska, Lastovo, Lumbarda, Mljet, Orebić, Pojezerje, Slivno, Smokvica, Ston, Trpanj, Vela Luka, Zažablje and Župa dubrovačka). The County centre is located in the town of Dubrovnik.

The territory of the County consists of two basic functional and physiognomic unities: a relatively narrow longitudinal coastal area with a series of islands located closely and further away from the coast (the most important islands are Korčula, Mljet, Lastovo and the group of Elaphiti Islands) and the area of Donja Neretva with the appertaining coastal part. The territory is divided by the national border with Bosnia and Herzegovina and it is connected with the internal part of Croatia and the Pannonian part of Croatia to the north only on the territory of the Valley of Donja Neretva.

Figure 13 Dubrovnik – Neretva County

The coast is very indented and variable; there are protected bays with sandy beaches of exotic beauty as well as cliffs facing the open sea, which makes this County one of the most beautiful areas in the Mediterranean. The County has all the characteristics of the Mediterranean climate with climatic differences due to the high mountainous barrier located immediately by the coast, the islands and occasional continental influences.

According to the first results of the year 2011 census, 78,570 inhabitants populate the five towns of the County (64% of the total number of County inhabitants). The other inhabitants, 44,168 of them, inhabit 17 municipalities (the most populated municipality is Konavle and the least populated Janjina). In comparison to

the census held in 2001, there is a decrease in the population number in the County, amounting to the insignificant 0.1%.

Table 3 Dubrovnik – Neretva County - General Information

Dubrovnik – Neretva County	**Coastal part**	**Sea part**	**Total**
County area (in km$^{2)}$	1,782.49	7,489.88	9,272.37
National border length (in km):	164.29	253.42	417.71
County border length (in km):	25.29	118.66	143.95
Border length in total (in km)::	189.58	372.08	561.66
% of the Republic of Croatia Area	3.15	22.56	10.32
Republic of Croatia	**Coastal part**	**Sea part**	**Total**
Surface (in km^2)	56,609.59	33,200.00	89,809.59
National border length (in km):	950	2,978.00	2,028

Source: Official pages of the Dubrovnik – Neretva County

The age structure indicates a negative trend in younger group of inhabitants, which indicates a gradual ageing of population although the average age (39 years) is still insignificantly lower than the national average. Approximately 16% of population is older than 65 and 18.3% of population is younger than 14. The average age of population in the County is slightly lower than the national average, which indicates that the age of population in the near future should not present a significant restrictive developmental factor. Additionally, the average age of population in municipalities is higher than in towns and the average age of population on islands is higher than in the remaining part of the County.

The area that is the subject of PFS can be roughly identified with the Adriatic coastline that connects the city of Ploče with the City of Dubrovnik. From the administrative and political point of view, this area includes:

- The entire Dubrovnik-Neretva County as portion of Croatian territory
- The municipality of Neum as portion of the territory of Bosnia and Herzegovina, forming part of the Herzegovina-Neretva Canton of the Federation of Bosnia and Herzegovina)

The Municipality of Neum has an overall surface of 225 km^2[13] and a population of 4605[14], while the Dubrovnik-Neretva County has an overall surface of 1781 km^2 with a population of 122.568 inhabitants at year 2011[15]. These values represent respectively a portion of 3,1% of the entire Croatian surface and of 2,9% of the entire Croatian population. The next tables (that is referred to year 2001 Census, and that therefore present slightly different totals) gives a detail of the population for each town and municipalities.

[13] Source: "Federation of Bosnia and Herzegovina in figures", year 2012, available on line at the address http://www.fzs.ba/Podaci/FedBiH_u_brojkama_2011.pdf
[14] Source: "Bulletin of Federation of Bosnia and Herzegovina, Federal Office of Statistics", Number 14.2.1, year 2009, available online at the address http://www.fzs.ba/saopcenja/2009/14.2.1.pdf
[15] Source: "Statistical Yearbook of the Republic of Croatia", year 2012, available on line at the address http://www.dzs.hr/Hrv_Eng/ljetopis/2012/sljh2012.pdf

Table 4 Population of Dubrovmik-Neretva County

	Sex	Total	Age				
			< 20	20-44	45-64	> 64	Unknown
County of Dubrovnik-Neretva	all	122.870	30.852	41.666	30.232	19.564	556
	m	59.378	15.763	20.726	14.787	7.851	251
	f	63.492	15.089	20.940	15.445	11.713	305
Towns							
Dubrovnik	all	43.770	10.128	15.079	11.659	6.723	181
	m	20.603	5.152	7.351	5.459	2.565	76
	f	23.167	4.976	7.728	6.200	4.158	105
Korčula	all	5.889	1.392	1.920	1.482	1.076	19
	m	2.888	714	974	737	457	6
	f	3.001	678	946	745	619	13
Metković	all	15.384	4.944	5.486	3.207	1.677	70
	m	7.597	2.591	2.671	1.624	681	30
	f	7.787	2.353	2.815	1.583	996	40
Opuzen	all	3.242	839	1.094	808	481	20
	m	1.605	442	570	402	182	9
	f	1.637	397	524	406	299	11
Ploče	all	10.834	2.948	3.802	2.615	1.434	35
	m	5.333	1.501	1.921	1.308	585	18
	f	5.501	1.447	1.881	1.307	849	17
Municipalities							
Blato	all	3.680	870	1.154	922	733	1
	m	1.749	434	566	451	297	1
	f	1.931	436	588	471	436	0
Dubrovačko primorje	all	2.216	462	656	519	570	9
	m	1.097	229	364	271	229	4
	f	1.119	233	292	248	341	5
Janjina	all	593	72	152	168	197	4
	m	279	31	83	77	84	4
	f	314	41	69	91	113	0
Konavle	all	8.250	2.018	2.799	1.976	1.427	30
	m	4.099	1.046	1.450	992	595	16
	f	4.151	972	1.349	984	832	14
Kula Norinska	all	1.926	567	632	378	339	10
	m	921	278	328	184	125	6
	f	1.005	289	304	194	214	4
Lastovo	all	835	214	272	181	168	0
	m	428	114	140	97	77	0
	f	407	100	132	84	91	0
Lumbarda	all	1.221	330	395	287	205	4
	m	619	190	203	141	85	0
	f	602	140	192	146	120	4
Mljet	all	1.111	226	302	255	326	2
	m	539	116	166	131	124	2
	f	572	110	136	124	202	0
Orebić	all	4.165	923	1.327	1.122	760	33
	m	2.047	453	675	558	343	18
	f	2.118	470	652	564	417	15
Pojezerje	all	1.233	317	414	237	194	71
	m	618	153	227	131	73	34
	f	615	164	187	106	121	37
Slivno	all	2.078	518	656	459	433	12
	m	1.015	265	329	222	196	3
	f	1.063	253	327	237	237	9

	Sex	Total	Age				
			< 20	20-44	45-64	> 64	Unknown
Smokvica	all	1.012	228	307	243	223	11
	m	490	103	143	132	105	7
	f	522	125	164	111	118	4
Ston	all	2.605	641	780	560	617	7
	m	1.251	317	396	279	257	2
	f	1.354	324	384	281	360	5
Trpanj	all	871	146	258	233	233	1
	m	406	68	136	108	93	1
	f	465	78	122	125	140	0
Vela Luka	all	4.380	942	1.407	1.123	899	9
	m	2.082	472	678	585	346	1
	f	2.298	470	729	538	553	8
Zažablje	all	912	216	332	168	196	0
	m	455	116	188	81	70	0
	f	457	100	144	87	126	0
Župa dubrovačka	all	6.663	1.911	2.442	1.630	653	27
	m	3.257	978	1.167	817	282	13
	f	3.406	933	1.275	813	371	14

Source: DZS, Year 2001 Census

The population was practically stable during the past decade, moving from a total amount of 122.870 at year 2001 to a total amount of 122.870 at year 2011.

4.1.2 MAIN ECONOMIC INDICATORS

The development of Croatian economy in the period from 2001 to 2005 was faster than during the preceding five-year period of time. Relatively high growth rates were achieved; therefore this period may be conceived as a period of certain rehabilitation of Croatian economy. The achieved economic growth of average value of 4.7% was faster than the global growth and the growth of EU 25 and the Croatian share in the world economy and the economy of EU 25 was slightly enlarged. At the same time, the GDP per capita was increased, which at the end of the period amounted to approximately 46.5% of the average achieved in the EU 25, expressed by the purchasing power parity. This presented an increase of 5.6 percentage points. The generators of such an economic growth were investments, which grew at the average rate of 10.7%, than export of goods and services (6.1%) and personal consumption (4.8%).

Table 5 Economic Indicators

	2005	2006	2007	2008	2009	2010	2011
Gross domestic product (GDP) – real growth (%)	4.3	4.9	5.1	2.2	-6.0	-1.2	0.0
Inflation, average	3.3	3.2	2.9	6.1	2.4	1.1	2.3
External debt (in mln. EUR)	25.990	29.725	33.720	40.590	45.244	46.483	45.733
Exchange rate (HRK/EUR), average	7.40	7.32	7.34	7.22	7.34	7.29	7.43
Unemployment rate, ILO (%)	17.9	16.6	14.8	13.2	14.9	17.4	17.9

Source: Croatian Bureau of Statistics

The real growth of the gross domestic product in 2006 amounting to 4.9% for the whole year of 2006, presented an acceleration of the economic growth of 0.6% in comparison to the year of 2005. In the year of 2007 the real growth of the gross domestic product amounted to 5.1% and in the year of 2008 it amounted to only 2.2%. The year of 2008 was recorded as the beginning of growth deceleration and the beginning of recession in Croatian economy.

Certain internal and external factors and their interconnection contributed to the above-mentioned GDP trends, which result from high level of economic openness. One of the important factors was high growth of crude oil price on the world market during the first half of the year of 2008, which had a direct impact to the growth of production costs. At the global level, the growth of crude oil price induced the growth of prices of food and other raw materials, which all induced the growth of industrial products prices in the Republic of Croatia amounting to relatively high 8.4%. These trends had an impact to the growth of prices in the retail trade and they induced inflation growth, which diminished the real income of population and indirectly induced decrease of demand. Another very important external factor was the crises of mortgage loans in the United States of America, which started in 2007. This crisis affected not only the USA, but also the majority of the world financial markets and showed sensitivity of the financial system considering the loan risks.

Intensifying of the crisis resulted in bankruptcy of many financial institutions and difficulties in functioning of those institutions world-wide, which had a major impact to the countries which based their economy on financial services. In Croatia the financial crisis started to be more apparent at the end of the year; however, the whole of 2008 was characterized by a significant drop of share value and retardation in growth of loans provided by business banks, which influenced the decrease of domestic demand. Moreover, a decrease of Croatian export also occurred due to the slow growth of import in the countries of the European Union. The intensity of the global economic crisis in the year of 2009 is best illustrated by the data that after more than a half-century there was a drop in economic activity worldwide. A significant drop was noted in four of five largest world economies, which makes about 50% of the global GDP, and a high growth rate was maintained only in China. At the same time, an economic activity drop of 4.2% was noted in the European Union, which is the largest economic partner of Croatia. After significant decrease of economic activity in Croatia in 2008, the first drop of GDP after nine years was registered in 2009. The drop amounted to -6.0%. The decrease of the overall economic activity reflected on one hand the disturbance on the world market and on the other hand many years of structural problems in Croatian economy.

The recession trends in Croatia were significantly increased during the first part of the year when a further drop of domestic production and foreign demand was recorded, as well as a significant decrease of industrial production and retail business, which reflects personal consumption, and of building industry, which reflects trends in investments. Furthermore, there was evident decrease of transport, especially the transport of goods. The same trends continued during the second half of the year; however the intensity of decrease was lower, which alleviated the drop of economic activity taking into consideration the whole year. Due to the lower demand, the external trade was also lower at the annual level; however the progress of import drop was faster than the progress of export drop, which resulted in a decrease of commodity deficit and an increase of export share in export-import relation.

The negative trend of the overall economic activity was attenuated in 2010 and reached the drop level of 1.2%. The only component which had a relatively positive impact to the GDP trend was the total net external demand. That is to say, growth of export of goods and services was recorded during the whole year and the growth rate of 6.0% was achieved on the annual level (which was still over 12% lower than in 2008). At the same time, the drop of import rate was lowered to 1.3%, although growth was registered in the second part of the year. Personal consumption was 0.9% lower on the annual level (i.e. 9.2% lower in comparison to 2008) and at the same time the national consumption dropped for 0.8%. During 2010 the investments were lowered for as much as 11.3% in comparison to 2009 (in comparison to 2008 the drop amounted to 22%). At the same time a significant decrease of reserve was also noted. Although it may be said that in 2010 a slight recovery of Croatian economy started, the recovery was significantly slower than in most countries members of the European Union. The negative trends in 2010 continued in Ireland, Greece and Spain (the problems in those countries were so serious that the stability of the European Union and European Monetary Union was disturbed) and Latvia and Romania. Poland was the only country which maintained GDP growth during the years of crisis. Recent data indicate zero growth rate in 2011, i.e. stagnation of GDP. In the unfavourable

global environment, especially the situation in the European Union, which fails to find a long-term recovery model, negative trends in the Croatian economy continued in the first quarter of 2012.

Projections presented in the latest Bulletin of the Croatian National Bank show that the Croatian economy shall record a drop of 0.2% in 2012. The preceding projection indicated continuation of economic recovery and growth rate of 2.2%. However, significantly changed conditions of the international environment, as well as anticipated relatively high fiscal consolidation in domestic public finances, resulted in a significant correction of real GDP and now the annual rate amounts to –0.2%, reports the Bulletin. The central bank stated that the expected stagnation of domestic economy in 2012 is determined primarily by the lower growth of external demand and anticipated fiscal consolidation. The decrease of external demand primarily reflects negative trends and expected low growth in countries members of the European Union, as well as structural weakness of Croatian economy. In reference to fiscal trends, it is expected that the Croatian Government shall decide on a tight budget and continuation of structural reforms directed to strengthening of domestic economy competitiveness, in order to preserve credit rating. Analysts of the Croatian National Bank point out that the first positive results of those measures are expected in the year of 2013 when the export of goods and services should be the main generator of slight growth, together with an increase in capital investments primarily in private sector. Projections of the central bank indicate that the domestic economy should start to grow in 2013, at the rate of 1.2%.

As regards the main economic indicators, the situation is presented inside the following table

Table 6 Gross Domestic Product for the Republic of Croatia, the Adriatic Croatia and the Dubrovnik-Neretva County at current prices – values for year 2010

Area	Gross domestic product, HRK	Gross domestic product, EUR [1)]	Population[2)]	Gross domestic product per capita, HRK	Gross domestic product per capita, EUR
	'000				
Republic of Croatia	323.806.969	44.440.948	4.419	73.277	10.057
Adriatic Croatia	105.629.574	14.497.151	1.468	71.956	9.876
County of Dubrovnik-Neretva	9.739.922	1.336.757	128	76.189	10.457

Source: DZS, "First Release" Bulletin of 14th February 2013, no. 12.1.2.

1) CNB, Table H9: Midpoint Exchange Rates of the Croatian National Bank (period average) http://www.hnb.hr/publikac/bilten/statisticki_pregled/h9.xls
2) Total average population of the Republic of Croatia for year 2010

The GDP of the Dubrovnik-Neretva County is around 3% of total national GDP, while the per capita GDP is 4% higher than the national average (10.457 vs. 10.057 EUR) and 6% higher than the average referred to entire Adriatic Croatia[16] (10.457 vs. 9.876 EUR). The source of the above GDP is coming from different sectors of activities as presented inside the next table.

[16] For "Adriatic Croatia" it is intended the area formed by the following counties: Pimorje-Gorski kotar, Lika-Senj, Zadar, Šibenik-Knin, Split-Dalmatia, Istria, Dubrovnik-Neretva

Table 7 Gross Value Added for Different Sectors of Activity for the Republic of Croatia, the Adriatic Croatia and the Dubrovnik-Neretva County at Current Prices – Values for year 2010

		Republic of Croatia	Adriatic Croatia	County of Dubrovnik-Neretva
		'000 HRK		
Agriculture, forestry and fishing	1	13.648.505	4.522.325	865.063
Manufacturing, mining and quarrying and other industries	2	55.935.100	16.121.325	425.322
of which manufacturing	2a	44.130.714	12.763.221	185.092
Construction	3	18.594.272	8.126.790	970.709
Wholesale and retail trade, transportation, storage, accommodation and food service activities	4	55.746.397	20.733.067	2.655.113
Information and communication	5	14.059.740	2.669.340	213.494
Financial and insurance activities	6	19.302.936	3.988.374	311.559
Real estate activities	7	29.305.336	12.679.874	986.091
Professional, scientific, technical, administrative and support service activities	8	20.196.652	5.823.131	582.329
Public administration and defence, education, human health and social work activities	9	42.990.085	13.052.359	1.132.766
Other service activities	10	7.273.707	2.661.215	191.135
Gross value added (sum from 1 to 10)	11	277.052.730	90.377.801	8.333.582

Source: DZS, "First Release" Bulletin of 14th February 2013, no. 12.1.2.

Table 8 Gross Value Added for Different Sectors of Activity for the Republic of Croatia, the Adriatic Croatia and the Dubrovnik-Neretva County at Current Prices – Percent Shares for year 2010

		Republic of Croatia	Adriatic Croatia	County of Dubrovnik-Neretva
		%		
Agriculture, forestry and fishing	1	4,9%	5,0%	10,4%
Manufacturing, mining and quarrying and other industries	2	20,2%	17,8%	5,1%
of which manufacturing	2a	15,9%	14,1%	2,2%
Construction	3	6,7%	9,0%	11,6%
Wholesale and retail trade, transportation, storage, accommodation and food service activities	4	20,1%	22,9%	31,9%
Information and communication	5	5,1%	3,0%	2,6%
Financial and insurance activities	6	7,0%	4,4%	3,7%
Real estate activities	7	10,6%	14,0%	11,8%
Professional, scientific, technical, administrative and support service activities	8	7,3%	6,4%	7,0%
Public administration and defence, education, human health and social work activities	9	15,5%	14,4%	13,6%
Other service activities	10	2,6%	2,9%	2,3%
Gross value added (sum from 1 to 10)	11	100,0%	100,0%	100,0%

Source: DZS, "First Release" Bulletin of 14th February 2013, no. 12.1.2.

The above tables show the remarkable contribution of the accommodation and food service activities, even if the available data are included within other parallel activities, such as trade, transportation and storage. These activities represent about 1/3 (31,9%) of gross value added (GVA) for the Dubrovnik-Neretva County, whereas the average value for the entire Country is 20,1% and the value for the Adriatic Croatia is 22,9%. This is due by the remarkable tourist activities of the area. Another sector that is characterized by an higher percentage of GVA in comparison with the rest of the Country is the Agriculture, forestry and fishing, that represent 10,4 of the local GVA in comparison of the national average value of 4.9%. Also the Construction sector performed better than the average Croatian value during year 2010, but it must be taken into account that this sector suffers from greater instability than the other two just considered.

4.1.3 DUBROVNIK-NERETVA COUNTY ECONOMY

The economic profile of the Dubrovnik – Neretva County is determined by its geo-political position, length, indentation and quality of sea coast, rich cultural-historical heritage of timeless beauty shaped in ambient most valuable Croatian areas and the sea and agricultural surfaces, which are valuable production resources. Traditionally important and commercially established economic activities have developed based on the above-mentioned features: tourism, transport and warehousing, commerce, construction, processing industry and agriculture, forestry and fishing, which still today support the economic development of the County. Other activities are auxiliary and their development is based on the development of the above-mentioned principle activities.

Table 9 Principle Effects of the Economy in the Dubrovnik – Neretva County and their Contribution in the Economy of the Republic of Croatia in 2010

Category	**Economic efficacy indicators in the Dubrovnik – Neretva County**	**Share in the economy of the Republic of Croatia** **%**
Number of companies	3,456	3.6
Total income (HRK)	8,781,890,000	1.5
Profit (HRK)	328,968,000	1.2
No. of employees – hours of work	19,840	2.3
Net salary – HRK - level	4,500	96.5

Source: Financial Agency, Elaborated by the County Chamber Dubrovnik

The Croatian Employment Service – Regional Office Dubrovnik, recorded 8,359 unemployed persons at the end of 2010 and the unemployment rate in the County amounted to 17.2%.

Merchandise trade with the foreign countries was decreased in 2010 in the Dubrovnik – Neretva County in both directions. The achieved export amounted to 41.3 million USD and the achieved import amounted to 71.8 million USD. The negative foreign trade balance amounted to 30.5 million USD and it was decreased for 36.7% in comparison to the preceding balance achieved in 2009.

4.1.4 EMPLOYMENT

The total of 5,861 unemployed persons was registered at the end of August 2011 on the territory of the Dubrovnik – Neretva County. In comparison to the preceding month, the unemployment was reduced for 1.0% and in comparison to August 2010 the unemployment was 3.6% lower.

Table 10 Data on Unemployment in The Dubrovnik – Neretva County

Branch office	Unemployed on August 31, 2011	Unemployed on August 31, 2010	Index 31/08/2011/ 31/08/2010	Unemployed (no working experience) in August 2011	Newly registered in August 2011	Employed from the registered list in August 2011
Dubrovnik	2,414	2,649	91.1	219	151	91
Korčula	841	838	100.4	81	75	24
Lastovo	34	30	113.3	5	2	6
Metković	2,008	1,976	101.6	267	132	44
Ploče	564	585	96.4	65	32	30
TOTAL	5,861	6,078	96.4	637	392	195

Source: Croatian Employment Agency

In August 2011, majority of workers found employment in the field of accommodation and food preparation and serving: 44 (22.6%), in wholesale and retail sale: 32 (16.4%) and on administrative positions: 15 (7.7%). The other categories of work positions were less represented. From the beginning of 2011 until the end of August 2011, the majority of unemployed persons found work positions in the field of provision of accommodation and food preparation and serving; their share in the overall employment record amounted to 35.6%.

At the end of August 2011, the register of the Regional Office Dubrovnik listed the total number of 1,577 money remuneration users, i.e. 7.0% less than in August of the preceding year. There were 730 regular money remuneration users in Dubrovnik or 7.6% less than in August 2010 and in Korčula their number amounted to 218 or 8.8% less than in August 2010. The number of regular money remuneration users in Metković was 499 or 5.0% less than in August 2010, in Ploče 123 or 8.9% less and on Lastovo 7, which equals the number in August 2010.

4.1.5 MAJOR ECONOMIC ACTIVITIES IN DNC

Tourism is the a principle economic activity and bearer of the economic development of the County. Its position and role in the county economy is determined by exceptional and priceless richness of material and spiritual culture and natural wealth. The beginning of development of this activity was in the second half of the 19th century and the full blossom was reached in the second half of the past century.

Past investments in this activity resulted in wider and better accommodation base, which is the basic precondition for the growing tourist traffic. The capacity of 23,340 hotel beds in 2010 provided tourist traffic of 4,538,036 nights, as well as the following results, based on the above-mentioned:

Table 11 Tourism Data

Category	**Efficacy indicators of provision of accommodation and preparation and serving of food**	**Share in the economy of the Dubrovnik – Neretva County in %**
Number of companies	423	12.2
Total income (HRK)	1,516,728,000	17.3
Profit (HRK)	35,892,000	10.9
No. of employees – hours of work	4,665	23.5
Net salary – HRK - level	4,984	110.8

Source: Financial Agency, Elaborated by the County Chamber Dubrovnik

5 PLANNING DOCUMENTS RELATED TO PFS

5.1 Spatial Plans and Regional Plans

Space planning documents of different levels (national, regional and local) are in force concerning the subject intervention, which have been elaborated and adopted in compliance with the Physical Planning Act (Official Gazettes No. 30/94, 68/98, 61/00, 32/02 and 100/04), and in compliance with the Physical Planning and Building Act (Official Gazettes No. 76/07, 38/09, 55/11 and 90/11):

A. Strategy and Programme of Physical Planning of the Republic of Croatia,

B. Regional Development Plan of the Dubrovnik – Neretva County (Official Papers of the Dubrovnik – Neretva County No. 6/03, 3/05, 3/06, 7/10),

C.1. Regional Development Plan of the Municipality of Ston (Official Papers of the Dubrovnik – Neretva County No. 9/10, 7/08, 9/09 and 11/09),

C.2. Regional Development Plan of the Municipality of Slivno (Papers Neretvanski glasnik No. 1/02, 5/08).

5.2 National planning documents

5.2.1 PHYSICAL PLANNING STRATEGY OF THE REPUBLIC OF CROATIA

The Physical Planning Strategy was adopted by the Croatian Parliament in June 1997. Concerning the transport connections, the Strategy places special focus on coastal and island areas: „Since the overall long-term policy of the Republic of Croatia is directed to the connection of the mainland and the Adriatic areas and the major investment projects in the construction of motorways are directed to the routes leading to the coast, the need for faster development of road infrastructure of coastal and island areas is inevitably imposed, as well as the need for faster development of their overall road and maritime connection, which is a continuation of the overall planned investment construction of motorways, semi-motorways and fast roads in that area.“ The Strategy provides the principle development directions in the area of regional development plans of infrastructural systems.

„Economical development of the Republic of Croatia is not possible without continuation of road traffic development. The importance of road traffic on the territory of the Republic of Croatia is pointed out due to the spatial distribution of the network and the most appropriate reaching to the users. Road traffic presents individual traffic, which means that the spatial requirements shall grow. Due to the above-mentioned, the principle directions of the road infrastructure development in the Republic of Croatia are the following:

- Progressive dealing with the critical sections and structures, primarily on the network of national and main roads, as well as on the roads approaching and bypassing larger towns and cities; procedures of modernisation and adequate equipping of roads do not require significant widening of road corridors, which means that this approach preserves and protects the space and the environment;
- Intensification of investments into road infrastructure maintenance in order to provide overall maintenance standard and to achieve the highest possible level of servicing the users;
- Application of higher criteria in road construction than those in force in the EU, in order to preserve the values of the Croatian territory;
- Construction and modernisation of roads on Croatian islands in order to achieve better interconnection and better integration into the national transport system, via connections with the coastal areas.“

5.2.2 PHYSICAL PLANNING PROGRAMME OF THE REPUBLIC OF CROATIA

Decision on the adoption of the Physical Planning Programme of the Republic of Croatia was reached by the Croatian Parliament of May 7, 1999.

In terms of the transport connections the Programme determines the following measures and activities of implementation of the Strategy, defining the basic development goals, criteria and directions:

„Road network development programme comprises aspects of the overall traffic system, in all components of operation, as well as planning of new routes, based on economical parameters and other relevant indicators of justifiability and reality of execution in reference to the following:

- intensification of investments into the road infrastructure maintenance in order to provide full standard of serviceability and gradual dealing with critical sections and structures, primarily on the national roads network and on roads approaching and bypassing larger towns and cities,
- application of higher criteria of environmental protection than those in force in the EU, in order to preserve the values of the Croatian territory,
- construction and modernisation of roads on islands in order to achieve better interconnection and better connection with the mainland, i.e. road communication of islands with the other parts of Croatia."

5.3 Regional planning documents

5.3.1 REGIONAL DEVELOPMENT PLAN F THE DUBROVNIK - NERETVA COUNTY

The Regional Development Plan of the Dubrovnik – Neretva County was adopted on the 19th sitting of the Dubrovnik – Neretva County Committee held on October 30, November 6 and December 23, 2003. The Decision on adoption was published in the „Official Paper of the Dubrovnik – Neretva County" No. 6/03. There are also several amendment that have been introduced since that time, concerning harmonization of the plan with environmental and other regulatory acts. The Plan defines the road connections categorised as traffic facilities of importance for the Republic of Croatia:

- Adriatic – Ionic motorway (A1 motorway Zagreb - Dubrovnik) (planned);
- A10 motorway: border with the Federation of Bosnia and Herzegovina - Metković interchange (A1), (planned) - TEM II motorway in the Vc corridor Ploče - Metković - Sarajevo - Osijek – the Republic of Hungary;
- Fast road Ploče intersection (interchange on the Adriatic – Ionic motorway) – Ploče;
- Connecting roads between the Adriatic – Ionic motorway and the traffic network of lower rank (planned);
- Fast road Dubrovnik (Osojnik) - Čilipi - Debeli Brijeg (planned);
- Fast road on Pelješac - Pelješac intersection (interchange on the Adriatic – Ionic motorway) – Pelješac Bridge - Pelješac - Doli intersection (interchange on the Adriatic – Ionic motorway) (planned);
- Other national roads.

That Plan states also that the optimal road traffic connections have to be provided within the County as well as between the County and the other parts of Croatia and Europe. The connections should be provided through construction of roads which would provide fast and efficient transit traffic flow within the County, resulting from construction of an optimal road traffic system and providing a positive impact to the lives of inhabitants. The following needs are listed, among others:

- Construction of a fast road on Pelješac, including bridge connecting Klek and Pelješac, which would be a developmental resource for the Peninsula of Pelješac and the Island of Korčula; the goal is provision of a firm connection of physically divided parts of the County into a single unit;

- Construction of a bridge or a submerged tunnel between Pelješac and Korčula in order to provide better traffic connection of the Island of Korčula;
- Improvement of the existing road traffic network (reconstruction, modernisation, heavy maintenance) with the accent placed on rehabilitation and reconstruction and partially on construction of new routes of national roads which form the backbone of the road network of the County;
- Provision of better traffic connections between towns and municipalities within the County;
- Construction of bypasses of settlements where transit traffic creates functional problems.

The Plan defines the fast road on Pelješac, Pelješac interchange - Komarna - Pelješac Bridge - Brijesta - Prapratno - Zaton Doli – Doli interchange. „The fast road route runs on a completely new route from the connection to the motorway at the Pelješac interchange up to the intersections Slivno Ravno and Duboka for the connection with the national road D8 and the Pelješac Bridge at Komarna. On the section Komarna – Duboka the corridor crosses the Bay of Mali Ston via the new bridge of the length amounting to approximately 2,200 m, connecting the Peninsula of Pelješac northern from the Brijesta settlement. The road on the Pelješac has a new route, independent of the existing national road D414. The following intersections are anticipated on the route: Brijesta intersection for the traffic in the direction of the western part of the Peninsula of Pelješac and in the direction of Korčula, Zaradeže intersection for the traffic to the existing national road D414, Prapratno intersection for the traffic in the direction of Ston and the Bay of Prapratno where the ferry port is located for the connection of the Island of Mljet with the mainland. After Prapratno intersection the route crosses the bridge across the Channel of Ston (length of the bridge amounts to approximately 750 m) and continues to the Zaton Doli intersection on the national toad D8 and Doli interchange on the Adriatic – Ionic motorway.“

5.3.2 REGIONAL DEVELOPMENT PLAN OF THE STON MUNICIPALITY

Due to its important properties, the territory of the Ston Municipality is of a special national interest and national geostrategic interest for the Republic of Croatia and the Dubrovnik – Neretva County. The territory is characterised by significant transport – geographical position and favourable geographical characteristics; however, it is also characterized by a very sensitive and important geostrategic and geopolitical position. At present, the territory of the Ston Municipality is an important transit area with a special intersectional-crossing transport-geographical importance.

Regional Development Plan of the Ston Municipality was adopted on May 20, 2010. The Plan determines conditions for a long-term development of the Ston Municipality, purposeful utilization, purpose, shape, rehabilitation and repair of building land and other types of land and especially protection of cultural heritage and valuable parts of nature and landscape. The bridge across the Bay of Mali Ston has been considered as a solution to the problem of the physical disconnection of a part of the County from the remaining part of the Republic of Croatia and better connecting of the Peninsula of Pelješac and the Island of Korčula with the other part of Croatia. This is a demanding traffic solution due to the length of the bridge and due to the considerations relating to the protected Bay of Mali Ston, which has to be investigated through an environmental impact evaluation. Within construction of this communication the construction of the connecting road is anticipated, from the bridge up to the national road D414 and further on in the direction of Orebić, in order to shorten the trip to the western part of the Peninsula of Pelješac and to the Islands of Korčula and Lastovo. The graphical part of the Plan contains the route according to the elaborated design documents and the route planned within the Regional Development Plan of the Dubrovnik – Neretva County.

The Regional Development Plan of the Ston Municipality anticipates construction of a road traffic infrastructure in the Ston Municipality as:

- Construction of a bridge between Klek and Pelješac, which would present a developmental element important for Pelješac and integration of the County into a unique unity;
- Route of the fast road in investigation Ploče – Pelješac - Rudine as a part of the Adriatic – Ionic motorway from Ploče interchange – Čeveljuša interchange –Opuzen interchange –Slivno interchange Ravno – Komarna -Duboka – the Bay of Mali Ston bridge – Brijesta – Zaradež interchange –Ston interchange;

- Channel of Ston Bridge (the alternative is in the national road D414 corridor towards Doli intersection) – Rudine interchange;
- Bypasses (replacing sections) on the national road D-414 – Ston Bypass, Bypasses Boljenović and Šparagović, Ponikve, Janjine, Kapetan and Orebić are mostly defined in the existing design documents, which shall be harmonised based on directions defined within the Regional development Plan of the Dubrovnik – Neretva County.

6 ASESSMENT OF REGIONAL ROAD TRANSPORT SYSTEM

6.1 Transport Connections Outside of Targeted Area

The development plans of the Republic of Croatia are harmonized with the international documents which define the development of the European road network. The European corridors are in line with the Croatian longitudinal and transverse transport routes, and by adding the Adriatic – Ionian corridor, the backbone of the entire traffic network would be defined.

The Zagreb – Split – Dubrovnik motorway (Adriatic Highway) is a part of the road route between the inland, north-west part of Croatia (Zagreb - Karlovac) and the Dalmatian region. This motorway, within the network of planned roads, compensates and creates a connection between two vital European routes: (E59) Maribor - Zagreb - Split and (E65) Rijeka - Split - Dubrovnik. It connects the Croatian north and south and is of vital importance for Croatia for several other reasons as well. It is a strategic pre-requirement of economic development in the broad sense, especially regarding tourism and management of transiting traffic.

The Bosnia and Herzegovina portion of the Adriatic Highway is of key importance for this PFS. The section of the Adriatic highway within Bosnia and Herzegovina passes via the City of Neum and is 9.25 km long. It is a two-lane road. Two border crossing points (BCPs) are located at both ends of this section of the Adriatic Highway:

- BCP Klek — Neum I on the western side
- BCP Zaton Doli — Neum II on the eastern side.

There are several other road projects impacting the regional transport system.

The Adriatic-Ionian Pan-European transport corridor is a stabilizing and development factor, connecting seven countries of the Adriatic-Ionian initiative, from Trieste in Italy to Kalamata in Greece. The corridor directs potential development forces to the west and southeast of Europe, which will form new values not threatening the existing ones on the parallel corridors. Approximately 70% of the Croatian part of the Adriatic-Ionian motorway is constructed in Croatia until now, from the Slovenian borderline near Rupa up to Rijeka and on the Lika and Dalmatian part from Žuta Lokva, through Split and up to Vrgorac in the immediate vicinity of Ploče.

The transport corridor Vc (road, railway, river and air traffic) is a complex link between the North – Central and South Europe and is exceptionally valuable in the context of economic and transport integration processes of this Central European area. Construction of the Corridor Vc, the connection between road, railway, river and air traffic, will have a direct influence on the development of a wider and significant transport junction for the whole Europe.

6.2 Transport System in Dubrovnik Neretva County

The narrow zone of influence of the project includes the southern part of Croatia. From the administrative point of view, i.e. according to the political division, the narrow zone of influence includes the Dubrovnik-Neretva county.

The main road transport corridor of the Dubrovnik-Neretva county, which covers most part of the traffic, is the State road D8, i.e. the so-called Adriatic trunk route, section Ploče - Opuzen - Dubrovnik. It connects the county with the rest of Croatian territory, with the neighbouring Bosnia and Herzegovina and Montenegro and further on with the remaining parts of South-eastern Europe. Almost all county roads connect to the State road D8. The following State roads connect to the State road D 8 in the Dubrovnik-Neretva county:

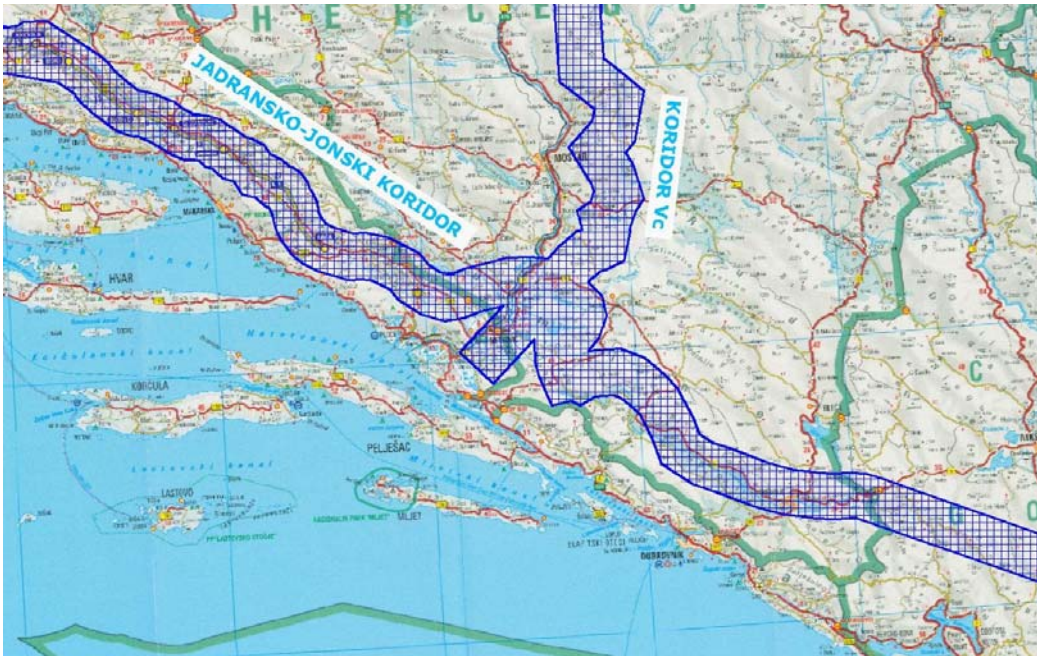
- D9 / BC Metković (B&H borderline) – Opuzen – D8,
- D62 / section Vrgorac - Kula Norinska - Metković (D9),
- D222 / GP Mali Prolog (B&H borderline) - D62,
- D223 / GP Gornji Brgat (B&H borderline) - Dubac (D8),
- D412 / Drvenik (D8) – Drvenik (Ferry Port),
- D413 / Ploče (D8) – Port of Ploče,
- D414 / Orebić (Ferry Port) - Ston – Zaton Doli (D8),
- D416 / Prapratno (D414) - Prapratno (Ferry Port),
- D420 / Sustjepan (D8) – Port of Gruž,
- D513 / Mali Prolog (D62) - Ploče (D8).

The Dubrovnik – Neretva County also includes the Islands of Korčula, Mljet, Lastovo and Šipan. According to their transport connections with the mainland, the island roads gravitate towards the State road D8:

- D118 / Vela Luka – Kapja - Dubovo - Korčula,
- D119 / Ubli - Lastovo,
- D120 / Pomena - Polače - Sobra - Saplunara,
- D122 / Šipanska Luka – Suđurađ.

Important administrative centres in the Dubrovnik – Neretva County are Dubrovnik, Metković, Opuzen, Ploče, Korčula, Ston. The county had 58.743 vehicles registered in 2010. Out of this number, 44.647 are private cars, which makes 76,0% of the total number of registered vehicles in the county area, i.e. 3,5% of the total number of registered private cars in Croatia.

Figure 14 International Corridors in the Targeted Area



7 ASSESSMENT OF TRAFFIC PATTERNS IN TARGETED AREA

7.1 General Traffic Patterns

The traffic patterns in the target area are as follows:

- Movement of passengers and goods, mostly transit between EU/Croatia, goes via two mentioned above border crossing points (BCP). These are mainly Croatian citizens and international tourists visiting Croatia. An increasing number of tourist offices treat Neum as a hub for cheaper hotel services. In the summer time, there is are a large number of buses calling major city hotels. They create traffic jams in the summer in the City of Neum.
- There is growing traffic from Bosnia and Herzegovina to Neum. Majority of these tourists come to Neum via Metkovic due to bad technical condition and quality or roads north of Neum towards Mostar. The time and safety are major motivations for using DB for this category of travellers.
- There is a significant traffic of residents of the City of Neum across the EU/Croatia and B&H border in the Neum corridor. They travel to Metkovic in Croatia to schools and for medical care (hospital). The majority of the resident of the City of Neum are Croats with dual citizenship.
- A significant portion of traffic is composed of travellers to and from the Peljesac peninsula on the way to Zagreb, Split or Dubrovnik.
- There are significant traffic jams in July, August and early September in the City of Neum. The City Council members indicated that the preferable solution for them would be the Peljesac bridge which could accommodate all the transit traffic from the city. This involves traffic flows Ploce – Dubrovnik, and movements to/from the Peljesac Peninsula. If the bridge is built, the City officials do not see an immediate need for by-pass construction. They are of the opinion that building such a bypass without earlier construction of modern highway to Mostar is not necessary for the community of 4 thousand residents. This according to them would be a road to nowhere and for very few. The priority is to have a road to the North towards Caplinja – a regional government headquarters. A spatial plan for the City has not been approved. The old plan does not have consider any by-pass construction. The City has a plan to build a road connection by Kamenica to improve local traffic situation.

7.2 Traffic Types in the Region

There are four major traffic types in the targeted area:

- Freight and passenger traffic related to Port of Ploce and other port activities (B&H and Croatia origin destination)
- Freight traffic facilitating commercial activities in the Dubrovniik-Neretva County (DNC) (direction to/from Dubrovnik and to/from the Peljesac Peninsula)
- Business passenger traffic related to activities of the citizens of the Dubrovniik-Neretva County, and other subjects conducting business in the targeted area
- Leisure passenger traffic related to tourism including three major categories: international tourism, EU/Croatia tourism, and B&H tourism.

7.2.1 PORT INDUCED TRAFFIC

Three seaports are located in the Dubrovnik-Neretva County: Ploče, Dubrovnik and Korčula. These three seaports are different:

- Ploče is mainly a freight port, serving Croatia and Bosnia and Herzegovina
- Dubrovnik is focused mainly on cruise traffic
- Korčula is an island port, with a presence of ferry traffic and some industry (shipyard)

The Port of Ploče is one of the most important institutions in the concerned area. Its capacities and activities significantly impact the B&H and Croatian economic development. The Port of Ploče is a landlord port managed by the Public Port Authority which is responsible for issuing concessions to private companies. The B&H interests are a major port user but no B&H subject has yet applied for a concession in the Port.

The Port of Ploče is mainly handles freight. Passenger traffic is less developed (except ferry line between Ploče and Trpanj). Approximately 90 % of the goods moved via the Port of Ploče is transiting the Croatian territory and destined to/from B&H. Only 10% of the commodities is shipped to Croatia. Approximately 1% of goods is shipped to the Dubrovnik region. They have to cross the B&H territory in Neum. In 2011, 35 percent commodities handled by the Port of Ploče were transhipped to vessels (35%), trucks (10%) and trains (49%). The Port of Ploče currently implements 160 million EUR project which should contribute to further development of its container terminal, establishing new gates and introduction of new modalities, and to eliminate the existing bottlenecks on port access roads.

Ploče is located at the end of branch C of the pan-European corridor V (Branch C connects Ploče - Sarajevo - Osijek – Budapest). The port is connected to the railway network, being at the end of the railway crossing the entire Bosnia – Herzegovina (crossing the Corridor X and entering in B&H, passing through Sarajevo and Mostar). The short railway section between Metković and Ploče is operated by the Croatian Railways, but it is practically isolated from the rest of the Croatian networks (rolling stock must be routed through B&H in order to reach the rest of the Croatian network). From the practical point of view, the railway link connecting the Port of Ploče operates as an extension of the Bosnian rail network. In the future Ploče will be at the end of the corridor Vc motorway, that is partially under construction (37 km north of Sarajevo are yet open and operating). Data on the Port of Ploce shipments are provided the following table.

Table 12 Port of Ploce, Freight (in thousands of tons)

Year	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
General cargo	346	301	405	565	539	439	403	428	488
Dry bulk cargo	1.518	2.211	2.291	3.098	4.027	2.080	3.724	3.567	1.625
Liquid cargo	167	303	485	551	576	350	402	435	469
Total	2.031	2.815	3.181	4.214	5.142	2.869	4.529	4.430	2.582

Source: Port Authority of Ploče, data available on line at http://www.port-authority-ploce.hr/statistics.asp

7.2.2 TOURISM INDUCED TRAFFIC RELATED TRAFFIC

The target area is characterized by a remarkable tourist demand during the entire year, with significant peak during the summer season. Recent figures give an overall amount of 1.122.420 arrivals per year with a total stay of 5.188.091 nights, with an average stay of 4,6 days

The City of Dubrovnik accounts for 656.852 arrivals per year, with a total amount of 2.374.227 nights spent and an average stay of 3,6 nights. In terms of nights spent, Dubrovnik represents about 46% of the entire County, while the County of Dubrovnik-Neretva represents 8% of the total Croatian tourist demand.

Table 13 Tourist Visits to the Dubrovnik-Neretva County for 2012

					Indices related to 2011		
		Total	***Domestic***	***Foreign***	***Total***	***Domestic***	***Foreign***
Republic of Croatia	**arrivals**	**11.835.160**	**1.465.934**	**10.369.226**	**103,3**	**95,9**	**104,5**
	nights	**62.743.463**	**5.221.326**	**57.522.137**	**104**	**93,2**	**105,1**
County of Dubrovnik-Neretva	arrivals	1.122.420	93.297	1.029.123	107,2	96,8	108,3
	nights	5.188.091	322.040	4.866.051	108,6	97,2	109,5
Dubrovnik	arrivals	656.852	48.233	608.619	108,4	95,2	109,6
	nights	2.374.227	131.178	2.243.049	110,2	98,6	110,9
Korčula	arrivals	-	-	-	103,3	106,1	102,9
	nights	-	-	-	104,7	96,1	105,7
Metković	arrivals	4.062	3.565	497	82,7	92,6	46,9
	nights	8.713	7.726	987	80,8	85,7	55,8
Opuzen	arrivals	-	-	-	679,2	361,5	[1]
	nights	-	-	-	930,6	791,9	[1]
Ploče	arrivals	2.333	594	1.739	81,1	45,7	110,3
	nights	7.313	1.479	5.834	53	24,8	74,5
Blato	arrivals	-	-	-	111,5	113,4	111,4
	nights	-	-	-	110	105	110,3
Konavle	arrivals	87.373	5.254	82.119	108,7	109,6	108,7
	nights	533.236	21.314	511.922	115,2	129,6	114,6
Kula Norinska	arrivals	-	-	-	176,2	181	148,2
	nights	-	-	-	176,2	181	148,2
Lastovo	arrivals	-	-	-	89,3	85,7	90,8
	nights	-	-	-	89,7	93,6	88,7
Mljet	arrivals	15.053	2.327	12.726	102,2	82,1	107
	nights	72.834	11.233	61.601	104,8	76,1	112,5
Orebić	arrivals	82.771	4.253	78.518	106,7	103	106,9
	nights	645.020	28.909	616.111	107,5	105	107,6
Slivno	arrivals	-	-	-	105,8	102	106,3
	nights	-	-	-	111,1	104,3	111,6
Smokvica	arrivals	5.366	617	4.749	127,4	100	132,1
	nights	35.065	3.434	31.631	109	75	114,7
Ston	arrivals	22.747	1.391	21.356	101,6	86,3	102,8
	nights	100.155	5.803	94.352	101,1	104,3	100,9

					Indices related to 2011		
		Total	***Domestic***	***Foreign***	***Total***	***Domestic***	***Foreign***
Vela Luka	arrivals	-	-	-	88,4	73,1	91,9
	nights	-	-	-	84,3	77,7	85,1
Dubrovačko primorje	arrivals	-	-	-	116,8	112,9	117
	nights	-	-	-	122	116,3	122,3
Janjina	arrivals	4.072	210	3.862	104,5	137,3	103,2
	nights	34.389	1.795	32.594	100,7	127,4	99,5
Lumbarda	arrivals	-	-	-	109,8	76,2	113,9
	nights	-	-	-	109,2	70,4	114,1
Trpanj	arrivals	14.272	1.108	13.164	98,7	103	98,3
	nights	103.603	6.366	97.237	95,2	82	96,2
Župa dubrovačka	arrivals	78.048	9.339	68.709	107,8	110,2	107,4
	nights	343.813	26.302	317.511	110,7	115,7	110,3

Source: DZS, "First release" bulletin, Number: 4.3.2/11, February 2013

There is also significant tourist traffic on the Pelješac peninsula (Janjina, Orebić, Ston and Trpanj). Data on tourist movements on Peljesac are provided ion the following table.

Table 14 Tourist Traffic at Peljesac Peninsula, 2012

		Total	***Domestic***	***Foreign***
Pelješac Peninsula (overall)	*arrivals*	123.862	6.962	116.900
	nights	883.167	42.873	840.294

The Pelješac peninsula with 883.167 nights annually spent in 2012 represents about 17% of all tourist visits to the County. The average stay at Pelješac is about one week (7,1 nights per presence), i.e. two times the average stay in Dubrovnik. This indicates different tourist vocation patterns in Peljesac.. The City of Dubrovnik is affected by a strong presence of short-term tourism, (related to cruise traffic), Pelješac is characterized by longer visits.

7.2.3 DATA FOR ASSESSMENT OF TRAFFIC PATTERNS

Traffic patterns in the area were assessed based on these data sources:

- Published historic data (secondary data). Major source of information were publications:
    - Brojanje Prometa na Cestama Republike Hrvatske Godine 2011, prepared by the Hrvatske Ceste d.o.o. in 2012; and
    - Brojanje Saobracaja na Magistralnim Cestama Federacije B&H u 2011 prepared by the Gradevinski Fakultet Institut za Saobracajnice.

- Data on traffic patterns received from the authorities of Bosnia and Herzegovina.
- A review of previous studies addressing transport system in the area provided by Hrvatske Ceste.
- Interviews with Hrvatske Ceste and the Dubrovnik-Neretva County (DNZ) officials and staff.
- Origin-Destination surveys (ODS) conducted by the Consultant.

7.2.4 ORIGIN-DESTINATION SURVEYS (ODS)

The ODS were conducted in Croatia and Bosnia and Herzegovina. The following data collection were used for traffic count:

- Automatic Count Continuous using the counter QLD-6CX nano;
- Automatic Count Periodical;
- Periodical manual count

ODS address and analysed traffic patterns on the following roads:

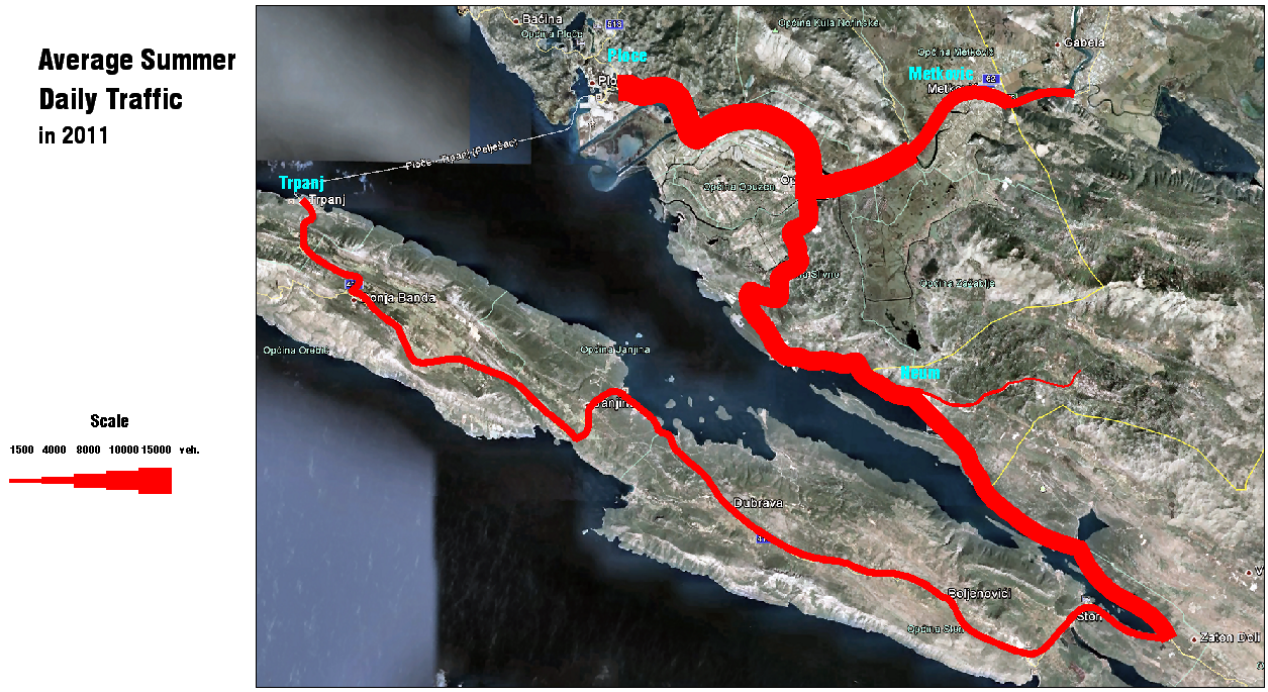
- In Croatia:
    - D8 Split -Dubrovnik;
    - D414 Trpanj-Zaton Doli;
    - D9 Ploce - Metkovic (corridor Vc)
- In B&H:
    - M17 Mostar-Metkovic (corridor Vc)
    - M17.3 Neum - Hutovo

The following counting points were established:

- Road D8 (Split – Dubrovnik): one near of Ploce, one before the B&H border, and one after the B&H border.
- On road D9 (Ploce – Metkovic) there were two counting points. The first was near of the town of Kula Norinska and the second close to Metkovic.
- On road D414 (Trpanj – Zaton Doli) there was one counting point near of the village of Golubnica.
- On road M17 (Ploce – Metkovic) close to Dracevo.
- On road M17.3 (Neum – Hutovo): one was close to Neum and another near of the village Cerovica.

The major flows of traffic at the regional transport system identified from secondary data and ODS are shown at the map below.

Figure 15 Traffic Flows on Regional Road Network



7.2.5 BORDER CROSSING TRAFFIC CONDITIONS

The BCP traffic is a major reason of congestion in the regional traffic system. The BCPs at Klek – Neum I and Zaton Doli – Neum II were refurbished and expanded on 27th April 2013. Previously existing two traffic lanes for border checks were replaced by five traffic lanes and the new booths.

The new border crossing points enable border authorities to pullover controlled vehicles and passengers from major traffic lanes. This was not possible before. After opening of the new Border Crossing Points, there are 2 traffic lanes for the cars, 1 traffic lane for the busses and 2 traffic lanes for the trucks. Buss lanes can also be used for cars, if needed.

There are currently two reasons for congestion in this area:

- BCPs – when control time is extended
- Narrow road before the BCP Klek – Neum I and Zaton Doli – Neum II

These limitations may significantly slow down traffic, especially during the high season. During the site visits, the Consultant observed in July and August, two to three kilometre lines to BCP in the area.

The situation at the border after Croatia joining the European Union is as follows:

- The Croatian Border Police have been conducting border checks in line with the Schengen Border Code and recent amendments of the Law on Control on State Border. This time may be expected to increase after the Schengen regulations are fully implemented. This may require additional checks by both EU/Croatia and B&H authorities. This time may be significantly increased if any of the states decides to increase the intensity of control procedures. This may occur because of various reasons. Such situations were reported in November and December of 2013.
- The border controls are facilitated by establishing shared border crossing points.

- Technical capacity of the Croatian Border Police IT system allows interconnection between the border crossings points what will facilitate the computer checks in the national databases and consequently enable quicker border checks. In addition to this, the technical capacity of the Croatian Border Police IT system already now enables connection to the Schengen Information System and Visa Information System though this is likely to occur in the next years. The admission to the Schengen area is subject to approval of the Council of the EU once Croatia fulfils all necessary Schengen criteria.
- Currently, B&H citizens cannot cross the BCP's only with identity cards (without passports) in line with the EU regulations. This may cause additional delays and difficulties for the B&H citizens, and reduce their mobility options. This is important since because of deficiencies of traffic infrastructure in the area north Neum, many B&H citizens arriving from the central part of B&H, use the Metković BCP and transit through Croatia territory to BCP in the Neum area.

Figure 16 The New Border Crossing Point (1)

Figure 17 The New Border Crossing Point (2)

8 A REGIONAL TRAFFIC DEMAND AND DISTRIBUTION MODEL (RTDDM)

8.1 Traffic Flows Assessment and Forecasting Methodology

A Regional Traffic Demand and Distribution Model (RTDDM) was developed specifically for the purposes of this study. The traffic model:

- Provides a complex traffic patterns overview and assessment for the entire area that may be affected by any of the development options.
- Provides modelling for a larger area and concerns more vehicle flows than it was presented in the previous studies. (explain and map)
- Is based on the newest historical secondary data sources of Croatia and Bosnia and Herzegovina annually, primary data from three Origin-Destination Surveys (ODS) completed by the consultant in 2013.

The distribution model considers traffic flows in the entire area affected by the Pre-feasibility study from Ploce, road D8, on the Peljesac Peninsula with traffic to Korcula considered, to Dubrovnik. The model and assessment considers passenger and other units as vehicles.

The traffic distribution model was designed in VISUM software. The following modules were created:

1. The spatial distribution of the origins and destinations for the set of zones. The zone is a spatial unit representing municipality or agglomeration areas of several municipalities. There were 15 zones used, representing the main origins and destinations of the traffic flows in the model area:

    a. B&H traffic (3 zones),
    b. Ploce,
    c. Dubrovnik,
    d. Cavtat,
    e. Peljesac Peninsula,
    f. Neum,
    g. Korcula,
    h. Zagreb,
    i. Split, Metkovic,
    j. Mljet,
    k. Opuzen,
    l. Salon.

2. Transport network, describing the characteristics of transport connections (sections and nodes). The road network nodes reflect the location of crossings and origins/destinations. The road network sections were divided in five categories:

    a. Two-lane fast roads (highways)
    b. One-lane fast roads
    c. One lane national roads
    d. One-lane regional roads (secondary roads)
    e. Border crossings
    f. Ferry lines

3. Transport connectors. The connectors describe the relation between the traffic generated/attracted in zones and the transport network. The connectors reflect the distribution of traffic between the nodes in the zone area.

Traffic Distribution. Based on the assumed growth rate for the traffic flows in the analysis period, the model distributes vehicle flows to the existing infrastructure under each development option at a given point in time. The traffic model was developed based on the following assumptions and conclusions from the observed and analysed traffic patterns:

- The historic data and the results of the Origin-Destination Survey indicate that traffic patterns in the model area are highly seasonal.
    - About 37 percent of total vehicle count occurs in July and August (peak season),
    - The remainder of annual traffic spread for other 10 months (out of season). That amounts to average 6.3 percent of annual traffic monthly.

- In July and August traffic increases about 100 percent compared to other months, while traffic in out of season months constitutes about 50 percent of annual season counts.
- Therefore two traffic model components were developed:
    - One for the peak season traffic (July-August)
    - One for out of season traffic (the rest of the year).
    - The output values (results) were consolidated in joint conclusions for CBA and MCA purposes. This approach properly illustrates infrastructure constraints and limitations, and is consistent with the principles for infrastructure capacity assessment for expansion purposes with consideration of infrastructure bottlenecks[17].

- Secondary data assessment and ODS results indicate that the overwhelming portion of traffic via BCP in the Neum area on D8 occurs during 12 hours from 9:00 to 21:00 hrs. The travel time savings calculations were than performed based on this assumption (for 12 hour periods).
- The current BCP in the Neum area situation has been incorporated in the modelling activities based on site visits and traffic observations[18]:
    - It was assumed that BCP in the Neum area on D8 provides three lanes.
    - The average vehicle check time was established as 2 minutes.
    - The border crossing area was set as 100 meters. These assumptions reflect the BCP site visit multiple observations conducted by the Consultant after July 1, 2013.
    - Based on interviews and observations, it was assumed that the estimated 2 minute vehicle border check time reflects: a) full adherence to the Schengen procedures and provisions by the Croatian border authorities, b) average border control time for EU and non-EU vehicles, c) the scope of border duties and vehicle control that can be performed at these BCP according to their border crossing status established in the international accords. This was confirmed by site observations at various border crossing points and time of the day[19].
    - Consequently, it was assumed that at the Neum area BCPs, the capacity of one lane is 30 vehicles per hour for the total of 90 vehicles per hour for 3 lanes (one way), for traffic distributed for 12 hours.
    - A vehicle occupancy rate was set as two passengers per vehicle, based on traffic patterns observations, ODS, and historic data.
    - Traffic growth patterns were considered for 2010-2046, to coordinate with data available and provide a justified traffic forecast.

[17] Other models prepared in the years 2000-2013, use average traffic numbers. This is an acceptable analytical procedure, however by smoothing traffic patterns they may be less effective in identifying transport system bottlenecks.
[18] !5 site visits to BCO were completed in the period between June 2013 and September 2013. A road inspection tours were completed in the area between Ploce, Metkovic, Cavtat, Korcula, Trpanj..
[19] The consultant has received information on periodical increase of the control time form the Croatian and B&H authorities and border police and customs staff. These occurrences have been treated as special events and were omitted from modelling. It is however important to indicate that there is always a chance of similar occurrences at any international border especially at borders between trade and economic areas such as the European Union and third parties. These situations definitely can contribute to significant traffic jams, especially in high season.

The specific assumptions for the traffic model were established based on the available historic data and results of the Origin-Destination Surveys (ODS) are shown below.

Table 15 RTDDM Specific Assumptions

Pre-Feasibility Study Assumptions (Base Scenario)	
Vehicle occupancy rate	2 pass/vehicle
BCP capacity (one direction)	30 vehicles/hour x 3 lines
The trade travel speed time	• Two-lane fast roads (highways): 80 km/h • One-lane fast roads (the new roads on the Peljesac Peninsula): 80 km/h • One-lane national roads: 60 km/h • One-lane regional roads (secondary roads): 40 km/h • Border crossings: 3 km/h • Ferry lines: 10 km/h

Operational travel speed was used to best and most realistically assess traffic patterns.

These assumptions were also checked for compatibility and consistency purposes with the available studies, expertise, and previous projects. In particular, the Peljesac bridge feasibility studies by IGH provided by Hrvatske Ceste according to the Terms of Reference which contain a complex assessment of the regional transport system and traffic patterns were considered. The IGH assumptions are based on the situation prior to July 1, 2013 when the Republic of Croatia joined the European Union. They do not consider capacity expansion at the Border Crossing Points in the Neum area in May 2013, and the content of international agreements on border traffic signed on June 19, 2013. The analysis presented by the Consultant considers these new circumstances. In addition, it is based on the observation of traffic patterns in 2013 before and after Croatia joining the European Union. Also, traffic data and models received from Bosnia and Herzegovina were considered (including traffic projections for the proposed Neum by-pass).

The two, earlier mentioned, traffic model components: for the peak season and out of season were developed in the following stages:

- A traffic Origin-Destination Matrix has been created for each of the models based on the socioeconomic and O-D survey data.
- The O-D matrices were distributed to the transport network, based on travel time dependent on assignment functions. There may be other reasons for drivers' decisions in addition to travel time criterion. Based on the Consultant's experience in similar modelling activities worldwide, their impact is negligible form the point of view of the objectives of this PFS,
- The traffic flow volumes which were compared with volumes of traffic counted in 2012 for the peak season (July and August) and remaining months. The O-D matrices were modelled and calibrated based on a comparison all data sources.

The traffic model (and its components) were calibrated for 2012 data. To prepare the simulations for 2017, 2046 and different development scenarios the following steps were accomplished:

- The O-D matrices, calibrated for 2012, were projected to O-D matrices for 2017 and O-D matrices for 2046, based on the traffic growth factor. Traffic growth rate was assumed at 2% annually.
- Transport network scenarios were developed, separately for the reference (no investment) option and for every development option.
- The traffic distribution procedure was conducted:
- for each analysis period (2017 and 2046)
- for each transport network scenario (reference scenario and development options)
- The results of the distributions were generated for the analysis periods: traffic volumes (ADT) and travel times (pas/hrs.).
- The difference values were calculated between the development options scenarios and the reference scenario.

- For years between 2017 and 2046, traffic distribution was extrapolated, using model results for 2017 and 2046. A linear extrapolation approach has been used. This approach assumes that traffic patterns and distribution (resulting from travel time savings) change gradually over time from the 2017 to 2046 structure.

The traffic distribution model was initially run for two years 2017 and 2046. For both years, the model based on the shortest travel time criterion, distributing traffic to transport infrastructure existing for a considered development scenario and year. For years between 2017 and 2046, traffic distribution has been extrapolated based on model calculations for 2017 and 2026. As indicated in the preceding paragraphs, a linear extrapolation methodology has been used. This approach assumes that traffic patterns and distribution (resulting from travel time savings) change gradually over time from the 2017 to 2046 structure.

8.2 Traffic Flows Forecast

The detailed results of traffic flow analyses are presented in the Appendix for this chapter. The summary of findings has been provided below:

1. Travel time in low season is similar for all development options. This is a result of low density of traffic, which does not exceed the capacity of BPCs.
2. Travel time in high season shows significant differences between development options.
3. The travel time for a reference scenario is more than 100% higher during high season than during the low season. This is a result of high density of traffic exceeding the capacity of BPCs on D8. This is confirmed by the results of analysis for other development options.
4. The travel time in high season is much lower for options A1, A2, B, C, F1, F2 and G, than in the reference scenario.
5. These results show that BPC constitute significant bottlenecks in the regional transport network. Eliminating these bottlenecks in options A1, A2, B, C, F1, F2 and G reduces the travel time in high season by about 40-50%.
6. The travel time in high season for options D, E1, E2 and H is similar to the travel time in reference scenario. This means that options D, E1, E2 and H do not solve the problem of the BPCs bottlenecks in the transport network.

    a. In options E1 and E2 the bottlenecks are not fully eliminated because of the limited capacity of the short ferry line.
    b. In option D, BPCs bottlenecks remain unchanged, as the improvements conducted for the Peljesac Peninsula roads do not impact the bottleneck problems existing BPCs.
    c. Option H does not constitute a significant alternative route for D8 on the analysed section. It will probably improve other traffic connections but does not have an impact on congestion problem as described in scope of this PFS.

7. The presented results are also confirmed by the analysis of the travel time savings of development options. They indicate that a majority (about 80%) of time savings is generated during the high season period (July, August). This is a result of heavy high season traffic at the BPCs bottlenecks on D8. These bottlenecks slow down the traffic flows when the capacity of the BPCs is exceeded.
8. Elimination of these bottlenecks results in significant time savings in options A1, A2, B, C, F1, F2, G. Options D, E1, E2 and H generate 10-20% of the time savings for other development options.

Figure 18 Monthly Travel Time in 2046 per Development Option [pas-hrs./month]

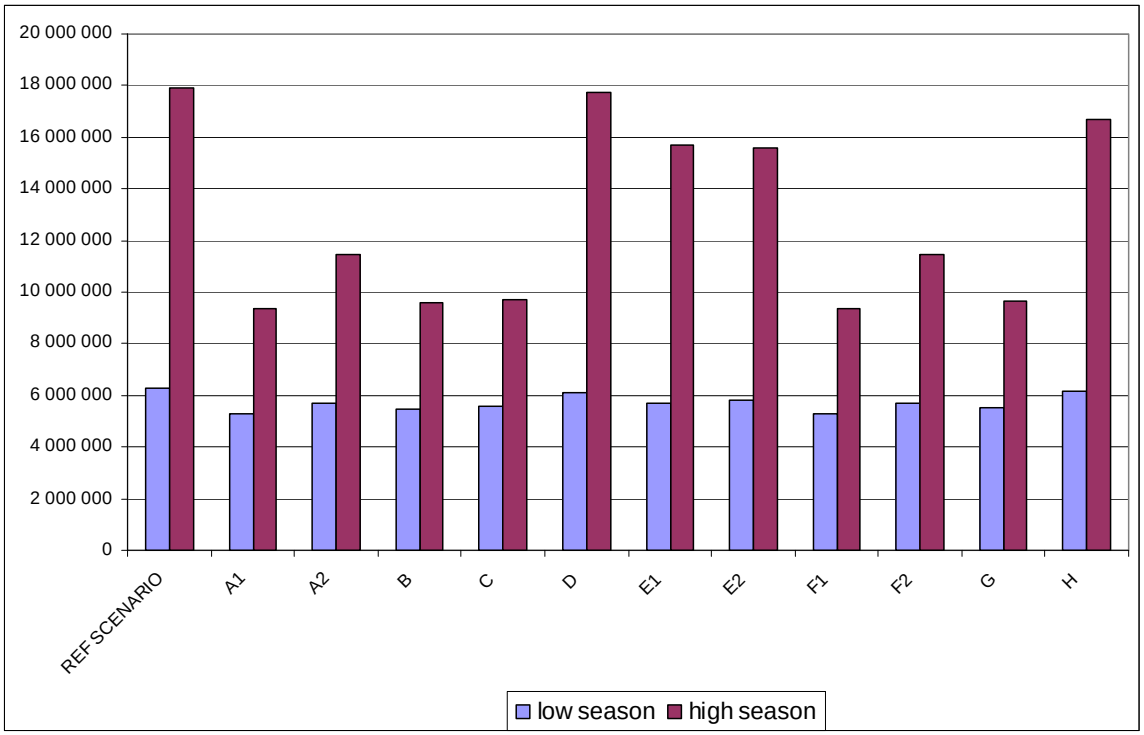
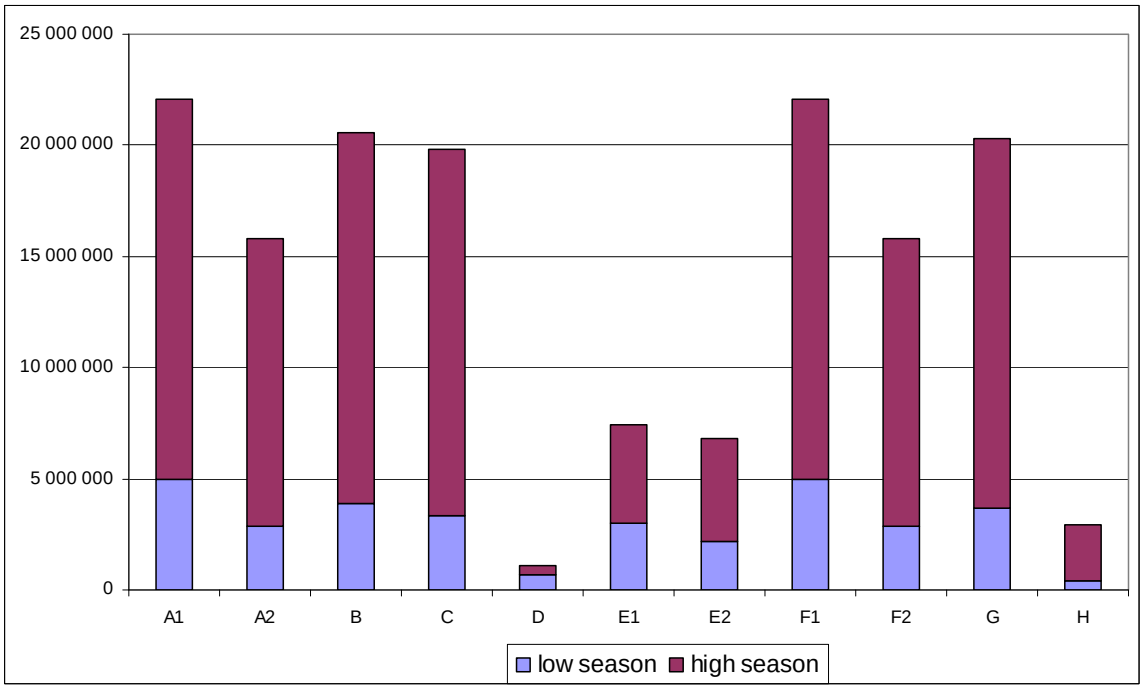


Figure 19 Cumulative Travel Time Savings in 2046 per Development Options [pas-hrs./month]



9 LEGAL AND GEOPOLITICAL ASSESSMENT

9.1 Introduction

This section:

- Evaluates possible transport development options from legal and EU border control perspective, in light of long-term feasibility and sustainability of these options.
- Assesses legal issues related to transport system bottlenecks, and legal and political border problems in the Neum area, between EU/Croatia and B&H
- Evaluates legal implications and impacts of the current situation on border and customs control, veterinary and phyto-sanitary inspection at the EU/Croatia and B&H border.
- Addresses other legal and geopolitical issues that impact development options considered in this PFS

The purpose of the following description of legal issues is to provide information on the complexity of these issues and their impact on development options addressed in PFS. This will also provide input for MCA. The legal implications related to the border and customs control, veterinary and phyto-sanitary inspection, have an immediate legal effect in case when traffic between separated EU territory has to cross B&H territory. They do not impact traffic that is fully routed via the EU (Schengen) territory. In addition, there are a number of specific legal and geopolitical issues related to the considered development options such as for example access to the sea or border issues definition and agreements. These problems have national, regional and the EU dimensions. They must be addressed in light of EU policies and strategies, and security of EU borders. They are particularly important for implementation of the EU cohesion policy that calls for economic, social, and territorial cohesion of the Union. Last but not least, legal and geopolitical issues should be addressed in light of their impact on increasing the quality of life of the EU citizens, and increasing the overall global competitiveness of this organization.

The following reflects the arguments that were raised during the PFS preparation by all three sides of the Advisory Committee. These arguments were considered by the Consultant and constituted a basis for a Multicriteria Assessment which results are shown later in this report. Based on other evaluation criteria – the Peljesac bridge options and the Neum-by pass are the most competitive options. There were also many legal comments regarding other development options. These options were however less competitive in MCA. It was therefore decided that for clarity purposes only comments on the front-runners would be presented in more detail in this section of PFS. The following are the selected issues addressed by the Consultant with the members of the Advisory Committee. They provide a valuable input to assess legal and political aspects of some development options and matters that may impact their competitiveness. Among other issues, possible needs for amendments/derogations from the acquis are addressed as an important and complicated issue related to some of the considered options. A general overview is provided and major specific problems are addressed.

9.2 General Overview of Legal Issues Related to Development Options

9.2.1 SCOPE OF LEGAL ISSUES

The considered development options can be divided in several groups in relation to legal and geopolitical issues:

- Options that require political consent and signing of international agreements prior to their implementation. That concerns: extraterritorial corridor and by-pass, and tunnel under Bosnian territory. The scope of these agreements is uncertain and there are no many precedents in this area. These activities would have to be designed and implemented from the beginning by the European Union or by Croatia, and Bosnia and Herzegovina as a third state.
- Options which design and implementation requires addressing and resolving side legal issues which do not directly concern these options but may impact opportunities for their successful implementation. Such issues exist for example in the case of a bridge, immersed tunnel or short ferry services. a number of legal an geopolitical issues were raised for these projects such as border issues, access to the sea, or consistency with UN conventions.
- Options which are not impacted by any of the above issues such as long ferry services in Trpanj.

9.2.2 CUSTOMS CONTROL

The EU accession of Croatia has a significant impact on trade patterns and customs control in the Neum area. From July 1, 2013, it is not allowed to transport live animals through the BCP Klek – Neum I and Zaton Doli – Neum II. Only cats and dogs are allowed to cross the Neum territory. Birds are be exempted from moving through the Neum area. Consequently, their owners have to use ferry line Ploče – Trpanj. The same concerns other live animals (e.g. cattle mostly transiting toward Albania, Monte Negro and Kosovo). There are no legal implications on the border and customs control, veterinary and phyto-sanitary for development options that divert traffic fully to the EU/Croatia territory.

9.2.3 PHYTO-SANITARY AND VETERINARY CONTROL

Veterinary checks of products originating from third countries, are currently carried out by the EU Member States in accordance with the *Directive 97/78/EC of 18th December 1997 laying down the principles governing the organisation of veterinary checks on products entering the Community from third countries* and with EC *Regulation* No 882/2004 *of 29th April 2004, on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules*. This may also contribute to increasing the border time for vehicles and passengers at the Neum area BCPs. There are no legal implications on the border and customs control, veterinary and phyto-sanitary for development options that divert traffic fully to the EU/Croatia territory.

The Treaty on Accession of the Republic of Croatia allows certain deviation from the Council Directive. Based on this, the Republic of Croatia has to follow the proceedings agreed by the Accession Treaty. Consignments of products coming from the territory of Croatia and transiting through the territory of Bosnia and Herzegovina at Neum ("Neum corridor") before re-entering the territory of Croatia via the points of entry at Klek or Zaton Doli, may be exempted from veterinary checks, subject to compliance with the following requirements:

- Croatia must have in place, points of entry to the north and south of the Neum corridor that are equipped, staffed and prepared to ensure compliance with these requirements
- Croatia ensures that:

a. only closed vehicles are used for transporting the consignments;
b. vehicles transporting consignments are sealed with uniquely numbered seals before transiting the Neum corridor;
c. a register is made, detailing which numbered seals have been attached to which vehicles, which allows for the necessary checks;
d. the date and time of leaving and re-entering the territory of Croatia of the vehicles transporting consignments are recorded, so that the total time of transit can be calculated.

- Croatia ensures that consignments are not allowed to re-enter Croatia's territory where:

a. a vehicle's seal has been broken or replaced during transit through the Neum corridor; and/or
b. the total time of transit considerably exceeds the acceptable total time of transit, given the total distance of transit unless the competent authority has carried out an assessment of the risks to animal and public health and has adopted effective, proportionate and targeted measures based on that assessment.

Important restrictions concern live shells bred up in the Pelješac – Mali Ston area. This concerns shells which are transported to the northern part of Croatia through the Neum area. The live shells intended for further breeding won't be allowed to pass these two BCPs while the live shells intended for food consumption will be allowed to cross the BCPs (in this case live shells are considered as goods).

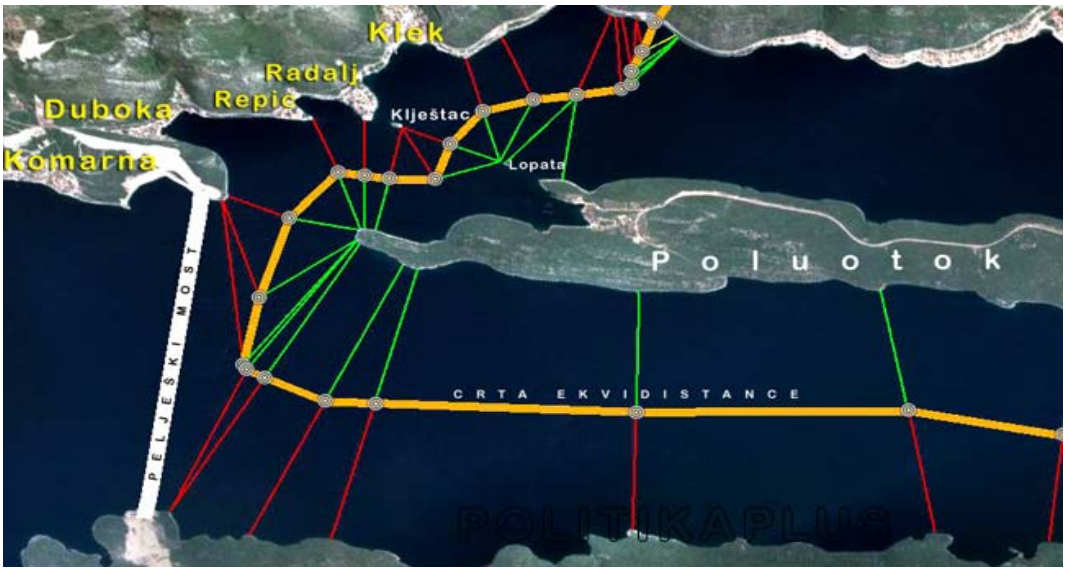
As stipulated in the EU regulations, all food products which exit the EU territory loose the EU origin status. Consequently, all the food products that exit the EU territory at one of these two BCPs are not allowed to re-enter to the EU/Croatian territory. Such a situation causes a lot of difficulties to the EU travellers, in particular to the numerous tourists transiting the Neum area and re-entering the EU/Croatian territory, who carry food for holidays (particularly meet and cheese products).

The Phyto-Sanitary and Veterinary administration prepared guidelines for the customs which will be responsible for control of the veterinary and phyto-sanitary provisions at these two border crossings. In accordance with these rules and in line with the EU Acquis, the customs officers will be obliged to control each vehicle passing one of these two BCP. This may significantly increase border time and decrease the overall capacity of the road system, and create additional bottlenecks. A list of relevant regulations is provided in the Appendix.

9.2.4 BORDER ISSUES

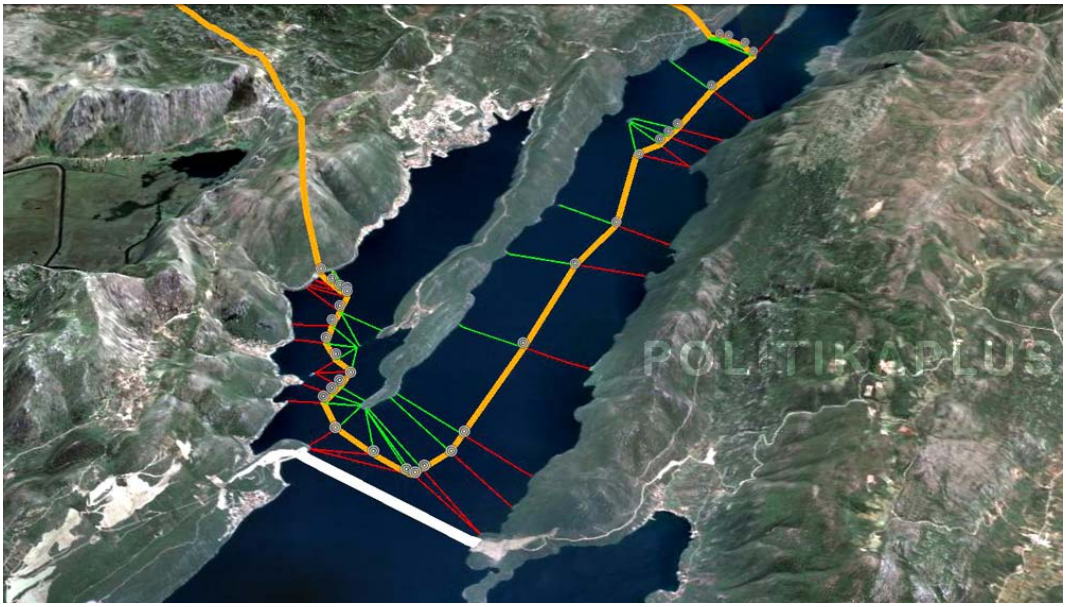
The Presidents of the Republic of Croatia and B&H signed on July 30, 1999 the Treaty on the State Border between the Republic of Croatia and Bosnia and Herzegovina (the Treaty). Although, the Treaty has not been ratified yet by the Parliaments of the Republic of Croatia and Bosnia and Herzegovina, article 22 of the Treaty stipulates that the Treaty shall be temporarily implemented as of its date of singing (July 30, 1999) and shall have an indefinite effect. Based on this, the Treaty has been *de facto* used from 1999. The Peljesac bridge construction plan developed by Croatia assumes that it will be constructed solely on the Croatian territory in line with the present delineation of the border between Croatia and B&H. In this situation, the Peljesac bridge project will not impact land territory of Bosnia and Herzegovina.

Figure 20 Bridge Location on the Croatian Territory



Legend: White line shows the position of the Pelješac bridge

Figure 21 Peljesac Bridge Location on the Croatian territory



Legend: White line shows the position of the Pelješac bridge

9.2.5 EU EXTERNAL BORDER SECURITY

The area in the vicinity of the proposed development options is under the jurisdiction of the Police Station Metković. This area is not conducive for illegal border crossing. Due to mountainous and swampy terrain it is very difficult to cross illegally the border line between Croatia and B&H in this region. Nevertheless, any incident of illegal crossing creates a large number of legal and political problems. Currently, there are some cases of illegal immigrations mainly from the territory of B&H towards Croatia. However, to insure security of the EU border, any corridor in this area should be properly constructed and sealed to limit possibilities for illegal activities against the EU/Croatia border and preventing and eliminating chances for terrorist activities.

Figure 22 The Neum/Metkovic Area Terrain Discouraging Illegal Immigration

9.2.6 EXTRATERRITORIAL ISSUES

Road corridor through the B&H territory with special traffic regime and status. As stated, the construction of a road corridor or a bypass through the B&H territory, requires a prior political consent between Croatia and B&H. An international agreement between these countries allowing such a construction would have to be concluded and ratified. A special regime and status of the corridor is needed. This requires conclusion of an international servitude agreement. Furthermore, ownership, land acquisition procedures, maintenance, and other relevant provisions for the corridor would have to be legally defined by these states.

In case of construction of the road corridor, the ex-territorial jurisdiction should be granted to the EU or Croatian authorities (e.g. traffic accidents, border surveillance, road maintenance, etc.) until B&H becomes a member of the EU and Schengen area. In order to prevent the illegal migrations and cross-border crime, the EU/Croatian authorities should be responsible for border surveillance of the corridor to effectively and efficiently control the EU external border in that prevent illegal migrations and cross border crime.

The potential corridor should be fenced and properly supervised by the state-of-art video surveillance technology and other technical means in order to prevent illegal migrations or use of corridor to illegally enter into the EU. There should be no entries or exits to the corridor on the B&H territory Finally, a prior consent should be obtained from the European Commission before this option could be introduced.

All of the above comments apply to any type of extraterritorial corridor including the proposed Neum By-pass development option..

Example of an International Traffic Servitude Agreements. Concluding of an international servitude for a extraterritorial corridor is an acceptable and known solution in the international law. So called *positive* and *negative* servitudes are known. They are usually defined by international agreements. A good example is the ex-corridor through the Italian territory in favour of SFR Yugoslavia and later of Slovenia, *so called corridor "Sabotinska cesta".* The conclusion of an international servitude between Italy and SFR Yugoslavia enabled the Yugoslavian citizens to transit through the corridor in order to get to SFR Yugoslavia through the Italian territory. The international agreement between SFR Yugoslavia and Italy, concluded in 1977, defined that the road corridor shall be constructed in the period of 2 years. However, the corridor was finished 8 years later, in 1985. According to the international agreement, it enabled the transit of the civil traffic for the period of 25 years with possibility of automatic prolongation for 10 years in case no contracting party cancels this international contract. The rules of detailed use, maintenance and responsibilities over the road corridor were defined by the Rulebook ratified by both contracting parties. The Rulebook precisely regulated the possibilities for crossings above and under the corridor, technical specifications of the road, maintenance of the fence, etc. Maintenance of the road was conferred to Italy while the Yugoslavian partners were empowered to control the traffic in the corridor.

In case of introduction of a similar corridor at B&H territory, similar provisions could be used. However, the necessity for obtaining a political agreement in both countries, conclusion of an international agreement, the land acquisition procedures and the necessary time for construction present the main disadvantages for this option. This is strengthened by the fact that various B&H express publicly contradictory opinions on possible acceptance of extraterritorial transport infrastructure on their land. In addition, extraterritorial solutions are not supported by the City of Neum Council and their constituencies[20].

One must remember, that even though both parties reach a political consensus and sign an international servitude agreement, the ratification process may be lengthy due to political reasons and fractured political opinions in both parliaments. This may contribute to further delaying the entire process and the investment itself. This poses a serious legal risk for any extraterritorial solution.

Adriatic-Ionian motorway route through hinterland of B&H with motorway exits to Metković and Dubrovnik. From the legal and border prospective, the Adriatic-Ionian Motorway option presents the same legal and border situation as any road corridors through the B&H territory. The Adriatic-Ionian motorway would require the same "fenced corridor system" and the Croatian ex-territorial jurisdiction until B&H becomes a member of the EU and Schengen Area.

For the earlier years, Croatia will have to perform border control at the external EU border in line with the EU Schengen Acquis. The border control with B&H will remain until B&H becomes a member of the EU and Schengen area. It takes usually 3 plus years since joining EU and the admission to the Schengen Area, it could be reasonably concluded that B&H won't become a member of the Schengen area. Therefore it can be assumed that in at least next 5 years, B&H will not become the Schengen member.

The implementation of the Adriatic-Ionian motorway as an extraterritorial corridor until B&H joins the Schengen area would require a prior consent from the European Commission and Council of the EU. In addition, approval should be received from B&H for exits on the B&H territory. They would be new border crossings points (BCP).

[20] Based on site visits and interviews conducted by the Consultant.

Figure 23 Former Road Corridor Through Italian Territory in Favour of SFR Yugoslavia and Later in Favour of Republic of Slovenia

Figure 24 Road Bridge Over the Former Road Corridor Through the Italian Territory

9.3 Specific legal issues related to the Peljesac Bridge Development Options

9.3.1 INTRODUCTION

In case of constructing the bridge for providing connection of the Croatian mainland with the Pelješac peninsula and join separated parts of EU/Croatia, there are no additional or further legal implications related to border and customs control, veterinary and phyto-sanitary inspection, since the traffic entirely runs over the EU/Croatian territory. Therefore, the provisions of the Schengen Border Code and Customs Code, and EU Acquis on veterinary and phyto-sanitary inspection do not have any impact in this case.

From a legal point of view, comparing with other development options, the construction of the Peljesac bridge, has a significant advantage. The Croatian Government has already mostly fulfilled all the national legal requirements related to the building of the bridge, and there is no need for obtaining additional building permits.

9.3.2 UN CONVENTION OF THE LAW OF THE SEA

The UN Convention of the Law of the Sea may impact the Pelješac Bridge development options. The possible scope of this impact has been addressed below.

During the pre-feasibility study, the B&H representatives indicated to the Consultant an opinion that the UN Convention of the Law of the Sea has not been completely implemented, in particularly with regard to the issues such as: question of the "straight archipelagic baselines", "sovereignty of a coastal State extends" and "freedom of navigation". According to the B&H representatives, the Republic of Croatia has not implemented the UN Convention on the Law of the Sea legally correctly and ignores the Convention. According to the B&H representatives, in line with article 47, paragraph 5 of the Convention, no state has a right to draw straight baselines and cut off an access to the open sea to the other countries as is in the case of B&H. In line with this, they claim, the Republic of Croatia doesn't recognize B&H's open access to the open sea. They have stated that for this reason B&H will oppose construction of the bridge, regardless of the fact that the Pelješac Bridge is to be built entirely on the Croatian territory. Furthermore, according to the B&H representatives, some of boats sailing through the Croatian territorial waters were sometimes stopped by the Croatian authorities.

Based on the B&H opinion it can be established that the B&H considers the current status of the straight baselines in contrary to the UN Convention of the Law of the Sea. Nevertheless, fact is that the B&H authorities have never initiated a judicial at the International Court of Justice nor gave an initiative to settle this issue by an international arbitration. However, there some bilateral activities were initiated in the past to address this question. They were unsuccessful. In sum, it can be concluded that such *status quo* remains unchanged since 1991 and 1992 when both countries declared independence and ratified the UN Convention of the Law of the Sea. The B&H authorities confirmed that by signing the Treaty on State Border in 1999.

If there is any potential for future legal proceeding regarding this question, it doesn't have a direct connection with the construction of the Pelješac Bridge. The UN Convention on the Law of the Sea doesn't contain provisions that would directly prevent construction of any objects or a bridge in similar cases. Based on the UN Convention on the Law of the Sea, each state has the right of innocent passage[21] in the territorial sea. Per this

[21] Passage means navigation through the territorial sea for the purpose of traversing that sea without entering internal waters or calling at a roadstead or port facility outside internal waters or proceeding to or from internal waters or a call at such roadstead or port facility. Passage shall be continuous and expeditious. However, passage includes stopping and anchoring, but only in so far as the same are incidental to ordinary navigation or are rendered necessary by *force majeure* or distress or for the purpose of rendering assistance to persons, ships or aircraft in danger or distress

Convention, ships of all states, whether coastal or land-locked, enjoy the right of innocent passage through the territorial seas. Based on this, all ships sailing through the Croatian territorial sea toward the Free and Foreign Trade Zone in Port Ploče[22] or into the B&H territorial sea, have the right to the innocent passage. The construction of the Pelješac bridge would not hamper this right. This would be fully confirmed if Croatia and B&H reach an agreement on dimensions (air draft) of the bridge which would allow bigger ships sailing under the bridge[23].

In addition to this, it should be mentioned that the Republic of Croatia and Bosnia and Herzegovina signed the *Agreement on Free Transit Through the Territory of the Republic of Croatia to and from the Port of Ploče and through the territory of Bosnia and Herzegovina at Neum*, concluded on 22th November 1998, recalling the provisions of the UN Convention of the Law of the Sea (1982), the Convention and Statute of the International Regime of Maritime Ports (1923) and other relevant international agreements. According to the *Implementing Protocol between the Republic of Croatia and B&H on free and unimpeded transit through the Neum corridor,* the contracting parties mutually provide unimpeded transit of people, baggage, goods and means of transport to and from Bosnia through the territory of Croatia for the utilization of the Port Ploče, and to and from Croatia through the territory of Bosnia and Herzegovina for use of the Neum Corridor.

In sum, the right of innocent passage is provided and implemented in accordance with the *UN Convention of the Law of the Sea* and bilateral *Agreement on Free Transit through the Territory of the Republic of Croatia to and from the Port of Ploče,* concluded between the Republic of Croatia and Bosnia and Herzegovina.

The UN Convention of the Law of the Sea certainly might have some political impacts and legal implications in case of further construction of the Pelješac Bridge. The described B&H's reservations could potentially lead to an international legal and/or political dispute between the Republic of Croatia and Bosnia and Herzegovina, initiated by Bosnia and Herzegovina concerning “straight archipelagic baselines”, “sovereignty of a coastal State extends” and “freedom of navigation”. It is therefore recommended that the Republic of Croatia and Bosnia and Herzegovina reach a political consensus which would define the specifications of the Pelješac bridge allowing further and future innocent passage under the Pelješac Bridge.

In that matter, the experts and representatives of the Republic of Croatia and Bosnia and Herzegovina on 7th December 2006 signed the Protocol[24] on providing unimpeded passage under the future bridge, mainland – Pelješac. Based on the following agreement, the both parties agreed that the future bridge shall be 200 metres wide (breadth of the sea lane) and shall have 55 meters aperture altitude/light hole (height).[25] The criteria set in this Protocol would provide bigger and higher ships the unimpeded passage under the future bridge toward to the B&H territorial sea. Both parties also agreed that the Protocol should be further developed and will contain also a proper legal and formal formulation. However, no further activities and steps have been taken since 2006. They are strongly recommended. This Protocol most probably doesn’t have an

[22] Based on the Agreement on free transit through the territory of the Republic of Croatia to and from the Porto of Ploče, the Republic of Croatia has established a Free and Foregin Trade Zone, see also UNCLOS provision defining the right of innocent passage.

[23] The design of the Peljesac bridge has been adjusted to provide for a 55 meter vessel air draft. This PFS does not get involved in detailed design of the bridge or any other fixtures. It however, seem that this bridge is more than sufficiently for the reasonably expected sailing patterns. The tallest cruise vessels in the World have air draft of about 65 – 70 meters. It is uncertain if 50 meter high cruise vessels will call the Port of Neum in the next 20 years, in particular since such a port neither exits nor is scheduled for construction by B&H authorities. Also, cruise sailing to the Bay of Neum may be prevented by environmental regulations. Taking this under consideration, the 50 meter high design for the bridge may be excessive and is only justified by B&H requirements. This issue should be addressed in a possible feasibility study if that development option is chosen. Significant cost savings for the bridge may occur if its high is adjusted to the real need of regional navigation. The bridge can always be elevated if such needs appear in the feature. This approach seems to be cost effective as proven for example by periodical bridge elevation in New York.

[24] The Croatian and B&H representatives used the term »Usuglašena bilješka« what could have meaning of »expert' working agreement«.

[25] The validity of the Protocol is subject to the verification of the Council of Ministries (B&H) – article 5 of the Protocol

international legal validity. Also some B&H governmental representatives don't recognize this validity[26]. The Protocol should be respected by the EU/Croatia authorities if the construction of the bridge progresses. This would minimize the possibility of success of any potential objections of B&H that the bridge is too narrow or too low, and limits the B&H right of the innocent passage. The best solution would be that both parties with the EC assistance reach a political consensus which would facilitate the construction of the bridge and eliminate potential international political or legal dispute.

The Croatian Ministry for Foreign and European affairs has been adjusting the relevant international agreements and protocols with B&H in order to keep their validity after the Croatian accession to the EU on July 1, 2013 as a legal legacy. In particularly that concerns the existing International Agreement on free transit through the territory of the Republic of Croatia to and from the port of Ploče and through the territory of Bosnia and Herzegovina at Neum (1998) as well as the Implementing Protocol between the Republic of Croatia and B&H. The Republic of Croatia and B&H signed on June 19, 2013, a common statement about the understanding and application of the article 11 of the aforementioned agreement which enables both parties to keep in force the existing agreement after the Croatian accession to the EU and in line with the EU Acquis.

In the course of the PFS preparation "the representatives of B&H expressed their opinion that the UN Convention on the Law of the Sea is not completely implemented, particularly the question of the "straight archipelagic baselines", "extents of sovereignty of a coastal State" and "freedom of navigation" (to high seas). According to the B&H representatives, the Republic of Croatia has not implemented the UN Convention on the Law of the Sea correctly and still further ignores the Convention. According to the B&H representatives, in line with article 47, paragraph 5 of the Convention, no state has the right to draw straight baselines and cut off other countries' access to the open sea, as in the case of B&H. In line with this, the Republic of Croatia doesn't recognize B&H and its open access to the open sea (high seas)..." It has been indicated that „Based on the UN Convention on the Law of the Sea, each state has the right of innocent passage[27] through the territorial seas. Subject to this Convention, ships of all States, whether coastal or land-locked, enjoy the right of innocent passage through the territorial seas". B&H indicates further that this is not correct. The Pelješac Bridge is in Croatia's internal waters. These internal waters do not exclude B&H Sea, according to Croatia's law on the sea.

The Croatian side reasons with regard to the B&H comment: "*The Bridge Pelješac is in internal waters of Croatia. This internal water has not excluded B&H Sea, according Law of the Sea of the Croatia",* is rather contradictory. Firstly, there is no "Croatia's law on the sea" but the International Law of the Sea Codified in the 1982 United Nations Convention on Law of the Sea. The Republic of Croatia passed in 2004 its Maritime Code which is in line with UNCLOS regarding, *inter alia*, determination of the straight lines, sea areas (internal and territorial waters, EEZ), its sovereign rights and jurisdiction without leaving out the right of innocent passage. This important right which allows access to the High Seas belongs to B&H indisputably and Croatia has been stressing this fact repetitively. It would be helpful though to find out what B&H actually means when stating that "*These internal waters do not exclude B&H Sea"*. As it is well known that B&H sea area and its outer limits are determined by the 1999 Agreement on State Border, and the bridge, as it would be located, is at least 500 m from the outer limits of the B&H sea area and spans over the area which is under Croatian sovereignty. This was even confirmed by B&H Minister of Communications and Transport Hadžić in a statement given at the end of 2013.

B&H indicates that "The core sea problem between B&H and Croatia is in Croatia's law on the sea. According to Article 18 paragraph (2) of the Croatian Maritime Law, straight baselines are defined contrary to the United

[26] The B&H representatives stated on the meeting in B&H on 29th May in Sarajevo that the B&H side has never expressed an agreement for construction of the Pelješac bridge and therefore any record done between the B&H and Croatian experts doesn't have a legal validity

[27] Passage means navigation through the territorial sea for the purpose of traversing that sea without entering internal waters or calling at a roadstead or port facility outside internal waters or proceeding to or from internal waters or a call at such roadstead or port facility. Passage shall be continuous and expeditious. However, passage includes stopping and anchoring, but only in so far as the same are incidental to ordinary navigation or are rendered necessary by force majeure or distress or for the purpose of rendering assistance to persons, ships or aircraft in danger or distress

Nations Convention on the Law of the Sea. Therefore, the sea of Bosnia and Herzegovina is cut off from the open sea, while the internal Croatian sea does not exclude the sea of Bosnia and Herzegovina. The set straight baselines in this Maritime Code are taken from former Socialist Federal Republic of Yugoslavia[28], neglecting the rights of Bosnia and Herzegovina and the fact that on 12 January 1994 Bosnia and Herzegovina became a party to the Convention, while Croatia became a party to the Convention fifteen months later, on 5 April 1995."

According to the Croatian side, the Croatian Maritime Code is in line with UNCLOS and it does not differ in definition of the breadth of the territorial sea, internal waters and establishing straight baselines either (Articles 3, 7 and 8 UNCLOS). Also B&H incorrectly comments that the measurement of straight baselines from which the width of the sea area of a coastal state is measured is imprecise given the fact that all hydrographic measurement simulations lead to the conclusion that B&H would not be entitled to rights broader then the existing ones. The part of B&H comments stating that "*Therefore, the sea of Bosnia and Herzegovina is cut off from the open sea, while the internal Croatian sea does not exclude the sea of Bosnia and Herzegovina.*", is confusing. As it was abovementioned, the B&H sea area does not enter into the part of Croatian waters where the bridge line would be passed and the regime of innocent passage precludes *the cut off effect* brought out by B&H in its comments. Finally, it is not clear why the fact that B&H became State Party of UNCLOS earlier than Croatia should have any importance in this matter.

Furthermore, B&H claims that "Article 6 paragraph (1) of Croatian Maritime Code defines the sovereignty on the Sea of the Republic of Croatia. This sovereignty extends to internal waters and territorial seas of the Republic of Croatia, to the air space above them, and to the bed and subsoil of the said sea area. Articles 6 and 18 of the Croatian Maritime Code are in contradiction with article 47 paragraph 5 and 6 of the United Nations Convention on the Law of the Sea."
The Croatian representatives indicate that it is not clear why B&H makes a reference to Article 47 of the UNCLOS which refers to defining archipelagic baselines in case of archipelagic states, since Croatia is not an archipelagic state.

The B&H authorities also refer to the statement of the Consultant indicating that it is strongly recommended that the Republic of Croatia and Bosnia and Herzegovina reach a political consensus which would define the specifications of the Pelješac Bridge allowing further and future innocent passage under the Pelješac Bridge in case of its further construction". Innocent passage is not the core problem of implementation of the UN Convention on the Law of the Sea. Bosnia and Herzegovina has not requested innocent passage, but all the rights regulated by the UN Convention on the Law of the Sea, which belong to Bosnia and Herzegovina."

The Croatian partners reason that it is correctly said that the application of the right of innocent passage is not the basic problem, as Croatia has never put that right into question nor has the intention to do so. It would be worth to know has it been a single case of infringements by Croatia of the rights which belongs to B&H according to UNCLOS and what other rights regulated by the UNCLOS B&H considers belong to them.

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[28] 1) low-water lines along mainland or island shores,
2) straight lines closing entrances to ports or bays,
3) straight lines connecting the following points on mainland and island shores:
a) Zarubača Cape– south-east cape of Mrkan Island – southern cape of Sv.Andrija Island–Gruj Cape (Mljet Island),
b) Korizmeni Cape (Mljet Island) –Glavat Island –Struga Cape (Lastovo Island) –Velje More Cape (Lastovo Island) – south-west cape of Kopište Island –Velo Danče Cape (Korčula Island) –**Proizd Cape – south-west cape of Vodnjak Island** –Rat Cape (Drvenik Mali Island) –Mulo Rock –Blitvenica Rock –Purara Island –Balun Island –Mrtovac Island –Garmenjak veli Island – point on Dugi otok Island, with the following coordinates: 43°53'12" of northern latitude and 15°10'00" of eastern longitude,
c) Veli rat Cape (Dugi Otok Island) –Masarine Rock –Margarina Cape (Susak Island) –Albanež Shoal –Grunj Island –Sv. Ivan na Pučini Rock –Mramori Shoal –Altiež Island –Kastanjija Cape.

The B&H authorities also state that "any of the UN Conventions are priority in regular implementation over other legal issues for either country." The Croatian partners agree with that notion saying that it is correctly concluded. They indicate that it would be properly by B&H experts to mention, that the 1999 State Border Agreement determined, among others, sea areas and its outer limits between two States, confirming the present straight baselines and the legal status of B&H waters. This international agreement also has priority over the national law regardless of its provisional application.

9.4 Specific legal issues related to extraterritorial corridors and the Neum by-pass

9.4.1 INTRODUCTION [29]

At the end of July 2013, the B&H members of the Advisory Committee submitted an **"Analysis of the possibility to connect the EU Schengen area through B&H via municipality Neum"**. According to the breakdown of costs attached to the document, the B&H side estimates the cost of the Neum by-pass (i.e. the "new" Neum corridor) at about 58 million €[30].

However, the analysis which lays out the B&H proposal seems to be incomplete in providing all related aspects of the proposed solution, and seems only to show the estimated costs of construction of the road with the usual accompanying facilities which do not include specific additional construction that would have to be built taking into account the very specific status which this road could potentially have ("sealed corridor").. It focuses only on *some* technical aspects of the proposed solution while at the same time neglecting to describe any tangible or intangible disadvantages of the by-pass option. Lack of any other criteria in this analysis is it's a major deficiency. A thorough additional assessment of all criteria needs to be performed and taken into account in the assessment of this proposal, as they have significant impact on the overall cost of the project and on the acceptability of this proposed solution. Even if the calculation of costs for the by-pass option made by B&H would be complete, it should be born in mind that the cost is not the primary and the only criterion for selection of *the best* solution.

9.4.2 NEEDS AND POSSIBILITIES FOR AMENDMENTS/DEROGATIONS FROM THE ACQUIS

The following issues should be considered:

- The by-pass option (the "new" Neum corridor) would require amendments to the *acquis* (derogations). Derogations from a certain number of provisions governing transport/transit of goods and passengers between the EU and third countries (i.e. through the territory of a third country) would have to be accepted by the European Commission and all Member States
- A by-pass solution would require a sealed road which passes through B&H territory and which fully implements the *acquis*.
- Priority should be given to a solution that can enable full implementation of the *acquis* (including Schengen) without additional derogations.
- This means that if the option of the corridor is to be *comparable* and thus *competitive* with the option of the bridge (ensuring *continuous* and *unhindered* flow of passengers and all types of goods**),** it should be designed and constructed in a way that does not imply a derogation from the *acquis*.
- This is not the case with the proposed solution of a by-pass/corridor , as it will not be deemed possible to avoid derogations from the *acquis* considering that the road would be located on the territory of a third country (i.e. B&H)

[29] Based on comments received from the Croatian authorities.
[30] In the following months, this cost estimate was updated to a larger number.

- Acts that would be covered include a wide range of regulations governing the transport of persons and goods across the territory of a third country, i.e. a series of regulations concerning border surveillance, border and customs control and inspection of goods crossing the territory of a third country.
- **Ensuring continuous transit without border controls of all kinds of goods**, including shipments/goods subject to veterinary and phytosanitary control would require a completely closed road through the territory of B&H, with a probable need for derogations from certain pieces of legislation.
- Regarding **customs control**, as the proposed road concerns a traffic way through the territory of a third country, i.e. a non-EU country, any transport which would be carried out through that area, as well as the exit and re-entrance of passengers into Croatian/EU area would concern the application of customs rules and the obligation of the Croatian Customs Administration to conduct checks and controls in accordance with EU rules.
- There are a number of regulations which may apply to the legal situation of the by-pass. The most important address EU legislation governing **trade in plants, plant products from non-EU countries** EU legislation governing **veterinary border control (a list of regulations provided in Appendix).** To be more precise, when it comes to transit of shipments subjected to veterinary control (products of animal origin and live animals included), a preliminary analysis indicated that at least two Directives would need to be derogated from/amended (Council Directive 97/78/EC and Council Directive 91/496/EEC). When it comes to shipments subjected to phytosanitary control, more detailed analysis and additional consultations with the European Commission services would have to be initiated to establish the need for derogations from the *acquis*. The same analysis should be made in relation to the **rules governing border surveillance and border checks/control of persons**, taking into account the fact that the Republic of Croatia, while not a member of the Schengen area at this point, applies most provisions of the Schengen *acquis*, including those provisions relating to **surveillance of EU external borders**. The Croatian border police applies the relevant *acquis* and performs border checks at the existing border crossing points Klek and Zaton Doli, in accordance with the applicable provisions of the Schengen Borders Code as well as in accordance with the Directive 2004/38/EC of the European Parliament and of the Council of 29 April 2004 on the right of citizens of the Union and their family members to move and reside freely within the territory of the Member States, and also in line with national legislation which is fully harmonised with the EU *acquis*. Any solution which would be chosen as the best one would have to ensure full applicability of the Schengen Borders Code, not putting into question its implementation by the *Croatian authorities* (again having in mind that continuous flow of traffic of persons and vehicles would have to be enabled, without checks and control but with appropriate surveillance).
- Exclusion of any border checks, which would be necessary in order to ensure a continuous and uninterrupted flow of traffic through the Neum by-pass would require a closed, sealed road, which should ensure that there is no communication with the territory of another country (i.e. B&H) by persons who transit through that area, and which should at the same time provide appropriate and easy access for police authorities (border police, traffic police, firemen, immigration officers, etc.) in case any intervention is needed at any time. The competent EU/Croatian authorities would have to have the possibility of complete control in the context of border surveillance (e.g. CCTV). It may be estimated that additional police staff would have to be deployed in order to secure appropriate and sufficient surveillance of the area.
- **Accession to the Schengen area is a strategic priority for Croatia, with a set goal to reach preparedness for the Schengen evaluation procedures two years after accession to the EU.** Thus, a time frame of three to four years necessary for accession to the Schengen area would be an objective estimation. Therefore, it is of utmost importance for Croatia to ensure that the Schengen evaluation procedures find no breaches of the Schengen *acquis* and to confirm that the Schengen security standards have been fully reached in all areas. Croatia cannot be in a position to jeopardize positive evaluation of its preparedness for Schengen, on which the Commission's recommendation to the Member States for Croatian membership in the Schengen area will depend. **The fact of Croatian entry into the Schengen area within medium-term also needs to be taken into account when assessing various development options for connecting the future EU-Schengen area in the south of Croatia**.
- The above primarily means the application of:

    - Council Regulation (EEC) No 2913/92 of 12 October 1992 establishing the Community Customs Code

  - Commission Regulation (EEC) No 2454/93 of 2 July 1993 laying down provisions for the implementation of Council Regulation (EEC) No 2913/92 establishing the Community Customs Code
  - Council Regulation (EU) No 479/2013 of 13 May 2013 on the waiver from the requirement to submit entry and exit summary declarations for Union goods that are moved across the Neum corridor *(applicable at the existing Neum corridor)*.

- Any movement of goods through the territory of the Neum corridor, in terms of customs means that such transport would be subject to the implementation of appropriate customs procedures and controls when the goods are exiting the EU customs territory as well as at the point of its re-entering the area of the EU, regardless of whether the goods have the status of Community/EU goods or not. In this sense, for goods transiting through the Neum corridor, appropriate customs procedure which regulates the transport of goods through foreign customs territory must be carried out in accordance with the provisions of the EU customs legislation.
- Regulation No. 479/2013 provides certain exceptions for enforcement of customs procedures for EU goods transported through the (current) Neum corridor. Under this Regulation, for such goods (EU goods) an exemption from the submission of entry and exit summary declarations is envisaged, if the value of the shipment is up to 10,000 €, and if the shipment is supported by appropriate documents - invoices or transport documents, as prescribed by Article 4 of this Regulation.
- However, if the value of shipment is exceeding this amount, for EU goods being transported through the Neum corridor, it is necessary to fully implement the provisions of the Regulation (EEC) No. 2913/92 and Regulation (EEC) No. 2454/93, which includes filing the appropriate customs documents which refer to domestic goods transported through foreign customs territory with the submission of prescribed and mandatory entry and exit summary declarations.
- In addition, EU goods subject to veterinary checks are required to be sealed by Croatian Customs Administration at the exit from the EU (Klek). The seal is again checked at the time of re-entry into the customs territory of the EU (Zaton Doli), pursuant to veterinary regulations.
- For goods which do not hold the status of EU goods, it is also necessary to carry out the appropriate customs checks at the exit from the customs territory of the EU and to determine the proper completion of customs procedures when re-entering.
- Currently, the implementation of EU customs regulations at border crossings in the Neum area requires 55 Croatian customs officers, who are required to carry out customs procedures at the exit and re-entry into the customs territory of the EU.
- The bypass, even if designed as a sealed road, would not be a satisfying solution in accordance with customs regulations, as this corridor would still represent a territory of a third country where customs controls and procedures would have to be carried out.
- In order for the proposed solution to be excluded from the implementation of appropriate customs procedures, **it should be defined as the customs territory of the EU**, and hence there would be no obligation of the Customs Administration to implement appropriate procedures. However, even in this case, there is **reasonable doubt as to the possibility of full control over the goods passing through the area** (road) because every stop and slowing down of a vehicle may result in an unauthorized access to goods from third parties.
- Also, it should be reminded that Croatian customs authorities (i.e. Ministry of Finance – Customs Administration) do not have competence to act and intervene in the Neum area (since it is foreign territory). Therefore, any unpredictable situations (e.g. traffic accident, vehicle malfunction) would put in question the manner and possibility of dealing with the situation and goods/shipments involved. A “special” status of some kind would thus have to involve giving full and unquestionable competences to Croatian authorities to act in that area.

In conclusion, it should be emphasized that the final number and list of derogations in all mentioned areas, does not depend only on the Republic of Croatia and B&H, i.e. on their mutual agreement, but primarily on the legal analysis by and negotiations with the competent Commission services. All derogations would need to be ultimately approved by the Commission and the Member States in the legislative procedure within the Council.

9.4.3 BILATERAL AGREEMENTS

Making the solution of a corridor through Neum feasible would require signing (at least) two international agreements:

- On the construction, and
- On the use of the Neum corridor (rules of operation, management, maintenance and control of the corridor, the authority of competent services).

To be able to establish a corridor through the territory of another country (B&H), and in order to enable the other country (Croatia), to have transport connectivity of its territory, an international act (agreement) would have to contain very detailed sets of rules on among others on the following:

- Area to which the corridor relates, including its dimensions, details on its development
- Property issues arrangements of the area
- Regulation of sovereign rights and jurisdiction over the area
- Duration of the contractual relationship
- Determining whether the construction of the Corridor is to be part of a separate agreement or an integral part of an agreement on the establishment of the corridor.

It is very important to recognize that all these elements do not exist in and are not regulated by the existing Agreement on free transit through the territory of the Republic of Croatia to and from the Port of Ploče and through the territory of Bosnia and Herzegovina at Neum (1998). Including all the above mentioned elements in the existing agreement would require a significant change of its content which would in conclusion indicate the need to draft a completely new agreement between the parties as the only reasonable option.

Any discussion of possible changes to the existing Agreement on free transit through Croatian territory and from the Port of Ploče and through the territory of B&H and Neum must take into account the fact of Croatian EU Member State status as of 1 July 2013. That is, the fact that on 19 June 2013 the Joint Declaration on the interpretation and application of Article 11 of the Agreement on free transit has been signed, which obliges B&H and Croatia to respect the agreement that the control of traffic and persons at border crossing points that are located at the ends of the Neum corridor, is to be carried out in accordance with the rules of the Accession Treaty (i.e. in accordance with the EU *acquis*). Accordingly, any consideration of amendments to the existing Agreement would require prior consultations and the opinion of the Commission on the above.

The purpose of the existing Agreement is significantly different from the goal which a new or an amended agreement would have, which should regulate the transport links between parts of the Croatian territory through the territory of Bosnia and Herzegovina. The purpose of the existing Agreement is to establish traffic in transit to and from Croatian territory through the territory of B&H, and also to allow traffic in transit through the Croatian territory "in order to use the Port of Ploče". Moreover, most of the existing Agreement refers to rules which regulate the use and management of the Port of Ploče. However, since the export and import of goods from B&H through the Port of Ploče is regulated by specific rules (derogations), valid between the EU and B&H, and no longer between Croatia and B&H, the rules of existing Agreement would not be applicable in this case.

As already mentioned, in addition to the specified elements which should be included as a mandatory part of a new agreement between Croatia and B&H, it should be borne in mind that in order to compare this solution on equal grounds with the functionality of the bridge solution (i.e. the fact that persons and goods would pass using the bridge without stopping for control), the same requirements and status of passing should be required from the by-pass/corridor through the B&H territory. This would mean that the citizens of the Republic of Croatia and other EU citizens should travel through this corridor freely and without any checks (and border crossing points). This would of course require that the new agreement(s) that would establish a corridor/road through B&H which should allow identical conditions for free flow of goods and persons as other options located entirely in Croatia such as the bridge development options.

Besides this, the content of any future agreement(s) on the use of the Neum corridor would most probably affect the content of the possible amendments to the *acquis* and *vice versa* (border crossing points, types of traffic/transport which would be allowed through the corridor, effect which this would have on the functionality of the existing transport corridor, obligations posed before Croatia as an EU Member State and a future Schengen area Member State, etc.).

9.4.4 EXTERRITORIALITY AND SOVEREIGNTY

Croatia (or EU) would have to have full sovereignty over the Neum corridor, in order to fully implement a regime comparable to the bridge solution and to be fully aligned with the *acquis* requirements[31].

Therefore, a bilateral agreement should be concluded between Croatia and B&H on using B&H territory (as a kind of international servitude), envisaging full application of the applicable EU *acquis* on the territory of a non-EU country. This could bring in certain political and legal issues by the B&H side. Political instability in B&H and protracted decision making procedures at entity and state levels may prevent conclusion of such an agreement. In addition, a grave risk of non-ratification of such an agreement would also exist, even if an agreement were to be signed.

Even if seen possible to determine this by an agreement between the two parties, it is very unlikely that such an agreement could predict and determine all possible practical situations which should be placed under the competence of Croatian authorities and enable them to act on B&H territory.

In addition, as the corridor would pass through B&H territory it would be necessary to determine applicable rules and time needed for the property related issues concerning the construction of the road, this including regulation of the expropriation of the land and entering the road plans in the appropriate spatial plan(s), which is particularly known to be a lengthy procedure (according to available information, this route is not in spatial plans in Croatia or in B&H).

According to the already available facts, land from B&H nationals (min. 210,000 m^2) would have to be purchased (in line with B&H regulations on the acquisition of real estate and considering the lack of reciprocity, in such a case a legal entity would have to be established in B&H to purchase this land). Alternatively, B&H would have to implement the institute of expropriation. This again brings in question determining competence of the court and applicable law in the case of a dispute, if the dispute pertains to the corridor in B&H territory.

Other difficulties that have already been mentioned during analysis made so far include issues such as transport and return of machinery, tools and equipment of the Contractor across the border and the issues of customs tariffs which should be resolved by a bilateral agreement.

On 30 August 2012, the Commission (DG Home) has sent a formal letter setting forth its position regarding the proposal to build a corridor through B&H, in the Neum area. According to the Commission's opinion, for the implementation of this project it is primarily necessary to enter into an international agreement between Croatia and B&H which would regulate all legal and other issues related to the corridor. It would also be necessary to establish a management system for the corridor in order to ensure that no person may have undetected access to the corridor, and to ensure that the passage through the corridor is smooth (i.e. not difficult), and that it does not interrupt transport links with the rest of the region of Neum in B&H.

Given the need to regulate the status of the territory through which the potential traffic route would pass, as well as all other related issues, through an international agreement(s), one can expect difficulties in the long

[31] The issue of which subject EU or Croatia as a member state or Croatia on behalf of EU would exercise these rights is not absolutely clear. This would have to be addressed by legal entities of EU and Croatia in depth, with consideration of international public law precedents.

and complicated negotiations which would need to be fully in line with respective national procedures of negotiations for the conclusion of an international agreement.

In Croatia, this is determined by the Constitution of the Republic of Croatia, the Law on the Conclusion and Execution of Treaties (Official Gazette, No. 28/1996), the Vienna Convention on the Law of Treaties and other applicable rules of international law. The Law on the Conclusion and Execution of Treaties does not define or prescribe the exact deadlines and time frames for implementation of any of the previously described procedures, because it depends on the circumstances in each case, the nature and complexity of each contract and possibilities for timely agreement between all participants and the acceptable content (i.e. the essential elements of the agreement). Depending on the circumstances and requirements as well as depending on the plans and deadlines for the implementation of certain activities, the dynamic of the process, including the negotiations and conclusion of proceedings following the finalization of the negotiations, is determined in each case by the competent authority in charge of the process of concluding a particular agreement/treaty.

A detailed overview of the national procedure on B&H side would also need to be prepared according to the Croatia side. Given all of the above, and since there are no comparable cases in the world (nor within the EU) which may serve as a model for this situation, negotiations and conclusion of such complex and unprecedented agreement(s), which would need to involve a number of unknown issues (legal, political, transportation, technical, safety), would **certainly mean a time-consuming and difficult process.** (see Appendix for an agreement negotiations procedure)

9.4.5 REQUIREMENTS OF EC FOR EXTRATERRITORIALITY ISSUES FOR THE CORRIDORS IN B&H

A number of requirements may be specified:

- All corridors, including the Neum Corridor passenger traffic route, must be a sealed road.
- While recognizing the importance of having a smooth connection between the two Croatian sides of the corridor, there are the commitments taken by Croatia during the accession negotiations must be met upon accession.
- Moreover, the international agreement with Bosnia and Herzegovina on free transit at the Neum corridor should be brought into full compliance with the EU *acquis.*
- Consequently, upon accession all entries and exits on both sides of the corridor must be subject to border checks in accordance with the Schengen Borders Code.
- Without putting into question the above mentioned commitments, building a sealed road is a long term solution to connect the two parts of the Croatian territory. However, such a plan needs complex detailed analyses.
- There are issues related to the customs regime and transport of goods which need to be considered carefully by Croatia agencies.
- Some border management aspects need to be taken into account for your possible future work on the project.
- First, it is the Commission's assessment that the realisation of the sealed road project would require the negotiation of an international agreement with Bosnia and Herzegovina since the sealed road will cross its territory. This international agreement should provide clear rules on issues like the legislation applicable to the sealed road, as well as the division of competences and responsibilities between the two parties.
- As regards the applicable legislation, the Croatian authorities would need to fully apply the EU *acquis,* in particular the Schengen Borders Code and its provisions on surveillance as well as on international protection. If a third country national claimed asylum when trying to enter the sealed road, the request would need to be dealt with by the Croatian authorities in accordance with the EU *acquis.* Second, it is essential to ensure that no person can access the road undetected.
- Although Croatia intends to guarantee this by constructing a fence around the road; a number of considerations will have to be taken into account in the project, both of a technical and operational nature. Apart from the fence being constructed in a way which makes unlawful access to the road virtually impossible, the Croatian authorities also need to ensure the situational awareness and reaction capability of their staff in case persons try to overcome the fence.

- Provisions must also be in place to regulate the maintenance of the sealed road and access in case of traffic accidents. In any event, it is important to recall that the final assessment of whether the sealed roads up to standards would be made during a Schengen evaluation, currently still under the responsibility of the Council. Moreover, while guaranteeing that no one can unlawfully access the sealed road, it should also be ensured that both parts of the territory of Bosnia and Herzegovina will remain connected and that there will be no negative impact on the internal circulation on B&H territory. On the basis of the received plan, it is unclear how such a connection would be guaranteed.
- Finally, even if it would be possible to provide for a legally and technically sound solution, the negative political image of such a sealed road in the middle of the B&H territory needs to be taken into account.

The B&H delegation to the Advisory Committee presents the following position regarding the Neum By-pass issue. They quote the opinion of the Consultant : *"In case of construction of a road corridor through B&H territory, political consent obtained in Croatia and B&H for implementation of this option is a first precondition. Following this, an international agreement between the Republic of Croatia and Bosnia and Herzegovina allowing for construction of a corridor shall be concluded and ratified afterwards. This option would require a special regime and status of the corridor, more precisely it would require the conclusion of an international servitude between the Republic of Croatia and B&H. Furthermore, ownership, land acquisition procedures, further maintenance and other relevant provisions for the corridor should be properly legally defined between the Croatian and B&H authorities".* B&H confirms the importance of this issue and indicates that in relation to the Neum By-Pass they need technical amendments to *Agreement on Free Transit through the Territory of the Republic of Croatia to and from the Port of Ploče and through the territory of Bosnia and Herzegovina at Neum,* signed on 22 November 1998. In their opinion **t**his is one of the preconditions, but not a very strong one, for the reason of good neighbouring relations between the two countries.

In response the Croatian side reasons that not only technical amendments to *Agreement on Free Transit through the Territory of the Republic of Croatia to and from the Port of Ploče and through the territory of Bosnia and Herzegovina at Neum,* signed on 22 November 1998, would be needed in order to ensure the necessary special regime and status of the corridor. They disagree with this notion and point out that due to the very specific legal requirements that would need to be fulfilled, as regards both international and EU law, a set of entirely new international agreement(s) would be needed.

9.4.6 MAIN FINDINGS RELATED TO DEVELOPMENT OPTIONS

The following transpires from the above analysis:

- From a legal point of view, all the options are feasible
- if a bridge, corridor or tunnel development options are selected, there will not be border, customs, veterinary and pyhto-sanitary check legal issues. Movement of the passengers and goods would be unimpeded.
- If a road corridor, by-pass through the B&H territory and tunnel under the B&H territory are selected – this will require a political good will and consent between Croatia and the B&H and the conclusion of an International agreement on international servitude.
- If a bridge option is selected, it is recommended that the Republic of Croatia and B&H reach a mutually acceptable solution in order to prevent a potential international legal or political dispute. It is recommended that both parties continue the dialogue commenced in 2006 when a consensus on the expert level about the dimensions of the Pelješac bridge for providing unimpeded passage was reached.
- One must remember that some additional requirements and time is needed for constructing the corridor/bypass and tunnel under B&H in comparison with the bridge namely. political consent, conclusion of an international agreement, spatial planning, preliminary designs, project documentation, issue of location and building permits, land acquisition processes, etc.
- There are several distinct advantages of the Pelješac bridge over other development options. They are: a significant portion of the necessary construction permits have already been issued, project documentation has been almost completed, and some works have been already done. From the legal and border point of view, this option is the least complicated. This reflects the advanced phase in which the construction of

the bridge is. It is the fastest option for achieving a permanent solution to the EU/Croatia land territory separation problem. The disadvantage is a potential legal or political international dispute about the bridge design. In light of the above this dispute, if raised, would purely political, since the current bridge design and assumptions (55 meter air draft) are by far exceeding reasonable needs for navigation in this area demand. In fact, based in international bridge construction standards this design can be defended only as a concession to the excessive B&H demands. It is recommended that if this scenario is chosen, the EC would participate in negotiations with the B&H authorities, as this will be one of the most important road transport structure in this part of the Union. These negotiations may lead to significant EU tax payers' money savings, regardless of the final source of funding.

There are a number of potential legal problems that must be addressed in relation to development options:

- If the corridor and tunnel through the B&H territory are selected, conclusion of an international agreements (e.g. international servitude) is required. Political instability or aberration from an agreed political solution may prevent or lengthen implementation of the selected solution (e.g. non-ratification of signed international agreement)
- With the exception of the Pelješac Bridge development options, no other option is in the existing spatial plans, neither in Croatia nor B&H
- The land acquisition processes is required, in particular for corridor/by-pass options. This may lead to a long administrative and judicial proceedings with the owners. The risk of prolonging construction because of this reason must be considered.
- If the corridor/bypass and B&H tunnel are selected, a prior consent of the EU Commission and Council of the EU are required. Furthermore, the EC would have to get actively involved providing detailed specifications and requirements for extraterritorial and EU border security fixtures.

The legal and geopolitical overview of the projects confirmed the existence or a possibility of existence of main bottlenecks in the Neum area:

- The current situation requiring two crossings of the state borders results in passengers and freight traffic delays, in particularly during the high tourist season. This situation will increase if not resolved in the years to come. The waiting periods during the tourist season mostly affect third country citizens, in particularly the B&H citizens while the EU passengers will cross the border more rapidly since they will be only subject to the basic border checks. EU citizens will be also affected since insufficient road in the border crossing points area doesn't allow for advanced traffic management before BCPs, to provide for smooth checks as required by the Schengen Code
- Since transport of the live animals is currently not be allowed via BCO in the Neum area, major difficulties regarding transit of shells from the Pelješac bay (area of Mali Stone and in its vicinity) toward northern part of Croatia and transit of the specific species of pets (e.g. rabbits, birds, etc.) will intensify.
- As transport of live animals through the BCP Klek – Neum I and Zaton Doli – Neum II won't be allowed anymore as well as carrying of food in personal luggage. Therefore all the food that will be exiting the Croatian and EU territory at one of these two BCP's won't be allowed to re-enter to the EU/Croatian territory. In these cases food will be considered as a third country' food which won't be not allowed to re-entry into the EU. Such situation will cause difficulties to many EU passengers, in particularly to numerous tourists transiting the Neum area and re-entering the EU territory, carrying with them food for holidays (in particularly meat and cheese products).
- The current border situation doesn't present difficulties only to people transiting through the B&H territory over the Neum territory, but also to the B&H citizens travelling from the central part of the B&H toward Neum and vice versa

The specific issues related to the UN Convention of the Law of the Sea should be resolved in a diplomatic way by Croatia and Bosnia and Herzegovina. At the current situation, and significant concessions made when proposing a new design of the bridge, these issues should not be sufficient to significantly impact or delay the bridge construction if chosen as a preferable option. With a good will and responsibility for geopolitical progress in the region, both parties should resolve their border and access to the sea issues. If that is difficult, the EU assistance or mediation may be called for in lieu of or prior to court proceedings. These issues have limited impact on bridge development options. The transport infrastructure development activities

contributing to the welfare of both states should not be delayed because of the continuing diplomatic efforts to resolve and establish friendly relationship between the parties.

The legal and geopolitical issues related to extraterritorial corridors and tunnels are very much complicated and do not have precedent. New legal solutions will have to be developed with significant assistance and participation of the European Union. Bilateral agreements will have to be signed. Derogations from acquis may have to be considered. Additional, high costs for security establishment may have to be expanded[32]. This may be a lengthy and complicated process. As a result a risk of delaying any extraterritorial development option addressed in this PFS is high. A historic overview of similar solutions in the World leads to a conclusion that they are usually temporary, not effective in reducing international tension, and not providing for geopolitical stability in the region. For more detailed examples, refer to extraterritorial corridors in the Israel-Palestine and Gaza region, the Danzig corridor or the Kaliningrad corridor. All of them involved long-term negotiations and arrangements and produced limited effects.

[32] Estimated costs for security equipment for the Neum By-pass amount to about 40- 50 percent.

10 ENVIRONMENT REPORT

The development options (alternative solutions) taken into account in the Pre-feasibility study are shown the table below:

Table 16 A List of Development Options

A Final List of Development Options Evaluated in the Pre-Feasibility Study
Option A: Bridge: mainland - Peljesac peninsula with access roads to the bridge, and: **A1**: with a new road across the Peljesac peninsula to the state road D8 **A2**: without a new road across the Peljesac peninsula to the state road D8
Option B: Neum bypass with connecting roads – city road corridor through B&H with special traffic regime (and status) in the Neum background (city in B&H)
Option C: Highway corridor through B&H with special traffic regime (and status) in the Neum background (city in B&H);
Option D: Long distance ferries with rehabilitation of existing peninsula road (Reconstruction of existing road and partial construction of new road across the Peljesac peninsula from the ferry port Trpanj to the state road D8, using existing ferry connections)
Option E: Short distance ferry line (on position of Pelješac bridge) with connecting roads and: **E1**: with a new road across the Peljesac peninsula to the state road D8 **E2**: without a new road across the Peljesac peninsula to the state road D8
Option F: Immersed tunnel to the Pelješac peninsula with access roads and: **F1**: with a new road across the Peljesac peninsula to the state road D8 **F2**: without a new road across the Peljesac peninsula to the state road D8
Option G: Tunnel under B&H
Option H: Adrian-Ionian Motorway (AIM)

10.1 Current situation - Natural Environment

10.1.1 BASIC CLIMATOLOGICAL PARAMETERS

An overview of the basic climatological parameters is provided on the basis of years of meteorological records and observations at Ploče weather station. More analytical climatological information on the under study area are presented in an environment study attached to this report.

General climate properties

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*" Ploče is located in moderate latitudes circulation area. Subtropical climate characteristics are prevalent in summers when Azores anticyclone prevents ingress of cold air into the Adriatic basin. Sea is one of the most important factors modifying the climate in the area therefore it may be called Mediterranean climate. More analytical information is presented in an environment study attached to this report.

Air temperature

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", the average annual variation of air temperature in Ploče is shaped as a simple wave with the maximum in July (25.0°C) and the minimum in January (6.8°C). More analytical information is presented in an environment study attached to this report.

Air humidity

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", during the first half of the year, from January till June, relative humidity of air in Ploče averages 61-63%. More analytical information is presented in an environment study attached to this report.

Snow

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", a snow day rarely occurs in Ploče, and during the 20 winters analysed, no such day occurred at all. More analytical information is presented in an environment study attached to this report.

Fog

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", fog occurs very rarely in Ploče. On average, fog occurs on just three days a year, and it is most frequent in January and October. More analytical information is presented in an environment study attached to this report.

Wind

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", the basic conclusion of wind pattern analysis according to wind speed and direction data from Ploče weather station are:

- The most frequent wind in Ploče is bora (44.5% from NNE-ENE sector).
- According to observations of wind strength in 1981-2000 20-year period, strong breeze occurs on average on 34 days, and gales on 5 days a year.
- Annual variation of monthly wind speeds indicates two maximums, in November and in March.
- In November 2001, the highest 10-minute wind speed was measured at 17.1 m/s from SSE when the absolute maximum gust of 32.7 m/s was recorded.

More analytical information is presented in an environment study attached to this report.

10.1.2 GEOLOGICAL, HYDRO-GEOLOGICAL AND ENGINEERING GEOLOGICAL PROPERTIES

Introduction

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", lithographically, on the north of the peninsula, from the Blace Cape, via Kobinja Glava and to the southeast, there are carbonate layers as Cretaceous limestones, but with significant bands of dolomite sediment sequences. Beyond this ridge, there is the first valley extending from Brijesta to Ston. The central part of a carbonate complex, from Koča to Lazina and Ston via Kuvija, is predominantly represented as dolomites, with limestone bands and ridges in isolated areas. South of Zaradež, Žuljane-Tomislavac-Boljenovići valley is sited in Cretaceous dolomites. The entire area on the Pelješac Peninsula is hilly. Since the carbonate sediments are hydrogeologically well permeable, no surface hydrographic network is formed. There is a gulley southeast of the Brijesta Bay, forking uphill into several thalwegs in the dolomite sediments where flash floods flow after

heavy rains. A part of the peninsula spanned by the planned road is covered with maquis and, in a lesser degree, with forests. Dolomite plains are cultivated, planted with olives and grapevines.

Geological properties of the broad area

The general area is composed of Lower and Upper Cretaceous and Lower Eocene carbonate sediments, Upper Eocene clastic flysch sediments and Quaternary sediments. The oldest sediments in the general area are Lower Cretaceous sediments chronostratigraphically classified as Hauterivian, Barremian and Aptian. They consist of dolomites and limestones. More analytical information is presented in an environment study attached to this report.

Tectonics

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", in terms of structural systems, according to a structural-tectonic analysis (Herak, 1991) there are as many as three regional structural units in the mainland investigated area. Dinaric regional structural unit is represented by Upper Cretaceous and the Lower Eocene carbonate sediments tectonically overthrusted atop Epiadriatic regional structural unit represented as Upper Eocene flysch clastic sediments. More analytical information is presented in an environment study attached to this report..

Hydro-geological characteristics of the investigated area

Sediments found in the area are classified into 3 basic hydrogeological groups. Their presence is indicated in relative terms, according to a field assessment. Those are:

- well water permeable carbonate sediments, predominantly consisting of weathered and tectonically fractured limestones;
- less permeable sediments, predominantly consisting of dolomites with limestone bands;
- partially impermeable dolomite sediments and clastic flysch sediments.

More analytical information is presented in an environment study attached to this report.

Groundwater

Based on groundwater flow routing east of Debela Ljut (Glava od Vode) an apparent groundwater flow rate of 950 m/day was determined, which is applied to areas northwest of Špargovići, i.e. Zaradeže, Dančanje, Suho Polje, Dumanja Jaruga, Doli, Gornje Selo and the Brijesta Bay, by analogy due to absence of direct routing at this level of design development. The Brijesta Bay is covered with detritus and clayey reddish material (terra rosa) partially filtering rainwater and surface water. Dinaric karst is well permeable with specific surface features and dissolution formations developed in carbonate rock complexes. Karst creates specific landscapes and hides numerous caverns, caves, karst shafts and most importantly karst aquifers. More analytical information is presented in an environment study attached to this report.

Soil

Pedogenetic properties

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", the general area is marked by pedogenetic specifics of karst. The base rock generally consists of limestones, with a small proportion of dolomites on Pelješac. Flysch sediments also occur in several places. The most prevalent limestone are Cretaceous, which leaves very little insoluble residue as it dissolves. Unlike them, dolomitized limestones, limestone-dolomitic breccias and transforming dolomites weather more physically producing detritus, allowing C-horizon to be distinguished in some areas of pedosphere, usually 5-10 cm deep (Martinović, 1985). More analytical information is presented in an environment study attached to this report.

Speleological sites

The caves located within or adjacent to the study area according to the State Institute of conservation of Nature in Croatia are presented in an environment study attached to this report.

10.1.3 FLORA - VEGETATION - MARINE ECOSYSTEMS

Flora

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", results of years of floral investigation indicate that Pelješac boasts about 1200 plant species (cf. Kovačić etal. 2000), a half of which is in the central part of the peninsula (representing a tenth of Croatia's flora). Lately, the area is inhabited by many neophytic species – "newcomers" (Trinajstić and Jasprica 1998b). The largest portion of indigenous species belongs to Mediterranean floral element, and Mediterranean character of the flora is confirmed by a large number of leguminosae (*Fabaceae*), true grasses (*Poaceae*) and aster (*Asteraceae*) family plants. Illyrian-Adriatic endemic species, which are neither rare nor endangered, should also be listed: pyrethrum (*Tanacetum cinerariifolium*), common sage (*Salvia officinalis*), Mediterranean spurge (*Euphorbia characias* supsp. *wulfenii*), South Dalmatian iris (*Iris pseudopallida*) etc. There are no stenoendemic plant species in the investigated area. Orchid population abundance in Croatia, including Pelješac, should be revised. Further analysis in the flora species in the under study area is presented in an environment study attached to this report.

Vegetation

According to the Environmental Impact Study "*Mainland - Peljesac bridge with access roads*", in littoral (coastal) vegetation belt of the area, there are two zones:

1. Steno-Mediterranean vegetation zone of wild olive forests (*Oleo-Ceratonion*)
2. Eu-Mediterranean vegetation zone of holm oak forests (*Quercion ilicis* p. p.).
3. The mountainous belt is occupied by hemi-Mediterranean vegetation zone of mixed holm oak and Ostrya carpinifolia (*Quercion ilicis* p. p.).

Analytical information on each of the above mentioned zones is presented in an environment study attached to this report.

Marine ecosystems

Physical properties of the sea

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", measurements of thermohaline properties in the Pelješac Bridge route area in late March and late April 2004 indicate a great influence of the Neretva River on distribution of temperature, salinity and density. More analytical information is presented in an environment study attached to this report.

Dynamics of the sea

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", in April, current patterns were predominantly characterized by a coastal current component. The most frequent directions were NW and SE, and in periods of strong northwest currents in the surface layer, the benthic layer exhibited a compensating predominant SE current. The maximum surface layer current velocity was about 55 cm/s, while the benthic layer current reached about 25 cm/s. More analytical information is presented in an environment study attached to this report.

Basic chemical parameters

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", in April, distribution of the nutrient salts in the water column also indicates greater levels in the surface layer than in the intermediate and benthic layers. Comparing the oxygen saturation levels and nutrient salts concentration levels measured in March and April 2004, it may be concluded that higher values were observed in March. More analytical information is presented in an environment study attached to this report.

Basic biological parameters

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", the investigated area exhibits heterotrophic bacteria densities in a range of 105 to 106 cells ml^{-1}, leading to a conclusion that the sea in the investigated area is a moderately eutrophic area, which is characteristic to the Croatia's coastal waters of the Adriatic Sea.

The areas occupied by the marine habitat types (according to the Directive 92/43/EC) in the study area are presented in an environment study attached to this report., according to the State Institute for Conservation of Nature.

Rare and protected plant species and vegetation complexes

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads" and to the most recent Red book of plant species (Nikolić and Topić, 2004), nine plant species in the general area of the works belongs to a protection category (after IUCN categorization 1983):

1. EN - endangered taxa, i.e. taxa threatened with extinction, with no chance of survival if causing factors continue to impact the habitat. The category includes taxa whose specimen count is reduced to critical levels or those whose habitats are drastically reduced, thus rendering them directly vulnerable to extinction.

2. VU - vulnerable taxa, i.e. taxa likely to be added to the EN category in near future, if causing factors continue to impact the habitat.

3. NT - endemic plants which are neither rare nor endangered.

Those are the following plant species (species name is followed by global endangerment category, regional endangerment category, assessment criterion and population trend):

1 *Carex divisa* Huds, EN, VU, A4c, decreasing
2 *Delphinium peregrinum* L., EN (VU), VU, A4c, possibly decreasing
3. *D. staphisagria* L., EN, VU, A4c, possibly decreasing
4. *Glaucium flavum* Crantz, EN, VU, A1ac+4ac, B2b (ii, iii, iv), decreasing
5. *Ophrys apifera* Huds, EN, VU, A4c, N/A
6. *Orchis italica* Poir, EN, VU, A4c, N/A
7. *O. quadripunctata* Cirillo ex Ten., VU (NT), NT, A4c, decreasing
8. *O. spitzelii* Saut. ex Koch, EN, VU, A4c, possibly decreasing
9. *O. tridentata* Scop. VU (NT), NT, A4c, decreasing

In the broad area the listed plant species are found in various habitats and multiple ecosystems: e.g. Aleppo pine forests, arable land, nitrophillic habitats (Delphinium, Glaucium) etc. A legally protected species of orchids is present - Pyramidal Orchid *Anacamptis pyramidalis* (L.) L.C.M. Richard. Its spatial distribution and abundance in the area are not known. At the same time, that species is not on the list of endangered taxa in Croatia.

10.1.4 FAUNA

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads" varying types of habitats are found in the study area: forests, maquis, wetlands and rocky ground. Considering the habitat diversity, a relatively large number of animals is present in the area.

Mammal fauna

At least 38 species of mammals were found in the broad area. Even though Chiroptera order comprises the highest number of species, it should be emphasized that the order is exceptionally sensitive and endangered. Among rodents, *Dinaromys bogdanovi* is a particularly significant endemic species. Besides, even though no protection applies, a special environmental significance belongs to jackal *(Canis aureus*) whose population in the area is relatively numerous.

Bird fauna

At least 120 bird species in the broad area, most of them nesting birds, while the remaining species spend winters in the area or overfly it during spring or autumn migrations. The birds in this area may be grouped as those primarily related to land habitats and those more related to the sea. The land habitat related birds most often live in four different biotope types: coniferous forests, maquis, wetlands, rocky ground, cultivated land and settlements and the coast. The birds related to the sea nest along shores and on surrounding islets and rocks.

Reptile fauna

Reptile fauna of the general area of construction of the broad area access road is very abundant, including at least 21 species, 3 of them turtles, 8 lizards, while 10 species belong to snakes. In the area, endemic Dalmatian wall lizard (*Podarcis melisellensis*), living in maquis and garrigue habitats, is especially significant and Dalmatian algyroides (*Algyroides nigropunctatus*) which is frequent in rock cracks.

Amphibian fauna

Amphibian fauna in the broad area comprises at least 7 species. One of them belongs to Urodela taxonomic order, and the other 6 species belongs to Anura order. They contain a species from Discoglossidae genus, two species from Bufonidae genus, one from Hylidae genus, and two from Ranidae genus.

Insect fauna

Based on a review of entomological literature (Franković, 1995; Krčmar et al., 1996; Kučinić and Bregović, 1996; Marcuzzi, 1986; Perović and Leiner, 1996;), in the broad area at least 61 species of Diptera were found, including Culicidae family species, 53 to Tabanidae family and 5 forest habitat species (Rucner and Rucner, 1994)); 122 butterfly species (Lepidoptera), including 11 forest habitat species (Rucner and Rucner, 1994), 111 Noctuidae family species; 30 species of beetles (Coleoptera); 207 species of Hymenoptera including 5 forest habitat dwelling species (Rucner and Rucner, 1994), 202 species of Symphyta suborder; 3 species of Heteroptera; and 25 species of Odonata, including *Lindenia tetraphylla* species strictly protected on the basis of Convention on the conservation of European wildlife and natural habitats - the Bern Convention (OG 6/2000). Finds of endemic insect species Speoplanes giganteus and *Neotrechus amabilis*, and relict insect species *Radziella styx*, *Biokovoaphaenopsis radici* and *Speoplanes giganteus*, not belonging to subterranean fauna of the broad area are especially significant.

Rare and protected animal species and habitats

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads" in the broad area, 14 strictly protected and 17 protected species of mammals, including an endemic species are found; 73 strictly

protected and 35 protected species of birds; 15 strictly protected and 6 protected species of reptiles, including two endemic ones, 4 strictly protected and 3 protected species of amphibians; a strictly protected, two endemic and 3 relict species of insects; an endemic species of centipedes; one relict species of crustaceans and 5 relict species of chelicerata. The overview of endemic, relict, strictly protected and protected animal species indicates an environmental sensitivity of the area. More analytical information is presented in an environment study attached to this report.

10.1.5 PROTECTED AREAS

Below are the protected areas (Special reserves, significant landscapes, Ramsar sites, IBA's and Natura 2000 sites), located within or adjacent to the study area that was designated in the present study.

Special reserves and significant landscapes

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads" a great part of the broad area, runs in onshore portion of Malostonski Bay Special Sea Reserve. Pursuant to decisions of Dubrovnik municipal council 01- 4408/1-82 and Metković municipal council 348/1-1983, the special reserve encompasses the entire maritime environment south of Sreser-Duba line and a surrounding belt. Besides the above, the nearest protected areas (>7 km away) on the mainland are the following sites protected in various categories: ornithological reserves:

- Pod Gredom, Prud and Orepak; ornithological - ichthyologic reserve -
- Neretva Delta; protected landscapes
- Modro Oko and Desne Lake
- lower course of Neretva (11500 hectares) which is one of four Croatia's marshes listed as Ramsar Convention protected marsh habitats, and it is significant to note that Neretva Delta protection is pending, currently enjoying provisional protection as a nature park.

Also, according to the State Institute for Conservation of Nature in the broad area there are ten protected areas.

Those areas are the following:

- **Delta Neretve - jugoistočni dio**: It is the south-eastern part of the delta of the Neretve River, spawning numerous fish species. It's important for migration, nesting and wintering birds. It's been characterized as Special Reserve. Besides the great ornithological importance the site has also ichthyologic importance. Besides ornithological importance the site presents also great ichthyologic importance.
- **Uvala Vučina**: Cove "Vučina" is in the south-western part of the Peljesac peninsula and the island Pelješva Kosmac. It's been characterized as Significant Landscape.
- **Prud**: It's the remains of Mediterranean wetlands in the lower course of the Neretva Down. Important for migrating and wintering birds. It has great ornithological importance. It's been characterized as Special Reserve.
- **Predolac - Šibenica**: It's the preserved pine forest with elements underbrush, east of Metkovic. It looks out over the valley of the Neretva. It's been characterized as Significant Landscape.
- **Uvala Prapratno:** It's a pebble beach surrounded by woods southwest of Ston. It's been characterized as Significant Landscape.
- **Pod gredom**: It's the remains of a Mediterranean wetland area in the lower Neretva valley, near the village of Vid. Important for migrating and wintering birds (ornithological significance). It's been characterized as Special Reserve.
- **Orepak**: It's the remains of Mediterranean wetlands in the lower course of the Neretva. Important for migrating and wintering birds (ornithological significance). It's been characterized as Special Reserve.
- **Čempresada "Pod Gospu**": It's a pyramidal cypress forest on the slope of the sea beneath the Franciscan Monastery. It's been characterized as Special Reserve.

- **Modro oko i jezero Desne**: This area is one of the representative in the lower course of the Neretva. It is characterized by plenty of water and wetland biotopes. It's been characterized as Significant Landscape.
- **Malostonski zaljev**: Encompass the entire Mediterranean ambiance southeast of lines Sreser-Dub and the surrounding coastline. Due to the special hydrographic characteristics and natural flow of nutrients from the land, the waters is of high bioproduction. Known mussel farm. It's been characterized as Special Reserve.

A figure that shows the previous 10 protected areas (special reserves and significant landscapes) and the study area, according to the State Institute for Conservation of Nature is presented in an environment study attached to this report.

Ramsar sites

Neretve River Delta. 18/01/93; Dubrovnik-Neretva County; 12,742 ha; 43°01'40"N 017°34'25"E. The Neretva is the largest river of the eastern Adriatic watershed, and its final section stretches through Croatian territory, forming an extensive delta with large reedbeds, lakes, wet meadows, lagoons, sandbanks, sandflats and saltmarshes. The area is important stopover place during migrations of birds from middle and northeast Europe to Africa, situated on the route of the Central European (Black Sea/Mediterranean) flyway. The river mouth is of greatest importance for migration of waders, the Spoonbill *Platalea leucorodia*, terns and gulls, as well as for breeding of the Kentish Plover *Charadrius alexandrinus* and the Stilt *Himantopus himantopus*. Ramsar Site no. 585. (*Source: www.ramsar.wetlands.org*).

Hutovo Blato - Bosnia Herzegovina: Hutovo Blato. 24/09/01; 7,411 ha; 43°03'N 017°37'E. Nature Park. Located near the estuary of the Neretva river, the site, comprising swamps, lakes, wet meadows, and riverine forest, provides favourable conditions for many wetland species, particularly of birds and fish, several of which are described as endangered. Human activities in the area include fishing and hunting; pressures from drainage, agricultural intensification, urbanization, and growing tourism are seen to pose potential threats. Ramsar site no. 1105. It is the first internationally protected area in Bosnia and Herzegovina.

More analytical information on the above mentioned Ramsar sites is presented in an environment study attached to this report.

Important Bird Areas (IBA)

The location of all the Important Bird Areas in Croatia is presented in an environment study attached to this report.

HR023 Neretve delta

The Basic characteristics of the Neretva Delta IBA (*source: Birdlife International*) are presented in an environment study attached to this report.

Site description: Neretva Delta contains the largest complex of wetlands in Croatian littoral with well-developed water-fringe vegetation (reedbeds, sedge communities, rush), floating and submerge vegetation around Neretva and its tributaries. The mouth of the river Neretva is characterised by wide lagoons, shallow sand bays, low coasts and saltmarshes. Reclaimed land is covered by agricultural landscape with many irrigation channels. The area holds the most important breeding population of Bittern and Baillon's Crake (*Porzana pusilla*). Main threats are river canalization, drainage, agricultural intensification, changes in traditional farming, unregulated recreational activities and tourism, overfishing, excessive or illegal hunting and destruction of mud and sand flats (*Source: Birdlife International*).

The IBA trigger species (*source: Birdlife International*) are presented in an environment study attached to this report.

Natura 2000 sites

Special Protection Areas (SPA)

3 SPA have been proposed within or adjacent to the study area. According to the State Institute for Conservation of Nature in Croatia those are: Delta Neretve - HR1000031, Biokovo i Rilic - HR1000030 and Srednjedalmatinski otoci i Peljesac - HR1000036. The 3 SPA and the study area defined in the present study is presented in a relevant figure in Appendix **. Information on the species of ornithofauna documented in the above mentioned proposed SPA sites are also presented in an environment study attached to this report, according to the Natura 2000 Standard Data Forms composed for each of the areas. More precisely, the following are presented in an environment study attached to this report.

- Species of ornithofauna present in the area Delta Neretve - HR1000031 (Annexes refer to the Directive 2009/147/EC)
- Species of ornithofauna present in the area Biokovo i Rilic - HR1000030 (Annex I refers to the Directive 2009/147/EC)
- Species of ornithofauna present in the area Srednjedalmatinski otoci i Peljesac - HR1000036 (Annex I refers to the Directive 2009/147/EC).

Sites of Community Importance - (SCI)

8 SCI have been proposed within or adjacent to the study area. According to the State Institute for Conservation of Nature in Croatia those are:

- Krotusa - HR2000951
- Delta Neretve - HR5000031
- Jama Kornjatusa - HR2001204
- Malostonski zaljev - HR4000015
- Gorsca jama - HR2000141
- Jl dio Peljesca - HR2001364
- Stonski kanal - HR3000163
- Lastovski i Mljeski kanal - HR3000426

The 8 above SCI and the study area defined in the present study are presented in a figures in an environment study attached to this report. Information on the habitat types and species of flora and fauna documented in the above mentioned proposed SCI sites are also presented in an environment study attached to this report according to the Natura 2000 Standard Data Forms composed for each of the areas. More specifically, the following are presented:

- Habitat types in the area Krotusa - HR2000951
- Habitat types in the area Delta Neretve - HR5000031
- Species included in the Standard Data Form for the proposed Natura 2000 area Delta Neretve - HR5000031
- Habitat types in the area Jama Kornjatusa - HR2001204
- Habitat types in the area Malostonski zaljev - HR4000015
- Habitat types in the area Gorsca jama - HR2000141
- Habitat types in the area Jl dio Peljesca - HR2001364
- Species included in the Standard Data Form for the proposed Natura 2000 area Jl dio Peljesca - HR2001364
- Species included in the Standard Data Form for the proposed Natura 2000 area Lastovski i Mljeski kanal - HR3000426.

10.2 Current situation - Manmade environment

10.2.1 DEMOGRAPHIC DATA

Administrative regions of the under study area

The under study area is situated in the following administrative divisions: Dubrovnic and Neretva County of Croatia and Herzegovina - Neretva Canton of the Federation of Bosnia and Herzegovina.

Croatia

According to census data, the population of Croatia displays a steady increase during the years 1857-2001. Analytical demographic information (Population and number of settlements of Croatia according to censuses) is presented later in this report. The most recent analytical demographic data for the County of Dubrovnik and Neretva (Population of the municipalities included in the under study area in the County of Dubrovnik-Neretva, according to the 2011 Census, *Source: Croatian Bureau of Statistics*) are also presented in the environment study attached to this report.

Bosnia and Herzegovina

The population data, show a stable increase in the population of Bosnia and Herzegovina. The most recent data for the Herzegovina - Neretva Canton show that the majority of the population of the Canton is situated in Grad Mostar and Konjic, while Neum is a relatively small settlement. Relevant analytical demographic data are presented in the environment study attached to this report.

10.2.2 LAND USES - PHYSICAL PLANNING - INFRASTRUCTURE

The land uses of the wider area are shown in an environment study attached to this report., according to the Corine program data.

Croatia

Land-uses and physical planning

The land-uses of the under study area are presented in Appendix ** according to the Dubrovnik - Neretva County spatial plan. According to the Dubrovnik - Neretva County Spatial plan, the planned Mainland - Pelješac Bridge with access road works (which is one of the alternative solutions examined in this study) are categorized as a part of the state road - expressway (investigated corridor) connecting the existing D 8 state road and D 414 Pelješac road with the following specific characteristics:

- The works begin at the existing D 8 road (chainage 0+000).
- In Komarna – Duboka area, the corridor spans Malostonski Bay (via a new, approx. 2300 m long bridge) to the Pelješac Peninsula, to the north of settlement of Brijesta.
- The works end at the connection to the existing D 414 road in an area east of Zaradež (chainage 14+660).
- The bridge spanning the Malostonski Bay is designed to address problems of physical separation of a part of the county from the rest of Croatia and improved links of the Pelješac Peninsula and the Korčula Island with the rest of Croatia. Such a transport solution is demanding due to length of the bridge, especially in respect of the protected Malostonski Bay.

Bathing waters[33]

The basic strategic orientation of the Republic of Croatia is sustainable management of the Adriatic Sea, the coast and islands, and the conservation of the resources and natural features of marine ecosystems and the coastal area, enabling a balanced development of economic activities in the coastal area and on the islands. In the Adriatic area, its coast and islands the most sensitive natural ecosystems of Croatia are located. Processes are taking place here which are dependent on the mutual interaction between the sea and the land. All these characteristics require a particularly meticulous and well-designed management. Development pressures and adverse impacts on natural ecosystems are constantly growing more pronounced. The coast is exposed to the following pressures which impose themselves in their scope and omnipresence: uncontrolled construction, particularly apartment development in the coastal zone, tourism development, accidents during transport and transhipment of oil and oil derivatives, problem of ballast waters, fishing and overfishing. More analytical information is presented in an environment study attached to this report.

Areas of special restrictions of use

Areas of special restriction of use according to the Dubrovnik - Neretva County spatial plan in the study area include the following:

- Protected submarine area
- Posidonia oceanica areas
- Increased erosion areas (lithological and geomorphological characteristics)
- Especially valuable areas - cultivated landscape
- Areas of intermittent flooding
- Port areas

The above are presented in the relevant figure in an environment study attached to this report.

Road transport infrastructure

The road transport system of the wider area is presented in an environment study attached to this report. according to the Dubrovnik - Neretva County spatial plan. According to the map the road network of the Peljesac peninsula includes:

- State roads (D/415 and D-414)
- Local roads (L-6906, L-69056, L-69039, L-69083, L-69030, L-69076, L-69028, L-69027, L-69026, L-69025, L-69002, L-69924, L-69023,)
- County roads (such as Z-6215, Z-6626, Z-6231)

According to the spatial plan, a state road - expressway is going to connect the peninsula with the mainland, via a bridge crossing. This is examined as an alternative solution in the present study. This road will connect with the state road - motorway that goes through the B&H territory.

Rail, sea and air transport system

The transport system is presented in an environment study attached to this report., according to the Dubrovnik - Neretva County spatial plan. The seaport at Ploče is characterized as of special international significance. It connects with the Trpanj seaport (at the Peninsula) which is of county level significance and to the Sreser seaport (also at the Peninsula), which is characterized as being of local significance. There is no airport connection between the peninsula and the mainland (except for two heliports).

[33] Sea bathing Water quality in the territory of the Republic of Croatia in 2008 (Republic of Croatia, Ministry of Environmental Protection, Physical Planning and Construction)

Bosnia and Herzegovina

Land uses

The structure of land use in Bosnia and Herzegovina is presented in Appendix **. According to the available data 52,8% of the Federation of B&H is covered by forest and mountainous terrain, while 49,2% is agricultural land.

Maritime activities and the protection of marine areas[34]

Bosnia and Herzegovina's primary maritime activities along the Mediterranean are fishing (2.005 tonnes caught in 2008), aquaculture (7.600 tonnes produced in 2008) and seashells production (oyster and mussel), taking place within the Neum-Klek bay. Regarding maritime transport in or near Bosnia and Herzegovina, it should be noted that no maritime ports are in operation in Bosnia and Herzegovina at the moment. Instead, the Croatian ports are used. However, plans exist for the construction of a harbour in Neum. Offshore wind energy or wave energy are not expected to be used as new energy sources in the short or medium term, as no specific plans with regard to these offshore renewables exist at present. Moreover, according to the Network of Managers of Marine Protected Areas in the Mediterranean (MedPAN), no Marine Protected Areas have been declared. Furthermore, no potential areas are currently being discussed. Currently, no national or cross-border competition between the different maritime activities in terms of space is experienced. However, the sea and coastal ecosystem did experience high pressure from among others the fisheries and mariculture sector.

Current status of Maritime Spatial Planning:

Triggered by plans for a harbour in Neum and specific needs related to the mariculture sector, the planning of maritime activities is foreseen in the new Federal Spatial Plan and the Spatial Plan of its coastal zone.

Marine Spatial Planning[35]

Status and Development of Sea Use in the Country

Bosnia and Herzegovina's part of the Adriatic coast is about 25 km long, and includes Klek peninsula, Neum-Klek bay with a natural port and the town of Neum. The Municipality of Neum is situated in the Adriatic coastal area, which makes part of the HN Canton of the Federation of Bosnia and Herzegovina. The bordering municipalities are Čapljina, Stolac and Ravno in the Federation of Bosnia and Herzegovina, Ljubinje in the Republika Srpska, and Dubrovnik and Metković in the Republic of Croatia.

Tourism, maritime industry, agriculture, fishery and the raw material utilisation, are the main economic activities in the region. In the past period, the use of natural non-renewable sources was not sustainable. The coastal area, as a unique and specific value, has almost been „spent" by the different economic and other human activities, which reflected in changes of the landscape. The sea and coastal area environment was exposed to particularly high pressure due to the unsolved wastewater treatment issues, harbour activities and other industrial and agricultural activities, as well as due to the activities on the sea, such as fishery and mariculture. Fish production is limited with the size of the sea surface of Neum bay. More analytical information is presented in an environment study attached to this report.

[34] Bosnia and Herzegovina - Country reports (February 2011) - European Commission (http://ec.europa.eu/maritimeaffairs/documentation/studies/documents/bosnia_and_herzegovina_01_en.pdf)
[35] National Report on Current Policy, Procedures, Legal Basis and Practice of Marine Spatial Planning in Bosnia and Herzegovina (PAP/RAC, Mostar, May 2007)

Condition and Main Characteristics of Coastal Area Planning

Some of the basic spatial planning documents are:

- Spatial plan of Neum Municipality, adopted by the end of 1979, and updated in 1987 for the planning period from 1985-2003;
- Urban plan; and
- Regulatory settlement plans for: Centar I and II, Surdup I and II, Jazine-Kamenice, Tanko Sedlo-Opuće, Ograde and Bregovi.

As a direct consequence of urbanisation, population and economic activities are concentrated in the small coastal area. *In order to reduce this pressure on the coast, some activities should be directed to the hinterland*. The main economic activity at Neum is tourism. *This activity should ensure better arrangement of the town and its coastal area (i.e. wider beaches, waterfront, walking paths, reconstruction of devastated buildings, protection of the bay, etc.)*.

Co-ordination and Conflict Resolution

The sea has a strategic meaning for sustainable development of the economy of Bosnia and Herzegovina. Being an important ecosystem, it provides better quality of living. *Management of the coastal area should be based on spatial plans. These plans should define sea corridors and zones used for navigation traffic, harbour services, nautical tourism, fishing, mariculture (aquaculture), fish processing, salt production, recreational and sports activities, etc*. In the field of **protection of the sea and coastal area from pollution**, international co-operation is very important. Special care needs to be dedicated to prevention of sea pollution from the neighbouring countries. Therefore, it is necessary to carry out, jointly with other countries, permanent control of the sea quality and to enhance sea protection measures. Implementation of these measures should be ensured through bilateral and multilateral contracts and activities. **Priorities and phasing** of activities related to sea protection should be in accordance with the general objectives of sustainable development. The priority is the protection of some endangered parts of the sea from land-based pollution, and particularly several critical points in the Bay of Mali Ston. According to the existing directives, the priority is to eliminate dangerous pollution and establish a unique monitoring system of the sea quality.

Road network - Corridor Vc in Croatia and Bosnia and Herzegovina

European traffic route on the pan-European corridor V, Baltic sea - Adriatic sea, stretches from the north of Europe, through Hungary, on south towards Adriatic sea and it finishes in Croatian port Ploče. Vc stretches from Budapest through eastern Croatia and Bosnia and Herzegovina to the port of Ploče in Croatia. Route of the motorway on the area of Republic of Croatia and Bosnia and Herzegovina is a part of European road network marked E73 and it represents the basis of road traffic infrastructure in Bosnia and Herzegovina as well as in eastern part of Croatia. Due to the fact that existing state road on the corridor does not satisfy the needs of today's traffic, it is planned to construct a motorway. Today some parts of the motorway are under construction[36].

Corridor Vc goes through Bosnia and Herzegovina taking meridian direction, 336 km long, thus connecting several economically active and densely populated areas with significant economic and large urban centres. E-road network passing through Bosnia and Herzegovina consists of the following six courses:

- E-762: Sarajevo-Brod na Drini-Šćepan polje (Montenegrin border)
- E-761: Bihać-Petrovac-Jajce-Travnik-Sarajevo-Višegrad (Serbian border)
- E-661: (Croatian border) Gradiška-Banja Luka-Jajce-Travnik-Lašva
- E-73: (Croatian border) Šamac-Doboj-Zenica-Lašva-Sarajevo-Mostar-Doljani (Croatian border)

[36] Motorway Vc corridor in the Republic of Croatia and Bosnia and Herzegovina (Stjepan Kralj, Dubravka Brajković, Tomislav Tomić)

- E-65: pass through Neum;
- E-59: (Croatian border) Izačič-Bihać-Ripač-Uzljebić37.

10.2.3 ATMOSPHERIC ENVIRONMENT

Croatia

The *National Network for Monitoring Air Quality* is presented in an environment study attached to this report.

Air Emissions - spatial distribution and trends[38]

Energy consumption in Croatia is approximately 1.8 t of the oil equivalent per capita. This low energy consumption puts Croatia at the very bottom of the list of European countries, even those, undergoing the process of economic transition. The structure of the total primary energy consumption in the period from 1990 to 1998 has not changed significantly: liquid fuels retain a prevailing share at 45%, followed by natural gas and hydropower. It is noteworthy that coal consumption decreased from 8.5% in 1990s, to 2.6% in 1998. Concerning the electricity generation, hydroelectric power plants accounted for 40% to 60% and nuclear power for 15% to 20% of total generation (in the period from 1990 to 1995).

Sulphur emissions arise primarily from the sulphur in solid and liquid fuels which have been burned in large quantities for electricity generation, domestic and industrial heating and for transport. Generally, Croatian **SO_2** emissions have declined by 60% since 1990. Reduction in sulphur emissions emerged because of two major factors. One is related to the forced industrial and energy consumption decline generated by war and occupation of one third of the Croatian territory in early nineties. Another reason for this decline is related to the economic transition processes that have taken place since the beginning of nineties.

Emissions of **nitrogen oxides** come mainly from road traffic (vehicle combustion engines) and high temperature combustion processes used in power production. Emissions have been rather constant, with slight increase in later years. This increase could be explained with the increase in road traffic. Emissions of **ammonia** are mainly from agricultural sources. Their share in emissions in 1990 was around 90% while in 2000 it decreased to 80%. Remaining 10% difference is attributed to the increase in road traffic.

Non-methane volatile organic compounds and carbon monoxide emissions contribute to the formation of tropospheric ozone which forms from the reaction of NOx, CO and NMVOCs in the presence of sunlight. NMVOCs and CO are emitted from a large number of sources including combustion (incomplete) mainly in road vehicles, small residential boilers, industrial processes using solvents, the manufacture of chemicals and petroleum refining and distribution. Natural sources (vegetation, forests) can significantly contribute to the total NMVOC emissions. Emissions of **NMVOCs** declined by 24% between 1990 and 2000, but this decline occurred mainly between 1990 and 1995.

Spatial distribution of five analysed pollutants confirms that there is a general emission reduction trend, especially in hot spot areas. Nevertheless, this trend is very slow and mainly constant in later years. More analytical information is presented in an environment study attached to this report.

Air quality - Present state[39]

According to more recent data, the state of air quality in the Republic of Croatia is much more favourable than in 1999. Generally speaking, the emissions of pollutants have decreased, partly due to the shutdown of major

[37] Corridor Vc as a factor of integration of Bosnia and Herzegovina into the European Union (2012, Djuro Maric)
[38] Transboundary Air Pollution in Croatia (Sonja Vidič,
[39] Republic of Croatia - 2007 State of the Environment Report Highlights (Croatian Environment Agency)

emission sources that existed in the 1990s, and partly as a result of measures taken to comply with international air quality conventions and protocols. In 2000, the use of low-sulphur fuels in thermal plants resulted in the largest improvement of air quality. Air quality measurements and modelling showed the air in **rural parts** of Croatia to be clean and the air in **inhabited areas** mostly to comply with current regulations. Further documentation on the subject is presented in an environment study attached to this report.

Bosnia and Herzegovina

Air quality[40]

Air emissions for the whole country have been calculated by the Meteorological Institute of the Federation of Bosnia and Herzegovina. They concern both entities and cover the major pollutants, including greenhouse gases (SO_2, NOx, NMVOC, CO, CO_2, CH_4 and N_2O). The values include all emissions from fossil-fuel burning, road transport and agriculture. However, direct emissions from waste and from process industries are not included. They are estimated to represent an additional 5-8%. The estimated air emissions and forecast emissions are presented in an environment study attached to this report.

Conclusion on air quality

The few relevant statistics collected during the environmental performance review (EPR) mission come from the Federation's Meteorological Institute and concern stations located in Sarajevo only. Only fragmentary data were obtained for some other cities and it is not possible to draw any firm conclusions from them. Owing to the lack of comprehensive information, the air quality in the country's other cities is largely unknown. Although the overall air quality is probably better now than before the war, it is feared that poor air quality still prevails at the local level and in particular in several **cities**. The Meteorological Institute has identified at least nine hot spots (Kakanj, Tuzla, Uglevik, Jajce, Mostar, Gacko, Zenica, Sarajevo and Banja Luka), affecting 1.3 million inhabitants, i.e. one third of the total population.

10.2.4 ACOUSTIC ENVIRONMENT

In the under study area in **Croatia**, the settlements are of relatively small size, with the exception of the town of Ploče (population of 6.013 according to the 2011 census). Moreover, Ploče is a seaport of county level significance and a railway station. There is no other settlement inside the under study area in Croatian territory, with more than 1000 inhabitants. Klek, Komarma (in the mainland) and Trpanj (in the peninsula) are seaports of local significance. In the under study area in **B&H**, the coastal town of Neum lists more than 4000 inhabitants. Tourism, maritime industry, agriculture, fishery and the raw material utilization, are the main economic activities in the region. No maritime ports are in operation in B&H (the Croatian ports are used). Plans exist for the construction of a harbour in Neum. It is estimated, that with the exception of the towns of Ploče and Neum, where industrial activities exist, the main source of impacts on acoustic environment of the under study area, is the existing road network.

Transport flows in the Study Area

The traffic data concerning the region of the study were extracted by two documents: Brojanje Prometa na Cestama Republike Hrvatske Godine 2011, prepared by the Hrvatske Ceste d.o.o. in 2012; and Brojanje Saobracaja na Magistralnim Cestama Federacije B&H u 2011 prepared by the Gradevinski Fakultet Institut za Saobracajnice.

[40] Environmental Performance Reviews - Bosnia and Herzegovina (Economic Commission for Europe, Committee on Environmental Policy, United Nations, 2004)

The traffic flows data were analysed on the following roads:

- In Croatia: D8 Split - Dubrovnik; D414 Trpanj - Zaton Doli; and D9 Ploce - Metkovic (corridor Vc)
- In B&H: M17 Mostar - Metkovic (corridor Vc) and M17.3 Neum - Hutovo.

The registered traffic is presented in Appendix * an environment study attached to this report. (Table: *Registered traffic in the Study Area* and relevant Map).

Noise pollution

The guidelines RLS-90 (Guidelines for noise protection at roads)[41] deal with noise protection measures and methods of calculation for a quantitative representation of the noise pollution. The results can also be seen in diagrams. The rating level at roads is determined in the guidelines of RLS-90 on the basis of traffic volume, percentage of trucks, speed limit, type of road surface and gradient. Gradients of more than 5% get a noise addition. The sound source is assumed at an altitude of 0.5 m above the road. Using the above mentioned guidelines and the main characteristics of the existing road network (AADT of 8000vehicles/day, with a 10% percentage of heavy vehicles), the noise level produced by the existing road network was estimated. The results of the estimation, as well as the analytical calculations, are presented in an environment study attached to this report.

The EU policy on environmental noise[42]

The *Environmental Noise Directive* (2002/49/EC) is presented in an environment study attached to this report.

Protection criteria in Croatia[43]

According to the Ordinance on the maximum permitted noise levels in areas of human work and residence (OG 145/04), applied values of permitted emissions in open spaces depend on use of areas defined by spatial plans, and are specified in the Table 3 of the Ordinance. Night emissions, without any exceptions, are relevant for road traffic noise. Night time is defined as period between 22:00 and 6:00 hours. The area located in the general area of the road may be considered a zone of "*Residential urban areas, other settlements, tourist zones, campsites and zones of educational institutions, scientific and research centres*", making it category 2 area conforming to the Ordinance on the maximum permitted noise levels in areas of human work and residence, where night emission may reach 45 dB (LA,eq). Daytime permitted noise levels in the zone is 55 dB(A).

10.2.5 ARCHAEOLOGICAL MONUMENTS

Croatia

The World heritage sites listed in Croatia according to UNESCO[44] are presented in an environment study attached to this report. None of the sites mentioned in the UNESCO list are situated in the study area.

The Tentative List includes the following:

[41] Noise Manual for Urban Development - Indications for urban land-use planning http://www.staedtebauliche-laermfibel.de
[42] http://ec.europa.eu/environment/noise/
[43] Environmental Impact Study for the Mainland - Peljesac Bridge and access roads (Civil Engineering Institute of Croatia, 2005)
[44] http://www.unesco.org/eri/cp/factsheets/HRV_facts_figures.pdf

- Zadar - Episcopal complex (2005)
- Historical-town planning ensemble of Ston with Mali Ston, connecting walls, the Mali Ston
- Bay nature reserve, Stonsko Polje and the salt pans (2005)
- Historical-Town Planning Ensemble Tvrda (Fort) in Osijek (2005)
- Varazdin - Historic Nucleus and Old Town (the Castle) (2005)
- Burg - Castle of Veliki Tabor (2005)
- Lonjsko Polje Nature Park (2005)
- Velebit Mountain (2005)
- Frontiers of the Roman Empire Croatian Limes (2005)
- Diocletian's Palace and the Historical Nucleus of Split (extension) (2005)
- Lubenice (2005)
- Primošten Vineyards (2007)
- Hermitage Blaca (2007)
- City of Motovun (2007)
- The historic town of Korcula (2007)
- Kornati National Park and Telašcica Nature Park (2007)
- Stecci - Medieval Tombstones (2011).

The historical-town planning ensemble of Ston is situated in the study area and its position is marked on the relevant map in an environment study attached to this report.. The areas of special condition of use - natural and civil engineering heritage are also presented in an environment study attached to this report., according to the Dubrovnik - Neretva County spatial plan. A wide area in the Neretva river delta is characterized as an Archaeological Site Area. In this area, several Historical complexes and structures have been documented (civilian structures and sacral structures). The area includes also individual archaeological sites. The following are pointed out about the area:

- Historical structural complex (urban settlement) in Metkovic
- Historical structural complex (urban settlement) in Opuzen.

Information on the two above mentioned urban settlements is presented in an environment study attached to this report.

Bosnia and Herzegovina

According to the UNESCO - World Heritage Centre, the following are included in the World Heritage List[45]:

- Mehmed Paša Sokolović Bridge in Višegrad (2007)
- Old Bridge Area of the Old City of Mostar (2005)

These monuments are north of the study area.

According to the Bosnia and Herzegovina Commission to Preserve National Monuments[46], in the area of the town of Neum, the following *National Monuments* are listed:

- Catholic church of St Anne in the village of Gradac, the historic building
- Hutovo's town (Hajjibeg town), the historic site
- Inscription of Radovac Vukanović in Novkovića klanac in Hutovo, the archaeological monument
- Necropolis with stećak tombstones in Crkvina in Hutovo, the archaeological site
- Necropolis with stećak tombstones at Groblje (burial ground) of stećak tombstones by Jurkovića kuća in Brštanica, Donje Hrasno, the archaeological site

[45] http://whc.unesco.org/en/statesparties/ba
[46] http://kons.gov.ba/main.php?id_struct=79&lang=4

- Necropolis with stećak tombstones in Međugorje in Glumina, the archaeological site
- Remains of a Roman settlement and a mediaeval necropolis with stećak tombstones in Vranjevo Selo, the archaeological site.

There is one monument in the area of the town of Neum, which is on *Provisional list*, which is: *Hutovo - Natpis Radovana Vukanovića i srednjevjekovna nekropola sa crkvinom (medieval necropolis with chapel)*.

Monuments, in the area of Neum, that are on *Petition list* are the following:

- Nekropola stećaka porodice Nikolić u Vranjevom selu (Necropolis Nikolic family tombstones in the village Vranjevo)
- Džamija u Neumu (Mosque in Neum)
- Nekropola stećaka Toplice.

The position of the above mentioned sites is shown in an environment study attached to this report.

10.3 Impact Assessment of Alternative Solutions - Natural Environment

This section describes the potential impacts which are expected to occur on habitats, protected areas, flora, fauna (birds and other fauna) and landscape for each of the contemplated alternatives of the project.

10.3.1 BRIDGE OVER SEA - ALTERNATIVE A1

Effects on flora and vegetation

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", a direct impact on flora and vegetation during construction of the route shall result in a reduction of areas of phytocenoses (mostly Phoenician juniper maquis) within climazonal vegetation. No adverse effects, caused by the road construction, are expected in terms of changes of floral composition of the biocenoses. All phytocenoses in the planned route are generally well spread in that area of Croatia, and some of them in other parts of the country. Because of that, and because of spatially limited impact of the route, it is not expected that construction and use of the road would have a significant impact on distribution of those phytocenoses in Croatia. No adverse impact on the biological and environmental system is expected in terms of changes of the floral composition of the phytocenoses.

According to the feasibility study for the road infrastructure upgrading in the area Mainland - Peljesac - Mainland (May, 2012) , the route and its wider area of impact are in an area of conifer, sclerophyllous forest vegetation, with prevailing Pistacio lentisci-Juniperetum phoeniceae macchia and Fraxino orni Quercetum ilicis macchia. Insignificant surfaces are covered with bushes. In this area the species Anacamptis pyramidalis is protected by law. Its number and arrangement in this area are unknown. Steno-endemic plant species in the wider zone of impact have not been found. Direct impact on the flora and vegetation during road construction, bridge and tunnel construction shall result in the less surfaces of biocenoses within the Climazonal vegetation (mostly macchia). Negative effects on the change of the flora system is not expected. Unnecessary damage to the vegetation and agricultural surfaces shall be avoided in the surrounding areas, and excess material from excavation shall be backfilled into embankments or stockpiled on sites planned in advance. These measures shall be especially implemented and monitored during tunnel construction.

Nine plant species (according to the work of Jaspric and Kovačić, 1997) in the wider zone of the project is included in one of the endangered categories (according to the IUCN categorization, 1983). These are the

following plant species (the name is followed by the global vulnerability category, regional vulnerability category, evaluation criteria and population trend):

1. *Carex divisa* Huds., EN, VU, A4c, decreasing
2. *Delphinium peregrinum* L., EN (VU), VU, A4c, possibly decreasing
3. *D. staphisagria L.,* EN, VU, A4c, possibly decreasing
4. *Glauciurn flavum* Crantz, EN, VU, Alac+4ac, B2b (ii, iii, iv), decreasing
5. *Ophrys apifera* Huds., EN, VU, A4c, N/A
6. *Orchis italica* Poir., EN, VU, A4c, N/A
7. *0. quadripunctata* Cirillo ex Ten., VU (NT), NT, A4c, decreasing
8. *0. spitzelii* Saut. ex Koch, EN, VU, A4c, possibly decreasing
9. *0. tridentata* Scop., VU (NT), NT, A4c, decreasing.

Šugar (1994) in the first Red Book of the plant species in Croatia gives most of these species. Red Book is only one view of the status of endangered plants, while for example, the Strategy and Action Plan for protection of biological and landscape diversity of Croatia (Radović 1999) gives a different list of endangered species. This list also includes some other species which can also be found in the area of works, but which are not mentioned in the Red Book (e.g. Iris pseudopallida etc.).

The mentioned plant species inhabit different habitats and enter into several ecosystems: e.g. Aleppo pine forests, arable surfaces, nitrophilous habitats (Delpliinium, Glaucium) etc. One plant species protected by law is registered - Anacamptis pyramidalis (L.) L.C.M. Richard. Its spatial arrangement and number in the area are unknown. At the same time, the species is not registered on the endangered list of species in Croatia.

The alternative A1 (new bridge and access roads) and habitat types (according to EUNIS - European Nature Information System) are presented in Appendix. All habitat types including their names and EUNIS, PHYSIS and Natura 2000 codes within the study area and the wider region are presented in a Table (*Habitat types, their names and EUNIS, PHYSIS and Natura 2000 codes*) in Appendix. The areas occupied by these habitat types (according to the codes EUNIS) is presented in an environment study attached to this report.

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", since no investigation of diversity and abundance of orchids in the area of the works were performed until now, it is hard to assess if any species is endangered. Generally, as traditional farming, favouring presence of orchids, is abandoned, a considerable part of the area transforms to thicket and forests, accompanied by a considerable reduction of number of species. Based on floral composition and distribution of phytocenoses, it may be assessed that the proposed works shall have no significant adverse effects on the natural vegetation, including the protected and endangered plant species.

The project roads pass in a great extent through the habitat type G2.12 which corresponds to the Natura 2000 habitat type 9340 which is not a priority habitat type. Also the planned road crosses at a small scale the habitat type F6.3 which does not correspond to a priority habitat of Directive 92/43. The same applies to the habitat type with code EUNIS G1.D/G2.91 which is covered to a very small extent from the planned roads. So no major impact on habitats from the construction and operation of alternative A1 will occur.

In any case, additionally to the national environmental permit that has already obtain the Bridge and its connection roads, before the establishment of the Natura 2000 network the European legislation has also to be followed. In particular, the procedures determined by the article 6 of the habitat directive 92/43/EU have to be applied. According to the paragraph 3 of the article 6: "*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects,* ***shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives****. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public»*.

Article 6 foresees as well the case in which the plan or project may have negative implications to the Natura 2000 site. According to the paragraph 4*: «If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest».*

By taking into account the aforementioned, for the finally proposed alternative road alignment, according to the European legislation an appropriate assessment study has to be carried out, in case it enters to a proposed Natura 2000 area. The main object of this study is to identify and evaluate in detail the environmental impacts on the important ecological elements of this Natura 2000 area. In particular has to evaluate the possible impacts on the habitats included in the Annex 1, and the species included in annexes II and IV of the Habitat Directive (92/43/EU) as well as on the bird species included in the Annex I of the wild Bird Directive (2009/147/EU). This study has to ascertain if the proposed road alignment will adversely affect the integrity of the Natura 2000 site. Emphasis has to be given on possible impacts on priority habitats and species, according to the Habitat Directive. Those habitats and species have been already mentioned to the chapter "Current situation, Natural and Manmade Environment".

The same necessity is presented in the official letter of the State Institute of Nature (Category:612-07/11-29/275) with the title: "Completion of the Application for the Land-Peljesac Bridge Construction Project – Delivery of Opinion". According to that letter: "*The Environmental Impact Study for the Land-Pelješac Bridge with Access Roads (hereinafter: EIS, orig. SUO), July 2005, written by the Civil Engineering Institute of Croatia joint stock company (orig. Institut građevinarstva Hrvatske d.d.), has not analysed the abstraction impact on the Republic of Croatia's (RC) ecological network area since the RC ecological network was proclaimed in 2007 (Ordinance on the Proclamation of the Ecological Network, Official Gazette 109/07); thereafter no assessment procedure related to the acceptability of an abstraction regarding the ecological network has been conducted according to the Regulations on the Assessment of the Acceptability of the Plan, Programme and Abstraction for the Ecological Network (Official Gazette 118/09). Having examined the EIS, it is established that adequate field research of land and sea species and habitats has been conducted that will be usable to a great extent when considering the impact on the ecological network and the proposed Natura 2000 areas. However, it is necessary to revise the whole EIS so that the collected data is processed and adapted for the purpose of considering the impact of this abstraction upon the preservation goals and the entirety of the ecological network (i.e. upon the needs of and for the purpose of preservation and upon the entirety of the proposed Natura 2000 areas for the submission of the application for EU funds), to conduct the acceptability assessment of this abstraction on the ecological network and, if necessary, to provide additional measures for the mitigation of the detrimental effects of the abstraction on the ecological network (i.e., if necessary for the proposed Natura 2000 areas)»*.

Effects on forest ecosystems and forestry

According to the "*Feasibility Study for the Road Infrastructure Upgrading in the Area Mainland – Pelješac - Mainland. Construction of the Pelješac Bridge and the approach roads to the Bridge (to the national road D8 and the national road D414) along with the new route of the Pelješac road on the section: Zaradeže – Đonta Doli"*, there are 102.00 ha (78.9 %) of forests and forest land in the zone of the project, and 25.36 ha (82.2 %) of forests and forest land in the zone of construction works. The forests are evenly distributed along the whole planned route, except from chainage 0+450 to chainage 1+100, and from chainage 12+900 to chainage 13+300, where agricultural surfaces are predominant.

The impact on forests and forestry is primarily visible through permanent loss of surfaces under forests by direct occupation of these forest producing surfaces by approach roads, where the forest production functions are lost and forest activities changes. Construction of the bridge and approach routes and their permanent occupation will cause the loss of 8.03 ha of national forests. The loss will contribute to the following: impact on the water regime and the hydropower system, protection and improvement of the environment, recreation,

tourist and health functions as well as impact on fauna and hunting. Permanent occupation of private forests will result in a loss of 17.46 ha. The approach road route, runs also through a special reserve at sea – the Bay of Mali Ston. Since the road design includes tunnels, it is estimated that it will not significantly impact the protected area.

It can be concluded that the construction of this bypass shall not have a significant impact on the forest surfaces, except the surfaces which will be permanently lost. Possible impact of traffic on the stands in the immediate vicinity of the road needs to be monitored for timely reaction. In any case, special attention has to be given to fire prevention and fire protection measures during construction works and during utilization of the road. Also, harmful effects can occur after the road is opened for traffic, through:

- Emission of harmful gasses from vehicles,
- Accidents in traffic (spilling of harmful substances, fire, etc.),
- Disposal of harmful waste etc.

Some parts of the forest along the route are not accessible. Construction of this approach road will enable better access to these areas, consequently better management and protection of these parts from fire.

Effects on marine ecosystems

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", grain-size distribution of the sediment particles indicates that their sedimentation rates may be balanced with the turbulent diffusion, causing them to be present in the entire water column at the site of the works after a while, if they are lifted off the seafloor mechanically. Intermittent lifting of the sediment from the seafloor would not cause any significant impact on fish and shellfish mariculture in the bay due to form of propagation of the suspended sediment particles. Problems may occur when greater quantities of the sediments would be lifted continuously, but that is not expected because of planned method of construction of the works (piles driven into the sediment). A computer model designed to determine trajectories of eroded particles (PartikTrak) determined form and range of the load in the area of the works. Pulsed sediment erosion causes the particles to be represented throughout the water column after 12 hours, but loading of the benthic layer of the seawater is significantly greater than loading of the surface layer. Their range depends on current velocity, thus for currents occurring in up to 90% of time (0.2 m s-1 in the surface and 0.1 m s-1 in the benthic layer) it may be about 5 km. Direction of currents shall have the most significant impact on propagation of the particles. It is demonstrated that the outflow current in the benthic layer shall have no great impact on concentration of the suspended particles in the bay. Those are therefore the most favourable conditions for performance of the submarine works in terms of the suspended particle load in the bay.

It is recommended to install automatic current meters with telemetric data gathering capacity in order to facilitate decision-making regarding performance of the submarine works. It is also necessary to perform intermittent control of the suspended particles in the bay through in situ measurements in order to pre-empt any fish and shellfish mariculture damage claims that need not be related to construction of the bridge.

The alternative A1 (new bridge and access roads) and marine habitat types (according to Directive 92/43) which the alternative covers are presented in an environment study attached to this report.

According to the figure below, the proposed, according to the alternative A1, Peljesac bridge (Green colour, is crossing the habitat types 1120 (brown colour). The 1120 habitat type (*Posidonia beds*) it is a priority habitat. Therefore possibly is expected to be affected by this alternative and some effects will occur on this habitat type. However due to the limited sea bed occupancy derived by the foundation works of the bridge these impacts will not cause significant impacts.

Additionally, it must be underlined that, according to the EIAS of the Peljesac Bridge the following documentation is presented: *"A consequence of the specified current characteristics are differences in structure of biocenoses, which exhibit a greater floral abundance in the Neum-Klek Bay are compared to the rest of the Malostonski Bay. Specifically, due to a slower sedimentation of particles in the area, there is a more*

favourable substrate for development of photophilic algae biocenosis, which are thriving in the Neum-Klek Bay, in contrast to the rest of the Malostonski Bay where coastal terrigenous muds biocenosis is dominant. Even though marine angiosperm biocenoses in the Malostonski Bay are very scant, and Posidonia oceanica angiosperm meadows are completely absent, there are settlements of Cimodocea nodosa exclusively in the Neum-Klek Bay, but they cover a very limited area".

It must be also underlined that according to the official letter of the State Institute of Nature (Category:612-07/11-29/275) with the title: "*Completion of the Application for the Land-Peljesac Bridge Construction Project – Delivery of Opinion"* no priority habitat 1120 (Posidonia oceanica beds) is referred to the location area of the Bridge.

As a result, the investigation of possible impacts on Posidonia oceanica meadows will be one of the main objects of the appropriate assessment study. This has to be applied for any proposed alternative solution which includes marine works for the road connection of the continental Croatian territory with Peljesac Peninsula.

It has been estimated that the construction and operation phase of the solution will not affect the application of the Marine Strategy Framework Directive in Croatia. In any case mitigation measures will be implemented during the construction and operation phase of the project.

Effects on fauna (birds and other fauna)

According to the "*Feasibility Study for the Road Infrastructure Upgrading in the Area Mainland - Pelješac - Mainland. Construction of the Pelješac Bridge and the approach roads to the Bridge (to the national road D8 and the national road D414) along with the new route of the Pelješac road on the section: Zaradeže - Đonta Doli"*, it is concluded that the construction and operation of the subject road shall have a negative impact on the fauna species due to the following reasons:

- It endangers the endemic, relict, strictly protected and protected animal species,
- Decreases the possibility of population migration of some animal groups,
- Decreases the surface habitats and endangers the underground habitats in the road construction area, especially during tunnel drilling and construction.

Construction of every road, even the unfenced road, makes communication for animals on one road side difficult with animals of the same type on the other side of the road. In this sense, on the route of Pelješac bridge approach roads, exception are the road sections running through a tunnel or over viaducts or bridges. Part of the road on the Pelješac peninsula includes construction of two tunnels, on 450 m long, beginning at the chainage 7+650 km, and the other 2170 m long, beginning at chainage 11+050 km. This road section also includes construction of a 500 m long bridge, beginning at chainage 9+400 km. The position and lengths of the subject two tunnels and the bridge shall allow a satisfactory level of communication, i.e. it will decrease the negative impact of the road on the migration of most part of fauna in the road part passing through the Pelješac peninsula. Part of the road passing along the coastline does not include tunnels or viaducts and this significantly decreases the level of communication for the animals. However, having in mind the section length of only 2280 m, and the fact that it is an unfenced road, unfavourable impact on the fauna is not expected. Tunnels proposed for the bypass road of the settlement Ston will also contribute to the better communication of fauna species in that area.

The construction of the Pelješac Bridge approach roads will decrease the surfaces of present habitats, however, considering the length of the planned section of 12,200 m, significant unfavourable impact on the fauna is not expected. Since this shall be an unfenced road, possible accidents with animals during crossing of the road can be expected. In this sense, no significant impact on the bird fauna is expected but a negative impact is expected on the reptile fauna, as well as on the fauna of small and middle size mammals.

The proposed alternative does not cross or affects any territory of Golden Eagles (*Aquila chrysaetos*). The relevant figure is presented in Appendix. The proposed new surface roads 1 (black) and 2 (yellow) crosses the

territory of *Testudo hermanni* (purple colour) and the surface road 2 crosses a small part of *Emys orbicularis* territory (green colour). The relevant figure is presented in Appendix. For this reason, impacts will be occurred to the habitat of the species *Testudo hermanni* while the impacts on species *Emys orbicularis* will be smaller because the proposed road does not cover a large area of the species territory. In any case, these impacts are not considered as significant, by taking into account the small percentage of habitat loss due to the construction of the proposed road.

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads" effects on game animals and hunting should be considered in view of several factors crucially important to the assessment. Habitat fragmentation leads to separation of populations and increased rates of killed game animals trying to cross the road, and affects migrations aimed at meeting the basic necessities of life, therefore attention should be paid to this problem all along the road route. Improperly disposed of construction site waste (motor oil barrels, plastic foil, waste bitumen etc.) represents potential hazard to wildlife (entanglement and injury). Food waste attracts predators (foxes and jackals) as easily accessible food and makes them lose their inherent fear of humans and then they present hazard to nearby settlements (sylvatic rabies). Earthworks and other works involving heavy machinery noise and movement of people shall disturb the game, and it shall have to seek safer and quieter places. Rise of probability of injuries and fatalities of humans and animals (traffic accidents) is also expected. For these reasons, mitigation measures have to be taken. During the design of the lighting of the project, special care needs to be taken for the decrease of the impacts on the fauna of the area (decrease of impacts of light pollution).

Effects on protected areas

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", construction and use of the access roads is not expected to have any significant adverse effects on onshore part of the Malostonski Bay special reserve at sea. Considering significant remoteness (>7 km) and scope of the works, no adverse effects are expected in protected areas of the Neretva River valley either.

Moreover, according to the "*Feasibility Study for the Road Infrastructure Upgrading in the Area Mainland – Pelješac - Mainland. Construction of the Pelješac Bridge and the approach roads to the Bridge (to the national road D8 and the national road D414) along with the new route of the Pelješac road on the section: Zaradeže – Đonta Doli*", most part of the approach roads to the Pelješac bridge, from the beginning to chainage 10+900, passes through the coastal part of the special reserve at sea – the Bay of Mali Ston. Apart from this, the nearest protected areas (at a distance of > 7 km) on the coastal part are areas in different categories of protection: ornithological reserves - Pod Gredom, Prud and Orepak; ornithological-ichtiological reserve – the Neretva River Delta, protected landscapes - Modro oko Lake and Desne Lake, and the lower Neretva River flow (11,500 ha), which has a temporarily protection level of nature park. A significant unfavourable impact on the land and sea fauna of the Special reserve protected area of the Bay of Mali Ston is not expected due to the construction and operation approach. Unfavourable impacts on the protected areas in the Neretva River Valley are also not expected because of the distance of >7 km).

The location of the proposed alternative A1 of the project, in relation to protected areas (special reserves and significant landscapes) aforementioned and Natura 2000 sites (SPA and SCI) is presented in a relevant figure in an environment study attached to this report. The construction of the proposed new surface roads 1 and 2 will affect the protected areas Uvala Prapratno and Malostonski Jaliev respectively. Especially the area Uvala Prapratno is expected to be affected to a greater extent due to its small size. Also the construction of the bridge takes place within the protected area Malostonski Jaliev. All the other protected areas are not expected to be affected by the alternative A1. The proposed roads 1 and 2 and the proposed bridge are located within both SPA sites. The relevant figure is presented in an environment study attached to this report. However due to the small area which the new roads cover in relation to the total area of the two regions, is not expected to result in serious impacts in these areas. The proposed roads 1 and 2 and the proposed bridge sited within three SCI sites. The relevant figure is presented in Appendix **. However due to the small area which the new roads cover in relation to the total area of the three sites, is not expected to result in significant impacts in these areas. In any case, an appropriate assessment study is needed according to the article 6 of the habitats Directive 92/43/EU, for the environmental approval of the road design. Regarding the Ramsar Sites, Neretve

river and Hutovo Blato, are not expected to be affected as the proposed roads and bridges of the alternative A1 are not sited within those areas.

Effects on the landscape

According to the "*Feasibility Study for the Road Infrastructure Upgrading in the Area Mainland – Pelješac - Mainland. Construction of the Pelješac Bridge and the approach roads to the Bridge (to the national road D8 and the national road D414) along with the new route of the Pelješac road on the section: Zaradeže – Đonta Doli*", the area of the project – the Pelješac peninsula, and a smaller part of the coastal area encompasses several areas with a characteristic common property – the South Adriatic landscape. The narrow areas of the project (location of the bridge and approach roads) can be divided in two parts with regard to landscape.

The first part of the route, in the Pozvizd area, includes a small part of the coastal part of the mainland, and crossing of the Bay of Mali Ston to the other side on the Pelješac peninsula. The main element, the basic structure of the landscape is the karst relief which descends locally from the Vjeternik, Pozvizd and Brijeg Mountains to a narrow valley towards the coastal mountain range - Sljeme. The Sljeme slopes suddenly descend towards the sea creating a high, mostly inaccessible shore. This route part – approach road app. 2 km long is on a dynamic terrain regarding the relief, which means frequent cuts and cuttings on most part of the route. The biggest impact will be the intrusion into the Brijega mountain slope, where the route will bring adverse effects from several aspects, the most significant being the loss of a certain part of the terrace, production surfaces covered with olive groves.

From Glavica towards the Cape Međed, the route approaches the coastal edge and passes over the Pelješac Bridge. The Bridge over the Bay of Mali Ston, as a structure with significant physical characteristics and wider social significance, shall greatly influence the visual perception of the landscape of the complete Bay of Mali Ston and the coastal part from which the bridge will be visible. The Bay of Mali Ston is an area protected according to the Nature Protection Act, in the category of special reserve at sea, and except the vital component it has a significant impact on the environmental component in the landscape protection. All above mentioned gives an exceptional importance to the technical-design solution of the bridge. Although the impact of such a big structure will surely be great, (bridge length 2,300 m), the introduction of a new artefact into the present landscape must not necessarily result in negative impacts. The bridge undoubtedly protrudes from the surrounding terrain with its size and height and cannot therefore achieve an incorporation into the landscape. Under such conditions, the only option is to look for a technical solution of the bridge which will have the smallest possible volume and height, at the same time respecting the architectural and landscaping aspects of a good technical and design solution. The result of the newly formed landscape picture will be a dominant artefact which will architecturally and visually be a structure "per se", and as a result will create a new landscape in which the bridge will be dominant. Due to the architectural design of the bridge, this will not result in the significant degradation of the environment.

On the other part of the route, from the Pelješac shore to the connection with the State road Ston - Orebić, smaller units of natural and cultural landscape exchange. Coastal part of the Brijest community is a natural landscape, and, because of neglected olive groves and individual abandoned structures all covered by Mediterranean vegetation, the landscape is getting a natural character and look. The next landscaping micro unit, around the developed Brijest community, consists of several hamlets Donje and Gornje Selo communities being the nearest to the road route. The communities in the valley which gradually narrows from the Brijesta Cove towards the Dumanja jaruga, have an exceptional importance in the landscape creation because of their cultural, historical and visual qualities. Except the cutting into the slopes and intrusion into the natural framework of the rural unit, the negative impacts of the works will also be evident through the visual impact because the south slopes of the near shore mountain range are visually exposed to a view from the local road.

The area from Brijest to Dančanja is covered with forest vegetation, varying in the stage of development and cover. The route is largely in the tunnel (tunnel length is 2170 m), which significantly decreases its impact on the landscape. The Dančanje community, as part of a larger rural unit, is situated at the foot of the Kuvija hill, and its respective rural area is at the Ravne ploče location. The community has a preserved traditional architecture visible in its residential and work structures and the spatial organization of the community, forming a specific cultural landscape of the Central part of the Pelješac peninsula. Except the central part of

the community, the rural unit also includes the Medieval church of St. Michael with the cemetery, surrounded by cypress, situated in a field on the east side of the present road. A significant part of the rural unit represent the remaining agricultural surfaces, exchanging with vineyards and olive groves south from the community in the area of the works. The route through this area will directly cause the loss of some arable land and indirectly it will influence the visual and functional component of the area, because a narrow strip of land between the new road and the parallel existing road will disappear. Introduction of a new infrastructural facility into the preserved rural unit will cause a loss of integrity of the physical – perceptive structure and a disruption in the cultural-historical component of the landscape.

The above mentioned impacts of the project (primarily the impact of the approach road) can be significantly alleviated through the implementation of defined landscape protection measures. Similar landscape impacts are expected for the Ston by pass road. Greater landscape impacts are expecting for the bridge passing the Ston Canal which will be visible by the old defensive stone walls of Ston settlement.

Effects on caves

The figure that shows that the alternative A1 does not affect any of the caves which are been located near or adjacent to the study area, is presented in an environment study attached to this report. In any case, during construction proper measures should be taken into account, especially in the tunnels area, in case new caves are found.

10.3.2 BRIDGE OVER SEA - ALTERNATIVE A2

Effects on flora and vegetation

According to the Environmental Impact Study "Mainland - Peljesac bridge with access roads", a direct impact on flora and vegetation during construction of the route shall result in a reduction of areas of phytocenoses (mostly Phoenician juniper maquis) within climazonal vegetation. No adverse effects, caused by the road construction, are expected in terms of changes of floral composition of the biocenoses. All phytocenoses in the planned route are generally well spread in that area of Croatia, and some of them in other parts of the country. Because of that, and because of spatially limited impact of the route, it is not expected that construction and use of the road would have a significant impact on distribution of those phytocenoses in Croatia. No adverse impact on the biological and environmental system is expected in terms of changes of the floral composition of the phytocenoses. Moreover since in this alternative is proposed to use existing roads on the peninsula, expected impacts on vegetation and flora will be much smaller than the previous alternative solution A1. The figure that shows the alternative A2 (new bridge and access roads) and the vegetation types, which the alternative covers is presented in an environment study attached to this report.

Also, the projected roads pass in a great extent through the habitat type G2.12 which corresponds to the Natura 2000 habitat type 9340 which is not a priority habitat type. Also the planned road crosses at a small scale the habitat type F6.3 which does not correspond to a priority habitat of Directive 92/43. The same applies to the habitat type with code EUNIS G1.D/G2.91 which is covered to a very small extent from the planned roads. So no major impact on habitats from the construction and operation of alternative A2 will occur. In any case, an appropriate assessment study is needed according to the article 6 of the habitats Directive 92/43/EU for the environmental approval of the road design.

Effects on forest ecosystems and forestry

The effects of alternative A2 is expected to be smaller than the alternative A1 since far fewer kilometres of new roads will be opened. Less natural areas and thus less forest ecosystems will be affected. It can be concluded that the construction of this bypass shall not have a significant impact on the forest surfaces.

Effects on marine ecosystems

According to the figure presented in an environment study attached to this report, compared with the alternative A1 in which has been proposed the use of one more small bridge in the southern part of the study area, the alternative A2 would have less effect to marine ecosystems because there is no bridge in the area of the settlement of Ston. As for the possible existence of *Posidonia* beds (priority habitat 1120*) in the location area of the bridge according to the EIAS of the Peljesac bridge this habitat do not exist there. In any case, an appropriate assessment study is needed according to the article 6 of the habitats Directive 92/43/EU for the environmental approval of the road design (see also subparagraph "Effects on marine ecosystems"). It has been estimated that the construction and operation phase of the solution will not affect the application of the Marine Strategy Framework Directive in Croatia. In any case mitigation measures will be implemented during the construction and operation phase of the project.

Effects on fauna (birds and other fauna)

The effects of alternative A2 is expected to be smaller than the alternative A1 since far fewer kilometres of new roads will be opened. Less natural areas and thus less bird habitats will be affected. There is no impact for golden eagles territory in the Peljesac peninsula. According to the relevant figure presented in an environment study attached to this report, the existing road passes through the territory of the species Mauremys rivulata. The alternative A2 will cause similar impacts on the habitat of sea turtles. During the design of the lighting of the project, special care needs to be taken for the decrease of the impacts on the fauna of the area (decrease of impacts of light pollution).

Effects on protected areas

The impact of alternative A2 in protected areas, especially during construction, is considered smaller than alternative A1, since less length of new road is needed. The same applies for Natura 2000 (SPA and SCI) sites.

Effects on the landscape

The impact on the landscape from the alternative A2 will be less in relation with the alternative A1 because fewer new roads are proposed.

Effects on caves

The alternative A2 does not affect any of the caves which are been located near or adjacent to the study area. In any case, an appropriate assessment study is needed according to the article 6 of the habitats Directive 92/43/EU for the environmental approval of the road design.

10.3.3 NEUM BYPASS WITH CONNECTING ROADS - ALTERNATIVE B

This alternative constitutes the closest to the City of Neum by pass corridor. It's main technical characteristics are the following:

- Road length: about 11,1 km. About 1,1 km is in the territory of the Republic of Croatia. The rest is on the territory of Bosnia and Herzegovina
- Computed speed Vr = 80 km/h
- Pavement width: 8,0 m (0,5 m + 3,5 m + 3,5 m + 0,5 m)
- Number of viaducts: 2; total length about 850 m
- Number of tunnels:1; L= about 450 m

The north - western part of the road has a close proximity to the coastline and its alignment passes close to and in parallel to the alignment of the existing national road D8. At the area where the Neum city is located

turns to the hinterland in order to bypass the city. The south eastern part of the road turns towards the coastline in order to meet the national road D8. The corridor is characterized by high cuts and embankments (over 15 m) in the sections where high topographic inclinations are found.

Effects on flora and vegetation

The north western part of the corridor passes through dense maquis vegetation where Juniper (*Juniperus phoenicea*) formations are also encountered. At the broad area of the Neum city mixed areas of natural vegetation and cultivations are covered by the corridor. High slopes of cuts and embankments are difficult to be planted.

Effects on forest ecosystems and forestry

No broad dense forests are encountered along the axis of the corridor. Forests mainly consist of Pine trees in the broad area of Neum City. Consequently, no significant impacts are expected on forest ecosystems.

Effects on marine ecosystems

No significant impacts on marine ecosystems are encountered during construction phase by taking into consideration that proper mitigation measures are taken in order to prevent pollution to the sea (prevention of accidental lubricants or oil leakages and increase of suspended soils to the sea). During operation special attention should be given to the prevention of sea pollution due to vehicle accidents. Emphasis should be given to the part of the road where it is located near the sea (north-west of the Neum city).

Effects on fauna (birds and other fauna)

During construction impacts on fauna species are expected mainly to the natural ecosystems. The natural ecosystems north of Neum city present greater biodiversity due to the intense relief, the diversity of vegetation types and the coexistence of natural ecosystems and traditional cultivations. The proposed alternative will cause fragmentation of the fauna biotopes. During the construction and operation phases the diversity of fauna will be reduced in the adjacent area of the corridor.

Effects on protected areas

According to the available data, the edges of the alternative solution B enters to the Malostonski zaljev protected area. The north edge also enters the following Natura 2000 areas: Delta Neretve - HR5000031 which has been declared as Site of Community Importance (SCI) and Delta Neretve - HR1000031 which has been declared as Special Protection Area (SPA). Relevant figures are presented in an environment study attached to this report.. As a result some impacts are expected for this solution to the protected areas.

Effects on the landscape

Where the relief is intense high embankments and cuts are expected for the construction of this alternative. For the sections that are near the coastline, cuts and embankments will be visible from the sea. The impacts will be greater in case the inclinations cannot support shrubs and tree vegetation.

10.3.4 HIGHWAY CORRIDOR THROUGH B&H - ALTERNATIVE C

The option C starts from the north side of Llijno Polje settlement going to Duži on the north side of the Žrnjevo Mountain and Sojak peak. The design speed of the road was not mentioned but according to the minimum horizontal radius cannot be higher than 90km/h. The road is design as an expressway. The width of the cross section is: 1.5 + 0.5 + 2 x 3.5 + 0.5 +3.0 + 0.5 + 2 x 3.5 + 0.5 +1.5 in total 22.0m. It is composed of: hard shoulder; safety strip; two lanes; safety strip; two lanes; safety strip; hard shoulder.

The following elements will be built on these sections (uncompleted list):

- two tunnels (2 x 0.25km);
- one viaduct (0.15km); and
- one cut over 25m high.

The total length of the new infrastructure is about 6.5Km, without the junctions with the road D8 on the both part of Croatia. Taking into account the necessary connection roads to the national road D8, in the Croatian territory the total length comes up to 22Km.

Effects on flora and vegetation

The greatest portion of this solution is located in natural ecosystems with a variety of vegetation types (maquis vegetation, pine and oak forests and deciduous forests). A relevant figure is presented in an environment study attached to this report. As a result impacts on vegetation types and flora are expected for this solution.

Effects on forest ecosystems and forestry

Impacts on forest ecosystems and Forestry are also expected as the solution is located mainly in natural ecosystems.

Effects on marine ecosystems

The alignment of the solution is generally far from the sea. No significant impacts are expected.

Effects on fauna (birds and other fauna)

The greatest portion of this solution is located in natural ecosystems with a variety of biotopes. As a result impacts on fauna species are expected for this solution.

Effects on protected areas

According to the available data, the connection roads (into the Croatian territory) of the alternative solution C enters to the Malostonski zaljev protected area. The north connection road also enters the following Natura 2000 areas:

- Delta Neretve - HR5000031 which has been declared as Site of Community Importance (SCI).
- Delta Neretve - HR1000031 which has been declared as Special Protection Area (SPA).

The relevant figures are presented in an environment study attached to this report. As a result mild impacts are expected for this solution to the protected areas.

Effects on the landscape

Due to intense relief and the prevailing of the natural ecosystems some impacts are expected on the landscape. These impacts are not visible from big cities or settlements.

10.3.5 LONG DISTANCE FERRY AND ROADS - ALTERNATIVE D

Effects on flora and vegetation

According to the Feasibility study for the road infrastructure upgrading in the area Mainland - Peljesac - Mainland (Rehabilitation of the National Roads D414i D415), direct impact on the flora and vegetation during construction works (reconstruction) on the bypass will result in the loss of some surfaces covered with natural vegetation and cultivated surfaces (olive groves, vineyards). Negative consequences on the replacement of the flora system of plant communities are not expected as a result of road construction. All plant communities on the planned bypass route are generally well arranged and distributed in these, and in other parts of Croatia. Therefore because of this, and because of the spatially restricted impact of the bypass, it is assumed that the construction and operation of the bypass will not significantly affect the distribution of these species in Croatia.

As seen from the figure presented in an environment study attached to this report., the planned roads (black and pink line) and also the existing roads for which maintenance is proposed (red, green and brown line), and cross most of the Peljesac peninsula cover a very large area of the habitat type G2.12 which corresponds to the habitat type 9340 (in accordance with Directive 92/43) and is not a priority habitat. Also the planned roads crosses to a small scale the habitat type F 6.3 which does not correspond to a priority habitat of Directive 92/43. The same applies to the habitat type G1.D/G2.91 (EUNIS code) who is covered to a small extent by the planned roads. Moreover the planned roads pass through the habitat type E1.33, E1.812 / F6.3 in a small extent. This habitat type, also does not correspond to a priority habitat of Directive 92/43. So, major impacts on priority habitats from the construction and operation of the alternative D will not be expected. Nevertheless the large natural areas of vegetation and habitats which are covered by this alternative make it more harmful to natural ecosystems in relation to alternatives A1 and A2 where the length of new roads and the size of total interventions in vegetation during the construction phase is much smaller.

Effects on forest ecosystems and forestry

According to the Feasibility study for the road infrastructure upgrading in the area Mainland - Peljesac - Mainland (Rehabilitation of the National Roads D414i D415), The impact on forests and forestry is primarily noted in the permanent loss of surfaces under forests and direct occupation of forest producing surfaces. Since the future road corridor consists of degraded macchia surfaces and not a forest, an influence on the economic aspect of forests is not expected, but on the protective and social functions of the forest ecosystems. There are 500 ha of surfaces in the zone of work influence, consisting of rocky terrain, macchia and garrigues. Permanent occupation of surfaces will result in the loss of 11.8 ha of forest and other surfaces. Construction of this road will not significantly influence forest surfaces, except the ones which will be permanently lost. Possible impact of traffic on the communities in the immediate vicinity of the road shall be monitored to be able to undertake timely prevention measures.

During construction works, special attention shall be given to handling of highly flammable substances since the route passes through an area susceptible to forest fires, especially during the summer period when ideal conditions for forest fire prevail. This is especially relevant for the Aleppo pine forests. Moreover the effects of alternative D are expected to be bigger than the previous alternatives (A1,A2, B and C) since far more kilometres of roads will be opened.

Effects on marine ecosystems

According to the figure presented in an environment study attached to this report, it seems that no serious effects on marine habitats will occur except for the effects on habitat types 1170 and 1110 from the small bridge construction at the Ston Canal and the negative effects related to the pollution from the frequent movement of the ferries. For these reason, if this alternative is going to be implemented, appropriate actions must be taken. It has been estimated that the construction and operation phase of the solution will not affect the application of the Marine Strategy Framework Directive in Croatia. In any case mitigation measures will be

implemented during the construction and operation phase of the project, especially for the prevention of sea pollution from the movement of ferries (operation phase).

Effects on fauna (birds and other fauna)

According to the Feasibility study for the road infrastructure upgrading in the area Mainland - Peljesac - Mainland (Rehabilitation of the National Roads D414 i D415), all measures will be undertaken to prevent destruction of individual species and their habitats in the area influenced by construction works. Such measures will be:

In the detailed design:

- Bridge structure shall be such not to disturb the dynamic of exchange of water mass in the Bay of Mali Ston.
- Passes for smaller and slow animals (amphibians, reptiles, smaller mammals) shall be designed and constructed as horizontal passes or culverts under the road, made of concrete pipes, between chainages 0.00 - 2.00 km; 5.50 - 7.50 km; 11.50 - 14.00 and 14.50 - 16.00 km. During all stages of construction, cooperation between the road designer and biologist has to take place.

In the construction site organization design:

- Prevent unnecessary damage of trees, tree tops and root systems within the natural vegetation framework, as well as damage of cultivated plants (olive trees, fig trees etc.).
- During tunnel excavation ensure bio-speleological supervision. If valuable communities are encountered, construction works shall be stopped and action shall be undertaken in accordance with the law.

Moreover, the proposed solution is situated within the territory of the golden eagle (*Aquila chrysaetos*) in the Peljesac peninsula so it is expected some impact on this important eagle. This alternative is also situated within the territory of reptile species *Zamenis situla and Testudo hermanni* in the Peljesac peninsula so it is expected some impact on those species. This alternative is situated within the territory of Sea turtles so it is expected some impact on this species from the continuous movement of ferries. During the design of the lighting of the project, special care needs to be taken for the decrease of the impacts on the fauna of the area (decrease of impacts of light pollution).

Effects on protected areas

According to the Feasibility study for the road infrastructure upgrading in the area Mainland - Peljesac - Mainland (Rehabilitation of the National Roads D414 i D415), the protected landscape “Uvala Prapratno”, directly intercepted by the road route, shall be reevaluated regarding its rank and scope of protection. This alternative is situated within the Uvala Prapratno protected area. Also the planned surface road 2 and the existent road are located close to Malostonski zaljev protected area. So some negative effects on those protected areas may occur. This alternative is also situated within the SPA site HR1000036 of Natura 2000 network, so some effects on this SPA may occur especially during the construction phase of the planned surface roads and during maintenance of the existing roads. This alternative is situated within the SCI site HR2001364 of Natura 2000 network, so some effects on this SCI may occur especially during the construction phase of the planned surface roads.

Effects on the landscape

According to the Feasibility study for the road infrastructure upgrading in the area Mainland - Peljesac - Mainland (Rehabilitation of the National Roads D414 i D415), it is estimated that the planned project has no significant negative impact on the landscaping values of the area. The areas of the Ston section is very vulnerable and needs to be especially carefully treated regarding aesthetics. The solutions need to rely on the principle of contrast according to the natural base, by applying technical solutions/creations which would presently counteract the living and present tradition. Especially sensitive parts of this section are the ones

passing over the Vresovice slope, penetrating into the forest parts, and the area where the route passes from the bridge to the tunnel portal, visible from the protected walls of Ston. The Prapratno section area is an „open space" looking from the land and the sea, and this increases its sensitivity. Therefore the road route needs to be staked out according to the present cut and treat it through landscaping. Analysis of the Ponikve/Šparagovići section shows that this is an area of great «consideration», in the sense of a completed, finished unit, especially analysed from a community point of view. Therefore great attention shall be given to the softening of the sharp line of the bypass, possibly using vegetation.

Effects on caves

As shown in the relevant figure presented in an environment study attached to this report, amongst the three caves within the study area, only one is located near the port area of the city Trpanj which will be the one of the two ports of the proposed solution of ferry. Nevertheless the cave is not expected to be affected by the port operation, as it lies on a hill at a distance of 500 meters from the port of Trpanj. Also the second of the three caves which is shown to be adjacent to the existing road and is going to be used in this alternative, the road is located 1, 5 km from the road so will not suffer any impact from any maintenance of the road as the alternative needs.

10.3.6 SHORT DISTANCE FERRY - ALTERNATIVE E1

The alternative E1 and the study area are presented in the relevant figure in an environment study attached to this report.

Effects on flora and vegetation & Effects on forest ecosystems and forestry

The same effects as A1 alternative.

Effects on marine ecosystems

The impacts on the marine ecosystem will have the same intensity with the effects by solution A1 but it will be of different kind. In the case of this alternative the effects will involve (mainly during the operation phase) the pollution of the Mali-Ston bay by the continuous movement of the ferries. The continuous operation of the ferries relates to oil and lubricants leakage into the sea. Deeper currents of the Mali-ston bay very often are directed to the South-east. As a result significant impacts to aquacultures may occur. The impacts may be severe in case of an accident where oil spill may occur. The E1 alternative, marine habitats and the Mali-Ston bay are presented in a relevant figure in an environment study attached to this report. It has been estimated that the construction and operation phase of the solution will not affect the application of the Marine Strategy Framework Directive in Croatia. In any case mitigation measures will be implemented during the construction and operation phase of the project, especially for the prevention of sea pollution from the movement of ferries (operation phase).

Effects on fauna (birds and other fauna)

The effects on *Aquila chrysaetos* and the reptiles will be the same as A1 alternative. However the effects on sea turtles during the construction and operational phase of the project will be much worse because of the continuous movement of the ferries within the sea turtles habitat as seen in the relevant figure presented in an environment study attached to this report.. During the design of the lighting of the project, special care needs to be taken for the decrease of the impacts on the fauna of the area (decrease of impacts of light pollution).

Effects on protected areas & Effects on caves

The same effects as A1 alternative.

10.3.7 SHORT DISTANCE FERRY - ALTERNATIVE E2

The alternative E2 and the study area are presented in the relevant figure in an environment study attached to this report.

Effects on flora and vegetation & Effects on forest ecosystems and forestry

The same effects as A2 alternative.

Effects on marine ecosystems

The same effects as A1 alternative. The continuous operation of the ferries generally relates to oil and lubricants leakage into the sea. Deeper currents of the Mali-ston bay very often are directed to the South-east. As a result significant impacts to aquacultures may occur. The impacts may be severe in case of an accident where oil spill may occur. In this case the operation phase of the solution may affect the application of the Marine Strategy Framework Directive and the Habitat Directive in Croatia. In any case mitigation measures will be implemented during the construction and operation phase of the project, especially for the prevention of sea pollution from the movement of ferries (operation phase).

Effects on fauna (birds and other fauna) & Effects on caves

The same effects as A1 alternative.

Effects on protected areas

The same effects as A2 alternative.

10.3.8 IMMERSED TUNNEL TO PELJEŠAC PENINSULA - ALTERNATIVE F1

The alternative F1 and the study area are presented in an environment study attached to this report..

Effects on flora and vegetation & Effects on forest ecosystems and forestry

The same effects as A1 alternative.

Effects on marine ecosystems

Due to the fact that the immersed under sea tunnel which is proposed in this alternative would be built on the seabed and covered with stones the expected priority marine habitat seagrass beds (1120) occurring at the site of the project, will suffer very significant and irreversible deterioration in a large area (2.5 km tunnel length and a width of 30 meters). So the impact on marine ecosystems of this alternative could be considered significant. The F alternative, marine habitats and the study area are presented in a relevant figure in an environment study attached to this report. It has been estimated that the construction and operation phase of the solution will not affect the application of the Marine Strategy Framework Directive in Croatia. In any case mitigation measures must be implemented during the construction phase of the project, especially for the prevention of sea pollution.

Effects on fauna (birds and other fauna)

The effects on *Aquila chrysaetos* and the reptiles will be the same as A1 alternative. The effects on Sea turtles during the construction will be important due to the construction of the tunnel at the bottom of the sea which will cause at least local alteration in the habitat of marine turtles. In contrast during the operation of the project is not likely to be significant impacts on sea turtle due to the fact that the tunnel will be covered by

stones. During the design of the lighting of the project, special care needs to be taken for the decrease of the impacts on the fauna of the area (decrease of impacts of light pollution).

Effects on protected areas & Effects on caves

The same effects as A1 alternative.

Effects on landscape

The same effects as A1 alternative except that the passage will be underground so it will not alter the landscape.

10.3.9 IMMERSED TUNNEL TO PELJEŠAC PENINSULA - ALTERNATIVE F2

The alternative F2 is the F1 solution without the construction of new roads in the Peljesac peninsula.

Effects on flora and vegetation & Effects on forest ecosystems and forestry

The same effects as A2 alternative.

Effects on marine ecosystems

Due to the fact that the immersed under sea tunnel which is proposed in this alternative would be built on the seabed and covered with stones the expected priority marine habitat seagrass beds (1120) occurring at the site of the project, will suffer very significant and irreversible deterioration in a large area (2.5 km tunnel length and a width of 30 meters). So the impact on marine ecosystems of this alternative could be considered significant. It has been estimated that the construction and operation phase of the solution will not affect the application of the Marine Strategy Framework Directive in Croatia. In any case mitigation measures must be implemented during the construction phase of the project, especially for the prevention of sea pollution.

Effects on fauna (birds and other fauna) & Effects on protected areas & Effects on caves

The same effects as A2 alternative.

Effects on landscape

No significant impacts on landscape are expected.

10.3.10 TUNNEL UNDER B&H – ALTERNATIVE G

No proposed design and location exist for this alternative. The environmental impacts are mainly related to the following:

- Impacts due to connection roads in the Croatian territory. These roads goes through protected areas (National protected areas and Natura 2000 areas).
- Impacts on the ground water regime
- Impacts due to the management and final disposal go the excavated material.
- Impacts to the man-made environment due to increased risk of accident in a long tunnel
- Impacts due to the continuous consumption of energy for the operation of the tunnel.

10.3.11 ADRIAN – IONIAN HIGHWAY - ALTERNATIVE H

No proposed specific alignment exist for the Andrian – Ionian Highway. Environmental impacts are related mainly to the change of land uses, landscape and occupation of agricultural and natural ecosystems. Consequently impacts on vegetation, flora and fauna species and protected areas are expected.

10.4 Impact Assessment of Alternative Solutions - Manmade Environment

10.4.1 BRIDGE OVER SEA - ALTERNATIVE A (VAR. 1 & VAR. 2)

The alternative A refers to the construction of a cable bridge over sea, for the connection of the peninsula with the mainland. The construction of the bridge and the road is in compliance with the following: Physical Planning Strategy or the Republic of Croatia (1997), Physical Planning Programme for the Republic of Croatia (OG 50/99), Regional Development Plan of the Dubrovnik and Neretva County (DNC Official Journal No. 6/03, 3/05, 3/06, 7/10), Physical Development Plan of the Ston Municipality (DNC Official Journal No. 9/10, 7/08, 9/09 and 11/09) and Physical Development Plan of the Slivno Municipality (Neretva Gazette No. 1/02, 5/08)[47]. The main issues concerning the impacts of Alternative A on the manmade environment of the area are summarized in the table that follows.

Table 17 Summary of the main issues regarding impacts on the manmade environment – Alternative A

Var.	Land uses - Physical planning	Atmospheric - acoustic environment	Archaeological monuments
A1	The bridge and the new roads are foreseen in the county Spatial plan. The bridge goes through a protected submarine area	The new road will bypass the settlements Ston, Metohija. Gornje Selo, Boljenovici and Sparagovici, (positive effects to the acoustic and atmospheric environment during the operation phase);	A new road is foreseen that bypasses Ston (which is included in the tentative list of the UNESCO World heritage sites) and goes over the Stonski Kanal with a bridge (tunnels are foreseen in the entrance and exit of the bridge).
A2	The bridge is foreseen in the county spatial plan. The bridge goes through a protected submarine area.	The existing roads will be used and the traffic loads will be increased, with negative impacts on the settlements the existing roads travel through.	The existing road will be used, that goes through the town of Ston.

[47] Feasibility Study for the Road Infrastructure Upgrading in the area Mainland - Pelješac - Mainland (INSTITUT IGH, d.d. IGH INFRASTRUCTURE ZAGREB, 2012)

Effects on Land Uses

Construction or roads and intensive motor vehicle traffic leads to a permanent loss of soil resources and pollution of surrounding soil. The permanent change of use shall affect soils valuable for production and other agricultural land. Part of that land is neglected and out of production use, since it is largely inaccessible to any type of agricultural machinery or transport. A minor part of the olive groves is rehabilitated and used for production. The affects by the pollution of surrounding soil due to increased traffic, can be mitigated by planting of protective vegetation belts along the route in areas where land is suitable for the ecological production. It must be pointed out that there are much larger areas of olive groves and vineyards which shall become more accessible after the access routes are completed, allowing restoration and improvement of production there. These effects refer to Var. A1, as new roads are going to be constructed. In Var. A2 there are no effects due to the occupancy of land used for other purposes in the peninsula (as the existing roads will be used). Nevertheless, negative impacts are expected due to the increase in traffic and relevant pollution of the roadside areas. The access roads to the bridge on the mainland will have to be constructed in both Var. A1 and A2.

Springs in the area

There is a permanent brackish coastal spring at the Pelješac Peninsula in the Brijesta Bay and an eponymous submarine spring. Because of sensitive ecosystems in the Malostonski and Brijesta bays, predominant water permeable carbonate sediments, structural system and its tectonic destruction, water should be collected all along the 14.660km of the Pelješac Bridge and the access roads, fed to grease traps and then discharged to concrete pools or underground[48]. These effects refer to both Var. A1 and A2 (source: Environmental Impact Study for the Mainland - Pelješac Bridge and access roads, Civil Engineering Institute of Croatia, 2005).

Seismicity of the area

It needs to be pointed out, that when defining the conditions for foundation works for the bridge, except the rock mass characteristics or the soil under the foundations, the greatest impact will have the high seismicity of the area around the bridge location (approximately 9th degree of seismicity has to be taken into account). This shows the necessity to undertake detailed engineering-geological and regional-tectonic as well as seismotectonic investigations of the wider area of the bridge location as well as the micro location. Results of the seismotectonic investigations shall influence the choice of the bridge structure and the means of foundations works. High degree of seismicity also needs to be considered when calculating the stability of embankments and slopes in the cuts and side cuttings.

Route of Ston bypass (Var. A1)

Special attention on this route is needed for the construction of the bridge over the narrow Ston Canal. Care has to be taken regarding the navigation of ships out of the Port of Ston and the vicinity of the salt farm (protection against pollution required). The route corridor borders with valuable arable areas, forests, forest soils and areas intended for urbanization and business activities (tourism) outside the community. The route of the Ston Bypass does not collide with areas intended for community development, or for development of business activities outside the community's tourism). The construction of the bridge and the tunnels of the Ston Bypass shall not be done during the spring, when the sea water is taken for the needs of the salt production factory. All protection measures have to be undertaken to prevent outflow of oil and lubricant. Cooperation with the salt factory authorities shall be on a regular basis[49].

Effects on Archaeological monuments

The tentative list of the UNESCO World heritage sites includes the following:

[48] Environmental Impact Study for the Mainland - Pelješac Bridge and access roads (Civil Engineering Institute of Croatia, 2005)
[49] Environmental Impact Study for the structure Bypass of Ston on the D-414 road

- Historical-town planning ensemble of Ston with Mali Ston, connecting walls, the Mali Ston
- Bay nature reserve, Stonsko Polje and the salt pans (2005).

In Var. A1 a bypass is designed that will bypass the Historical-town of Ston, while in Var. A2 the existing road, which goes through Ston will be used.

On the Pelješac Bridge route, archaeological heritage investigation works were performed using a submersible vehicle with a camera. No remains of grouped or scattered cultural heritage were detected on the Pelješac Bridge route Also, biologists hired to dive along the subject route did not notice any historical artefacts (source: Environmental Impact Study for the Mainland - Peljesac Bridge and access roads, 2005).

On either sides of the access roads to the bridge (on the mainland), two monuments have been recorded (Austrian Fortification of 19th Century at Glavina and Memorial Structure of 20th Century at Duboka).

- Glavica, Austrian fortress is located southwest of the route, in the zone of direct impact (2 x 250 m). The fortification should be documented in detail and protected in situ.
- Duboka - monument is located within the settlement, north of the route, in the zone of direct impact (2 x 250 m).

At Brijesta (on the Peninsula) the following monuments have been recorded:

- Kula Kabuzic Fortification of 16th Century (Fortification)
  Kula Kabužić is located southwest of the route, in the zone of direct impact (2x250m). After completion of the new road east of the Brijesta Bay, the existing road located adjacent to this tower shall become less frequently used, therefore the tower will become less exposed to vibrations and less threatened.
- St. Libourius' church and cemetery, Brijesta, baroque (Sacral monument)
  St. Libourius church and cemetery is located southwest of the route, in the zone of indirect impact (2x500m). It is within a rural complex, and is not directly threatened.
- Villa rustica, Brijesta, classical antiquity - Rome (archaeological site)
  Villa rustica is located southwest of the route, in the zone of indirect impact (2x500m).

As far as the Ston Bypass, foreseen in Var. A1, is concerned, the following are pointed out[50]:

[50] Environmental Impact Study for the structure Bypass of Ston on the D-414 road

Table 18 Summary of impacts on the cultural monuments and related protection measures – Alternative A1

Cultural Monument	Impact	Protection Measures
"Pod mirine" late antique fortification.	Archaeological zone not directly threatened.	Archaeological supervision during preliminary and earth works is required.
Gomila	Immediately threatened by road.	During design development consultations with the conservation specialists are required.
Summer house Betondić - Sorkočević with the chapel of St Anthony of Padua.	The site is not physically directly threatened by the route, but the visual site is changing.	During design development consultations with the conservation specialists are required.
The All Saints Church on the Broca Cemetery	Locality is physically threatened by the road route.	During design development, consultations with the conservation specialists are required.
Solila	Locality is in the immediate vicinity of the planned road route.	
Broce Community	Locality is in the immediate vicinity of the planned road route, which will change the visual appearance of the community	During design development consultations with the conservation specialists are required.
Church of St. Srđ	The locality is not immediately threatened.	Before execution of earth works structural analysis is required as well as investigations and documentation of the condition of the church remains. Consultations with the conservation experts are required during detailed design development.
Gomila	Locality is immediately threatened.	Experts are required during detailed design development. During execution of earth works, archaeological supervision is required as well as investigations and documentation of the site and possible archaeological findings.
Crkvena glava - gradina (fortified town)	Locality is not threatened.	Archaeological supervision is required as well as supervision during execution of earth works, as well as additional investigation and documentation of the cultural monument.
St Mark's Church	Cultural monument is not immediately threatened.	Archaeological supervision is required as well as supervision during execution of earth works.
Gomile	The zone is immediately threatened	During further stages of design development, consultations with the conservation experts are required. Archaeological supervision is needed during construction works, investigations and possible documentation of possible archaeological discoveries.

Effects on atmospheric - acoustic environment

In Var. A1, the new road will bypass the settlements Ston, Zabrde, Sparagovici, Boljenovici and Metohiga. As a result, the atmospheric and acoustic environment of these settlements will improve, due to the reduction of the traffic loads. In Var. A2, the existing roads will be used and the traffic loads will be increased, with negative impacts on the atmospheric and acoustic environment of the settlements the existing roads travel through.

Conclusions

The Var. A1 is preferable to the Var. A2, according to the evaluation of the expected impacts on the manmade environment of the area. As regards to Var. A1, the positive impacts of the project on the social and economic structure of the area need to be pointed out. More precisely, the implementation of the project is most likely to have the following impacts on the socio-economic environment[51]:

1. Shortening of the travel route in terms of time and space.
2. Revitalization of the peninsula in terms of generally improved traffic routes and establishment of a better link to the island of Korčula.
3. Revitalization of the existing settlements and creation of new (tourism) development zones on Pelješac.
4. Development of various facilities on the peninsula which shall shorten communications to the Mljet Island (planned ferry dock in Prapratna Bay on Pelješac).
5. Creation of new jobs, especially in tourism, hospitality and service sectors.
6. Increased interest of the local population for sale of land for holiday home construction, especially in zones closest to point of contact of the bridge and the peninsula.
7. Increased interest of potential short-term holidaymakers for land purchase and existing real-estate on the peninsula.
8. Development of services, as the traffic volume increases.
9. Increase of real-estate price is, as noted above, an indirect consequence of implementation of the project.
10. Opening of new tourist facilities and increase of number and variety of diverse business ideas (tourist bureaus, organization of travel and excursions, significant improvement of tourist accommodation - e.g. the existing hotel in Veli Ston).
11. Creation of new and development of the existing secondary communications - transport routes.
12. Considering the existing indirect, but definitely predictable impact, it shall certainly become necessary to expedite development of urban development plans.

The position of the alternative solutions evaluated is presented in the relevant Figures of Appendix, as regards to the land uses, areas of special restriction and areas of special conditions of use, according to the Dubrovnik - Neretva County Spatial Plan.

10.4.2 NEUM BYPASS WITH CONNECTING ROADS - ALTERNATIVE B

The alternative B refers to the construction of the Neum bypass with connecting roads. It consists of a corridor in the area of B&H with special traffic regime. The main issues concerning the impacts of Alternative B on the manmade environment of the area are summarized in the table that follows.

[51] Environmental Impact Study for the Mainland - Pelješac Bridge and access roads (Civil Engineering Institute of Croatia, 2005)

Table 19 Summary of the Main Issues Regarding Impacts on the Manmade Environment – Alternative B

Var.	Land uses - Physical planning	Atmospheric - acoustic environment	Archaeological monuments
B	In the Dubrovnik - Neretva County spatial plan (Croatian) a motorway is foreseen, north of the solution B. Solution b is not foreseen in the Spatial Plan.	The motorway is situated north of the town of Neum. Due to the proximity of Neum some impacts are expected on the acoustic and atmospheric environment of the town during the high traffic season.	The alignment goes through the area south of Vranjevo Selo (which is an archaeological site).

Effects on Land Uses

The alignment of Var. B passes close to the city of Neum. As a result will be partially visible of the city of Neum. The north section of the road will be also visible from the sea. During the construction phase some interference with the existing traffic of the Neum city will take place. The eastern section of the road is located in agricultural cultivations. As a result relevant changes to the land uses will take place in that area. Construction and operation phases of the corridors may cause impacts on the ground water of the area which is used for the water supply of the town of Neum. Due to this fact special attention must be given for the implementation of pollution preventive facilities. The impacts may be severe in case of a traffic accident with trucks transporting oil fuels.

Effects on Archaeological monuments

Archaeological monuments in B&H, in the vicinity of Var. B are the following:

- Vranjevo Selo is an archaeological site, included in the National Monuments of B&H
- Džamija u Neumu (Mosque in Neum) is a monument in the Petition List (national).

In Var. B, the alignment goes through the area south of Vranjevo Selo. Due to the morphology of the area, it is expected that the motorway will be partially visible from the archaeological site.

Effects on atmospheric - acoustic environment

The solution B is very close to the building area which is located north to the city of Neum. The closest distance of the main area of the city comes up to 440m. Consequently It is estimated that the construction and operation of the corridor will have some impacts on the atmospheric - acoustic environment of the town of Neum.

10.4.3 HIGHWAY CORRIDOR THROUGH B&H - ALTERNATIVE C

The alternative C refers to the construction of a highway in the area of B&H. The main issues concerning the impacts of Alternative C on the manmade environment of the area are summarized in the table that follows.

Table 20 Summary of the Main Issues Regarding Impacts on the Manmade Environment – Alternative C

Var.	Land uses - Physical planning	Atmospheric - acoustic environment	Archaeological monuments
C	In the Dubrovnik - Neretva County spatial plan (Croatian) a motorway is foreseen. The alignment of the solution generally follows the alignment of that of the spatial plan. Connections roads have to be built in the Croatian territory in order to connect with the national road D8.	The motorway is situated north of the town of Neum. No negative effects are expected on the acoustic and atmospheric environment of the town due sufficient distance from the city	The alignment goes through the area north of Vranjevo Selo (which is an archaeological site).

Effects on Land Uses

The alignment of Var. C do not follow existing roads, therefore is not expected to have negative impacts on the existing traffic of Neum city, during the construction phase. Due to the morphology of the area, the Var. C is not expected to be visible by the town of Neum, which is a significant touristic destination. Construction and operation phases of the motorway may cause impacts on the ground water of the area which is used for the water supply of the town of Neum. Due to this fact special attention must be given for the implementation of pollution preventive facilities. The impacts may be severe in case of a traffic accident with trucks transporting oil fuels. Taking into account the necessary connecting roads and the motorway alignment impacts on land uses (mainly agricultural and natural areas) are expected.

Effects on Archaeological monuments

Archaeological monuments in B&H, in the vicinity of Var. C are the following:

- Vranjevo Selo is an archaeological site, included in the National Monuments of B&H
- Džamija u Neumu (Mosque in Neum) is a monument in the Petition List (national).

In Var. C, the alignment goes through the area north of Vranjevo Selo. Due to the morphology of the area, it is expected that the motorway will not be visible from the archaeological site.

Effects on atmospheric - acoustic environment

In the area that the Var. C goes through there are no settlements of considerable size. The nearest settlement is Duzi, which has a close proximity with the motorway alignment. Therefore impacts on the atmospheric and acoustic environment will take place there. The adequate distance of the alignment from the city of Neum (1150m) ensures no impacts to the acoustic and atmospheric environment.

10.4.4 LONG DISTANCE FERRY AND ROADS - ALTERNATIVE D

The alternative D refers to the use of the ferry line between the Ploče harbour and Trpanj harbour. The existing road network on the peninsula will be used and the new roads foreseen in Var. A1 will be constructed. Moreover, a new road north of the settlement of Potomje is foreseen. The load on the ferry connection amounts to AADT (Average Annual Daily Traffic) of 2692. The traffic on D414, between Janjina and Prapratno amounts to 3.738 vehicles, which is an increase of 100% in comparison to the present traffic (1.835 vehicles)[52].

[52] Feasibility Study for the Road Infrastructure Upgrading in the area mainland - Pelješac - Mainland, Rehabilitation of the National Roads D414 i D415 (INSTITUT IGH, d.d. IGH INFRASTRUCTURE ZAGREB, 2012)

The main issues concerning the impacts of Alternative D on the manmade environment of the area are summarized in the table that follows.

Table 21 Summary of the Main Issues Regarding Impacts on the Manmade Environment – Alternative D

Var.	Land uses - Physical planning	Atmospheric - acoustic environment	Archaeological monuments
D	The new roads are foreseen in the spatial plan, with the exception of the new section that will move north of the settlements of Potomje and Pijavicino	The new road will bypass the settlements Ston, Metohija. Gornje Selo, Boljenovici Sparagovici, Janjina, Drace, Picavicino, and Potmoje (positive effects to the acoustic and atmospheric environment during the operation phase);	Trpanj includes historical complexes and structures (civilian structure, sacral structures and urban rural settlement)
			The new road north of the settlement of Pijavicino moves north of the historical structural complex (rural settlement) of D. Selo.
		The traffic loads on the road network of the Peninsula will increase, with negative impacts on the environment of the settlements that are situated in areas adjacent of the roads that will be used.	A new road is foreseen that bypasses Ston (which is included in the tentative list of the UNESCO World Heritage sited) and goes over the Stonski Kanal with a bridge (tunnels are foreseen in the entrance and exit of the bridge).
			South of Ston, the new road moves north of an historical structural complex (urban-rural settlement)

Effects on Land Uses

Var. D foresees the use of road network on the peninsula (both existing and new) of significant length, with negative impacts due to the permanent loss of soil resources (direct impact by the construction of new roads) and pollution of surrounding soil (indirect impact by the operation of road network with significant traffic loads). The impacts on land uses by the implementation of the D alternative include the impacts estimated for the A1 alternative, as far as the road network on the peninsula is concerned.

Moreover in Var. D (compared to Var. A1):

- Two new road sections will be constructed on the peninsula. Agricultural land and land covered by forest will be occupied respectively.
- Road network on the peninsula will be used at an area of total length of 30km approximately (more than in Var. A1).

Positive impacts are expected to the mobility and traffic connection by the realisation of the upgrading of the road network on the peninsula, as foreseen in Var. D. More precisely:

- The realisation of the works shall provide efficient and quality connection on the Peninsula of Pelješac and enable better road-ferry communication of the Peninsula of Pelješac and the Islands of Korčula, Mljet and Lastovo with the mainland. Furthermore, the concerned area shall receive a new momentum for tourist and economic development.
- The project of rehabilitation of the national roads D414 and D415 in the Area Mainland - Pelješac - Mainland shall significantly increase the road network capacity and serviceability level and shorten the trip duration. The redirection of major traffic flows from centres of settlements shall significantly unburden the existing roads and have an impact to the increase of the traffic safety. Especially during tourist season, traffic jams occur and present an additional safety risk, deteriorating air quality and elevating the level of noise in settlements.

These positive impacts are also valid for Var. A1, where new roads that bypass settlements are also foreseen.

Effects on Archaeological monuments

The impacts on Archaeological monuments estimated for the section of Var. A1 situated on the peninsula, are valid for Var. D as well. Moreover, the following are added, referring to Var. D:

- In Var. D, the Trpanj harbour will be used by the ferries, which will arrive from Ploče harbour. Trpanj includes historical complexes and structures (civilian structure, sacral structures and urban rural settlement). The increase in traffic will have some negative impacts on the monuments of the area.
- The new road north of the settlement of Pijavicino moves north of the historical structural complex (rural settlement) of D. Selo. Necessary measures should be taken mainly during construction.

Effects on atmospheric - acoustic environment

The new road will bypass the town of Ston and the settlements Zabrde, Sparagovici, Boljenovici and Metohiga. As a result, positive impacts are expected on the acoustic and atmospheric environment of these settlements. The traffic loads on the road network of the Peninsula will increase, with negative impacts on the environment of the settlements that are situated in areas adjacent of the roads that will be used.

Conclusions

The alternative D will have more significant impacts on the atmospheric and acoustic environment of the settlements on the peninsula that are situated in areas adjacent to roads that will be used, compared to the alternatives A and B. In alternatives A and B, the road network that will be used, is of significantly smaller length. The sea area that the ferry line crosses in alternative D is not characterized as a protected submarine area (as is the case with the position of the Pelješac Bridge of alternative A and B). Nevertheless, the frequent movement of ferry boats will have a significant negative impact on the bay, due to the position of the harbours that will be used (Ploče and Trpanj harbour). In the case of the Pelješac Bridge (var. A & B), negative impacts can be expected on the marine area during the construction phase, which is limited. In var. D the impact on the marine environment will be constant, due to the frequent movement of the ferries.

10.4.5 SHORT DISTANCE FERRY - ALTERNATIVE E (VAR. E1 & E2)

The alternative E refers to the use of the existing piles of the Pelješac Bridge as a provisionary harbour for ferries (short distance ferry). In alternative E1 new roads are foreseen on the peninsula (as in var. A1), while in alternative E2, the existing road network of the peninsula, will be used. The main issues concerning the impacts of Alternative E on the manmade environment of the area are summarized in the table that follows.

Table 22 Summary of the Main Issues Regarding Impacts on the Manmade Environment – Alternative E

Var.	Land uses - Physical planning	Atmospheric - acoustic environment	Archaeological monuments
E1	The new roads are foreseen in the county Spatial plan. The ferry will move in an area characterized as a protected submarine area. Pollution to the aquacultures may happen during the operation phase. The impacts will be severe in case of accident.	The new road will bypass the town of Ston and the settlements Zabrde, Sparagovici, Boljenovici and Metohiga.	A new road is foreseen that bypasses Ston (which is included in the tentative list of the UNESCO World heritage sites) and goes over the Stonski Kanal with a bridge (tunnels are foreseen in the entrance and exit of the bridge).
E2	The ferry will move in an area characterized as a protected submarine area. Pollution to the aquacultures may happen during the operation phase. The impacts will be severe in case of accident.	The existing roads will be used and the traffic loads will be increased, with negative impacts on the settlements the existing roads travel through.	The existing road will be used, that goes through the town of Ston.

Effects on Land Uses

The impacts on terrestrial land uses are similar between Var. E1 and Var. A1 and between Var. E2 and A2 as well, because the same existing and new roads will be used (both on the mainland and on the peninsula). Var. E and A have different impacts on the marine environment. In Var. E, the ferries, which will connect the peninsula and the mainland, will move in an area characterised as a protected submarine area. As a result, negative impacts are expected on the marine environment and the relevant productive uses (shell production, fishing etc.) during the operation phase of Var. E. Intense ferry traffic is expected to disrupt the water quality of the area at the relatively closed bay.

Effects on Archaeological monuments

The impacts on archaeological monuments are similar between Var. E1 and Var. A1 and between Var. E2 and A2 as well.

Effects on atmospheric - acoustic environment

The road network that will be used in Var. E1 is similar to that, which will be used in Var. A1. The same is valid for Var. E2 and A2. In Var. E instead of a bridge for the connection of the mainland and the peninsula (as is the case in Var. A), ferries will be used to cover the same distance. The atmospheric pollution in the harbours that will be used for the short distance ferries is expected to increase, due to the fact that the traffic of vehicles that will have to park or wait with the engine on, in order to embark the ferry, will increase. The acoustic environment of the harbours is also expected to be deteriorated, due to the fact that the movement of the vehicles will not be unhindered (as in the case of the bridge).

Conclusions

The Var. E1 is preferable to the Var. E2, according to the evaluation of the expected impacts on the manmade environment of the area. The alternative E (short distance ferry) is less preferable to the alternatives A (Pelješac Bridge) for the following reasons:

- The marine area that the ferry line crosses is characterized as a protected submarine area (as is the case with the position of the Pelješac Bridge).

- The frequent movement of ferry boats will have a significant negative impact on the Neum-Klek bay and the relative maritime activities (fishing, aquaculture, seashells production).
- In the case of the Pelješac Bridge (var. A), negative impacts can be expected on the marine area during the construction phase, which is limited.
- In var. E the impact on the marine environment will be constant, due to the frequent movement of the ferries.

If the Var. E1 or Var. E2 had to be implemented, some technical issues would have to be resolved as well, such as whether the construction site quay that has been constructed for the abutments is adequate for a ferry port. Moreover, the bridge abutments are at a height of 33m approximately, consequently the approach roads to the port have to be designed to adjust to this height.

10.4.6 SHORT DISTANCE FERRY - ALTERNATIVE F (VAR 1 & VAR 2)

The alternative F1(with new roads in the Peljesac peninsula) and F2 (without new roads in the Peljesac Peninsula) refer to the construction of an immersed tunnel, which will be covered by stones. The alignment of the tunnel is estimated to be the same as that of the Pelješac Bridge. The same access roads and new roads are needed as in var. A1 and A2 correspondingly.

Effects on Land Uses

The impacts on terrestrial land uses expected by the implementation of Var. F1 and F2 are similar to those already estimated by Var. A1 and A2 correspondingly, as the same roads will be used as mentioned above. The area of the alignment of the tunnel is characterized as a protected submarine area. The impact of the construction of a tunnel will be significantly greater compared to the impact expected by the construction of the Pelješac Bridge (Var. A1 and A2).

Effects on Archaeological monuments

The impacts of Var. F1 and F2 on terrestrial archaeological monuments are similar to those estimated for Var. A1 and F2 correspondingly. In the marine area, where the tunnel is proposed to be constructed there has been no documentation of archaeological findings.

Effects on atmospheric - acoustic environment

The impacts of Var. F1 and F2 on the acoustic and atmospheric environment of the settlements situated on the mainland and the peninsula are similar to those estimated for Var. A1 and A2 correspondingly as the same roads will be used in both Variants. It is estimated that the ventilation of the immersed tunnel will be utilised via the entrance and exit of the tunnel. Thus, the atmospheric environment of the entrance and the exit of the tunnel will be negatively impacted due to the concentrated emissions of a significant amount of vehicles. The impacts on the acoustic environment are expected to be weaker in the case of the tunnel, instead of the bridge, as the noise produced by the vehicles will be partially absorbed by the walls of the tunnel. These impacts affect an area of approximately 2,4km (estimated length of the tunnel).

Conclusions

Based on the available data and the impacts estimated for the alternative solutions, the solutions A1 and A2 were found to be preferable to the solutions F1 and F2.

10.4.7 TUNNEL UNDER B&H - ALTERNATIVE G

The alternative G refers to the construction of a road tunnel under the B&H area. The alignment of the tunnel has not been designed. The following can be assumed with a certain degree of certainty:

- The tunnel will have to be constructed north of the town of Neum, which is spread across the coastal area of B&H.
- The tunnel would have to cover a distance of 8km to connect with the existing road network of Croatia, west and east of the border with B&H.

Effects on Land Uses

For the construction of a tunnel, detailed maps need to be compiled, concerning the geological conditions of the area, where the tunnel will be constructed. The geotechnical uncertainties during the construction phase have to be taken into account, as well as the impacts on the environment in case of an accident inside the tunnel, during the operation phase. During the design phase of the alignment of the tunnel, test drilling will have to be carried out inside the B&H territory. It has to be pointed out that a road tunnel of such magnitude cannot be constructed without the provision of ventilation shafts (or tunnels) and the relative access roads to them. The access roads will be used for the maintenance of the electromechanical equipment that needs to operate for the ventilation of the tunnel. In case the construction of ventilation tunnels (instead of shafts) is permitted by the prevailing geotechnical conditions, the maintenance can be carried out from inside the tunnel and no access roads are necessary. Nevertheless, safety exits for pedestrians and vehicles will have to be constructed. These works will have to connect with existing roads inside the territory of B&H. Tunnel construction and operation may also affect the ground water of the area which is used for the water supply of the town of Neum.

Effects on Archaeological monuments

The archaeological site of Vranjevo Selo can be negatively impacted during the construction phase of the tunnel, if it is situated in close vicinity to the tunnel and if the overburden of the tunnel is not significant. The exact alignment of the tunnel has not been determined.

Effects on atmospheric - acoustic environment

The operation of a road tunnel will cause negative impacts on the atmospheric environment of the area, were fumes from the road traffic inside the tunnel come out of the tunnel. The operation of the road tunnel in not expected to have significant impacts on the acoustic environment of the tunnel alignment, as the walls of the tunnel will absorb part of the noise produced by the movement of the vehicles inside the tunnel.

Conclusions

To sum up, a detailed impact assessment for the construction and operation of a road tunnel cannot be carried out, due to the insufficient data. It is pointed out, that alternative G is not entirely independent of the B&H territory.

10.4.8 ADRIAN - IONIAN HIGHWAY - ALTERNATIVE H

The alternative H refers to the possibility of the use of the Vc corridor by Croatian traffic, through the B&H territory. The Bosnian section of the Corridor Vc is planned to be 330 kilometres long, running from Svilaj on Bosnia-Herzegovina's northern border with Croatia to the southern border with Croatia near Ljubuski. The motorway is divided into four Lots, running north to south:

- LOT 1: Section Svilaj (Northern Border with Croatia) - Doboj South
- LOT 2: Section Doboj South - Sarajevo South (Tarcin)
- LOT 3: Sarajevo South (Tarcin) - Mostar North,
- LOT 4: Mostar North - Southern Border with Croatia53.

The Corridor Vc in B&H is presented in a relevant figure in Appendix **. Since today there is no proposed road section of Adrian - Ionian motorway in order to connect the two Croatian territories.

10.5 Evaluation of alternative solution based on environmental criteria

For the analysis of the alternative scenarios, the following evaluation of the environmental indicators is applied:

Table 23 Environmental Evaluation Classes and Values Used in MCA

Environmental evaluation classes	Values used in the MCA
Significant positive effects	0
Medium positive effects	1
Weak positive effects	2
No impacts	3
Weak negative impacts	4
Medium negative impacts	5
Significant negative impacts	6

During the construction phase, according to the table 24, the alternative solution ***E2*** received the highest evaluation (smaller environmental impacts), while during the operation phase, according to the table 25 alternative solutions ***A1*** and ***F1*** received the highest evaluation (smaller environmental impacts). The following table present the environmental scoring of the alternative solutions by using the cumulative results of the impacts during construction and operation phase. It is mentioned that to that scoring the impacts during construction have a weight factor of 25% whereas the impacts during operation have a weight factor of 75%.

[53] Corridor Vc motorway, Bosnia - Herzegovina (EBRD Annual Meeting, London, May 2009)

Table 24 MCA Environmental Impact Indicator Values

Alternative solutions	Marine environment	Terrestrial environment	Protected areas	Manmade environment	TOTAL*	Environmental Score Ranking**
A1	10,5	19,5	4,0	6,8	40,8	10,0
A2	10,5	18,0	4,0	13,3	45,8	6,1
B	10,0	20,3	4,0	11,8	46,0	5,9
C	9,0	22,0	4,3	11,0	46,3	5,7
D	12,0	22,5	5,0	14,0	53,5	0,0
E1	14,8	19,5	4,8	9,5	48,5	3,9
E2	14,3	17,3	4,8	13,3	49,5	3,1
F1	12,0	19,3	4,3	7,0	42,5	8,6
F2	12,0	15,0	3,3	12,8	43,0	8,2
G	9,0	18,5	4,0	11,3	42,8	8,4
H	9,0	20,3	3,3	11,8	44,3	7,3

**Higher values correspond to greater environmental impacts*
*** Higher values correspond to the more environmental friendly solutions*

As a result the most environmental friendly solution is the alternative A1 (Bridge over the sea with new roads in the Peljesac Peninsula). The evaluation of the alternative solutions, according to environmental criteria, is summarized in the two tables that follow.

Table 25 Construction Phase

Alternative solutions	*Natural Environment*									*Manmade Environment*		
	Avifauna [54]	Marine Habitats [55]	Sea Pollution[56]	Sea Turtles[57]	Other species of fauna[58]	Terrestrial Habitats - Flora[59]	Inland water resources[60]	Protected Areas[61]	Geomorphology / Landscape[62]	Land Uses [63]	Atmospheric and Acoustic Environment [64]	Archaeological Monuments[65]
A1	3	4	4	4	4	5	4	4	5	5	4	3
A2	3	4	4	4	3	4	4	4	4	4	4	3
B	4	4	3	3	4	4	5	4	4	4	4	3
C	5	3	3	3	5	5	5	5	5	4	4	3
D	5	3	3	3	5	5	4	5	5	5	5	4
E1	3	4	4	3	4	5	4	4	5	4	4	3
E2	3	3	3	3	3	4	4	4	4	4	4	3
F1	4	6	6	6	4	4	4	5	4	6	4	3
F2	3	6	6	6	3	3	3	4	3	3	3	3
G	3	3	3	3	4	3	6	4	4	4	4	4
H	5	3	3	3	5	5	4	4	5	5	5	4

[54] Medium negative score indicates the construction of a road of significant length through *Aquila chrysaetos* habitat.
[55] High negative score indicates possible occupancy of *Posidonia oceanica* habitat.
[56] Negative score indicates that the alternative will cause significant impacts on quality of the marine water (production of suspended solids).
[57] Negative score indicates the occupancy and disturbance of sea turtle marine habitat.
[58] Negative score indicates the construction of roads (of significant length) through herpetofauna habitats.
[59] Negative score indicates the occupancy of terrestrial habitats inside a proposed Natura 2000 site.
[60] The water supply of the town of Neum comes from a karstic system north of the town. The construction of a motorway north of the town might have negative impacts on the hydro-geology.
[61] Negative score indicates new roads (of significant length) travelling through protected areas.
[62] High negative score is associated with the construction of new roads of long distance (alternative D) and the construction of the motorway in B/H through an area where it will be visible by the town of Neum (alternative B)
[63] High negative score indicates occupancy of marine protected area and construction of new roads. Sea pollution may result to severe impacts to the aqua cultures.
[64] Medium negative impacts are expected in B due to the position of the solution in comparison to the Neum settlement.
[65] In D solution the negative score refers to the construction of new roads of significant length across the peninsula, adjacent to several monuments.

Table 26 Operation Phase

Alternative solutions	*Natural Environment*									*Manmade Environment*		
	Avifauna[66]	Marine Habitats[67]	Sea Pollution[68]	Sea turtles[69]	Other species of fauna[70]	Terrestrial Habitats - Flora[71]	Inland water resources[72]	Protected Areas[73]	Geomorphology/ Landscape[74]	Land Uses[75]	Atmospheric and Acoustic Environment[76]	Archaeological Monuments[77]
A1	3	3	4	3	4	4	4	4	4	1	1	3
A2	3	3	4	3	4	3	4	4	4	5	5	4
B	3	3	4	3	4	4	5	4	4	5	4	3
C	4	3	3	3	4	4	5	4	4	4	4	3
D	4	4	5	4	5	4	4	5	5	5	5	4
E1	3	5	6	5	4	4	4	5	4	5	1	3
E2	3	5	6	5	4	3	4	5	3	5	5	4
F1	3	3	3	4	4	4	4	4	4	1	1	3
F2	3	3	3	4	3	3	3	3	3	5	5	4
G	3	3	3	3	3	3	6	4	3	3	4	4
H	4	3	3	3	4	4	4	3	3	4	4	3

[66] Low negative score indicates the operation of a road of significant length through *Aquila chrysaetos* habitat.
[67] Negative score indicates sea pollution with possible negative impacts on *Posidonia oceanica* habitat, due to ferry traffic.
[68] Negative score indicates pollution during the operation phase, due to: petroleum products from ferry traffic or wash out from the bridge
[69] Negative score indicates the occupancy of sea turtle marine habitat or the increased movement of ferries in areas used by sea turtles.
[70] Negative score indicates the increase in traffic in roads that go through herpetofauna habitats (negative impacts refer to death of herpetofauna species and degradation of quality of roadside ecosystems, due to noise and air pollution).
[71] Low negative score indicates degradation of roadside ecosystems, due to air pollution and wash outs from the road.
[72] The water supply of the town of Neum comes from a karstic system north of the town. The operation of a motorway north of the town might have negative impacts on the hydro-geology.
[73] Negative score refers to the operation of a road network of significant length inside protected areas (air pollution, noise pollution etc.).
[74] High negative score is associated with the operation of new roads of long distance (alternative D) and the operation of a motorway in B/H through an area where it will be visible by the town of Neum (alternative B)
[75] Medium negative score refers to the degradation of the quality of the roadside environment, from the increase in traffic. Medium positive score refers to the positive impacts on the environment of settlements when bypasses are constructed.
[76] Medium negative score indicates that the alternative goes near settlements, causing increased noise and air pollution. Medium positive impacts indicate that the alternative uses bypasses of settlements.
[77] In all other solutions, the negative score refers to the increase in traffic in the existing roads, in case the bypasses are not constructed. The operation of the Ston bypass and the Sparagovici bypass will result in decreased traffic in the archaeological sites in the area.

10.5.1 ADDITIONAL COMMENTS ON PROJECT SCORING

Additional comments are warranted to address some last minute comments on environmental issues. Each alternative was given a score according to the environmental criteria taken into account and this score is unique for each alternative. Therefore, the proposed alternatives are differentiated from each other. Each environmental criterion used in the evaluation of the alternative solutions, includes sub-criteria (for example the criterion "*terrestrial environment*" includes the sub-criteria "*avifauna*", "*other species of fauna*", "*terrestrial habitats-flora*", "*inland water resources*" and "geomorphology-*landscape*") that were all taken into account during the ranking of the solutions. scoring the impacts during construction have a weight factor of 25% whereas the impacts during operation have a weight factor of 75%.

In the frame of preparing the final environmental document the differences between alternatives become bigger. These differences are presented in the yellow column of the following table. According to this column the Environmental Score Ranking of each alternative is presented in that table.

Table 27 MCA Environmental Impact Indicator Values

Alternative solutions	Marine environment	Terrestrial environment	Protected areas	Manmade environment	TOTAL*	Environmental Score Ranking**
A1	10,5	19,5	4,0	6,8	40,8	10,0
A2	10,5	18,0	4,0	13,3	45,8	6,1
B	10,0	20,3	4,0	11,8	46,0	5,9
C	9,0	22,0	4,3	11,0	46,3	5,7
D	12,0	22,5	5,0	14,0	53,5	0,0
E1	14,8	19,5	4,8	9,5	48,5	3,9
E2	14,3	17,3	4,8	13,3	49,5	3,1
F1	12,0	19,3	4,3	7,0	42,5	8,6
F2	12,0	15,0	3,3	12,8	43,0	8,2
G	9,0	18,5	4,0	11,3	42,8	8,4
H	9,0	20,3	3,3	11,8	44,3	7,3

**Higher values correspond to greater environmental impacts*
*** Higher values correspond to the more environmental friendly solutions*

As shown in the table that follows the solutions including ferries were given high values (5 & 6 in sea pollution), indicating medium and significant negative impacts. As for the issue of polluting the marine ecosystems for alternatives E1 and E2 (Short distance ferries) we could evaluate with more negative value (value 6 instead of value 5) the environmental criteria "marine habitats", "protected areas" and "land uses" (see the following table). This should give greater difference to the alternatives E1 and E2.

1. The position of the alternative solutions as regards to the areas of the Network Natura 2000, is briefly clarified as follows (and is presented in detail in the chapter "Impact Assessment"):

   - A1 alternative is partly within the SPA areas HR1000031 and HR 1000036 (as shown in Figure 1.1-5).
   - A1 alternative is partly situated within the SCI areas HR20001364, HR3000163, HR4000015 and HR50000031 (as shown in Figure 1.1-6).
   - The same applies for the A2 alternative.
   - The alternative B is partially situated within the SCI area HR50000031 and SPA area HR1000031 (as shown in Figures 1.3-2 and 1.3-3).
   - The alternative C goes through the SCI area HR50000031 and the SPA area HR1000031 (as shown if Figures 1.4-3 and 1.4-4).
   - The alternative D is situated within the SPA area HR1000036 (as shown if Figure 1.5-7)

- The alternative D is situated within the SCI area HR2001364 (as shown in Figure 1.5-8).
- The E1 and E2 alternatives go through the same Natura 2000 Network areas as alternative A1.
- The F1 and F2 alternatives go through the same Natura 2000 network areas as A1.
- In alternative G, the connection roads in the Croatian territory will go through Natura 2000 areas.
- In alternative H, no specific alignment exists.

2. Negative effects were taken into account for alternatives D (long distance ferry) and E (short distance ferry) related to the pollution of marine ecosystems from the frequent movements of the ferries. More precisely:

    - For alternative D, negative effects are expected on marine ecosystems, related to the pollution from the frequent movements of the ferries. For this reason, if this alternative is going to be implemented, appropriate actions must be taken.
    - For alternative E,: the effects on marine ecosystems will involve the pollution of the Mali-Ston bay by the continuous movement of the ferries. The continuous operation of the ferries relates to oil and lubricants leakage into the sea. Deeper currents of the Mali-ston bay very often are directed to the South-east. As a result significant impacts to aquacultures may occur. The impacts may be severe in case of an accident where oil spill may occur.

The pre-feasibility study cannot result in the prohibition of navigation in the bay. In any case, the problem of pollution is pointed out in the environmental section of the study.

3. The possible effects during the construction of the bridge are presented analytically in the attached environment report. Problems may occur if large quantities of sediments are lifted continuously, something that can be avoided with the planned method of construction (piles driven into the sediment). In this section the following are proposed:
    - To install automatic current meters with telemetric data gathering capacity in order to facilitate decision-making regarding performance of the submarine works.
    - The investigation of possible impacts on *Posidonia oceanica* meadows will be one of the main objects of the appropriate assessment study. This has to be applied for any proposed alternative solution which includes marine works.

Table 28 Operation Phase

Alternative solutions	*Natural Environment*									*Manmade Environment*		
	Avifauna	Marine Habitats	Sea Pollution	Sea turtles	Other species of fauna	Terrestrial Habitats - Flora	Inland water resources	Protected Areas	Geomorphology/ Landscape	Land Uses	Atmospheric and Acoustic Environment	Archaeological Monuments
A1	3	3	4	3	4	4	4	4	4	1	1	3
A2	3	3	4	3	4	3	4	4	4	5	5	4
B	3	3	4	3	4	4	5	4	4	5	4	3
C	4	3	3	3	4	4	5	4	4	4	4	3
D	4	4	5	4	5	4	4	5	5	5	5	4
E1	3	5	6	5	4	4	4	5	4	5	1	3
E2	3	5	6	5	4	3	4	5	3	5	5	4
F1	3	3	3	4	4	4	4	4	4	1	1	3
F2	3	3	3	4	3	3	3	3	3	5	5	4
G	3	3	3	3	3	3	6	4	3	3	4	4
H	4	3	3	3	4	4	4	3	3	4	4	3

11 COST-BENEFIT ANALYSIS

11.1 CBA Methodology

11.1.1 APPLIED METHODOLOGY

Cost - Benefit Analysis (CBA) is one of the major tools applied to evaluate development options for connecting two parts of the EU/Croatia land territory. Due to technical and transport characteristics of the considered options it is however, not the only tool that had to be used for proper evaluation of a variety of options identified in the Terms of Reference (ToR) and by the Advisory Committee. The entire evaluation process is anchored by the provisions of ToR to the Multi-criteria Assessment (MCA). This indicates that many other factors in addition to a simple comparison of costs and benefits have to be considered to meet the selection criteria. Other elements of the evaluation process are described later in this report. This section concentrates on CBA.

11.1.2 DATA AVAILABILITY

The limitations of data on various aspects of the considered development options and their limited comparability due to specifics of these options impacted the CBA approach. Primary data sources are limited. Some of the development options are still in a very initial development stages so no hard data are available. Furthermore, lots of primary data sources are inconsistent or even contradictory. For example, the costs of security establishments for the Neum Bypass were evaluated differently by the Croatian and Bosnian partners. Final requirements of European Commission for these establishments are not precisely defined yet. This creates a significant uncharted area that allows for various interpretation and estimates of cost factors.

The analysis was completed as a as much as possible based on verified primary data sources. Where the data were not available, the cost and benefit estimates were made based. A number of assumptions, benchmarking, indicators and estimates had to be used for the purpose of CBA and MCA evaluation. To accomplish that, the consultant used data typical for similar construction works in the area, region or worldwide. This approach was necessary for the Consultant to be impartial and not to side with information received from a particular interest. The data were used consistently and in a logical sequence. As a result, the CBA results are fully justified and provide a sufficient basis for development options prioritization. The assessment meets the criteria of comprehensiveness and fairness.

11.1.3 CBA VERSUS MCA

There are two basic approaches to MCA and CBA usage in the process of transport investment evaluation:

- The first approach involves conducting MCA instead of CBA. It is usually implemented if there are no sufficient or reliable data for reasonable completion of CBA. Such usage of the MCA methodology takes place when other than economic and financial criteria are critical, significantly impact project assessment, and reflect beneficiaries' or investors' preferences. In these cases, project selection is made primarily on other criteria than cost and benefits. It is used frequently for transport investments although costs and benefits for such investments are

significant. This is because transport infrastructure investments significantly impact social, economic development, and public policy matters. Consequently, decisions regarding these projects are not based on a pure cost and benefits comparison.

- The second approach treats CBA as a component of MCA. It involves: a) conducting CBA to the level that is allowed by data availability, b) utilization of CBA results as input and element of a multi-criteria project assessment. Even if, because of limited information, the CBA is simplified or based on general assumptions/benchmarking, the consideration of its results in the scheme of MCA assessment, together with other criteria and indicators, usually provides fair and sufficient project evaluation. This has been the case in this pre-feasibility study. Per ToR, the Beneficiary decided that MCA with a CBA component will be used for selecting the preferable development option. A fair cost and benefit assessment is needed to properly judge the projects and the impact of the considered public investment on economic development. As for public investment social welfare and quality of life factors will have to be consolidated during the MCA with the CBA component.

The completed CBA assessment concentrates mainly on direct benefits. Indirect benefits have been considered through estimation and in sensitivity tests. Induced benefits were omitted. This is not a full-fledged cost-benefit analysis which is customarily and methodologically conducted during feasibility studies. This analysis is however fully justified and serves the purposes of the pre-feasibility study. A complex cost-benefit assessment will be in the scope of future feasibility studies for the preferred option.

The proposed approach insures appropriate consideration of the EU tax-payers interests, consideration of the principles of the EU cohesion and transport policies, and the EU objectives to spend public funds for creating equal development opportunities in all regions of the Union. Usually new member states receive additional funding to insure mutually beneficial and coordinated development of the overall EU transport systems at their territories. One must also remember that, new member states' citizens also contribute to the EU budget.

11.1.4 SCOPE OF CBA

The applied CBA involves:

- Assessment of investment, maintenance and operation costs,
- Evaluation of monetized benefits from time savings represented by travel time savings,
- Assumptions on project staring, duration and ending dates.
- Conducting CBA calculations

The consultant attempted, wherever it was justified, to consider the recommendations and comments of the interested parties. For example, the consultant considered the B&H recommendations on the expected date for joining the European Union, or the Croatian suggestions on the costs of ferry services. If the recommendations received from various sources were contradictory, the consultant used its professional experience and judgment to make appropriate choices.

The CBA was performed for all the considered development options at the base case scenario assumptions discussed further in the following subsections.. Subsequently, a number of sensitivity tests were completed. The sensitivity tests were done mainly for the most likely development options namely the Peljesac bridge and the Neum bypass.

11.1.5 GENERAL ASSUMPTIONS FOR CBA

Data

- The CBA was completed based on generally available public data and data provided by the stakeholders, results of the Origin-Destination Surveys (ODS) and site visits, and meetings conducted by the Consultant.
- The assumptions for the assessment were also checked for compatibility and consistency with the available studies, expertise, and development options description[78]. In addition benchmarking was used for the items that could not be precisely identified. It is important to recognize that the majority of the available data sources have been developed prior to July 1, 2013 when the Republic of Croatia joined the European Union. These data do not consider many new factors and circumstances such as for example capacity expansion at the Border Crossing Points (BCP) in the Neum area in May 2013, and the content of international agreements on border traffic signed on June 19, 2013. The analysis presented by the Consultant considers these new circumstances. This was accomplished by:

    - Acquisition and assessment of the newest primary data by a series of meetings and interviews
    - Site visits, meetings with national, regional and local authorities, and observation of traffic patterns in 2013, before and after Croatia joining the European Union.
    - Development of a traffic model by the Consultant that provides a complex traffic patterns overview and assessment for the entire area that may be impacted by the introduction of any of the considered development options (not only the bridge option). The traffic distribution modelling efforts presented by the Consultant encompass a larger area and more vehicle flows than it was presented in the previous studies.

- A number of assumptions were made for CBA, consistently with the Terms of Reference, to address and response to the objectives of the Pre-feasibility study (PFS). For clarity and transparency purposes, some data standardization and equalization were done. It was however insured, that the level of presented analyses is sufficient for full accomplishment of the objectives of the study – selection of the preferred option to connect the separated EU/Croatia land territory.

11.2 Base Case Scenario General Assumptions

The CBA was completed for the base case scenario that reflects the most likely situation and involves critical inputs and outputs from the point of view of a project evaluator.

The following general assumptions were made for the basic scenario:

- The analysis period was set for 30 years - 2017- 2046. The duration of the assessment is consistent with the EU guidelines[79].
- The earliest capital outlay for any of the considered development options is scheduled for 2017. All the current data were adjusted to reflect the passage of time and provide best data estimates for 2017.
- Economic discount rate was assumed at 5%. This is consistent with the EU guidelines[80].

[78] For example, the Peljesac bridge feasibility study by IGH provided by Hrvatske Ceste according to the Terms of Reference which provides a complex assessment of the regional transport system and traffic patterns.
[79] The guidance on the methodology for carrying out cost-benefit analysis, Working Document No. 4, European Commission, 2006
[80] The guidance on the methodology for carrying out cost-benefit analysis, Working Document No. 4, European Commission, 2006

- The date for B&H accession to the EU was assumed to be 2025 (eleven years from 2014). This reflects the B&H recommendations and comments submitted to the Advisory Committee[81]. After this date, the benefits for the development options affected by B&H joining EU were reduced with consideration of specific characteristics of each scenario (impacted traffic flows).
- The dates for the completion of development options (dates from which the benefits are estimated) were assumed based on the primary data collected and technical analysis of the preparation and implementation process, and their current status
- The residual value was calculated based on the economic life of the infrastructure elements (30 years for road infrastructure, 50 years for bridges and tunnels). The period for this analysis is, as stated earlier - 30 years.
- Maintenance and operation costs were assumed based on the EU benchmarks for infrastructure elements with consideration to the specific characteristics of each of development option. The advice of the project Advisory Committee was also taken under consideration.
- It was assumed that capital outlays are made at the last year of construction For comparing and selecting various development options, this approach is justified, if applied consistently.
- Other assumptions are shown in the table below.

Table 29 CBA Assumptions for Development Options

Development Options	Completion Date	Residual value ratio (% of capital costs)	Maintenance and operations costs ratio (% of capital costs)
A1	**2018**	40%	0,5%
A2	**2018**	40%	0,5%
B	**2023**	10%	5,0%
C	**2024**	10%	5,0%
D	**2017**	10%	0,5%
E1	**2017**	10%	1,0%
E2	**2017**	10%	1,0%
F1	**2020**	40%	0,5%
F2	**2020**	40%	0,5%
G	**2025**	40%	0,5%
H	**2030**	20%	0,5%

[81] In their comments dated September 27, 2013, the B&H delegation to the Advisory Committee indicated that: *The Consultant should take into account the process and commitment of B&H to join the EU at a given period of time. For the purpose of this study, we can anticipate three scenarios: July 1th 2023, July 1th 2025 and July 1th 2027. Consultant should consider these proposed dates (periods) for discounting the financial value of Study options.* These requests were repeated at the last Advisory Committee in December 2013. The Consultant has agreed to include a middle scenario, the year 2025, to the base case scenario assumptions.

11.3 Specific Assumptions for Benefit and Costs Assessment

11.3.1 ECONOMIC BENEFITS

- Direct benefits for this CBA were represented exclusively by travel time cost savings. This is sufficient for the purposes of the Pre-feasibility Study. It is possible that additional benefits are identified in the feasibility study for the preferred option. Possible additional benefits are for example costs of avoided road accidents and fatalities. If these additional benefits are related to the size of vehicle flows, they will definitely increase overall benefits for scenarios with larger traffic such as bridge development options at the expense of the Neum by-pass and road corridor via B&H options to which smaller flows are diverted.
- Transport infrastructure investments may also create indirect economic development benefits. A detailed quantitative identification of the economic development indirect benefits is a very challenging, in particular in the limited data situations, like this experienced in this study. To indicate such an option, several sensitivity tests on impact of the estimated economic development benefits were conducted for two most competitive options: the bridge and the Neum bypass. They are described later in the text of this report. It is however, worth mentioning at this point, that although the bridge options may generate such indirect benefits, the Neum by-pass and Corridor via B&H options operating under the extraterritorial regime do not generate such benefits until B&H enters EU, these roads are transferred from a sealed corridor to a typical, standard by-pass connected with a local road network.

11.3.2 TRAVEL TIME VALUE

A JASPERS methodology was implemented to valuate travel time savings (express them in monetary terms). The JASPERS methodology guidelines developed for other EU new-members states in the 2007-2013 period were used[82]. Based on this methodology, the Value of Travel Time Savings (VTTS) was calculated. The following assumptions were made for that purpose:

- VTTS for business and non-business trips were calculated separately for: a) Croatian/B&H passengers, and b) average EU27 passengers. This reflects differences between standard of life and income levels of these groups of individuals[83].
- VTTS for business and non-business trips for Croatian passengers were calculated based on the HEATCO[84] unit values for average EU27, adjusted to the Croatian GDP level (coefficient 53% was used, according to Eurostat data for 2002 – this reflects the share of Croatian GDP in the EU GDP[85]). As the HEATCO values were calculated for the year 2002, the adjustment to 2017 was conducted based on the Croatian GDP growth rate – historical and forecasted[86].
- VTTS for business and non-business trips for EU27 passengers were calculated based on the HEATCO[87] unit values for EU27, adjusted to 2017 based on EU27 GDP growth rate – historical and forecasted[88].
- Published historic data and Origin-Destination Surveys (ODS) indicate that in the peak season (July-August) about 50% of traffic in the targeted area are non-Croatia and B&H vehicles. In the remaining months, the overwhelming majority of traffic are Croatian and B&H vehicles. Consequently:
    - It was then assumed, that 50% of traffic in the peak season will be valued at international value of time rates, and 50% at Croatian rates.

[82] Blue Book for Road Infrastructure Projects in Poland, JASPERS, 2008
[83] International tourists visiting Croatia usually represent a middle or upper class in their societies, with incomes equal or exceeding median income for the country.
[84] HEATCO, Developing Harmonised European Approaches for Transport Costing and Project Assessment, 2006
[85] http://epp.eurostat.ec.europa.eu,
[86] http://epp.eurostat.ec.europa.eu,
[87] HEATCO, Developing Harmonised European Approaches for Transport Costing and Project Assessment, 2006
[88] http://epp.eurostat.ec.europa.eu,

- During the rest of the year, the travel time savings valuation (benefits) was done at the Croatian rates. (This assumption is justified since international traffic in the area off-season is minimal)

- It was assumed that business trips account for nine percent of total trips in the targeted area. This assumption was made based on the ODS surveys completed by the Consultant.
- There are two approaches for measuring travel time value increase in time.
  - One is to assume travel time increase at a given rate, usually equal to the GDP rate.
  - The second approach assumes no travel time value increase.
  - It was assumed for the purposes of this assessment that the travel time value will increase at a rate equal to the rate of growth for GDP.

- Time savings in peak season and off-season months were multiplied by the respective average value of one hour of trip, which was calculated as the weighted average of business and non-business trips value.

Table 30 Summary of CBA Assumptions

CBA Assumptions (Basic Scenario)		
GDP growth 2016-2041 (time value increase ratio)	2017-2020: growth rate 2% 2020-2030: growth rate 3% 2030-2046: growth rate 4%	
Rate of Increase of Value of Time	As above	
Share of business trips	9%	
Value of business time	22,00 €/h (summer)	15,17 €/h (rest of the year)
Value of non-business time	6,57 €/h (summer)	4,53 €/h (rest of the year)
Value of time (average)	7,95 €/h (summer)	5,49 €/h (rest of the year)
Cost of a fatality	NA	
Traffic growth ratio (30 years)	1,78 for 30 years (2017 – 2046) 2010-2046 – annual traffic growth rate of 2%,	
Vehicle occupancy rate	2 pass/veh	
BCP capacity (one direction)	30 veh/hour x 3 lines	
Vehicle Speed at BCP	3 km/h	
Benefits ratio after B&H accession to the EU (Remaining benefits after the B&H accession) per development option	A1, A2, F1, F2: 40% B,C, D, G: 10% E1,E2: 20% H: 100%	

11.3.3 PROJECT IMPLEMENTATION PERIOD

Assumptions on implementation period for development options are provided in the following table. They were made based on: a) engineering evaluation of typical time needed for each of the activities listed in the table, b) evaluation of the stage at which each development option is in 2013. Data were acquired through interviews and assessment of the available secondary information. This provided for a realistic assessment of the time needed for project implementation, and estimate of capital outlay schedules.

11.4 Capital Outlays for Development Options

Capital expenditures for the considered development options were estimated based on the available primary and secondary data sources. A Delphi expert opinion method was also used to obtain the most objective evaluation of costs of investments.

The provided estimates are generic, in the meaning that they estimate costs for particular type of structure but not for a concrete design. This approach was necessary since the majority of the development options are still in the very early design stage. Plus this is consistent with the ToR which does not call for any particular design preference to be considered (for example for the Peljesac bridge). Furthermore, many issues related to the cost of investments were raised during the Advisory Committee consultations. For example, (although this project is the most advanced from all addressed options), there were discussions regarding the cost of the Peljesac bridge with the peninsula roads development option. The consultant decided to disassociate itself from any particular design-related estimate provided by the interested parties. The consultant used a multiple expert assessment and international benchmarking techniques to develop its estimate. This is justified, since even for this project critical elements of the design have not yet been agreed upon. There have been several engineering designs of the bridge developed in the last years. The last one included a 50 meter air draft, allegedly to provide large vessel traffic to the non-existing Port of Neum. The tallest cruise vessels in the World have about 67 – 70 meters air draft, the largest vessels that called the Port of Dubrovnik have about 63 – 66 meter air draft, while the majority of cruise fleet sailing the Adriatic waters have 30 to 45 meters air draft[89]. At this juncture, it is difficult to assume that such large vessels will travel to the Port of Neum. The consultant was informed during its visits with B&H government officials in Sarajevo and Neum that there are no immediate plans to even start design works for a large cruise terminal in the Neum area. A small marina may be planned. Furthermore, in light of the environmental assessment results presented in this study, any kind of large vessel and frequent ferry services in the Neum Bay area may be very environmentally dangerous for local aquaculture industry due to pollution risks and the currents in the bay which push water towards the Mali Ston area. This industry puts bread on tables for thousands of local residents and any water pollution may have disastrous effects for the local population. It is therefore; quite possible that the current design of the bridge may change. A lower bridge may be built, at a much lower cost than that used for the study CBA calculations.

The detailed cost and benefit calculations will be made for the selected option in relevant feasibility studies. It was also decided that data from particular and available reports are either not current anymore, to some extent biased, or difficult to compare since the design process for these projects is in various stage. In light of the above, and based on the provided data and other assessment methodology generic estimates were made. The cost estimate procedure based primarily on expert opinion and benchmarking with reasonable consideration of secondary data. This seems to be the most effective approach under the circumstances.

[89] The largest cruise vessels that ever called the Port of Dubrovnik are: MS Voyager of the Seas with air draft of 63 meters; MS Divina with air draft of 67 meters, MS Regal Princess about 67 meters air draft.

The calculations were based on the primary data collected and provided to the Consultant, and European benchmarks[90]. Special attention was given to the European Court of Auditors report from 2013, which provides the analyses of road construction costs for EU funded infrastructure projects. Also, the organization of European Road Research Institutes was contacted for input to this analysis. The primary data were verified by the Consultant and compared to European benchmarks. Wherever the significant discrepancies in the primary data occurred, the relevant European benchmark was used for unit costs of the infrastructure. The final unit costs values are presented in the table below. They reflect the estimates verified according to the procedures described above. In some instances, first benchmarked unit costs were assessed, the size of infrastructure elements was identified, and final investment costs were calculated for the development options (table below).

One must realize, that the cost of the Schengen security equipment and investment for development options: Neum bypass and extraterritorial corridor through B&H is very high when compared with other cost elements for these investment. This is particularly visible for the Neum by-pass option where the security related fixtures account for about half of the total investment cost. This raises a justified question if such expenditure is worth this money. The cost estimates did not include the costs of dismantling a minimum a portion of these security establishments when B&H joins the EU, to allow for connecting this by pass with local road network. Also, the connection costs have not been included. This issue becomes particularly important when the expected time for B&H EU accession is shortened. Logically thinking, one might say that the support for funding this investment from the European taxpayers' monies is worth considering only if the European Commission expects lengthy accession procedures for Bosnia and Herzegovina, approximately 30 years or more. Please see the subsection on the CBA sensitivity tests, further in this report.

[90] What Causes Cost Overrun in Transport Infrastructure Projects?, Bent Flyvbjerg, Mette K. Skamris Holm and Søren L. Buhl, 2004; Analysing International Tunnel Costs, Nathaniel Efron, Megan Read, 2012
Road infrastructure cost and revenue in Europe, Claus Doll (Fraunhofer-ISI), Huib van Essen (CE Delft), 2008; Are EU Cohesion Policy funds well spent on roads?, European Court of Auditors, 2013

Table 31 Implementation Period for Development Options:

Option	Feasibility study	EIA and environmental permit	Spatial Plan	Expropriation	Detailed design	Construction permits	Construction	Total implementation period (months)
A1	4	0	0	0	6	6	**36**	**52**
A2	4	0	0	0	6	6	**36**	**52**
B	12	12	12	12	12	12	**36**	**108**
C	12	12	12	12	12	12	**36**	**108**
D	4	0	0	0	6	6	**24**	**40**
E1	12	6	6	0	6	6	**24**	**60**
E2	12	6	6	0	6	6	**24**	**60**
F1	12	12	6	0	6	12	**24**	**72**
F2	12	12	6	0	6	12	**24**	**72**
G	12	12	12	0	36	24	**36**	**132**
H	24	24	24	24	36	24	**60**	**216**

Table 32 Infrastructure Unit Costs by Development Options

Unit costs [mln EUR/km]	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Motorway (4 lanes)				13,23							10,90
Fast roads (2 lanes)	6,03		6,20		3,28	6,03		6,03			
Access roads	6,66	6,66		1,50		6,66	6,66	6,66	6,66	1,50	
Tunnels								250,00	250,00	100,00	
Bridges	83,17	83,17									
Ferry harbour [mln EUR/unit]						50,00	50,00				
Vehicles (ferry boats) [mln EUR/vessel]						1,13	1,13				
Land acquisition			1,50	0,80							1,00
Schengen requirements			8,00	8,00							

Table 33 Investment Costs for Development Options

Investment costs [mln EUR]	A1	A2	B	C	D	E1	E2	F1	F2	G	H
including:											
4-lane roads				241,7							1090
2-lane roads	109,1		68,8		121,4	109,1		109,1			
Access roads	80,0	80,0		44,55		80,0	80,0	80,0	80,0	7,5	
Tunnels								577,5	577,5	1200,0	
Bridges	202,9	202,9									
Ferry harbour						50	50				
Vehicles (ferry boats)						2,26	2,26				
Land acquisition			16,7	17,8							100,0
Schengen requirements			88,8	177,8							
TOTAL [mln EUR]	**392,1**	**282,9**	**174,3**	**481,9**	**121,4**	**241,4**	**132,3**	**766,6**	**657,5**	**1207,5**	**1190,0**

11.5 Cost Benefit Analysis Results (Base Case Scenario)

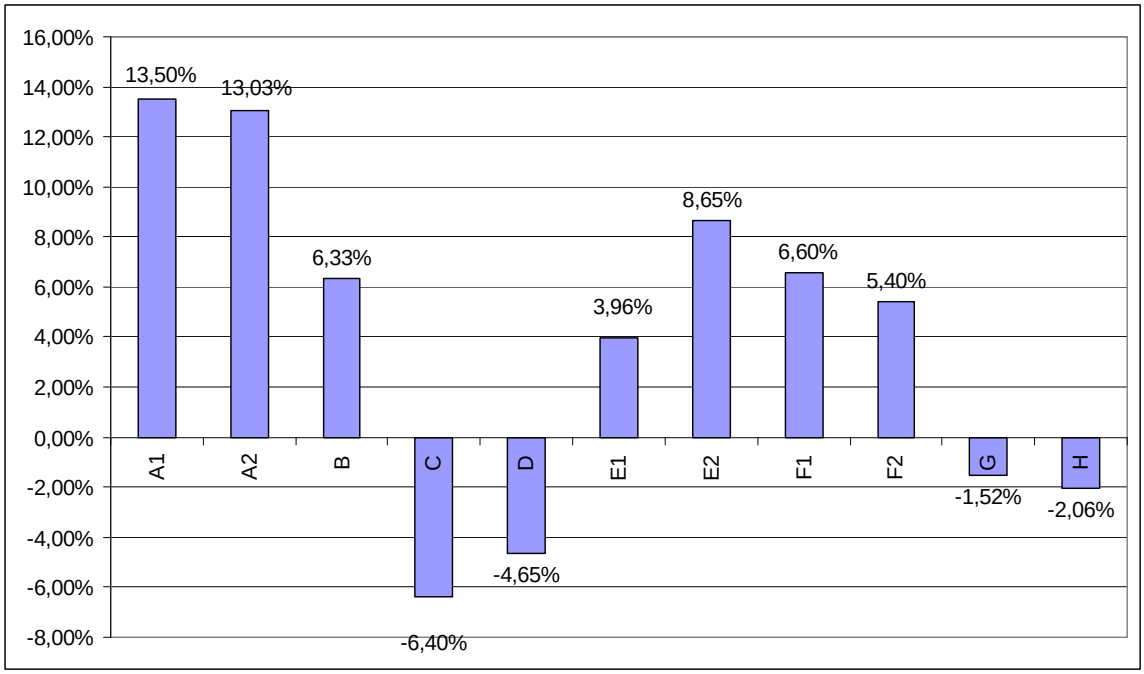
11.5.1 CBA RESULTS FOR BASE CASE SCENARIO

The results of CBA assessment are presented below in a table and graphically.

Table 34 CBA Base Case Scenario Results By Development Options

Development Options	EIRR (%)	B/C ratio
A1	13,50%	2,55
A2	13,03%	2,49
B	6,33%	1,11
C	-6,40%	0,39
D	-4,65%	0,33
E1	3,96%	0,89
E2	8,65%	1,42
F1	6,60%	1,27
F2	5,40%	1,06
G	-1,52%	0,22
H	-2,06%	0,19

Figure 25 A Summary of CBA Base Case Results



The presented data lead to several conclusions:

- Two development options score the best with the assumptions made for the CBA base case scenario. These are:
    - Development option A1: The bridge with roads on the Peljesac Peninsula
    - Development option A2: The bridge without new roads on the Peljesac Peninsula
- The Neum by-pass is less competitive which reflects the assumption on the accession date for B&H. If that period were made longer, the cost benefit feasibility for this option would increase. This is because a significant investment in the Schengen related security fixtures would be justified economically in a longer period of time. One must remember, that the traffic patterns for the bypass after B&H accession to the EU will change from primary transit to local usage. This will significantly reduce the benefits stream related to this investment.

To address issues related to the assumptions made for CBA Base Case Scenario an number of sensitivity tests were run to illustrate how changes in some of the assumptions impact CBA results. This exercise is warranted by the fact that a number of general assumptions were made, and their impact and correctness should be verified. This is a typical practice in similar, multiple choice pre-feasibility studies. It will provide very much needed input to making final conclusions and recommendations, including the CBA results to MCA, and describing value for money for leader-options.

11.6 Sensitivity tests

11.6.1 INTRODUCTION

A number of sensitivity tests were run to assess the possible impact of some possible developments and occurrences on the choice of preferable scenario. The assumptions and results of these tests are described below. These tests were completed:

- For all development options on the date of Bosnia and Herzegovina accession to the EU,
- For only the bridge A1 and by-pass development options for all other tests.

11.6.2 SENSITIVITY TEST : DATE OF BOSNIA AND HERZEGOVINA EU MEMBERSHIP

Assumptions. Sensitivity tests on changes in the date of Bosnia and Herzegovina accession to the European Union was completed. It is impossible at the current time to clearly establish when this country may join the Union. The consultant conducted numerous interviews and meetings on this issue and could not receive a fully justified response.

The year 2025 was used for the base case scenario based on the B&H Advisory Committee recommendations. It may however happen that Bosnia and Herzegovina will join the EU later. Two test were than conducted, assuming B&H joining EU in 2034 and 2044

The date of joining the EU may significantly impact economic aspects and feasibility of some development options – especially those which involve creation of temporary security and extraterritoriality related structures, for which opening of the Croatia- Bosnia and Herzegovina borders will mean significant changes in traffic patterns.

The tests results indicate that:

- If Bosnia and Herzegovina joins the EU in 20 or 30 years, the time for accumulating the benefits for each project is extended compared to the Base Case Scenario. The extraterritorial by-pass and corridor enjoy larger benefits for a much longer time which makes them more competitive and attractive, as far as CBA is concerned.
- The test confirms that some options generate benefits that are more sensitive to geo-political situation in the area than others. The solutions and investments which are based on "politically independent – not related to geopolitical changes " benefits are more stable and justified. This for example concerns the bridge development options.
- If B&H joins EU in 20 years, EIRR for the Neum By-Pass is 1,5 percent point higher that for the Peljesac Bridge A1 development option. This difference is 2,8 percent points if the accession time is moved to 2044. With all the assumptions and generalization made in during the development of costs and benefits estimates, this difference may be considered negligible. One must remember, that the Neum By-pass costs of taking apart security systems required by the Schengen regulations and connecting this road with local road system, have not be considered. This might change the CBA results to the advantage of competitive development options.

Table 35 CBA Results for Development Options – Bosnia and Herzegovina Joins EU in 2034

Development Options	EIRR (%)	B/C ratio
A1	17,20%	3,40
A2	16,66%	3,33
B	18,79%	2,90
C	5,04%	1,00
D	-0,49%	0,57
E1	9,40%	1,52
E2	15,11%	2,45
F1	9,08%	1,71
F2	7,58%	1,43
G	1,80%	0,60
H	-2,06%	0,19

Figure 26 A Summary of CBA Results - Bosnia and Herzegovina Joins EU in 2034

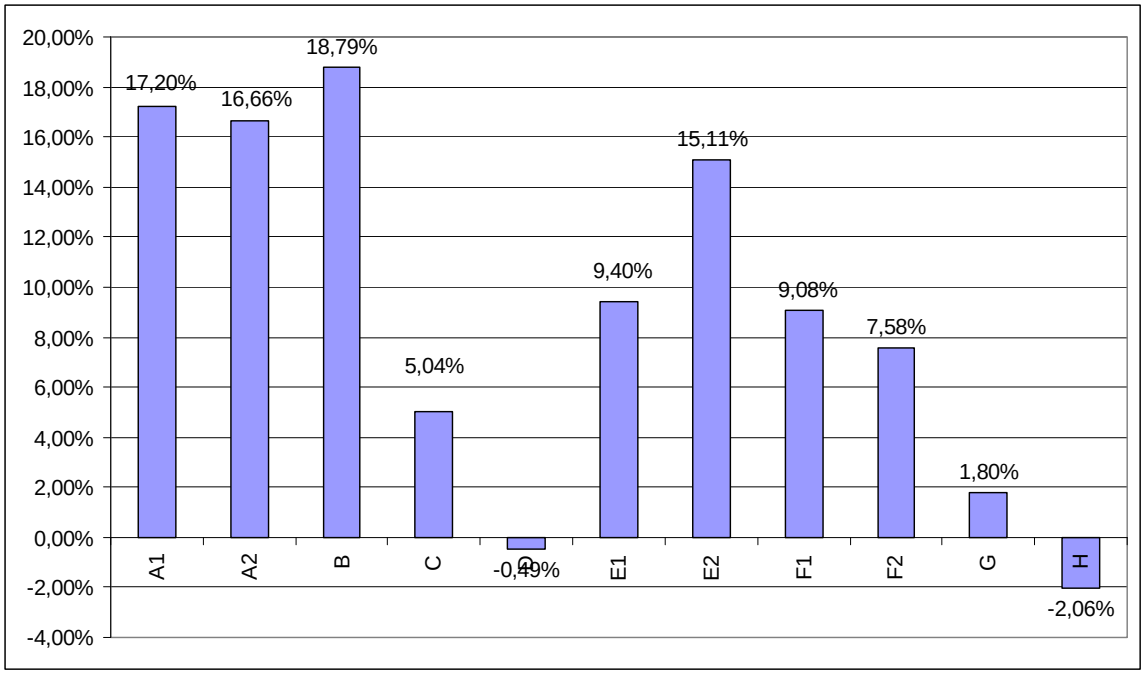
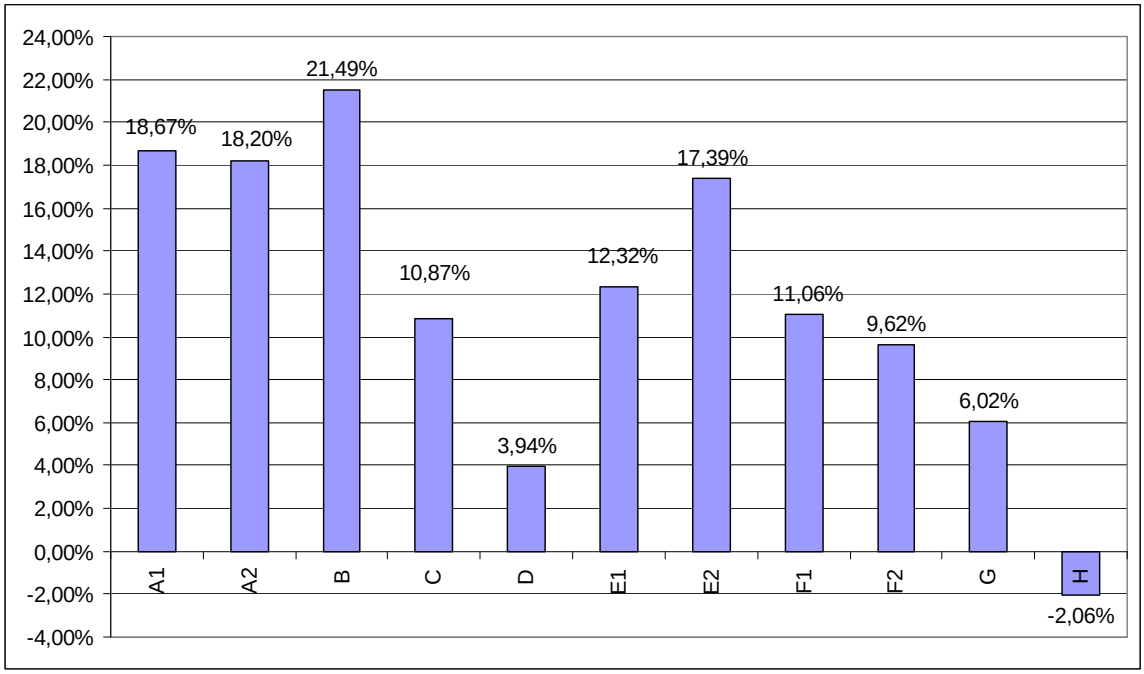


Table 36 CBA Results for Development Options – Bosnia and Herzegovina Joins EU in 2044

Development Options	EIRR (%)	B/C ratio
A1	18,67%	4,68
A2	18,20%	4,60
B	21,49%	5,64
C	10,87%	1,96
D	3,94%	0,87
E1	12,32%	2,38
E2	17,39%	3,91
F1	11,06%	2,37
F2	9,62%	1,98
G	6,02%	1,19
H	-2,06%	0,19

Figure 27 A Summary of CBA Results– Bosnia and Herzegovina Joins EU in 2044



11.6.3 SENSITIVITY TEST: THE COMPLETION OF A1 AND B OPTIONS DELAYED (FOR B&H JOINING EU IN 2034 AND 2025

At base case scenario, a delay in starting the Peljesac Bridge or the Neum By-pass investments by two or three years would not change the ranking since the difference between these projects in CBA results is large. The situation might be different if we assume that B$H joins the Union in 2034 (20 years from now). This sensitivity test responds to the comments submitted by the B&H Advisory Committee members. It was assumed that the starting day for both projects was moved by two or five years with all other assumptions remaining the same.

The delay of two and five years does not change the competitive situation between these two projects meaningfully. The difference between EIRR for these projects remains the same. The Peljesac Bridge becomes slightly more competitive compared to the by-pass scenario. This is similarly to the preceding test, because the time for accumulating benefits is shortening and the bridge has more benefits that are independent of the current cross border traffic. This confirms that the bridge performs a function of an important element of the regional transport system in a larger scale than the by-pass which has basically a road of a local importance and its economic justification is stemming mainly from temporary facilitating transit traffic between Croatia and Croatia. Unfortunately, for the B&H investors this is a temporary phenomenon. Once B&H join the European Union the additional trait related benefits diminish, and the investment is less justified. In light of the above, one may doubt if the Neum By-pass meets the requirement of ToR to be a permanent solution for connecting two parts of Croatia.

Table 37 CBA Results for A1 and B Development Options – Project Completion Delayed By Two Years

Development Options	EIRR (%)	B/C ratio
A1	15,40%	3,25
B	16,33%	2,71

Table 38 CBA Results for A1 and B Development Options – Project Completion Delayed By Five Years

Development Options	EIRR (%)	B/C ratio
A1	13,17%	2,97
B	12,85%	2,29

Compared with the previous sensitivity test, the situation is completely different if we assume that the Peljesac Bridge and the Neum By-pass will be delayed by two years, but at the Base Case Scenario, assuming B&H accession in 2025.

In this situation, the bridge option is much more competitive than the By-pass option. This because the time for accumulating benefits is shortening and the bridge has more benefits that are independent of the current cross border traffic. The change is more visible since the period of time when bridge enjoys additional, transit traffic related benefits, is much shorter than in the previous sensitivity test. This confirms the contention that the bridge performs a function of an important element of the regional transport system in a larger scale than the by-pass which is of basically a local importance, and its economic justification is stemming mainly from facilitating transit traffic.

Table 39 CBA Results for A1 and B Development Options – Project Completion Delayed By Two Years

Development Options	EIRR (%)	B/C ratio
A1	11,86%	2,39
B	3,45%	0,84

Table 40 CBA Results for A1 and B Development Options – Project Completion Delayed By Five Years

Development Options	EIRR (%)	B/C ratio
A1	9,76%	2,10
B	2,14%	0,66

11.6.4 SENSITIVITY TEST ON PRICE FOR THE EQUIPMENT/FIXTURES FOR THE SCHENGEN REQUIREMENTS UNIT COST COMPARED TO THE BASE CASE SCENARIO OF B&H JOINING EU IN 2034 AND 2025

In other sections of the PFS, a complicated situation regarding providing extraterritorial infrastructure for projects that cut through the Bosnia and Herzegovina territory has been addressed. It was proven that:

- The EU requirements for such establishments are not clearly defined and are for all practical purposes unknown. The directions provided in this respect are vague and insufficient for decisive cost estimate making. Therefore, estimating the cost of necessary equipment and design is a very difficult task.
- Furthermore, there is a large risk that the provided design will not be accepted by the EC and the Schengen requirements will not be met. This may result in serious delays or stalemating such projects and investments.
- There are significant doubts regarding the necessity for spending about 50 to 100 million of Euro for by-pass security equipment and fixtures, which have to be dismantled immediately after Bosnia and Herzegovina will join the EU. This expenditure for longer extraterritorial corridors is even higher.
- There are major geopolitical and social concerns regarding creating any extraterritorial corridors (bypasses) dividing the Bosnia and Herzegovina territory.
- Major issues for operating such extraterritorial arrangements have also not been fully clarified by the EC and contacted associations of road research institutes in Europe and the United States.
- It was pointed out that any extraterritorial solutions in complicated geopolitical context and situation contributed rather to increase than decrease of conflicts and political tension. There are also doubts if due to legal grey area for extraterritorial solutions the implementation of such an idea is at all feasible because of non-monetary issues.

The cost for the Schengen fixtures was assumed for the base case scenario based on the best professional assessment, comparison to similar construction both at extraterritorial and other projects. Benchmarking to similar from the point of view of engineering roads was conducted. All that did not result in one costs estimate. The most likely estimate was used in the base case scenario. Therefore, in addition to the assumptions made for the base case scenario, a sensitivity test was made for a lower cost of the Schengen security establishments for the by-pass development option.

The cost security equipment for the Neum By-pass amounts to about 40 to 50percent of the entire investment. That is a lot. The B&H government officials indicated that this cost may be significantly lower. What if we

reduce it than by 25 percent. It was assumed that as a result the costs per one kilometre of the road will be lower and sum up to 6 million EUR/km instead of 8 million EUR/km (a 25 percent decrease) . This is still a tremendous expenditure which raises issues and concerns as to its sensibility. But, at this assumption this cost is definitely lower. The following are the results of CBA for that assumption.

Table 41 CBA Results for A1 and B Development Options – The Schengen Cost Reduced to 6 million per kilometre (B&H Accession in 2034)

Development Options	EIRR (%)	B/C ratio
A1	17,20%	3,40
B	20,63%	3,32

If the cost of the security system is reduced, the Neum By-pass option becomes more attractive. However, this conclusion must be interpreted with the consideration of other sensitivity tests. One should refer to the previous sensitivity tests. For example, the delay in construction of such a by-pass by two or five years (as indicated above in this report - highly likely) will basically wipe out all the gains from the reduced cost assumptions. All these conclusions are not advantageous for resolving the issue of permanent connecting the EU territory by a temporary, extraterritorial construction with significant security cost component, which in addition will have to be partially taken down in ten to twenty years. This may raise the issue of justification and feasibility of such a use of either national or international funds or the EU taxpayers' funds. The value for money issue may be raised here. Unfortunately, negatively for extraterritorial ideas for joining two parts of the EU/Croatia territory.

It is needed to remind again that the costs of dismantling this security equipment and connecting the by-pass with local road system have not been included in the calculations.

Similarly to the previous test, computation for B&H joining EU in 2025 also indicates the obvious, that the feasibility and CB ratio for the Neum By-pass increases if the cost of security equipment decreases. This increase however, does not eliminate the lower competitiveness of this scenario compared to the Peljesac bridge, if the B&H accession date is 2025.

Table 42 CBA Results for A1 and B Development Options – The Schengen Cost Reduced to 6 million per kilometre

Development Options	EIRR (%)	B/C ratio
A1	13,50%	2,55
B	8,06%	1,27

11.6.5 SENSITIVITY TEST ON ADDITIONAL (INDIRECT) BENEFITS FROM REGIONAL ECONOMIC DEVELOPMENT FOR A1 AND B DEVELOPMENT OPTIONS COMPARED TO SCENARIOS FOR B&H JOINING EU IN 2034 AND 2025

As described in the earlier paragraphs, this CBA was limited to the major benefit category – time savings for travellers. This simplified method is preferred and accepted by the EC and sufficient for the purposes of this PFS. In practice however, there are many other benefits that are more difficult to quantify and define. The investment in regional transport system should add to regional economic development opportunities, otherwise the entire concept of spending public resources on such activities may be questioned. In the evaluation of development options in this report, this element should also be considered. The EC CBA methodologies pay limited attention to considering all economic development benefits in investment assessment process, like it takes place for example in the U.S or Australia. This is probably because of fear of fraudulent or unjustified usage of this benefit category to receive EU co-funding for not feasible projects. The matter of fact is however, that these benefits are widely used in many regions and countries all over the World including the states where the efficiency of public capital budgeting for transport infrastructure is much higher than in Europe.

The development options considered in the PFS, usually also create indirect benefits. For example, the creation or improvement of transport connection may result in attracting economic development or private investments. This funds influx creates indirect benefits. In our case this refers to for example these development options which result in significant accessibility improvements to some areas, for example at the Peljesac Peninsula. Opportunities for stimulating economic development there are high, since these are mainly agricultural, poorer regions of EU/Croatia. The introduction of additional development opportunities to such economically disadvantaged regions is one of the major objectives of the EU Cohesion policy which stimulates economic, social and territorial development and cohesion. Transport infrastructure improvements are a tool to achieving the cohesion policy objectives.

This sensitivity test assumed creation of indirect benefits by the Peljesac Bridge and the Neum By-pass scenarios. In estimating these benefits, we considered the real situation. The Peljesac Bridge option (with new roads on the peninsula) has a full capacity to stimulate indirect benefits, while the By-pass being the closed dome over the B&H territory is separated from the surrounding areas, its indirect benefits generating capacity is almost totally impeded. Data on the assumed direct benefits are provided in tables below.

It is clear that these benefits for the bridge and related roads, which provide a regional connection to large areas where economic development may be easily encouraged and has not occurred in the past due to insufficient transport links, are higher than for a local and short by-pass or a corridor. The sensitivity test indicates that:

- If reasonable economic development benefits are considered, the CBA competitiveness of the bridge increases.
- The overall amount of benefits that may be created by the bridge through supporting economic development exceeds the cost of the project. This is not the case for the by-pass. This conclusion could be an important factor in a decision making process for any astute public investor and policy maker.
- The consideration of economic development benefits changes the results of CBA in terms of project priority.

This sensitivity test was done also to show the monetary impact of other benefits that may occur and shed necessary light on this situation if anybody would like to address the feasibility of the Neum by pass just based on the CBA results.

The second test is the same as the previous except that it assumes earlier B&H accession to the European Union (2025). This also indicates significant advantage of the Peljesac Bridge over the Neum By-pass development option if indirect benefits are taken into picture. The Bridge is simply a larger indirect benefits generator than the by-pass.

Table 43 CBA Results for A1 and B Development Options – The Economic Development Benefits Considered (2034 B&H Accession)

Development Options	EIRR (%)	B/C ratio
A1	22,11%	4,58
B	19,54%	3,09

Table 44 Economic Development Benefits for A1 Development Option (2034 B&H Accession)

Period	Time savings	Economic development	Residual value	Benefits total
2017	0	0	0	**0**
2018	36 693 989	10 000 000	0	**46 693 989**
2019	42 165 716	15 000 000	0	**57 165 716**
2020	47 841 634	20 000 000	0	**67 841 634**
2021	54 254 466	25 000 000	0	**79 254 466**
2022	61 009 010	30 000 000	0	**91 009 010**
2023	68 119 997	31 500 000	0	**99 619 997**
2024	75 602 736	33 075 000	0	**108 677 736**
2025	83 473 131	34 728 750	0	**118 201 881**
2026	91 747 707	36 465 188	0	**128 212 895**
2027	100 443 632	38 288 447	0	**138 732 079**
2028	109 578 739	40 000 000	0	**149 578 739**
2029	119 171 554	40 000 000	0	**159 171 554**
2030	129 241 317	40 000 000	0	**169 241 317**
2031	141 165 370	40 000 000	0	**181 165 370**
2032	153 836 562	40 000 000	0	**193 836 562**
2033	167 295 584	40 000 000	0	**207 295 584**
2034	72 634 076	40 000 000	0	**112 634 076**
2035	78 700 116	40 000 000	0	**118 700 116**
2036	85 135 225	40 000 000	0	**125 135 225**
2037	91 959 223	40 000 000	0	**131 959 223**
2038	99 192 924	40 000 000	0	**139 192 924**
2039	106 858 187	40 000 000	0	**146 858 187**
2040	114 977 962	40 000 000	0	**154 977 962**
2041	123 576 345	40 000 000	0	**163 576 345**
2042	132 678 635	40 000 000	0	**172 678 635**
2043	142 311 385	40 000 000	0	**182 311 385**
2044	152 502 470	40 000 000	0	**192 502 470**
2045	163 281 144	40 000 000	0	**203 281 144**
2046	174 678 107	40 000 000	156 823 013	**371 501 121**
NPV	1 394 491 362	498 781 821	38 099 574	1 931 372 758

Table 45 Economic Development Benefits for B Development Option (2034 B&H Accession)

Period	Time savings	Economic development	Residual value	Benefits total
2017	0	0	0	**0**
2018	0	0	0	**0**
2019	0	0	0	**0**
2020	0	0	0	**0**
2021	0	0	0	**0**
2022	53 267 488	3 000 000	0	**56 267 488**
2023	60 028 409	3 500 000	0	**63 528 409**
2024	67 147 044	4 000 000	0	**71 147 044**
2025	74 638 771	4 500 000	0	**79 138 771**
2026	82 519 570	5 000 000	0	**87 519 570**
2027	90 806 042	5 000 000	0	**95 806 042**
2028	99 515 434	5 000 000	0	**104 515 434**
2029	108 665 665	5 000 000	0	**113 665 665**
2030	118 275 345	5 000 000	0	**123 275 345**
2031	129 610 058	5 000 000	0	**134 610 058**
2032	141 662 308	5 000 000	0	**146 662 308**
2033	154 471 361	5 000 000	0	**159 471 361**
2034	16 807 848	5 000 000	0	**21 807 848**
2035	18 252 701	5 000 000	0	**23 252 701**
2036	19 786 250	5 000 000	0	**24 786 250**
2037	21 413 279	5 000 000	0	**26 413 279**
2038	23 138 812	5 000 000	0	**28 138 812**
2039	24 968 126	5 000 000	0	**29 968 126**
2040	26 906 763	5 000 000	0	**31 906 763**
2041	28 960 543	5 000 000	0	**33 960 543**
2042	31 135 573	5 000 000	0	**36 135 573**
2043	33 438 270	5 000 000	0	**38 438 270**
2044	35 875 365	5 000 000	0	**40 875 365**
2045	38 453 927	5 000 000	0	**43 453 927**
2046	41 181 373	5 000 000	17 427 000	**63 608 373**
NPV	792 916 501	54 240 139	4 233 826	851 390 466

Table 46 CBA Results for A1 and B Development Options – The Economic Development Benefits Considered (2025 B&H Accession)

Development Options	EIRR (%)	B/C ratio
A1	19,22%	3,73
B	8,32%	1,31

Table 47 Economic Development Benefits for A1 Development Option (2025 Accession)

Period	Time savings	Economic development	Residual value	Benefits total
2017	0	0	0	**0**
2018	36 693 989	10 000 000	0	**46 693 989**
2019	42 165 716	15 000 000	0	**57 165 716**
2020	47 841 634	20 000 000	0	**67 841 634**
2021	54 254 466	25 000 000	0	**79 254 466**
2022	61 009 010	30 000 000	0	**91 009 010**
2023	68 119 997	31 500 000	0	**99 619 997**
2024	75 602 736	33 075 000	0	**108 677 736**
2025	33 389 252	34 728 750	0	**68 118 002**
2026	36 699 083	36 465 188	0	**73 164 270**
2027	40 177 453	38 288 447	0	**78 465 900**
2028	43 831 496	40 000 000	0	**83 831 496**
2029	47 668 622	40 000 000	0	**87 668 622**
2030	51 696 527	40 000 000	0	**91 696 527**
2031	56 466 148	40 000 000	0	**96 466 148**
2032	61 534 625	40 000 000	0	**101 534 625**
2033	66 918 234	40 000 000	0	**106 918 234**
2034	72 634 076	40 000 000	0	**112 634 076**
2035	78 700 116	40 000 000	0	**118 700 116**
2036	85 135 225	40 000 000	0	**125 135 225**
2037	91 959 223	40 000 000	0	**131 959 223**
2038	99 192 924	40 000 000	0	**139 192 924**
2039	106 858 187	40 000 000	0	**146 858 187**
2040	114 977 962	40 000 000	0	**154 977 962**
2041	123 576 345	40 000 000	0	**163 576 345**
2042	132 678 635	40 000 000	0	**172 678 635**
2043	142 311 385	40 000 000	0	**182 311 385**
2044	152 502 470	40 000 000	0	**192 502 470**
2045	163 281 144	40 000 000	0	**203 281 144**
2046	174 678 107	40 000 000	156 823 013	**371 501 121**
NPV	1 035 567 670	498 781 821	38 099 574	1 572 449 066

Table 48 Economic Development Benefits for B Development Option (2025 Accession)

Period	Time savings	Economic development	Residual value	Benefits total
2017	0	0	0	**0**
2018	0	0	0	**0**
2019	0	0	0	**0**
2020	0	0	0	**0**
2021	0	0	0	**0**
2022	53 267 488	3 000 000	0	**56 267 488**
2023	60 028 409	3 500 000	0	**63 528 409**
2024	67 147 044	4 000 000	0	**71 147 044**
2025	7 463 877	4 500 000	0	**11 963 877**
2026	8 251 957	5 000 000	0	**13 251 957**
2027	9 080 604	5 000 000	0	**14 080 604**
2028	9 951 543	5 000 000	0	**14 951 543**
2029	10 866 566	5 000 000	0	**15 866 566**
2030	11 827 535	5 000 000	0	**16 827 535**
2031	12 961 006	5 000 000	0	**17 961 006**
2032	14 166 231	5 000 000	0	**19 166 231**
2033	15 447 136	5 000 000	0	**20 447 136**
2034	16 807 848	5 000 000	0	**21 807 848**
2035	18 252 701	5 000 000	0	**23 252 701**
2036	19 786 250	5 000 000	0	**24 786 250**
2037	21 413 279	5 000 000	0	**26 413 279**
2038	23 138 812	5 000 000	0	**28 138 812**
2039	24 968 126	5 000 000	0	**29 968 126**
2040	26 906 763	5 000 000	0	**31 906 763**
2041	28 960 543	5 000 000	0	**33 960 543**
2042	31 135 573	5 000 000	0	**36 135 573**
2043	33 438 270	5 000 000	0	**38 438 270**
2044	35 875 365	5 000 000	0	**40 875 365**
2045	38 453 927	5 000 000	0	**43 453 927**
2046	41 181 373	5 000 000	17 427 000	**63 608 373**
NPV	302 196 008	54 240 139	4 233 826	360 669 972

11.7 Sensitivity Test for Increased Cost of the Peljesac Bridge at the Base case Scenario (B&H EU Accession 2025).

This sensitivity is test assumes that the cost of the Peljesac Bridge will increase from 200 million Euro to 500 million Euro. At this assumption the B/C ratio for the bridge option significantly decreases. The bridge scenario still has better CBA results than the By-pass however the difference is not so obvious. If additional costs of the Neum By-pass were considered this difference would be probably by several points higher. The conclusion is that despite of the increase in cost the bridge is still very competitive versus the By-pass in the CBA assessment terms.

Table 49 Base case scenario, A1 Investments Costs, Bridge Cost 200 million Euro

Investment costs [mln EUR]	**392,1**
including:	
4-lane roads	
2-lane roads	109,1
access roads	80,0
tunnels	
bridges	202,9
ferry harbour	
vehicles (ferry boats)	
land acquisition	
Schengen requirements	

Table 50 CBA Results, A1 Investments Costs, Bridge Cost 200 million Euro

Development Options	**EIRR (%)**	**B/C ratio**
A1	13,50%	2,55
B	6,33%	1,11

Table 51 Base case scenario, A1 Investments Costs, Bridge Cost 500 million Euro

Investment costs [mln EUR]	**689,1**
including:	
4-lane roads	
2-lane roads	109,1
access roads	80,0
tunnels	
bridges	500,0
ferry harbour	
vehicles (ferry boats)	
land acquisition	
Schengen requirements	

Table 52 CBA Results for A1 and B Development Options – The Cost of the Bridge Increased to 500 million Euro (Base Case Scenario - 2025 B&H Accession)

Development Options	**EIRR (%)**	**B/C ratio**
A1	8,01%	1,49
B	6,33%	1,11

11.8 CBA Calculations for All Scenarios

Cost and Benefits calculations for all development options are provided in Appendix foe Chapter 11 at the end of this pre-feasibility report. They show the calculations and assumptions made for each scenario. There are two scenarios that are of special interest in this PFS:

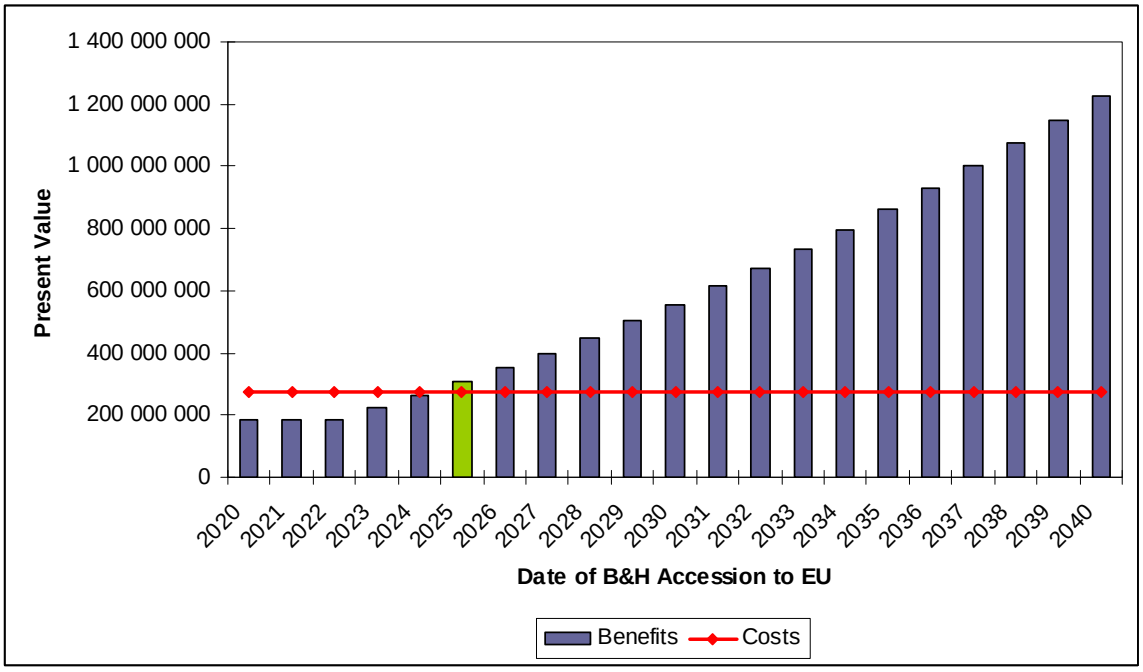
- The Bridge Scenario with new roads on the Peljesac Peninsula (A1)
- The Neum By-pass scenario.

They lead the CBA ranking of development options. There are however several special factors that impact the relationship between them. Full understanding of these relationships is critical to properly understand the results of this CBA. See the following subchapter for more details.

11.9 The Bridge with new roads (A1) and the Neum By-pass Scenario – Important Comments on CBA Assessment of These Options.

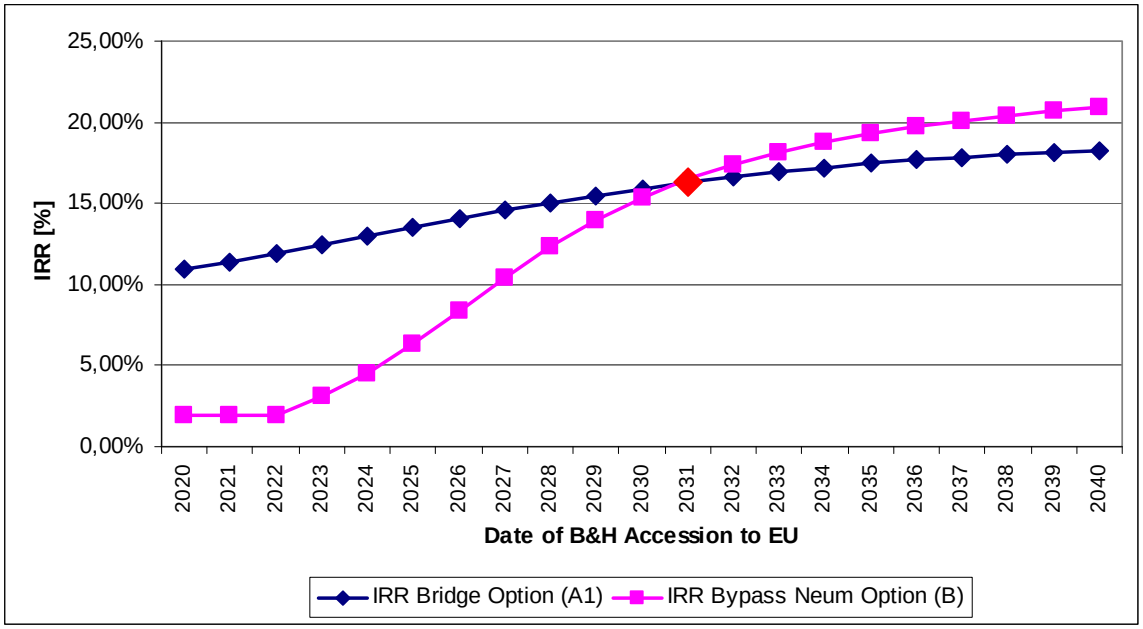
The Bridge with new roads and the Neum By-pass scenarios have been the most addressed development options during the development of this PFS and debates of the Advisory Committee. This is understandable since they are front-runners for becoming the preferred, chosen development option. Technical and design features of these options were described earlier in this PFS. In this chapter, CBA assessment of these options has been completed. As far as the CBA is concerned it makes sense to summarize some conclusions on these options using a comparative approach. The assumptions for the Neum By-pass development option have been changed several times in the last months. This is justified since there are many uncertainties regarding financial and design assumptions for this option. There were differences in cost estimates for the project and difficulties in an advance definition of all the needed security equipment necessary for meeting the Schengen requirements. Also, the assessment of this option depends on the date of B&H accession to the EU. This is because the character of this road will change from an international transit and sealed like an over-the-land-tunnel road to a typical local by-pass at the moment B&H becomes the Schengen country. The traffic flows will change. International transit will most likely decrease and new flows of local movements will appear. Altogether, the overall flows of cars and buses will decrease, so will the benefits. So, from the point of view CBA the B&H accession date is very important. The following shows the relationship among this date and the flows of benefits for the both scenarios.

Figure 28 Break-Even Point for the Neum By-Pass Development Option



This figure indicates that at the projected stream of benefits and the assumed costs (using the world benchmarks), the Neum By pass reaches its breakeven point in 2024. After that the project generates benefits which exceed the PV of the investment cost. Is it however competitive when compared with the Bridge A1 development option. This is shown at the next figure.

Figure 29 EIRR for the Peljesac Bridge (A1) and the Neum By-Pass Development Options



This figure indicates that to be competitive with the Bridge (A1) option, the Neum By-Pass would have to function as an international sealed corridor until minimum the year 2013 to have more or less the same CBA results. Since the By-Pass is a complicated project because of its extraterritorial features, it is less competitive on many non-cost and non-benefit MCA criteria (see next chapter). To compensate for these disadvantages even better CBA score would be needed. That may occur in the years around 2038 – 2040, it means 25 plus years from now (see the graph above). This is contradictory to the statements that have been repeatedly made by B&H members of the Advisory Committee. They indicate that B&H will get to the Union in 12 to 15 years. At this assumption, the Neum By-Pass project is not competitive by the assumptions of CBA. If B&H is accepted to EU within this time framework the Neum By-pass cannot be justified. There are no reasons to challenge the position of the B&H delegation expressed in official comments to the drafts of PFS. This however leads to a conclusion that the Bridge A1 development option is an obvious choice and a preferred scenario, which best responds to all the requirements for PFS described in the Terms of Reference.

12 MULTI-CRITERIA ANALYSIS (MCA)

12.1 MCA Assumptions

Multi-Criteria Analysis (MCA) is an analytical and evaluation technique combining a wide range of quantitative and qualitative assessments into project decision making process. The objective of the MCA methodology is to provide evaluation of different development options, assign scores and create a list of prioritized solutions by collecting and assessing data and information from various disciplines and according to the defined evaluation criteria.

MCA is a process emphasizing collective assessment and judgment of stakeholders and decision making teams in establishing objectives and criteria for evaluation, defining and categorizing relative importance preferences of these criteria. MCA approach extends the decision making process beyond the practical reach of CBA, and complement the monetary financial and economic criteria with wider range of judgment factors (legal, environmental, technical). This is particularly important in assessing public capital expenditure projects which have more than only financial and profit objectives. MCA is frequently used for prioritizing public transport infrastructure alternatives, especially those funded by national and international donors. MCA has been assigned as an evaluation system for this study to assess development options for providing land connection between two parts of EU/Croatia territory.

ToR provides a catalogue of factors which have to be used within MCA for development options assessment. It includes:

- Financial impact (value for-money) of the possible project,
- Project (development option) long-term sustainability,
- Impact of the proposed option on economy and environment in the target area,
- Requirements of Schengen Acquis and in particular the Schengen border Code (Regulation 2006/562),
- Customs control, veterinary and phytosanitary inspection,
- Trans-European Transport Networks
- Likely political impact and the United Nations Convention on the Law of the Sea.
- Existing and future environmental legislation and in particular Natura 2000, the Maritime Directive and also proposed Natura 2000 sites in the targeted area.
- Opportunity costs of one option against the others
- Legal implications

ToR also implies a methodology for developing a set of criteria to create a foundation for MCA assessment. This involves the following elements:

- Each proposed option should be assessed on the basis of the identified criteria,
- Each proposed option should be discussed thoroughly with the Beneficiary.
- An Advisory Committee has been formed with purposes such as: to discuss the development scenarios proposed by the Contractor based on results of the analysis and identified transport bottlenecks and the proposed criteria and methodology for the multi-criteria analysis; address the results of the multi-criteria analysis and the identified “best” option; and assess the draft report. The Advisory Committee has an advisory role and consist of the representatives of the Croatian Ministry of Maritime Affairs, Transport and Infrastructure, Ministry of Foreign and European Affairs, Central Finance and Contracting Agency (CFCA), Ministry of Regional Development and EU Funds, Ministry of Environment and Nature Protection, the representatives of European Commission, the representatives of Bosnia and Herzegovina as well as the Contractor’s experts in Zagreb.

The ultimate result of the MCA is that the Consultant will propose the preferred transport option.

12.2 Implementation of the MCA Work Scheme

It is clear that the intention of the above MCA work scheme is to insure cooperative efforts by the Consultant, Beneficiary, and the members of the Advisory Committee (Croatia, Bosnia and Herzegovina, and European Commission partners). This has been fully implemented. A list of development options for evaluation was jointly established and agreed upon. The same concerns major elements and methodology of CBA and MCA. The consultant was in constant contact with the Beneficiary and the Advisory Committee, and addressed their comments. The MCA approach has been addressed latter in this section. A description of the agreed and mutually accepted MCA assumptions follows.

12.3 MCA methodology

12.3.1 BASIC DEFINITIONS

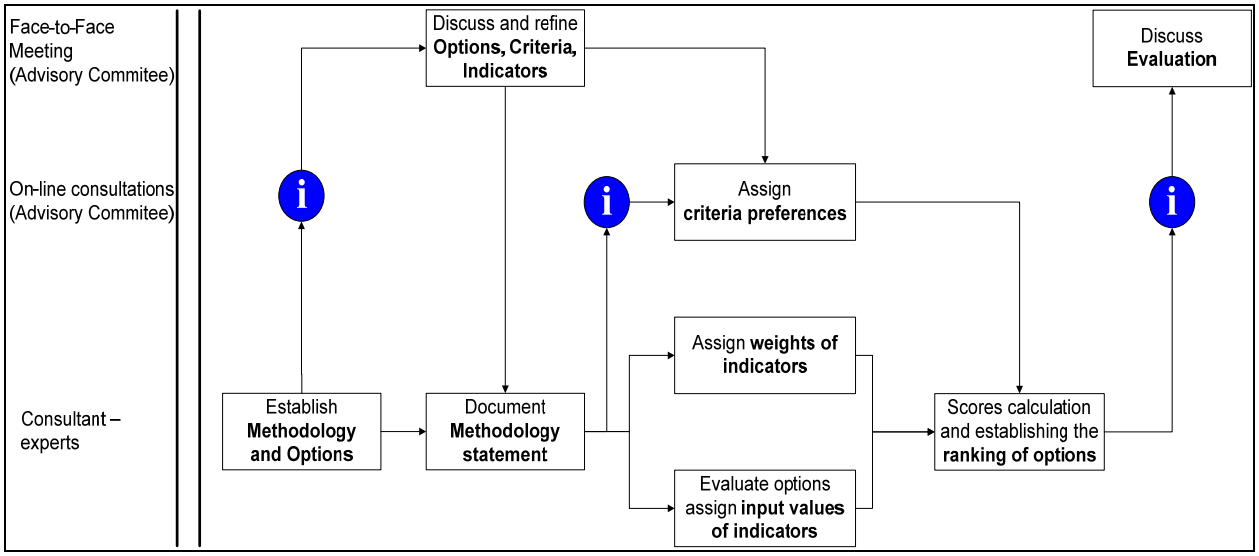
There are a number of basic terms that have to be used and understood uniformly throughout the MCA activities. Major definitions are:

- ***Criteria*** are sets of indicators that relate to separate and distinguishable components of the overall objective for the decision. Criteria are logically defined and interconnected and reflect the commonly accepted in literature and practice MCA standards.
- ***Indicators*** are the measures of performance by which the options are judged. They reflect important aspects of PFS objectives. Indicators may be either quantitative or qualitative. In the latter case, the methodology of the assessment is clearly provided to lowers risks which could be caused by indicators which are prone to strictly subjective opinions.
- ***Weights*** represent the value of impact of indicators on the assessment of the criteria.
- ***Preferences*** represent points of view of different stakeholders concerning the importance of the criteria in the project assessment

12.3.2 MCA DECISION MAKING APPROACH

The MCA approach adopted for this prefeasibility study is shown in a figure below.

Figure 30 MCA Decision Making Approach



12.3.3 METHODOLOGY FOR PROJECT SCORING

The MCA results in assigning final scores for each development option. This allows for prioritization of these options and selection of the most preferable solution. The system of assigning final scores involves six steps:

- Step I: Assigning input values of indicators
- Step II: Normalization of the indicators' values
- Step III: Assigning weights of the indicators
- Step IV: Score calculation for each criterion
- Step V: Assigning preferences of the criteria
- Step VI: Calculation of final scores for evaluated development options

Step I: Assigning input values of indicators

The first step involves assigning input values corresponding to the results of project options assessment for each indicator. The input values may be expressed in quantifiable or qualitative terms, based on a professional expertise of evaluators. The input values are summarized in the input table. An input table example for one of the criteria is shown below:

Table 53 Impact Criteria and Indicator Input Table (template)

CRITERIA	INDICATOR	UNIT [U]	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10
			O1	O2	O3	O4	O5	O6	O7	O8	O9	O10
Criterion 1	**Indicator 1**	*U1*										
	Indicator 2	*U2*										
	Indicator 3	*U3*										
	Indicator 4	*U4*										

Step II: Normalization of indicator values

The next step is normalization of indicators values. In the input table, each indicator is has values which may be expressed in various units and in different ranges (maximum and minimum). It is necessary to normalize these values to one comparable range and unit to allow for assigning a total score reflecting all indicators. In this MCA methodology, the normalization process is conducted, for each indicator, by mapping the indicator's values onto the [0,100] interval. It is done by the recalculation of the indicator's values into a scale between 0 and 100, considering its maximum - minimum range (extent). This involves assigning 100 to the highest score and 0 to the lowest score. Consequently every indicator *i* of the criterion *k* may be expressed, for a given project *p* with an normalized value $S_{ik,p}$ that is between 0 and 100 : $0 < S_{i,k} < 100$.

Step III: Assigning weights to indicators

Once impacts (indicator values) have been normalized, the indicators are mathematically comparable. They are however, not necessarily equally important for the purposes of criteria assessment. Therefore, the set of indicator weights is defined. The weights reflect the level of importance of each indicator in the assessment process within criteria. Weights are developed based on the professional expertise and according to the objectives of MCA. The weights are expressed by weight factors which represent the impact of a given indicator on the final score calculation within the criterion.

Step IV: Score calculation for each criterion per project

Assigning the score for each criterion is conducted by summing up: a) indicator scores, b) multiplied by weights of these indicators. For each alternative *p*, the score of the criterion *k* is characterized by the scores for each indicator $S_{ik,p}$ and its weight $A_{i,k}$ given by the sum:

$$S_{k,p} = \sum_{i=1}^{n} S_{ik,p} A_{i,k}$$

Step V: Assigning preferences of the criteria

The stakeholders, in this case the Beneficiary and the Advisory Committee, may have special preferences as to the importance of factors used for development option final assessment. If they do not, the MCA is usually completed on the assumption that all the factors are equally (proportionally) important. To identify the preferences, according to the standard MCA procedures, the stakeholders are asked to give their relative preferences for impact criteria. Preferences represent points of view of various stakeholders concerning the importance of the criteria in the assessment. Usually it is done by the means of survey forms, but verbal expression is also acceptable. In this case, a set of joint preferences was developed based on input received from the Advisory Committee input. According to the literature on group decision-making[91], the approach adopted is that of considering the collective result, obtained by the aggregation of individual preferences, and is the result of consensus.

Step VI: Score calculation for project options

The scores of the options represent the final result of MCA analysis. The score of the option *p* is the result of summing the products (values) between scores $S_{k,p}$ and preferences A_k attributed to each criterion *k*:

$$S_p = \sum_{k=1}^{m} S_{k,p} A_k$$

The S_p is the final score for option *p* that will be adopted in order to set-up a ranking among all development options.

12.4 Applied MCA Criteria and Indicators

12.4.1 ASSUMPTIONS FOR CRITERIA

Based on ToR requirements for the scope of MCA, described earlier in this report; a standard MCA methodology approach; and inputs received from the Advisory Committee, the following five criteria were established for evaluating development options:

- Economic sustainability
- Regional development impact
- Technical improvements and risks
- Environmental sustainability
- Geopolitical and legal impact

The evaluation criteria must provide for complex and comprehensive overview of the effectiveness, sustainability and feasibility of development options. They should result in a fair and justified multidisciplinary assessment of these options. This assessment should create a sound and defendable basis for identifying the most desirable solution.

A very important issue is to eliminate duplicity in criteria definition. According to the standard MCA methodology the same factor cannot be used twice to assess projects or options. This is a commonly committed mistake in MCA. It is therefore, very important that a thorough review of criteria be conducted prior to the assignment of evaluation criteria. The final evaluation of investment projects should be based on: a) assessment of project subjected to the scoring system (direct evaluation) and b) assessment of other factors which add or supplement the scoring categories (indirect evaluation)

[91] *A collective choice method based on individual preferences relational systems (p.r.s.) [An article from: European Journal of Operational Research]* Jabeur & Martel, 2007

The next important principle is to achieve full understanding and consent of all stakeholders regarding the accepted set of evaluation criteria. Once they are agreed upon they should not be changed in the course of evaluation process. This is based on practical experiences described in the MCA literature.

There are many instances indicating that very often some stakeholders faced with unfavourable assessment results attempt to change the criteria to enforce preferred evaluation outcomes. In MCA, where many evaluation process elements are qualitative, this should be avoided at any price, unless serious logical or methodological errors are proven. Some MCA experts call for maximization of quantitative criteria and indicators. This does not seem to be absolutely necessary. The MCA approach by its definition involves qualitative judgments and it should stay this way. More important is to insure full independence and professionalism by the evaluators, and eliminate any kind of pressure on them. They are supposed to provide logical reasoning and explanation of the evaluation activities.

If some of evaluation requirements cannot be considered inside of the evaluation process due to any of the above reasons, according to the international standards they can and should be addressed separately to strengthen and explain the conclusions resulting from scoring. This has occurred in this MCA. A list of factors included in the MCA (direct evaluation) and other factors considered for making final recommendations for development options (indirect evaluation) in comparison to the ToR requirements is provided in table below.

A description and reasoning for all selected criteria is presented below.

Table 54 Selected Evaluation Criteria and Indicators versus ToR Requirements

Selected Evaluation Criteria	Indicators	Terms of Reference Activity Requirements Covered by Criteria and Indicators
Direct Evaluation		
Economic sustainability	EIRR	Financial impact and economic impact
Regional development impact	Social accessibility Regional economic development Compliance with regional development strategies	Impact on economy of targeted area
Technical improvements and risks	Transport system capacity Investment preparation risk Engineering and geotechnical risk	Transport system impact and Origin-Destination Survey and transport infrastructure
Environmental sustainability	Impacts on natural ecosystems Impacts on protected areas Impacts on man-made environment	Impact on environment Natura 2000 (current and future) Maritime Directive
Geopolitical and legal impact	Compliance with the Schengen Acquis International accessibility impact Necessity of additional international agreements Compliance with the UN Convention on the Law of the Sea	Requirements of Schengen Acquis and in particular the Schengen border Code (Regulation 2006/562), Customs Control, Veterinary and phytosanitary inspection, Trans-European Transport Networks, Geopolitical impact, United Nations Convention on the Law of the Sea; Legal implications
Indirect Evaluation		
		Long term sustainability and feasibility Permanent character of development options Value for money and Possibilities for EU funding Opportunity cost Political factors Transport problems and bottlenecks and Trans European Transport Networks Border issues

12.5 Criteria Description

The following is a description of five criteria applied for development options assessment in this MCA.

12.5.1 ECONOMIC SUSTAINABILITY

Economic effectiveness is one of the most crucial factors in transport infrastructure projects evaluation, especially when the external funds are required to finance project implementation costs. It is even more important when the projects are going to be co-financed from public (tax-payers) funds such as the EU funds. This is the case for this PFS.

The EU regulations clearly state that *one of the main criteria applied to ensure the high quality of the projects are their medium-term economic and social benefits, which shall be commensurate with the resources deployed; an assessment shall be made in the light of a cost-benefit analysis*[92]. Therefore, the economic sustainability criterion used for this MCA will concentrate on the economic effectiveness of development options and take into consideration the balance between project costs and direct economic benefits resulting from the infrastructure improvements.

12.5.2 REGIONAL DEVELOPMENT IMPACT

The impact of development options on regional development issues may be considered in two ways. First, it is very important to insure that there is a land connection between all EU/Croatia regions. This is the only way to address the following problem issues as indicated in ToR: fond permanent solution that will ensure unconstrained flow of goods and persons through the EU/Croatia and Schengen area, avoid any traffic bottlenecks negatively impacting development options from EU, the Balkan region, and Croatia perspective, ensure the security of the Schengen borders, provide for full consideration and implementation of EU regulations on the customs and transit of goods for all EU members. Also, lack of land territorial cohesion of EU in that region makes it very difficult to efficiently implement EU the Cohesion Policy principles. In that perspective, the land connection is a major European Union problem that needs to be urgently and permanently addressed.

Regional development and cohesion of Croatian territory are major priorities of „*Strategy of Regional Development of the Republic of Croatia*" dated June 1997. In Chapter 2.1 of this Strategy, it is stressed out that „the overall Croatian national territory should be completely and firmly integrated and all of its constituent parts should be quality and efficiently interconnected." Furthermore, Article 2.3. states that measures should be taken to „decrease the differences in development of individual areas, stop negative demographic trends, utilize insufficiently valorised potentials of certain areas and resources."

The assessment of regional development impact is one of the major elements of transport infrastructure projects. Transport infrastructure does not only provide for better mobility of EU citizens and their trade, but also is a major catalyst of the overall economic and quality of life growth – which are major objectives of almost all activities of the Union and the key to competitiveness of the entire European continent in the global economy environment. The importance of these priorities been strengthened after Croatia accessed the European Union. The EU regulations indicate that investment projects should be evaluated according to *the priorities established by the beneficiary Member States*[93]. Therefore, in the MCA methodology adopted in this

[92] Council Regulation (EC) No 1164/94 establishing a Cohesion Fund
[93] As above: Council…

PFS, the regional development criterion was defined as the impact of project options on regional socio-economic development and regional cohesion in short-term and long-term perspective.

12.5.3 TECHNICAL IMPROVEMENTS AND RISKS

Each development option provides different technical results and contributions to transport system capacity. They also have different constraints and risks stemming from the adopted design and technology, and from the maturity of project preparation process. These issues have a significant impact on the efficiency and effectiveness of meeting objectives of development options, materializing the planned results. The MCA technical criterion reflects the abovementioned key aspects and risks of the project preparation, implementation and operation phases and advancements.

12.5.4 ENVIRONMENTAL SUSTAINABILITY

The contribution which projects make to the EU environment policies is a key issue impacting development option choice and its later implementation. This has been included in the MCA scheme adopted for the PFS. The environmental impact of development options must consider crucial EU environmental policy priorities, for example investment impact on protected areas NATURA 2000, natural and man-made environment.

12.5.5 GEOPOLITICAL AND LEGAL IMPLICATIONS

The current separation the EU/Croatia territory Bosnia and Herzegovina (B&H) results in many legal issues which have a direct impact on the feasibility and sustainability of development options. Major areas of concern are related to the compliance with the UN Convention on the Law of the Sea, necessity for international agreement related to possible creation of road corridor or by pas through B&H territory (third country). Additional issues related to the Schengen Acquis and EU legal framework surfaced after Croatia joined the Union. As a result there is a complex and complicated legal situation which needs to be considered when assessing development options. It is necessary to measure how each option may contribute the improvement of this situation. There is also a large political and social area which has to be addressed. The land discontinuity of EU territory in the Neum area may contribute to social and political tensions. For example, a vast majority of the City of Neum residents are of Croatian decent. They and their children need unlimited and unconstrained access to the EU/Croatia territory for family reasons, school attendance, and other social needs. The construction of extraterritorial corridors in B&H territory may create unneeded regional tension in particular with predominantly Croatian population. This was confirmed during the origin-destination surveys and meetings with local governments in the target area. If B&H joins the European Union, all these issues may be will be resolved partially without the need to construct temporary solutions like sealed corridors. The saved funds may be used to provide for transport solutions contributing to the increased quality of life of the current and future residents of the European Union. For example, about 60 to 70percent of houses and dwellings in the Orebic area are owned by the current citizens of B&H. The provision of a better access to this area which at the same time would insure the EU territory land connection would achieve additional political and economic benefits, and contribute to the improvement of geopolitical situation and creation of sustainable stability in the Neum region.

12.6 Definition of Indicators

The five criteria defined in the previous paragraphs are general and need to be focused on particular representative indicators capable to reflect the effects and differences between the analysed investment options. Indicators should be mutually independent of each other. No duplicate indicators are allowed. The evaluation of one indicator cannot influence the assessment of another, as much as possible, to avoid overlapping. In this way, the distribution of scores in the MCA will be as balanced as possible. It is therefore important to define exactly the content of each indicator, especially for those indicators that can be estimated only by qualitative assessment. The following indicators were defined:

1. Economic sustainability indicators: EIRR :
2. Regional development impact indicators: Social accessibility, Regional economic development, Compliance with regional development strategies.
3. Technical improvements and risks indicators: Transport system capacity; Investment preparation risk; Engineering and geotechnical risk
4. Environmental sustainability indicators: Impacts on natural ecosystems; Impacts on protected areas; Impacts on man-made environment;
5. Geopolitical and legal impact indicators: Compliance with the Schengen Acquis; International accessibility impact, Necessity of additional international agreements; Compliance with the UN Convention on the Law of the Sea

Some of the above indicators cannot be expressed in quantifiable terms. Therefore, qualitative assessment, based on a professional expertise, will be used to express the impact these indicators. The assumptions for the assessment of indicators are presented below.

12.7 Weights and Preferences

12.7.1 INTRODUCTION

According to the MCA scheme, after criteria and indicators are established, weights and preferences are applied. Weights are applied by to indicators within each criterion. These are technical issues and decisions related to the concept and logic of the MCA activities. It is the Consultant's prerogative to establish the strength of each indicator, and its impact on the final criterion evaluation. The weights are applied by the Consultant as a part of a technical design of MCA efforts. The situation is different for preferences which are usually assigned by the beneficiary or its agents. The preferences are applied to criteria, and reflect the beneficiary's priorities for a given investment.

12.7.2 WEIGHTS

According to the principles of the state-of-the-art MCA methodology, the indicator weighting system must adhere to several basic rules:

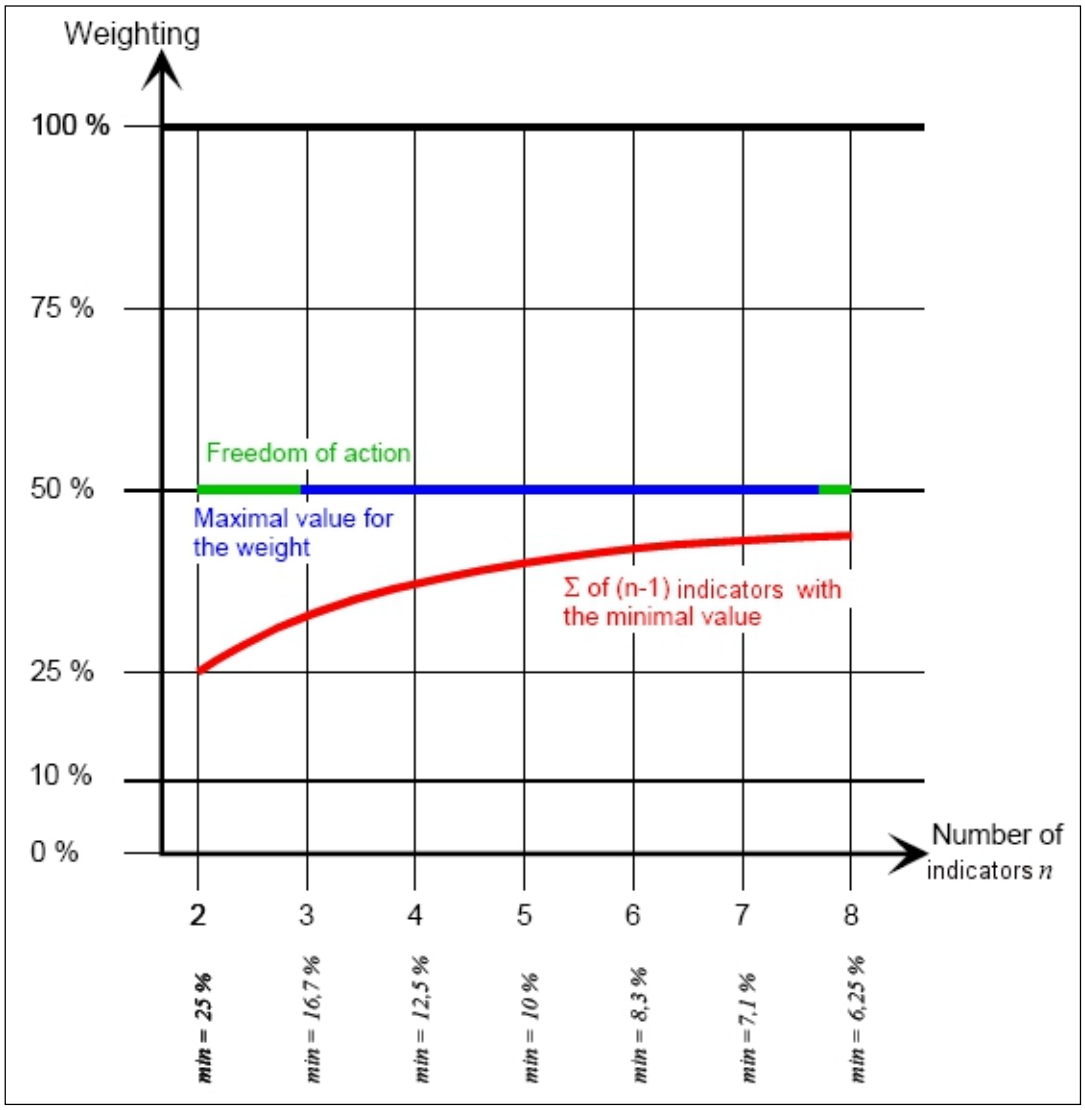
- Weights are attributed to indicators in percent
- The total weight value within a criterion amounts to 100 %
- If more than two indicators are in a given criterion, the maximum weight for an individual indicator is fixed, and cannot exceed 50 %
- A minimum weight attributed to any indicator is also fixed. It cannot be smaller than the amount resulting from the following formula:

    - Wmin = ΣWi 100/2n, where
    - Wmin - minimal weight attributed to an indicator

- ΣWi = 100% - sum of the weighting of the different indicators in a criterion
- n - number of indicators in a criterion

Figure provided below depicts these rules.

Figure 31 Weighting validation scheme



At the validation principles stated above, the weighting system assures that each indicator is properly taken into consideration, and enables avoiding generation of too many indicators and introducing "fake indicators" which exist but do not have the real impact on MCA results. As also transpires from the figure above, the number of objectives within a category should not in general be lower than three and higher than seven. Beyond this value, the distinctions between the criteria (their relative importance) is going thin and contribute to make weighting homogeneous (obtain of the same criteria weight or with weak relative difference

The abovementioned validation procedures were applied to the MCA conducted within this PFS. One indicator for a criterion is used only in one case, for an economic sustainability criterion. One should however notice that this indicator (EIRR - Economic Internal Rate of Return) encompasses and considers several key financial and economic factors such as: investment cost, maintenance and operating costs, and monetized benefits of time travel savings, etc. Therefore, in this case, the application of a single economic indicator, fully complies with the principles of the validation procedure addressed in the preceding paragraphs.

The weights applied to each indicator for the purposes of this analysis are shown in Figure below.

Table 55 Weight System for MCA Indicators

Indicator	Assigned Indicator Weight
Economic indicators	
EIRR	100%
Regional indicators	
Regional economic development impact	40%
Compliance with regional development strategies	20%
Social accessibility impact	40%
Technical indicators	
Transport system capacity	40%
Investment preparation risk	40%
Engineering and geotechnical risk	20%
Environmental indicators	
Impacts on natural ecosystems	25%
Impacts on protected areas	50%[94]
Impacts on man-made environment	25%
Legal indicators	
Compliance with the Schengen Acquis	20%
Necessity of additional international agreements	40%
International transport accessibility impact	20%
Compliance with the UN Convention on the Law of the Sea	20%

12.7.3 PREFERENCES

The final stage of the integrated MCA methodology[95] used in this study is preference application. Preferences were developed and applied in consultations with the Beneficiary and Advisory Committee. The final voice for criteria and preferences approval, per ToR was that of the beneficiary. The initial assessment was done based on preferences suggested by the Advisory Committee which were fully accepted by the Beneficiary. The Consultant also accepted these preference distribution. Subsequently, a number of sensitivity tests for other preference distribution were completed.

[94] This was done according to the EU regulations concerning NATURA 2000 presented in the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (which Council where is that information from)

[95] Integrated approach involves usage of weights and preferences in an evaluation and assessment process.

Table 56 MCA Criteria Preferences Suggested By Beneficiary and Advisory Committee for Base Case Scenario

Criteria	Applied preferences
Economic	25%
Regional	10%
Technical	25%
Environmental	15%
Legal	25%

The process of evaluation and its results with these preferences provide the MCA Base Case Scenario. They are described in the following subsections.

12.8 MCA Base Case Scenario

12.8.1 INTRODUCTION

The MBA Base Case Scenario was carried out according to the methodology assumptions provided in the preceding subsections. This involves three major steps completed based on the assumptions for MBA Base Case Scenario:

- Assigning values to particular indicators
- Normalization of values for indicators
- Applying weights to indicators by the Consultant
- Computation of scores by criteria
- Applying preferences established with the Beneficiary ad the Advisory Committee for MBA Base Scenario
- Calculation of final scores for MBA Base Case Scenario

Subsequently, a number of sensitivity tests were run on various sets of preferences. The following subsections describe these procedures.

12.8.2 ECONOMIC SUSTAINABILITY INDICATORS

EIRR (Economic Internal Rate of Return) indicator has been chosen to reflect economic sustainability of the development options. It is calculated according to the standard EIRR calculation procedures using the following variables:

- Costs: investment, maintenance and operating costs.
- Benefits: monetized travel time savings resulting for a given development option.

The Economic Internal Rate of Return (EIRR) was calculated for all the development options based on the assumptions described in this PFS report[96]. A summary of the results is presented below:

[96] See: Section on Cost-Benefit Analysis

Table 57 EIRR by Development Options

Development option	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic Rate of Return (EIRR)	13,50%	13,03%	6,33%	-6,40%	-4,65%	3,96%	8,65%	6,60%	5,40%	-1,52%	-2,06%

The highest EIRR have the Peljesac Bridge development options:

- A1 (EIRR of 13,50%)
- A2 (EIRR of 13,03%).

12.8.3 REGIONAL DEVELOPMENT IMPACT INDICATORS

Three indicators described have been established to reflect regional development impact of the evaluated development options.

Social accessibility impact indicator

This indicator reflects impact of development options on local communities' accessibility to the main regional and national centres. The indicator is assessed quantitatively and measured by the number of inhabitants affected by accessibility improvements resulting for development options, multiplied by the average non-season time savings per passenger in the period 2017-2046.[97] It concerns the area included to the traffic model prepared in this PFS.

The impact of the development options on local communities' accessibility to the main regional centres was calculated using the following data:

- Accessibility impact of the project options, based on the traffic model results (traffic model developed for this PFS)
- Statistics on number of inhabitants in cities and municipalities, affected by accessibility improvements;
- Average non-season travel time savings resulting from the given development option per passenger in the period 2017-2046, based on the traffic model results. The non-season data were used because this impact concerns locals.

Figure 32 shows the location of the main regional centres, providing education, public and social institutions, health care and other services. Figures 33 and 34 show the traffic flows in options A1 and B (as an example for two most likely development options), and provide information about the changes of traffic patterns within these options. Tables 58, 59 and 60 show the assumptions for the calculation of social accessibility impact indicator.

[97] This reflects assumptions of EU policies that establish shortening travel time to major cities and country capital as a major transport accessibility and mobility improvement metrics.

Figure 32 Municipalities and Towns of Dubrovnik-Neretva County

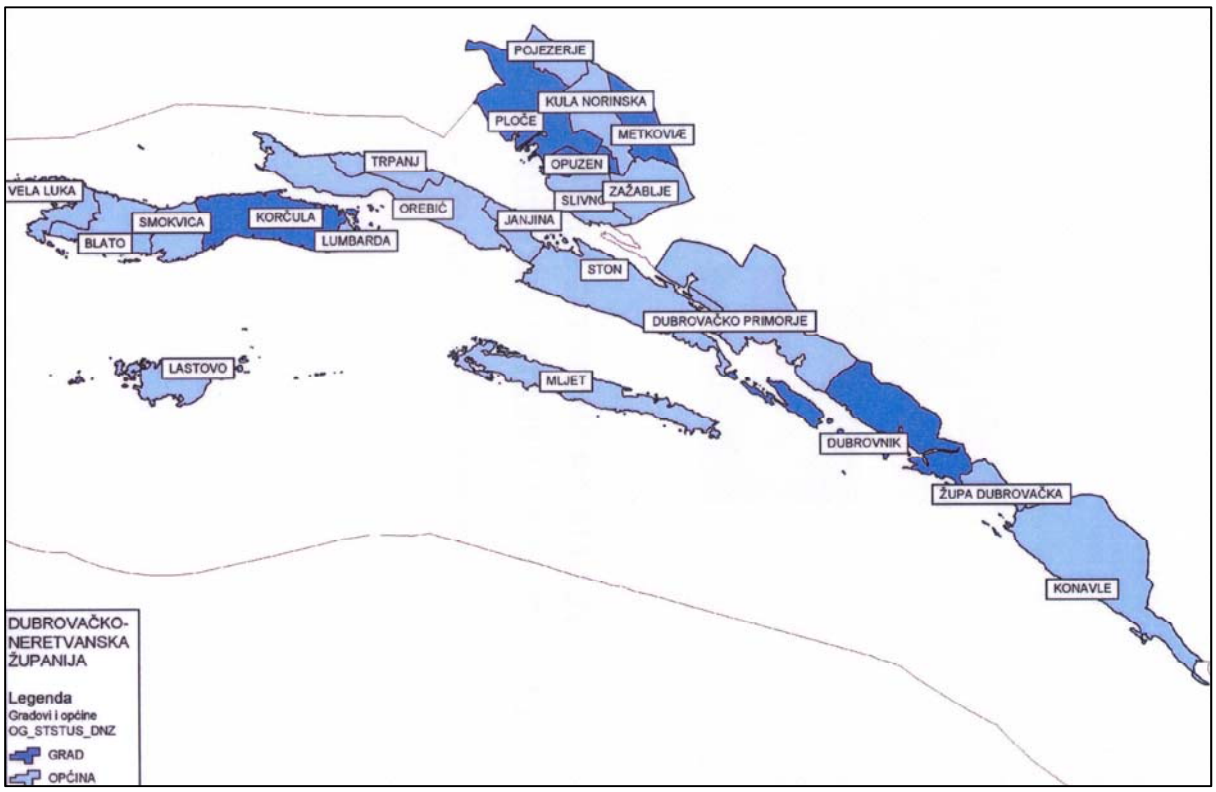


Figure 33 Accessibility Impact of A1 Option on the Peljesac Cities and Municipalities

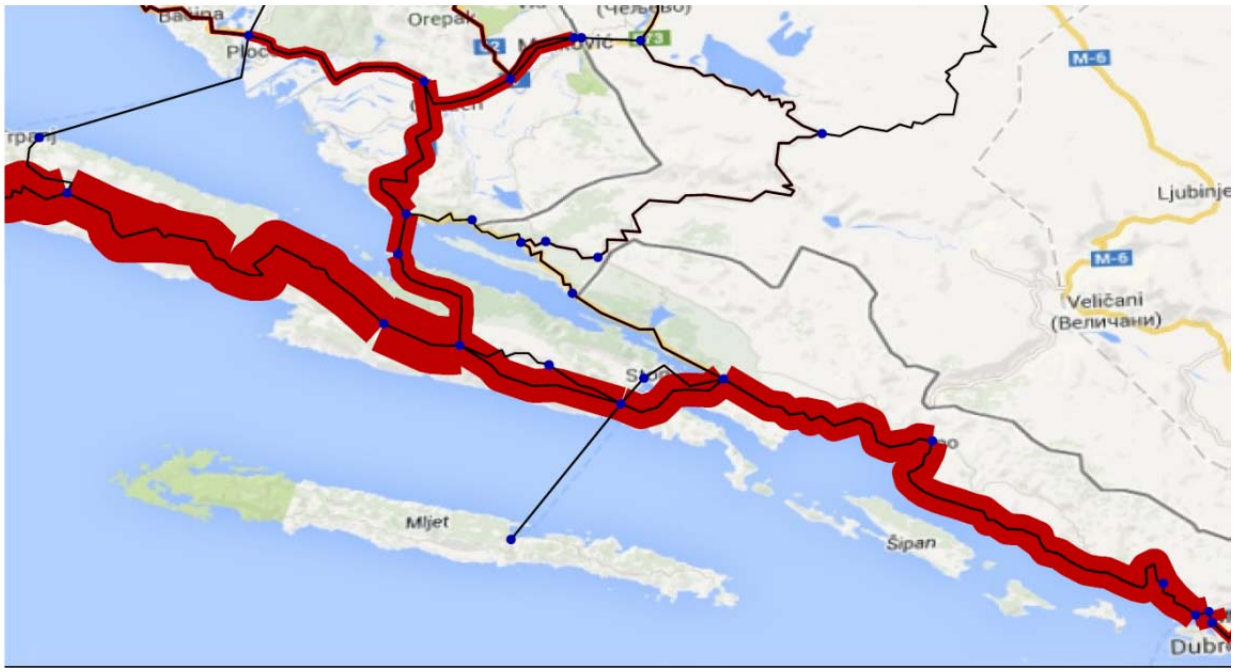


Figure 34 Accessibility Impact of B option on the Peljesac Municipalities and Towns

Table 58 Number of Inhabitants Affected by Accessibility Improvements

Towns and municipalities	Number of inhabitants	Number of inhabitants affected by the accessibility improvements										
		A1	A2	B	C	D	E1	E2	F1	F2	G	H
Dubrovnik	43,77	43,77	43,77	43,77	43,77		43,77	43,77	43,77	43,77	43,77	43,77
Korčula	5,89	5,89	5,89	1,472	1,47	5,89	5,89	5,89	5,89	5,89		
Metković	15,38	15,38	15,38	15,38	15,38		15,38	15,38	15,38	15,38	15,38	
Opuzen	3,24	3,24	3,24	3,24	3,24		3,24	3,24	3,24	3,24	3,24	
Ploče	10,83	10,83	10,83	10,83	10,83		10,83	10,83	10,83	10,83	10,83	
Blato	3,68	3,68	3,68	0,92	0,92	3,68	3,68	3,68	3,68	3,68		
Dubrovačko primorje	2,22	2,22	2,22	2,22	2,22		2,22	2,22	2,22	2,22	2,22	
Janjina	0,59	0,59	0,59	0,148	0,15	0,59	0,59	0,59	0,59	0,59		
Konavle	8,25	8,25	8,25	8,25	8,25		8,25	8,25	8,25	8,25	8,25	
Kula Norinska	1,93	1,93	1,93	1,93	1,93		1,93	1,93	1,93	1,93	1,93	8,25
Lastovo	0,84	0,84	0,84	0,209	0,21	0,84	0,84	0,84	0,84	0,84		
Lumbarda	1,22	1,22	1,22	0,305	0,31	1,22	1,22	1,22	1,22	1,22		
Mljet	1,11	1,11	1,11	0,278	0,28	1,11	1,11	1,11	1,11	1,11		
Orebić	4,17	4,17	4,17	1,041	1,04	4,17	4,17	4,17	4,17	4,17		
Pojezerje	1,23	1,23	1,23	1,23	1,23		1,23	1,23	1,23	1,23	1,23	
Slivno	2,08	2,08	2,08	2,08	2,08		2,08	2,08	2,08	2,08	2,08	
Smokvica	1,01	1,01	1,01	0,253	0,25	1,01	1,01	1,01	1,01	1,01		
Ston	2,61	2,61	2,61	0,651	0,65	2,61	2,61	2,61	2,61	2,61		
Trpanj	0,87	0,87	0,87	0,218	0,22	0,87	0,87	0,87	0,87	0,87		
Vela Luka	4,38	4,38	4,38	1,095	1,10	4,38	4,38	4,38	4,38	4,38		
Zažablje	0,91	0,91	0,91	0,91	0,91		0,91	0,91	0,91	0,91	0,91	
Župa dubrovačka	6,66	6,66	6,66	6,66	6,66		6,66	6,66	6,66	6,66	6,66	
Neum	4,61	4,61	4,61	4,61	4,61		4,61	4,61	4,61	4,61	4,61	
TOTAL		**127,48**	**127,48**	**107,70**	**107,70**	**26,36**	**127,48**	**127,48**	**127,48**	**127,48**	**101,11**	**52,02**

Source: DZS, Year 2001 Census

Table 59 Average Non-season Time Savings per Passenger in 2017-2046

Average non-season time savings per passenger in the period 2017-2046 (hrs/pass)										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
83	45	60	46	14	47	35	83	45	55	5

Source: Traffic model

Based on the above social accessibility indicator values were calculated. They are presented below.

Table 60 MCA Social Accessibility Indicator Values by Development Options

MCA social accessibility indicator values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
10 536	5 695	6 423	4 988	360	6 049	4 480	10 536	5 695	5 523	285

The analysis and indicator value computation indicate that the highest impact on local communities' accessibility to the main regional centres will be generated by implementation of options A1 and F1. These options provide additional, high capacity connections of the Peljesac Peninsula communities and the regional centres with the rest of Croatia and the Peninsula.

Regional economic development indicator

It reflects changes in local and regional economies caused by development option implementation. The assessment will consider key economic development factors, especially additional tourism-related revenue for the affected area. The indicator will be assessed quantitatively and measured by the gross value added for tourism related activities in Dubrovnik-Neretva county (wholesale and retail trade, transportation, storage, accommodation and food service) multiplied by the share of tourists travelling in the region, and multiplied by the % increase of leisure time (share of summer season travel time savings for average passenger in 12h).

Changes in local and regional economies caused by possible implementation of development options were assessed based on the additional tourism-related revenue for the area affected. The following data were used:

- Gross value added for tourism related activities in Dubrovnik-Neretva county (wholesale and retail trade, transportation, storage, accommodation and food service): 354 mln EUR/year[98]
- Share of tourists travelling in the region: 50%[99]
- Average increase of leisure time in percent (the share of summer season travel time savings for average passenger in 12h), based on the traffic model results

[98] *DZS, "First Release" Bulletin of 14th February 2013, no. 12.1.2.*
[99] An assumption based on the OD surveys results

Table 61 Average Increase of Leisure Time For Development Options

Average increase of leisure time										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
12,7%	1,7%	10,0%	11,7%	11,5%	0,5%	4,3%	4,1%	12,1%	9,1%	10,2%

The final computed values for regional economic development indicator are presented below.

Table 62 MCA Regional Economic Development Indicator Values

MCA Regional Economic Development Indicator										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
22,55	17,69	20,65	20,28	0,87	7,59	7,21	21,46	19,12	18,10	2,19

The analyses indicate that the highest additional revenue from tourism can be obtained:

- By introducing development option A1 (Peljesac Bridge) .
- Options B, C and F1 also generate high additional volumes of revenues resulting from additional visitors' consumption.

Based on the accepted assumptions, these options have the highest impact on local and regional economies.

Compliance with Regional Development Strategies

This indicator reflects the development option compliance with the strategic and planning documents on the international, national, regional and local level. This concerns strategic and planning documents such as: public investment plans/programs, development strategies/plans, transport strategies/plans, etc. from EU, Croatia, and Bosnia and Herzegovina. This indicator has been valued qualitatively based on data collected during the PFS by assigning points according to the following rules:

- 0 is assigned when the development option is not included in any international, national, regional nor local strategic and planning documents;
- 1 is assigned when the development option is included in international strategic and planning documents;
- 2 is assigned when the development option is included in national strategic and planning documents;
- 3 is assigned when the development option is included in national and regional strategic and planning documents;
- 4 is assigned when the development option is included in national, regional and local strategic and planning documents;

The assigned values for the indicator are presented in the table below

Table 63 MCA Compliance With Regional Development Strategies Indicator Values

MCA compliance with regional development strategies indicator values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
4	4	2	1	4	0	0	0	0	0	1

The results show that the options A1, A2 and D meet the strategic goals of the national, regional and local plans and strategies. Other options require the changes in the strategic documents including the procedures of community dialogue and consultations of these strategic documents.

12.8.4 ENVIRONMENTAL SUSTAINABILITY INDICATORS

The documentation and analytical environmental assessment of development options are presented in other sections of this PFS. The following presents indicators used for MCA[100]. The environment assessment was done based on three indicators described below.

- **Impact on natural ecosystems.** This indicator reflects impact of development options on terrestrial and marine ecosystems, for the most significant ecologically habitats: flora and fauna species. The indicator is assessed qualitatively. A basis for the evaluation is presented in the environmental section of this PFS. The values of the indicator are presented as cumulative values for the grouped criteria presented in the environmental report and below.
- **Impact on protected areas.** This indicator reflects impact of development options on nationally protected areas and Natura 2000 areas in the targeted area. The indicator is assessed qualitatively, based on the conclusions of the environmental assessment presented in other sections of this PFS.
- **Impact on man-made environment.** This indicator reflects impact of development options on land uses, acoustic and atmospheric environment and historic and cultural environment[101]. The values for this indicator have been assessed qualitatively. The detailed results of the environment assessment are presented in other sections of this PFS. The value of this indicator is an average of value of the grouped criteria presented in the table below.

The documentation and analytical environmental evaluation of development options are in an environmental report provided as an attachment to this PFS. Based on these analyses the qualitative assessment of the environmental indicators was conducted. The results are presented below.

Table 64 MCA Environmental Impact Indicator Values

Indicators	MCA environmental impact indicators values										
	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Impact on natural environment	15,0	14,3	15,2	15,5	17,3	17,2	15,8	15,7	13,5	13,8	14,7
Impact on protected areas	4,0	4,0	4,0	4,3	5,0	4,8	4,8	4,3	3,3	4,0	3,3
Impact on man-made environment	6,8	13,3	11,8	11,0	14,0	9,5	13,3	7,0	12,8	11,3	11,8

[100] A standard assessment system was used for environmental analysis conducted in this PFS. A scoring system typical for standard environmental analysis was used. This system uses positive and negative scores. These scores were converted to the evaluation system used in this MCA for consistency purposes. The principles and results of scores conversion are described in Appendix to this chapter. The converted scores are used for MCA and described in this subsection.

[101] The environmental assessment also included assessment of some general socioeconomic conditions, consistently with a typical environmental evaluation approach. These factors have however not been included in this indicator. This was done to avoid duplicity and overlapping with socioeconomic assessment included in other elements of MCA.

The assessment indicates that:

- The highest negative impact on the natural environment will result from implementation of options D and E1. In option D this is caused by the impact on terrestrial environment, and in option E1 by the cumulative effect of impact on terrestrial and marine environment.
- The highest negative impact on protected areas will result from implementation of options D and E1.
- The highest negative impact on the man-made environment will result from implementation of options D, A2 and E2 as the result of building new sections of roads in populated area.

12.8.5 TECHNICAL INDICATORS

Three indicators described below have been established to reflect impact of the evaluated development options.

Transport system capacity

This indicator reflects the changes in transport system capacity resulting from implementation of a given development option. The assessment is focused on the capacity of roads providing connection between Ploce and Dubrovnik. It represents a reduction of existing bottlenecks between these O-D points. The indicator is assessed quantitatively and measured for each option by a bottleneck severity indicator. The transport capacity indicator is calculated according to the following formula:

Transport system capacity indicator value = minimum (bottleneck) capacity of the road system in 2046 / total traffic flows (relation Komarna – Zaton Doli) in 2046: 20114 vehicles/day

Table 65 Bottleneck Minimum Capacity

MCA Minimum (bottleneck) Capacity of the Road System in 2046 between Komarna and Zaton Doli										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
20280	13080	19200	20280	3180	5280	5280	20280	13080	19200	1080

The Transport System Capacity Indicator *(bottleneck severity indicator*) of the road system between Ploce – Dubrovnik is shown below:

Table 66 Transport System Capacity Indicator

MCA Transport System Capacity Indicator Values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
100,8%	65,0%	95,5%	100,8%	15,8%	26,3%	26,3%	100,8%	65,0%	95,5%	5,4%

The assessment indicates that the highest capacity will be produced by implementation of options A1, C and F1. This is caused by providing the alternative route on the whole section Komarna – Zaton Doli.

Investment preparation risk

This indicator reflects the current status of preparation of development options and estimated risk related to timely completion of the remaining activities needed for starting the construction phase. The current progress of the project options preparation and the estimation of the risk associated with the remaining preparatory steps were assessed quantitatively based on the availability of feasibility studies and technical designs and the development of the administrative procedures, the congruence with the spatial planning documentation and the necessity of international approval of construction permits or related international agreements, etc.

This is represented by a risk factor which reflects possibilities of delays, cost increase risks, and chances for significant changes in project assumptions and scope. The indicator has been expressed quantitatively. It has been measured by the estimated number of months necessary to start the implementation phase of each project option, multiplied by the risk factor *R.* It was calculated according to the following formula:

Investment preparation risk indicator value = total number of months needed to obtain necessary documentation to start investment implementation phase multiplied by R, where:

R = 1 if there is a congruence with spatial plans and there is no requirement for international approvals of construction permits
R = 1,5 if there is no congruence with spatial plans but there is no requirements for international approvals of construction permits
R = 2 if there is no congruence with spatial plans and there is a requirement for international approvals of construction permits

Table 67 Preparation Periods of Development Options

Option	Feasibility study	EIA and environmental permit	Spatial Plan	Expropriation	Detailed design	Construction permits	Preparation period (months)
A1	4	0	0	0	6	6	**16**
A2	4	0	0	0	6	6	**16**
B	12	12	12	12	12	12	**72**
C	12	12	12	12	12	12	**72**
D	4	0	0	0	6	6	**16**
E1	12	6	6	0	6	6	**36**
E2	12	6	6	0	6	6	**36**
F1	12	12	6	0	6	12	**48**
F2	12	12	6	0	6	12	**48**
G	12	12	12	0	36	24	**96**
H	24	24	24	24	36	24	**60**

The total lengths of preparation periods of development options were multiplied by the risk factor, reflecting the possibilities of delays, cost increase and significant changes in project assumptions and scope. The final assessment of development options for this indicator is presented below:

Table 68 MCA Investment Preparation Risk Indicator Values

MCA Investment Preparation Risk Indicator Values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
16	16	144	144	16	54	54	72	72	192	312

The highest investment preparation risk is associated with options B, C, G and H, for which the documentation development process may result in significant changes in scope, costs and timeline of implementation.

Engineering and geotechnical risk.

This indicator reflects the risk of experiencing engineering and geotechnical problems (complications) during the project design and construction phases of the investment. That may result from such factors as: geological, hydrological and seismic characteristics of the area where the investment is located. The estimate of this risk is related to the length of the structures (tunnels, bridges) to be constructed, weighted by the availability of the results of geological and hydrological studies, investigations and expert opinions. The indicator has been expressed quantitatively.

It has been measured by the estimated length of the structures multiplied by the risk factor A, which has been projected in relation to the availability of geological, hydrological investigations and other expertise. The following formula has been used for these calculations.

Engineering and geotechnical risk indicator value = total length of the structures per option multiplied by A, where:

A = 1 if necessary geological and hydrological investigations, and analyses results are fully available for a given construction area
A = 2, if necessary geological and hydrological investigations, and analyses results are partially available a given construction area
A = 3, if necessary geological and hydrological investigations, and analyses results are not available for the construction area.

Table 69 Input Values for Engineering and Geotechnical Risk Assessment

	Input values for engineering and geotechnical risk assessment										
	A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
Length of structures	8,6	5,4	1,3	6,7	3,2	6,1	3,0	8,5	5,3	11,0	30,0
Availability of the geological and hydrological investigations	1	1	3	3	1	2	2	2	2	3	3

Table 70 MCA Engineering and Geotechnical Risk Values

MCA investment preparation risk indicator values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
8,6	5,4	3,9	20,0	3,2	12,3	5,9	16,9	10,6	33,0	90,0

The highest engineering and geotechnical risk is associated with options H, G, and C, for which the engineering and geotechnical surveys may show the necessity of additional scope of works to secure the stability of constructed structures, which may result in significant changes in costs and timeline of implementation.

12.8.6 GEOPOLITICAL AND LEGAL IMPACT INDICATORS

Four indicators have been used in the MCA assessment regarding legal and geopolitical issues.

Compliance with the Schengen Acquis and EU legal framework (EU external border security risk)

This indicator addresses a variety of issues related to security risks for EU external borders. It takes into account such factors as: requirements of border and customs control, and security risks for the EU external border (illegal migrations & cross border crime risk). Three values have been assigned to this indicator based on expert evaluation:

- 1 = low risk,
- 2 = medium risk
- 3 = high risk.

The results of the assessment are presented below:

Table 71 Mca Security Risks for EU External Border Assessment

MCA security risks for EU external border assessment										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
1	1	3	3	2	2	2	1	1	2	2

The highest EU external borders security risk is associated with options B and C, for which the traffic flows cross the territory of non-EU country with no border checks or customs control. The security measures assumed in options B and C make these options compliant with the Schengen Acquis and mitigate, but they do not remove the risks of illegal migrations, terrorism and cross border crime.

International accessibility impact

This indicator represents impact of development options on international transfer of goods and people. The indicator will be assessed qualitatively, by assigning points by experts, in three groups of impact. The results of the assessment are presented below:

Table 72 MCA International Accessibility Impact Assessment

	MCA international accessibility impact assessment										
	A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
TOTAL:	**4**	**4**	**4**	**4**	**5**	**4**	**4**	**5**	**5**	**3**	**5**
Impact on naval accessibility of the Port of Neum	2	2	1	1	1	2	2	3	3	1	1
Impact on regional cohesion of B&H territory	1	1	2	2	1	1	1	1	1	1	1
Impact on passengers and freight accessibility of Dubrovnik – Neretva County	1	1	1	1	3	1	1	1	1	1	3

where:

- Impact on naval accessibility of the Port of Neum: 3 = significant restriction of naval approach to Port of Neum; 2 = minor restriction of naval approach to Port of Neum; 1 = no restriction of naval approach to Port of Neum;
- Impact on regional cohesion of B&H territory: 3 = significant restriction of internal accessibility of B&H territory (inside a densely populated area of B&H territory); 2 = minor restriction of internal accessibility of B&H territory (outside of densely populated areas of B&H territory); 1 = no restriction of internal accessibility of B&H territory;
- Impact on passengers and freight accessibility of Dubrovnik – Neretva County[102]: 3 = significant restriction of accessibility; 2 = minor restriction of accessibility; 1 = no restriction of accessibility;

Necessity of additional international agreements.

This indicator reflects the need for concluding additional international agreements to implement a given development option. Development options which implementation requires advance conclusion of international agreements, legal preparations, and require political good will, are usually more difficult to implement and the process of their preparation is more lengthy than for other development options. The indicator has been assessed qualitatively. The results of the assessment are presented below:

Table 73 MCA Necessity of Additional International Agreements Indicator Values

MCA necessity of additional international agreements indicator values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
1	1	3	3	1	2	2	2	2	3	3

where:

- 1 = additional international agreements not needed,
- 2 = additional international agreements recommended but not compulsory;
- 3 = additional international agreements compulsory.

[102] Impact related to border, customs, veterinary and phyto-sanitary regulations of EU

The international agreements are necessary in options B, C, G and H, which creates lots of uncertainty in the whole investment process, associated with the timeframe, conditions and results of international multiparty negotiations (Croatia, B&H and EU).

Compliance with the UN Convention on the Law of the Sea.

This indicator takes into consideration a possibility of a conflict between development options and the provisions of the UN Convention of the Law of the Sea, which may lead to an international legal dispute or law suit. The indicator is established qualitatively by assigning points, by an expert panel. The results of the assessment are presented below:

Table 74 MCA Compliance with UN Convention on the Law of the Sea Indicator Values

MCA Compliance with UN Convention on the Law of the Sea indicator values										
A1	**A2**	**B**	**C**	**D**	**E1**	**E2**	**F1**	**F2**	**G**	**H**
2	2	1	1	1	3	3	3	3	1	1

where:

- 1 = low risk of a potential international legal dispute or a law suit
- 2 = medium risk of a potential international legal dispute or a law suit
- 3 = high risk of a potential international legal dispute or a law suit

The highest risk of a potential international legal dispute or a law suit is associated with options E1, E2, F1, and F2, for which no initial agreements were made between Croatia and B&H concerning the compliance of these options with UN Convention on the Law of the Sea. The Peljesac Bridge (options A1 and A2) was initially agreed between Croatia and B&H to keep the standards of B&H free access to the open sea. The UN Convention on the Law of the Sea does not apply to options B, C, D, G, and H, therefore cannot be the legal basis for any claim or law suit.

12.9 MCA Base Case Scenario Results

The indicators described in the previous subsections were used as input values in the MCA analysis model. The following tables show:

- Input Values for Indicators
- The results of input values recalculation. Input values were recalculated into the scale from 0 to 100 and multiplied by the weight of the indicator. The result is the matrix of points assigned to the indicators by options
- Prior to assigning the preferences, the points have been summed up and a matrix of total number of points per criteria and option was created. The result of this step is a basis for preferences assignment.
- Finally preferences were assigned and the MCA Base Case Scenario results are presented

Table 75 Input Values of Indicators

CRITERIA	INDICATOR	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Econ. Impact	**EIRR**	13,50%	13,03%	6,33%	-6,40%	-4,65%	3,96%	8,65%	6,60%	5,40%	-1,52%	-2,06%
Regional development indicators	**Social accessibility**	10 536	5 695	6 423	4 988	360	6 049	4 480	10 536	5 695	5 523	285
	Regional economic development	23	18	21	20	1	8	7	21	19	18	2
	Compliance with regional development strategies	4	4	2	1	4	0	0	0	0	0	1
Technical indicators	**Transport system capacity**	100,8%	65,0%	95,5%	100,8%	15,8%	26,3%	26,3%	100,8%	65,0%	95,5%	5,4%
	Investment preparation risk	16	16	144	144	16	54	54	72	72	192	312
	Engineering and geotechnical risk	8,58	5,41	3,90	19,98	3,18	12,28	5,93	16,90	10,55	33,00	90,00
Environmental indicators	**Impacts on natural ecosystems**	15,00	14,25	15,15	15,50	17,25	17,15	15,80	15,65	13,50	13,75	14,65
	Impacts on protected areas	4,00	4,00	4,00	4,30	5,00	4,80	4,80	4,30	3,30	4,00	3,30
	Impacts on man-made environment	6,80	13,30	11,80	11,00	14,00	9,50	13,30	7,00	12,80	11,30	11,80
Geopolitical and legal impact	**Compliance with the Schengen Acquis and EU legal framework (security risks for the EU external border)**	1	1	3	3	2	2	2	1	1	2	2
	International geopolitical and accessibility impact	4	4	4	4	5	4	4	5	5	3	5
	Necessity of additional international agreements	1	1	3	3	1	2	2	2	2	3	3
	Compliance with the UN Convention on the Law of the Sea	2	2	1	1	1	3	3	3	3	1	1

Table 76 Points Assigned by Development Options Based on Input Values of Indicators and Weights

CRITERIA	INDICATOR	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic impact	**EIRR**	100	98	64	0	9	52	76	65	59	25	22
Regional development indicators	**Social accessibility**	40	21	24	18	0	22	16	40	21	20	0
	Regional economic development	40	31	36	36	0	12	12	38	34	32	2
	Compliance with regional development strategies	20	20	10	5	20	0	0	0	0	0	5
Technical indicators	**Transport system capacity**	40	25	38	40	4	9	9	40	25	38	0
	Investment preparation risk	40	40	23	23	40	35	35	32	32	16	0
	Engineering and geotechnical risk	19	19	20	16	20	18	19	17	18	13	0
Environmental indicators	**Impacts on natural ecosystems**	15	20	14	12	0	1	10	11	25	23	17
	Impacts on protected areas	29	29	29	21	0	6	6	21	50	29	50
	Impacts on man-made environment	25	2	8	10	0	16	2	24	4	9	8
Geopolitical and legal impact	**Compliance with the Schengen Acquis and EU legal framework (security risks for the EU external border)**	20	20	5	0	10	10	10	20	20	10	10
	International geopolitical and accessibility impact	10	10	7	10	0	10	10	0	0	20	0
	Necessity of additional international agreements	40	40	0	0	40	20	20	20	20	0	0
	Compliance with the UN Convention on the Law of the Sea	10	10	20	20	20	0	0	0	0	20	20

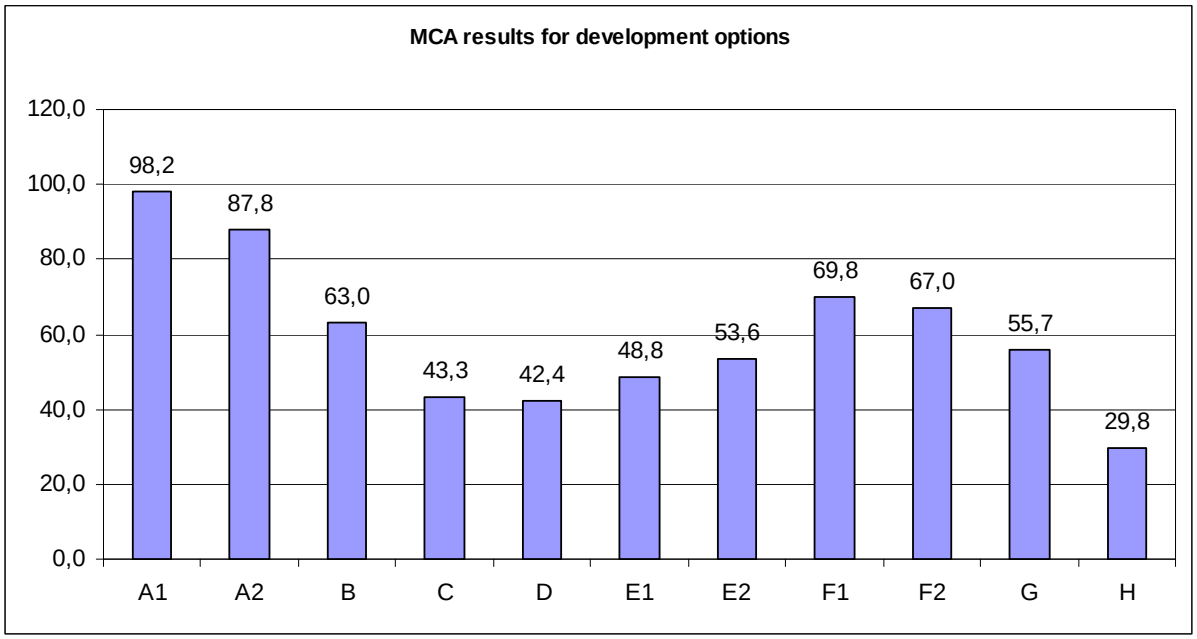
Table 77 Total Number OF Points per Criterion Prior to Assigning Preferences

CRITERIA	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic impact	100	98	64	0	9	52	76	65	59	25	22
Regional development indicators	100	72	70	59	20	35	28	78	55	52	7
Technical indicators	99	84	80	79	64	62	63	89	76	67	0
Environmental indicators	69	52	51	43	0	22	18	56	79	62	75
Geopolitical and legal impact	80	80	32	30	70	40	40	40	40	50	30

Table 78 Final Base Case Scenario Assessment Results (After Applying Preferences for this Scenario)

CRITERIA	Preferences	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic impact	**25%**	25	24	16	0	2	13	19	16	15	6	5
Regional development indicators	**10%**	10	7	7	6	2	3	3	8	5	5	1
Technical indicators	**25%**	25	21	20	20	16	16	16	23	19	17	0
Environmental indicators	**15%**	13	10	10	8	0	4	3	11	15	12	14
Geopolitical and legal impact	**25%**	25	25	10	9	22	13	13	13	13	16	9
TOTAL	**100%**	**98,2**	**87,8**	**63,0**	**43,3**	**42,4**	**48,8**	**53,6**	**69,8**	**67,0**	**55,7**	**29,8**

Figure 35 Final Base Case Scenario Assessment Results



12.10 Conclusions from MCA Base Case Scenario

The following are major conclusions:

- Based on the established and agreed upon criteria two Peljesac Bridge options are the most competitive. Their scores are significantly higher than scores for other development options.
- Immersed tunnel is the next preferable option
- Third runner up is the extraterritorial Neum By-pass
- Other options are scored lower.

Based on this assessment, the Beneficiary should proceed with a feasibility study for a development option involving the construction of the Peljesac Bridge. In this feasibility study all the gamut of issues raised in the PFS should be addressed. That may contribute to providing the value for money (VfM) in the entire investment process from investment preparation, financing, construction to its full and efficient completion.

12.11 Sensitivity Scenarios

In addition to the MCA Base Case scenario, three sensitivity tests for different sets of preferences have been completed. The sets are shown in the following table.

Table 79 Assumptions for Sensitivity Tests (Preference Sets)

Criteria	Preference Set 1	Preference Set 2	Preference Set 3
Economic	30%	20%	20%
Regional	10%	10%	20%
Technical	20%	25%	20%
Environmental	20%	20%	20%
Legal	20%	25%	20%

The results of the computations under different preferences are shown in the following tables. The following major conclusion transpires from the sensitivity tests:

- Under each preference set the development options related to the Peljesac Bridge are by far the most desirable.

The results of specific MCA sensitivity test results are shown below.

Table 80 MCA Assessment Results: Preference Set 1

CRITERIA	Preferences	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic impact	**30%**	30	29	19	0	3	16	23	20	18	7	7
Regional development indicators	**10%**	10	7	7	6	2	3	3	8	5	5	1
Technical indicators	**20%**	20	17	16	16	13	12	13	18	15	14	0
Environmental indicators	**20%**	18	13	13	11	0	6	5	14	20	16	19
Geopolitical and legal impact	**20%**	20	20	8	8	18	10	10	10	10	13	8
TOTAL	**100%**	**97,5**	**86,7**	**63,4**	**40,2**	**35,2**	**47,2**	**52,8**	**69,5**	**68,6**	**54,4**	**33,7**

Figure 36 MCA Assessment Results: Preference Set 1

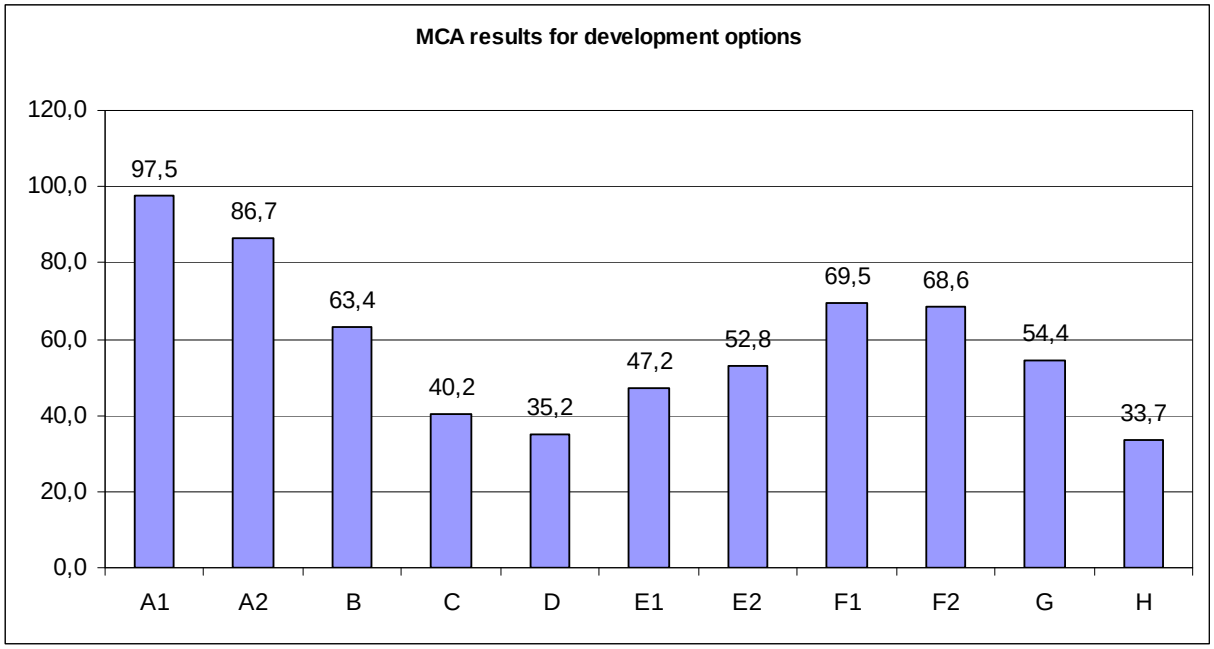


Table 81 MCA Assessment Results: Preference Set 2

CRITERIA	Preferences	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic impact	**20%**	20	20	13	0	2	10	15	13	12	5	4
Regional development indicators	**10%**	10	7	7	6	2	3	3	8	5	5	1
Technical indicators	**25%**	25	21	20	20	16	16	16	23	19	17	0
Environmental indicators	**20%**	18	13	13	11	0	6	5	14	20	16	19
Geopolitical and legal impact	**25%**	25	25	10	9	22	13	13	13	13	16	9
TOTAL	**100%**	**97,5**	**86,2**	**63,1**	**46,0**	**42,0**	**47,6**	**50,9**	**70,0**	**69,0**	**58,4**	**33,4**

Figure 37 MCA Assessment Results: Preference Set 2

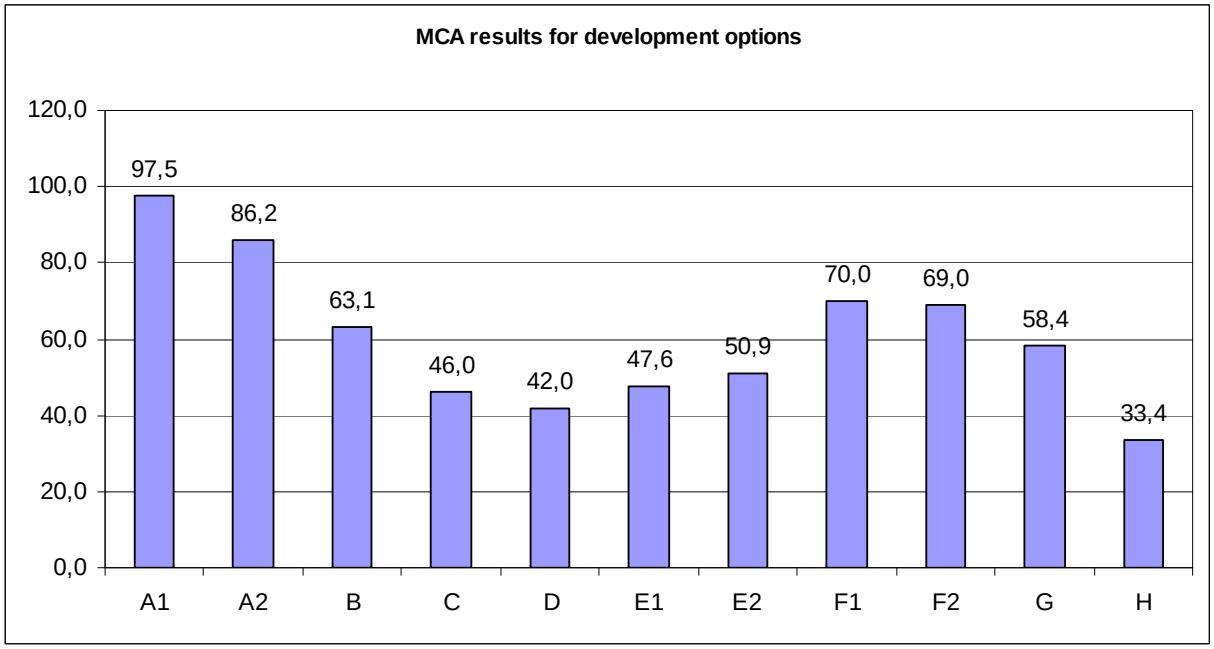
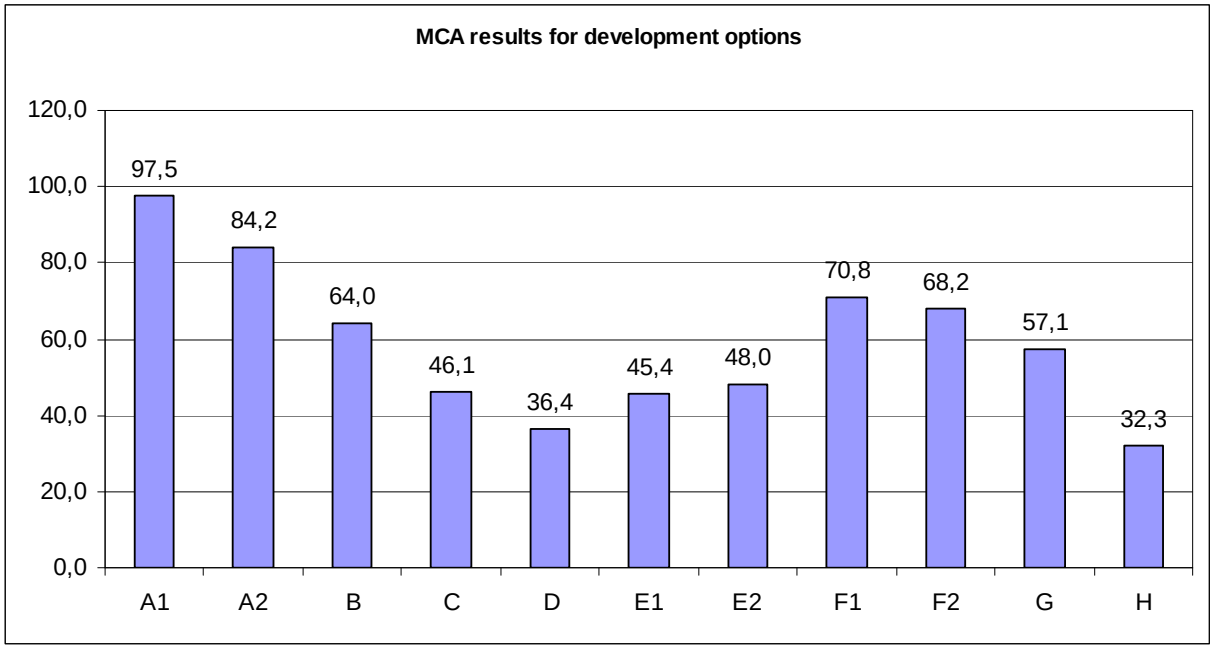


Table 82 MCA Assessment Results: Preference Set 3

CRITERIA	Preferences	A1	A2	B	C	D	E1	E2	F1	F2	G	H
Economic impact	**20%**	20	20	13	0	2	10	15	13	12	5	4
Regional development indicators	**20%**	20	14	14	12	4	7	6	16	11	10	1
Technical indicators	**20%**	20	17	16	16	13	12	13	18	15	14	0
Environmental indicators	**20%**	18	13	13	11	0	6	5	14	20	16	19
Geopolitical and legal impact	**20%**	20	20	8	8	18	10	10	10	10	13	8
TOTAL	**100%**	**97,5**	**84,2**	**64,0**	**46,1**	**36,4**	**45,4**	**48,0**	**70,8**	**68,2**	**57,1**	**32,3**

Figure 38 MCA Assessment Results: Preference Set 3



13 OPPORTUNITY COST ISSUES

The PFS is also supposed to address the opportunity cost issues. Here are some comments on this issue.

13.1 Opportunity Cost for Development Options

13.1.1 DEFINITION OF OPPORTUNITY COST

There are a number of definitions of social opportunity costs. Here are some examples. :

- The opportunity cost to the society of making a certain good or service, at the expense of using the factor of production for a different good or service
- The added cost of using resources (as for production or speculative investment) that is the difference between the actual value resulting from such use and that of an alternative (as another use of the same resources or an investment of equal risk but greater return)
- The amount of other goods which has to be forgone because resources are used to make some particular good. When any goods or services are produced, the resources used to make them are not available for other purposes. Social opportunity cost takes account of any external economies and diseconomies, as well as direct costs to the producers. It is contrasted with private opportunity cost, which takes account only of direct opportunity costs to the producers, disregarding any external diseconomies.
- In microeconomic theory, the **opportunity cost of a choice** is the value of the best alternative forgone, in a situation in which a choice needs to be made between several mutually exclusive alternatives given limited resources. Assuming the best choice is made, it is the "cost" incurred by not enjoying the benefit that would be had by taking the second best choice available.
- The loss of potential gain from other alternatives when one alternative is chosen.

Opportunity cost is a key concept in economics, and has been described as expressing "the basic relationship between scarcity and choice". The notion of opportunity cost plays a crucial part in ensuring that scarce resources are used efficiently. Thus, opportunity costs are not restricted to monetary or financial costs: the real cost of output forgone, lost time, pleasure or any other benefit that provides utility should also be considered opportunity costs.

13.1.2 METHODOLOGY FOR COMPUTATION OF THE SOCIAL OPPORTUNITY COST OF CAPITAL FOR TRANSPORT INVESTMENT[103]

Assume that an infrastructure investment needs to be built. It will be paid by tax-payers.
For the purposes of further elaborations we establish the following notation:

b_r = expected interest on investment if equal or similar risk for example a coupon rate on government bonds
i_r = inflation rate
t_r = tax rate
r = rate of time preference (inter temporal preference, i.e., the discount rate)
s_r = national savings rate
C = capital cost of project PV

[103] Richard Layard, Editor: Cost-Benefit Analysis, How to compute the social opportunity cost of capital in a known economy, Penguin Modern Economics Readings, New York, NY 1972

The social opportunity cost computation will be done according to the following scheme, and in several steps.

- By making an infrastructure investment from taxes, the private savings (in forms of bonds) and consequently investments will decrease by s_r and private consumption rates will be (1-s_r).
- If the investment is financed by taxation, each euro spent may reduce private investment by approximately the marginal propensity to save (or rather more). This may be represented by national savings rate.
- If we assume that the inflation rate is i_r the real earnings on bonds will be $b_r - i_r$. Assuming that the bond rate, b_r, will be of the console type that never expires, we have that the real income stream that will be discounted at r.
- We now have that the opportunity cost of 1 Euro invested in infrastructure investment will be [s_r *(b_r - i_r)/r + (1- s_r)].
- We can eliminate the tax issue for this computation by calculating the social opportunity cost according to the formula: *[s_r *((1 - t_r)* b_r - i_r)/r + (1- s_r)].* This assumes a fairly perfect market for borrowing and lending. We have herein disregarded the taxes paid by the private sector.

To assess the success of the investment we need to compare the opportunity cost with the benefits from the infrastructure of project, according to the formula for perpetual PV of benefits

$Y = \sum_{i=1}^{\infty} \frac{x_i}{(1+r)^i}$

if $x_i = \alpha$ (constant) then

$Y = \alpha/r$, i.e.

This is on the assumption that the benefits are not reinvested. We also assume that the infrastructure investment will be there forever. If the perpetual stream of benefits is larger than the opportunity cost than the investment should be made. The larger the B/C RATIO, the better the investment.

For calculations like these, it is very important to make appropriate assumptions that reflect market trends.

13.1.3 ASSESSMENT OF SOCIAL OPPORTUNITY COST FOR DEVELOPMENT OPTIONS

Assumptions

It is required by ToR to take under consideration social opportunity cost when evaluating development options. A comparison among options should be made. To accomplish that the following assumptions on computation variables were made taking under consideration the economic situation of Croatia. It was assumed that:

b_r = return on investment will be 10 percent. (this reflects the trends in coupon rate on government bonds and the private sector return expectations)

i_r = inflation rate for Croatia for was assumed to be 3 percent[104].

t_r = tax rate was assumed to be 20 percent[105]

r = rate of time preference (inter temporal preference, i.e., the discount rate) was established as 3 percent. The discount rate was established at the level recognizing the current financial market and economic situation

[104] http://www.focus-economics.com. The real inflation rate for 2013 was estimated as 4,7 percent. It expected to be around 2,2 in 2014 and 2015. In the following years it may increase. Thus, an assumption for the calculation was made at 3 percent. Other sources confirm that estimate.
[105] http://www2.deloitte.com – an average income tax rate was used as reported by Deloitte.

s_r = national savings rate was assumed to be 20 percent[106]

C = capital cost of project PV was used consistently with the CBA assumptions. This approach should be acceptable for the purposes of this computation, although it involves some simplification. Definitely it is warranted for development options comparison

13.1.4 SOCIAL OPPORTUNITY COST COMPUTATION RESULTS

Assumptions:

Return on the investment	10%
Inflation rate for Croatia	3%
Tax rate	20%
The discount rate	3%
National savings rate	20%

Table 83 Social Opportunity Cost Calculations considering taxes

Development Option	Cost	Benefits	Social opportunity cost	B/C Ratio for opportunity cost
A1	392,06	1 074	496,61	2,16
A2	282,93	758	358,38	2,12
B	174,27	306	220,74	1,39
C	481,89	298	610,39	0,49
D	121,40	43	153,77	0,28
E1	241,39	246	305,76	0,81
E2	132,26	215	167,53	1,28
F1	766,63	1 037	971,06	1,07
F2	657,50	746	832,83	0,90
G	1207,50	283	1529,50	0,18
H	1190,00	236	1507,33	0,16

[106] http://www.economywatch.com/economic-statistics/economic-indicators/Gross_National_Savings_Percentage_of_GDP By Economy Watch the gross national savings rate is 20.5 % of GDP

Table 84 Social Opportunity Cost Calculations with elimination of tax issue:

Development Option	Cost	Benefits	Social opportunity cost without taxes	B/C Ratio for opportunity cost
A1	392,06	1 074	444,33	2,42
A2	282,93	758	320,66	2,36
B	174,27	306	197,51	1,55
C	481,89	298	546,14	0,54
D	121,40	43	137,59	0,31
E1	241,39	246	273,57	0,90
E2	132,26	215	149,89	1,43
F1	766,63	1 037	868,84	1,19
F2	657,50	746	745,17	1,00
G	1207,50	283	1 368,50	0,21
H	1190,00	236	1 348,67	0,18

13.2 Conclusions

The completed calculations and comparisons of social opportunity costs indicate that:

- At the given assumptions, only several development options provide larger benefits than social opportunity cost. These are: both scenarios involving the Peljesac bridge, the Neum By-pass, short distance and immersed tunnel.
- The Peljesac bridge options provide the highest ratio of benefits versus social opportunity cost ratio. The Neum by-pass and short distance ferry development options provide lower and similar ratio. These development options may be considered for implementation.
- Obviously the ratio level would change if general assumptions were changed, however the rating of the development options would not. The Peljesac bridge options are the most attractive as investments compared with social opportunity cost.
- The situation might be different if the accession of Bosnia and Herzegovina to the European Union were significantly delayed, for about 20 years. The Neum By-pass would have generated larger benefits for a longer time. This however, would be contradictory to the statements and conviction of the Bosnia and Herzegovina officials expressed during the Advisory Committee and in comments to the previous versions of this assessment.
- It also must be reminded that smaller investments provide smaller benefits. They do not facilitate regional traffic in such a scale as the larger investments do. This may raise questions if these development options are fully mutually exclusive. For, the purposes, of this assessment it is however clear that the larger expenditure is fully justified since it better serves the needs of the regional transport system and economic development.
- The B/C ratio presented in the above tables shows the real value for money effectiveness of the development options.
- As indicated in the opportunity cost definition at the beginning of this analysis, also other foregone benefits could have been considered. If that were the case, the advantage of the Peljesac bridge would have been even more clearly visible.

14 BENCHMARKING THE PFS RESULTS IN LIGHT OF POSSIBLE EU FUNDING

The European Commission and other EU countries supported research programs concerning the comparison of the economic effectiveness of different investment projects in various sectors, including roads and highways. The analyses included data on the economic rate of return of investment projects sponsored by three international institutions: the European Union (EU), the European Bank for Reconstruction and Development (EBRD), and the World Bank (WB).

For the EU two data sets of different funding programs were analysed: one data base of 183 major projects built for the European Commission in 1990-2001 was analysed, of which 91 project in roads and highways. The second data base included projects cofinanced from ISPA pre-accession funds in 2000-2006 – the set included 118 projects, including 24 road projects.

For the World Bank, data on 98 projects, collected by the Office of the Chief Economist were made available for the research, of which 34 in roads and highways. Finally, for the EBRD the database comprised 109 projects, including 15 in roads and highways.

The comparison of the EIRR of the projects (table below) provides the benchmarking tool for other infrastructure projects cofinanced from different international institutions.

Table 85 Comparisons of Average EIRR Rates for Projects Cofinanced from Three International Institutions

SECTORS	EBDR	WB	EU
Energy transport and distribution	35,73%	22,94%	14,19%
Energy production	44,48%	14,69%	11,70%
Roads and highways	23,51%	33,34%	18,63%
Railways and underground	21,43%	25,97%	16,68%
Ports, airports	No data	23,15%	17,43%
Water supply, transport and distribution	25,90%	10,68%	18,92%
Telecommunication infrastructures	38,56%	24,11%	No data
Industries and other productive investments	28,28%	26,71%	19,59%
Total sample	**31,82%**	**25,03%**	**17,19%**

Source: An International Comparison of the Financial and Economic Rate of Return of Development Projects, Massimo Florio, 2000

The other benchmarking tool comes from the second analysis focused on ISPA projects in 2000 – 2006. The results for different sectors are shown in the table below.

Table 86 Comparison of average EIRR rates for projects cofinanced from ISPA funds 2000-2006

	Max	Min	Average	Sample
Water and environment	20.34	0.00	8.54	7
Sewage	38.71	1.01	11.15	32
Environmental protection	27.00	7.62	14.73	11
Waste management	40.00	0.00	12.57	13
Airport	13.10	8.40	10.75	2
Highway	23.87	7.50	13.55	11
Railroad	19.00	1.00	10.48	18
Road	50.00	7.00	18.23	24
Total	**50.00**	**0.00**	**13.04**	**118**

Source: Cost-benefit analysis of infrastructure projects in an enlarged European Union: an incentive-oriented approach, Massimo Florio, 2004

For the first set of road infrastructure projects the average economic rate of return for road infrastructure projects was above 18%, with the minimum at 16,3%% and maximum at 20,9%.

For ISPA projects, the average economic rate of return for road infrastructure projects was also above 18%, with the minimum at 7% and maximum at 50%.

Two conclusions come out from this benchmarking for the PFS:

- The considered development options and the results of this analysis are fully in the frame of prevailing practices and results for road projects in the EU and in the World
- The preferred option meets also this benchmarking test. It is therefore a good candidate for applying for the EU funds.

From the point of view of VfM considerations this and preceding subsections confirm that the preferred option insures a good return, significant economic impact, and contributes to EU policies, and is a permanent econo0mically justified solution with a good geopolitical influence on the region. .

15 SWOTCOMP ASSESSMENT FOR BRIDGE A1 AND NEUM BY-PASS SCENARIOS

15.1 Introduction

The following provides an assessment of the two front-runners: the Bridge A1 and the Neum By-pass development options using the SWOTCOMP Methodology. This approach combines the principles of SWOT analysis with a comparison of two or more options by indicating a preference for the chosen option. It is less stringent than MCA and has usage for these categories that cannot be fully incorporated into MCA. In addition, SWOTCOMP methodology may be used for a summary of the findings of a given assessment or a study. This was the application in this PFS. The results are self-explanatory; they refer to various chapters of the PFS. Some observations and facts which were not included in earlier chapters have also been tabularised. This provides a final overview of the reasoning and findings in the PFS. It organizes and presents in a form of recommendations basic conclusions of the report using a comparative approach.

Table 87 A SWOTCOMP Methodology

An Assessment and Comparison of Two Development Options

The Peljesac Bridge with New Roads on the Peninsula Option (A1) and the Neum By-pass Option (B)

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	Neum By-Pass	Bridge Option (A1)	Neum By-Pass	
Contribution to Regional Transport System	Provides a permanent addition to the regional transport system from Ploce to Dubrovnik. Serves D8 corridor and provides additional safe and fast transport capacity to Peljesac Peninsula and Korcula, releases congestion at the ferry system in Trpanj. Provides stable connection to Korcula in the low season not dependent on limited ferry traffic.	Provides a temporary addition to regional transport system with a target to create a local by-pass. Initially will accommodate exclusively transit traffic later local traffic in the Neum area.		No major impact on regional transport system, No impact on the Neum transport system until B&H joins EU.	*Preference for Bridge* Bridge option contributes to the entire regional system while the By-pass ultimately has local meaning.
Permanent Solution	Provides a permanent and unrestricted solution to the congestion problem in the D8 corridor, improves mobility and accessibility for the Peljesac Peninsula, Korcula, Miljet, and other areas on the peninsula	Provides a temporary solution to the D8 congestion problem.		Restrictions for traffic in the sealed corridor will occur, no contribution to local community until B&H joins EU. After, accessibility and mobility contributions only to local community in the Neum area. Extraterritorial corridor is a temporary solution to address a portion traffic problems	*Preference for Bridge* Funds expanded for the bridge scenario provide for sustainability and long term development of the entire regional Impact on economic development of large areas outside of the D8 corridor. The By-pass concerns ultimately only local community.

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
				for the period until B&H joins EU	
Security of the EU Border	Provides traffic solution located entirely within the EU territory. EU internal investment not related to security of EU borders			Provides initially an extraterritorial solution at the third state land, not favoured by local community, prone to unfriendly behaviour of extremists. The sealed infrastructure dividing the city my cause aggressive sentiments by citizens whose intercity mobility will be significantly reduced, and citizen freedom rights limited.	*Preference for Bridge* The bridge is a safer solution
Assessment of possible co-financing by EU	Meets standard EU requirements for co-financing	Meets standard EU requirements for co-financing		A number of issues will have to be resolved when providing EU funding due to extraterritorial character of the investment. A possibility of providing funding for the third country not being a member of EU is difficult to address and would require special consideration.	*Preference for Bridge* Standard funding procedures may contribute to faster achieving the objectives defined in this PFS

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
Customs control, veterinary and phytosanitary inspection	These issues do not apply to internal EU structures	Provides a possibility for meeting all EU requirements but special efforts will have to be addressed by all the parties involved.		Complicated issues may arise due to extraterritorial character of the investment. Some commodities may not be allowed to transit due to safety regulations to be moved via a completely sealed structure for example trash and waste, explosives etc. This may hinder various activities at EU/Croatia territories for example modern waste management system as required by EU.	*Preference for Bridge* The usage of bridge simplifies procedures and is more effective for the majority of users.
Trans-European Transport Network	Provides and option to extend the network to the remote areas of EU and increase accessibility and mobility of residents according to various EU policies including Cohesion Policy and transport strategies. Creates a high capacity alternative international corridor along D8 corridor and connection to major European cultural heritage and tourist attractions with	.		Provides a temporary solution with limited impact on the D8 corridor capacity. Lack of direct relationship to international routes in a long run after this road becomes a local corridor.	*Preference for Bridge* Provides international connections and accessibility

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
	consideration of environmental issues.				
Future political developments (EU extension)	Provides a high capacity solution that serves current and future (B&H) members of EU. By redirecting traffic provides larger capacity for local and tourist traffic via the centre of Neum allowing the City to develop its resort functions. Increases the attractiveness of the City of Neum to tourists.	Provides release of some local traffic and allows for the City to develop its resort functions. Increases the Neum area transport system capacity increasing tourist attractiveness of the City of Neum.	No impact	The capacity to be fully used only after B&H joining EU and creating modern road capacity towards Capljna, Mostar and Sarajevo.	*Neutral Impact*
Regional system transport organization	Provides a regional transport option for all traffic types including public transport system regional and international influencing a large geographical area.	Provides ultimately local release for traffic problems for the community of four thousand citizens and abundant number of tourists.	No impact	Local character of the solution with limited regional impact.	*Preference for Bridge* Larger area impacted by this option.
Border crossing situation	Provides for avoiding all reasons for the Neum area gridlocks: limitations of D8 corridor before and after the Neum corridor BCPs, BCPs limitations, congestion in the City of Neum due to excessive transit traffic.	Releases BCP problem, and limitations of D8 corridor before and after the Neum corridor, BCPs limitations, congestion in the City of Neum due to excessive transit traffic.		Total capacity of this option is smaller than that for the bridge. Change of use after B&H joining EU to local by-pass reduces positive impact.	*Preference for Bridge* This option provides a permanent solution to the border congestion situation and capacity for next 30 plus years.

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
Movement, mobility and accessibility impact	ODS indicate that it provides for increased mobility to a large area and access to the state capital and international routes.	After B&H accession to EU releases local traffic.		ODS indicate limited, only local impact on accessibility and mobility. Does not resolve B&H accessibility issue to the north of the country (supported by historic data and ODSs). Travellers may not be interested in driving via the sealed tube having an option to visit the City of Neum. Also a trip via the Peljesac peninsula may be more attractive.	*Preference for Bridge* It is more predictable that the bridge will be used rather than a closed and sealed Neum by-pass..
Long-term sustainability	Provides long-term sustainability as a major regional transport system improvement impacting remote areas of EU/Croatia and improving access to major attractions of EU in the region. Will accommodate traffic flows for a long term period in several directions.	Provides a sustainable option for local Neum area. Sustainability different before and after B&H joining EU. The character of investment changes and that impacts its sustainability as an international corridor. It may be sustainable as a local by-pass but that raises questions as for VfM for temporary but costly EU security measures.		Extensive security expenditures accounting for about 40 – 50 percent of the total costs and need to completely refurbish the by-pass after B&H joining EU may impact level of sustainability as a long-term investment.	*Preference for Bridge* Clear sustainability situation

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
Schengen requirements	Fully compatible with Schengen with no additional costs.	May provide for Schengen meeting requirements.		The way this investment meets Schengen requirements has not been finally defined. The risk for not meeting these requirements will exist until final EU inspection is conducted. Possibilities for complications exist, mainly due to lack of precedents and regulations on extraterritorial transport solutions in Europe. Possibilities for delaying opening the connection exist.	*Preference for Bridge* The Schengen situation for the bridge is clear for the By-pass it is not.
UN Convention of the Sea	The investment is completely on the EU territory	No impact.	Possibilities for raising issues related to the UN Convention exist but they are unlikely to be related to the bridge itself. Bridge designs adhere to all principles of the Convention		*Neutral* The problems raised with regard to this issue should not impede the construction of the bridge.
Opportunity cost	Highest ratio of B/C for social opportunity cost. Investment desirable.	Reasonable ratio of B/C for social opportunity cost. Investment justified.			*Preference for Bridge*

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
Impact on the City of Neum	Positive, releases traffic in the city and provides for economic development to the largest extent among assessed options. Desired by the City Council	Positive, releases traffic in the city and provides for economic development		Controversial for the City Council and in the proposed design not included in any accepted spatial plan for the city. Negative attitude of the citizens proven by site visits and interviews. Alternative transport system improvements prioritized by the City Council instead of the by-pass as long-term sustainable solutions..	*Preference for Bridge* No controversy solution.
Impact of Dubrovnik-Neretva County	Provides cost and time effective solution to the county economic development and eliminates obstacles for this development. Options for large indirect benefits and new business development in high and low traffic season. Creates options for development of off-season activities from Dubrovnik to Korcula and Ploce. Provides good solution for Ploce transit. May decrease costs of life in Dubrovnik by about 10 to 20 percent due to			Minimal impact on the County.	*Preference for Bridge* Larger impact on the county

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
	transport cost lowering.				
Economic development in the region	Provides opportunities for significant economic development in the entire county especially Peljesac peninsula and Dubrovnik. May divert existing exodus of citizens from that area due to lack of efficient transport links and accessibility to basic services like and schools. Significant EU and international investment options identified and possibilities for indirect benefits due to this project. Highly desired by locals.			Minimal economic impact except of possibilities for releasing traffic in the Neum corridor.	*Preference for Bridge* Larger impact on economic development
Traffic Increase	Capable of accommodating increased traffic until D8 capacity before and after the investment is reached. Provides time for developing other traffic accommodating investments in a long run.	Accommodates local traffic increases with smaller impact on regional transportation.	Long-term solution	Medium-term solution.	*Preference for Bridge* Long term solution accommodating all the projected traffic volumes
Border Crossings Improvements	Eliminates needs for further improvements	Eliminates current needs for further improvements		The amount of traffic diverted by this option is smaller than for the bridge scenario which may cause	*Preference for Bridge* Provides for more stable

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
				needs for BCP further improvements if B&H accession date is delayed	and long term problem solution with no need for BCPs improvements.
Extraterritorial issues	No impact	.		A large number of legal and organizational issues may surface. Need for international agreements needed. EU comprehensive actions are necessary. Significant risks for delays and lack of acceptable solution. This may eliminate this option as a viable solution for many years which is against the purposes of this PFS and the needs in the region consistent with EU policies.	*Preference for Bridge* Major legal and related issues may be avoided if the bridge option is built
Time factor	Provides for the quickest resolution of the problem. The fact of life I that a portion of this development option has already been prepared. Pragmatically speaking this is a serious advantage which can be translated to significant monetary benefits (delays have their cots).			Significant uncertainties may delay the implementation beyond investment reasonability and justification.	*Preference for Bridge* The bridge option better provides for timely solution of the problems defined for addressing in this PFS

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
Legal issues	No special international legal issues identified. Some legal issues raised in the course of PFS are not directly related to this investment but are a portion of a process of creating the post-Yugoslavia international law order in the region for example border issues or access to the sea.			A plethora of possible international issues related to the project extraterritoriality may arise, create delays and defeat the purpose of initiating this investment. EU laws and acquis derogations may be needed.	*Preference for Bridge* The bridge scenario allows for avoiding many legal problems and related delays.
Political support	Full multiparty political and economic support in Croatia.			Lack of a uniform official position on extraterritorial corridors at the B&H territory. No official written statement has been received by the consultant nor any other entity involved in PFS. Publicly available statements are contradictory and confirm uncertainty regarding this issue which may delay this development option.	*Preference for Bridge* The political climate is more conducive to the bridge option.
Environmental issues	The development option meets environmental criteria. Construction will impact environment in the way acceptable for this kind	The development option meets environmental criteria. Construction will impact environment in the way acceptable for this			*Neutral*

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
	of projects and international benchmarks. EU laws will be fully obeyed.	kind of projects and international benchmarks. EU laws may be fully obeyed; however this would require pre-construction international accords since B&H is not a member of EU and as such does not have to implement all EU rules.			
Investment Cost	The cost of the investment is justified for a project of this magnitude by any EU and world standards and benchmarks. Risk of exceeding the cost assumptions is not larger than for similar investments. The expenditure creates benefits fully justifying this development option according to standards for investment project evaluation.	Smaller nominal cost than for the bridge option.		Much smaller benefits created in comparison to the bridge option. The benefits related to political events as B&H accession date.	*Preference for Bridge* In the theory of economics, if only possible and can be afforded, larger initial outlay resulting with better B/C ratio is more desirable.
Cost Benefit Assessment (CBA)	The best development option with regard to CBA, stable and secure traffic flows. Justified and conservative benefits calculations based on EU	The EIRR and B/C ratio for this project increase with the passage of time. If B&H is not allowed to EU by 2031-2032 this project is as competitive as the		Lower benefits after EU accession of B&H. The cost structure of this investment raises question as to Value for Money (VfM) validity of this	*Preference for Bridge* As CBA indicates.

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
	benchmarks suggested by Advisory Committee support this conclusion. Produces the largest benefits of all projects nominally and comparatively. At the same time the cost of this investment is higher for the By-pass. This is not a standard mutually exclusive project situation. CBA indicates that economically with assumptions made this is a more desirable investment. Inclusion indirect benefits would increase the competitiveness of this development option.	Bridge Scenario. The &H authorities however rejected so much delayed EU accession of their country, so this position was included in the CBA assumptions for this PFS. The same justified and conservative benefits calculations based on EU benchmarks suggested by the Advisory Committee were used for all development options.		options. About 40 to 50 percent of the cost spent on security establishments of extraterritorial by-pass with minimal benefits and need to dismantle these fixtures upon B&H joining EU. VfM of such a solution should be revisited. The fact that benefits are related to political events as B&H accession date makes it difficult to complete typical for such investments feasibility assumptions. Risk for investors is therefore high. Not achieving requested VtM is a real possibility. It is not fully comparable with the bridge option since produces lower benefits for lower cost. This is not a standard mutually exclusive project situation. Consideration of all costs needed to transfer the By-pass from an international transit connection to (after EU joins EU) a local road would decrease CBA	

Issue/Criterion	Strengths		Weaknesses		Comparative Competitive Assessment
	Bridge Option (A1)	**Neum By-Pass**	**Bridge Option (A1)**	**Neum By-Pass**	
				results for this option.	
Multi-criteria Assessment (MCA)	The most advantageous scenario when all cost and non-cost aspects of the investment are considered. Risk of delaying this investment is minimal if any at all. This development option provides for quick advancement in achieving of EU economic, social and territorial cohesion may be delayed with simultaneous accomplishing of ambitious EU geopolitical objectives in the region. to the advantage of the entire Union.	A reasonable option provided that legal and security cost issues are resolved prior to initiating any activities.		Starting any development option activities prior to resolving legal and extraterritorial character related issues, and accepting the Schengen design requirements and construction requirements including environmental issues by EU may not be justified in terms VfM requirements. Risk of delaying this investment is relatively high. The cost of the delay might be high to the region and EU. The achievement of EU economic, social and territorial cohesion may be delayed with possible geopolitical consequences.	*Preference for Bridge* As per MCA results.
Social acceptance	Fully supported by citizens, local governments, and chambers of commerce.			Not fully accepted by the local community of Neum.	*Preference for Bridge*

15.2 SWOTCOMP Conclusion

A review of findings provided in the SWOTCOMP table and taking under consideration results of MCA and CBA leads to a conclusion that the Peljesac Bridge with new roads at the Peljesac peninsula is the most preferable development option that best meets the criteria established in the Terms of Reference. It definitely provides the best value for money and is also the most competitive for non-financial factors. This development option is straightforward, close to the standard road project design so with limited risk, and does not involve needs for developing various new and uncertain legal schemes and signing international agreements. This option is already in regional and national plans and spatial plans, several designs are ready for a review and this development has justified chances for EU funding. Although the cost of this option is high, the stream of well documented benefits makes it the most feasible for all alternatives evaluated in this PFS. The sensitivity test indicated that also a significant increase of the cost of the investment (theoretical) would still make it most competitive. It indicates that there is a margin for various risks and changes which will not change this choice of preferred option. Because of the growing traffic in the area this development scenario should be implemented immediately. Taking under consideration all the necessary procedures and the construction process, the next steps to develop this project should be started with no delay. This approach would allow all the parties to achieve the best value for money. In this development option and in light of the projected trends and demand growth action is needed. The delays have their price and my reduce VfM for the EU/ Croatia taxpayers money.

16 VALUE FOR MONEY CONSIDERATIONS

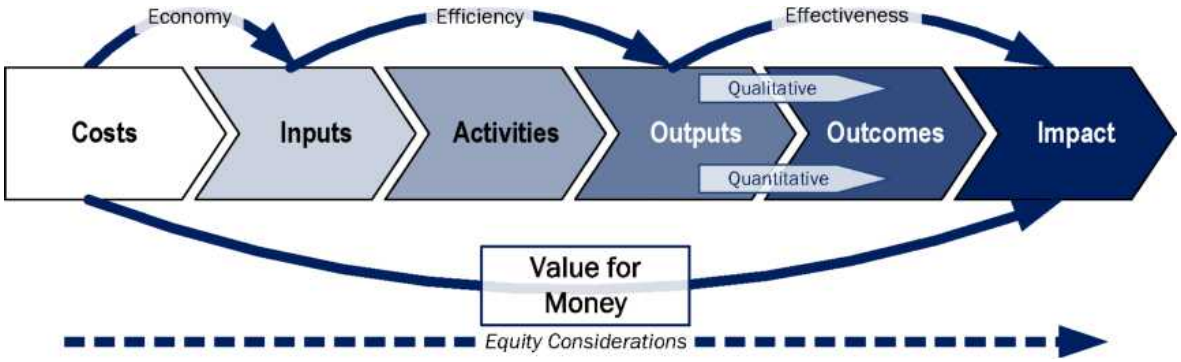
16.1 General Issues

An overview of practical experience provides a conclusion that infrastructure and in that transport infrastructure are a major objective to which donors and international finance institutions are assigning their resources Many international finance institutions (e.g. Asian Development Bank, World Bank, etc.) spend as much as half of their total resources on infrastructure development, and some governments in particular those using regional organizations co-funding spend even more. The main rationale for directing such high volumes of donor funding to infrastructure projects is that well-functioning infrastructure provides the foundation for the development of all other sectors and overall economic growth. Economies are both literally and figuratively built on infrastructure. This has been a foundation of an approach for this PFS. It was based on MCA which allows for complex assessment of the proposed development options. As it is said in the literature .donors and investors focus on whether or not their support created positive, lasting changes. The funding and deliverables of the activities are only the means: the ends are what matters most. This indicates that financial and cost considerations are not the only factor involved in the Value for Money assessments, the multidisciplinary lasting changes are. Considering the sums of money involved, the critical role infrastructure plays in poverty reduction, increasing the overall quality of life of societies and the unique characteristics of infrastructure make it essential for maximizing and measure VfM in infrastructure programming. The maximized VfM is more than only the lowest cost of the investment and CBA results, it is the overall impact that infrastructure investments make on the lives of the citizens and in combating poverty.

The system of evaluating development options presented in MCA insured that all aspects of projects were considered in the five criteria categories used for making the evaluation. They provided for the multidimensional assessment of VfM and assessed value that is created for tax payers' funds, be it national or EU. The most important is that these funds contribute to the strategic objectives of the Union. The recommended development option, the Peljesac Bridge with new roads on the peninsula provides definitely the best value for money at the assumptions and objectives for this evaluation. This development option is not only the best in terms of economic categories but also meets the best other established criteria. It is relatively environment friendly, does not create complicated legal issues and what is very important is very conducive for economic growth in a large area. The completed sensitivity tests indicated that even significant changes in assumptions do not change the choice of the preferred scenario. This option is simply the best permanent solution for providing the enhancement of regional transport system in the targeted area. Its results are undisputed, and most convincing. The results of this investment are not dependent on political decisions or any other factors that not infrastructure project related, It is well-designed and advanced, which gives it a competitive edge. This project is not a novice among development options for infrastructure enhancement in the targeted area. It can be found in almost all regional plans and strategies developed for this area within the last ten years or so. The major problem with this investment is the need to find funding for this endeavour. There is a question regarding the total cost of this development option which higher that for the alternatives. The total cost is however, not the only consideration for infrastructure investment. The return on the investment provides a better measure. Saying more, Value for Money consideration measured in terms investment impact is even more important. All the assessment and analyses in this PFS confirmed that VfM for this development option ids the largest. This has been proven by all indices and results of analyses presented in this PFS.

The Value for Money is not a one uniform indicator but a set of results in the entire investment development and implementation process. Almost all donor agencies are using such an approach to assessing and maximizing the Value for Money (VfM). It can be presented as a Results Chain framework that has been presented below[107].

Figure 39 Results Chain Framework



The presented framework shows that VfM monitoring and maximizing concept consists of a variety of activities at various stages of project development. This PFS addresses only the initial stage of the process, the selection of the preferable scenario. This has been done in this selection process with full consideration of all the elements of this process.

The concepts of economy, efficiency and effectiveness (collectively the "3 E's") are keys to measuring VfM throughout the Results Chain. In general, VfM can be assessed across the 3 E's in the following manner:

- **Economy** relates to how cost-effectively financial, human or material resources are acquired and used in an intervention. VfM is typically assessed in terms of the unit costs of inputs involved (e.g. how much a TA costs). At the economy level, VfM focuses on cost control, and it is important to scrutinize the unit costs of key VfM drivers, such as personnel costs, procurement costs, travel costs, and other costs, and then compare these costs to the quality received and examination of key cost/value ratios.
- **Efficiency** relates to how resourcefully inputs are converted into outputs and subsequent outcomes. Cost efficiency measures can throw light on options for a donor intervention (e.g. will outcomes be achieved more efficiently by a donor managing an activity directly or setting-up other solutions). VfM is typically assessed on how quickly, accurately, and sustainably outputs can lead to desired outcomes. Quality and approach are keys to maximizing VfM.
- **Effectiveness** relates to how successfully an intervention achieves its intended outcomes and subsequent impacts are realised (e.g. in attracting additional private financing to fund infrastructure investment, increasing the capacity of infrastructure operations, expanding access of target populations). VfM is typically assessed by whether or not the milestones and targets of observable verifiable indicators (OVIS) are achieved[108].

To reach an assessment of the overall value for money of an intervention or program requires weighing the analyses of its economy, efficiency and effectiveness, and reaches a synthetic conclusion. It has been done during this evaluation. Also cost effectiveness indicators were provided, benchmarking was used to establish investment cost estimates and insure that they are in line with costs of similar investments, conservative approach has been implemented and various designs have been considered The results show that the best scenario is the A1 development option – The Peljesac Bridge with new roads on the peninsula.

[107] Measuring and Maximizing Value for Money in Infrastructure Programs, Adam Smith International, August 2012.
[108] Measuring and Maximizing Value for Money in Infrastructure Programs, Adam Smith International, August 2012.

16.2 Needs for Timely Proceeding with the Preferred Development Option.

The time is of essence to insure that VfM is maximized. It is therefore necessary to quickly and effectively go to the next steps of project final design and implementation. This implementation should adhere to international infrastructure standards. It is beyond the scope of this PFS to address these issues, only several may be mentioned as an example

- Need to quickly proceed after PFS and engage internationally TA providers
- Develop firm relationships with stakeholders and decision makers
- Implement a system of permanent monitoring of value for money at each of the following project stages
- Proceed with the following steps with no delay to avoid procrastination costs
- Measure impacts not only costs and financial or economic return on the investment according to the 3Es principles.

The preferred scenario, the Peljesac Bridge should be proceeded with as soon as it is possible with the result chain framework set up by the donor agency. This will contribute to achieving the highest VfM

17 GENERAL FINAL COMMENTS

17.1 General Issues

In relation to the presented MCA results, and to generally sum up the entire development option evaluation process a number of remarks can be made. They are:

- The applied MCA and other assessment methodology recognized that:
    - With the Republic of Croatia becoming an EU member, the borders in the Neum became EU's external borders.
    - Permanent solution is needed to ensure unconstrained flow of goods and persons through the EU territory and quick implementation of the Schengen area,
    - The choice of solution must increase the capacity of the regional transport system and permanently eliminate traffic bottlenecks now and in the in the future,
    - The solution that must ensure the security of the future external Schengen borders
    - The preferred solution must contribute also to the EU Cohesion policy focused on economic, social and territorial cohesion of the Union
    - The preferred solution must be prepared and meet the requirements for EU funding. Therefore, the MCA must reflect the requirements and methodology approach adopted by EU for projects assessment and evaluation.
    - Value for money and the most competitive solution related to the opportunity cost must be proposed

The following other conclusions transpire from the analytical process completed in this study:

- The MCA results are a basis for providing full recommendations in the Pre-feasibility study. They were developed in concert with all the members of the Advisory Committee. The comments of the Advisory Committee were implemented as much as it was possible. In contradictory comments situation, the Consultant used its judgment, set up the Delphi panels or asked for assistance of international organizations experts and professors. They assisted in justifying development options evaluation and provided input to addressing and responding to analytical questions.
- The MCA is based on all the data received and acquired by the Consultant.
- The detailed substantiation of the MCA has been provided in PFS.

17.2 Comments on the Choice of Preferable Option.

- The PFS results indicates that A1 Bridge scenario is the most preferable development option when the criteria and objectives of this study are concerned and considered.
- The strength of scenario A1 in PFS (MCA) results from its superiority as far as regional economic development, technical indicators, and geo-political factors are concerned. At the same time the cost difference between the A1 scenario and other options especially extraterritorial by-pass and corridors is critically significant. This is because the EC extraterritoriality requirements are very costly which undermines any temporary and extraterritorial solution to connecting two parts of EU/Croatia..
- The Bridge A1 and A2 development scenarios are also more of a regional economic development tool than any other considered option. This is consistent with EC cohesion policies and strategies, policies of the Croatian government and interests of the Adriatic counties especially the Dubrovnik-Neretva county. Significant regional economic benefits from transport infrastructure investments and improvements are a feature of well-designed and justified and effective public expenditures – which has been proven in the theory and practice of public expenditure and budgeting systems.
- The overall benefits offered by the A1 and A2 scenarios justify a larger initial investment since it brings in a long run, larger benefits than a smaller initial outlay proposed for some other development options. This

is proven by opportunity cost consideration. Furthermore, taking under consideration opportunity cost and other financial and economic features of options, this larger initial expense seems to be fully justified. This is also a conclusion from a comparison of these investment projects with similar projects co-funded by the EU and other IFIs.

- Some other, especially, extraterritorial investment ideas are to some extent cost competitive (if somebody wants to save funds) but may result in unexpected delays which will create additional costs, lost benefits and may involve large political risks. The total cost of a transport investment rarely is the only criterion for a final funding decision. This is particularly true when not fully comparable and mutually exclusive projects are concerned.
- The overall assessment has also indicated that to fully consume the benefits of the A1 or A2 development options, additional smaller but very much needed for regional transport system in the targeted area, immediate transport infrastructure investments may be warranted in Bosnia and Herzegovina especially in the Neum area and connecting this area with other regions by safe and modern roads. This by itself may reduce the congestion at the EU territory in the region.
- The assessment also shows that to fully benefit from the proposed options, they should be implemented as soon as possible; definitely not later than in the dates specified in PFS which is 2018. This means that all the needed activities to construct these options should be initiated without any delay.