



**NATIONAL ROAD AXIS HERAKLION – MESSARA: COMPLETION
OF THE CONSTRUCTION OF AG. VARVARA – AG. DEKA
(KASTELLI) SEGMENT AT HERAKLION - CRETE**

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QUICK APPRAISAL REPORT

**NATIONAL ROAD AXIS HERAKLION – MESSARA:
COMPLETION OF THE CONSTRUCTION OF AG.
VARVARA – AG. DEKA (KASTELLI) SEGMENT AT
HERAKLION - CRETE**

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1 INTRODUCTION

1.1 Project Appraisal Fundamentals

This Quick Appraisal (QA) is prepared in accordance with the *QA Check List* for major transport investments agreed with the EC – Directorate General Regional Policy Financial Greffe REGIO.

The objective of this QA is to support a constructive dialogue between the EU and the Applicants providing recommendations and suggestions, based on an in depth analysis of the application form and annexed documentation.

The structure of this report is in line with the sections and headings of the Quick Appraisal Check List and the Investment Application Form.

Along with the description of the findings of the analysis in each Chapter or Section of Chapter in relation to which: a) the quality of the information provided and available is not satisfactory, or b) the quality of the project is deemed to be improved, or c) the methodological and technical solutions adopted to undertake the CBA analysis, demand studies and project design are deemed as not adequate or reliable, the comments are highlighted in a recommendations and suggestions box.

In the concluding remarks Chapter we summarize the main findings of our appraisal commenting on the essential elements of the project, and suggesting any potential solution that can improve its quality according to the findings of the analysis as appropriate. This section highlights any important issue that should be considered before the Commission can approve the project.

1.1.1 Applicant and project managing authority

The Applicant is the Greek Management Authority responsible for the implementation of the 2007-2013 ERDF Regional Operational Programme, Improvement of Accessibility (2007-2013 *Ε.Π./ Ενίσχυση της Προσπελασιμότητας*). The project subject of this quick appraisal is included in this programme under the Priority Axis A - Road Transport.

The Beneficiary of the project is the Greek Ministry of Infrastructure, Transport and Networks/ General Secretariat for Public Works, Directorate for Road Projects (*Διεύθυνση οδικών έργων – Δ1*).

1.1.2 Documentation available

The application dossier made available in electronic format through the CIRCABC Library of the European Commission includes the following documentation:

- Application Form;
- Natura 2000 declaration;
- Cost-Benefit Analysis;
- Non-technical summary of the EIA.

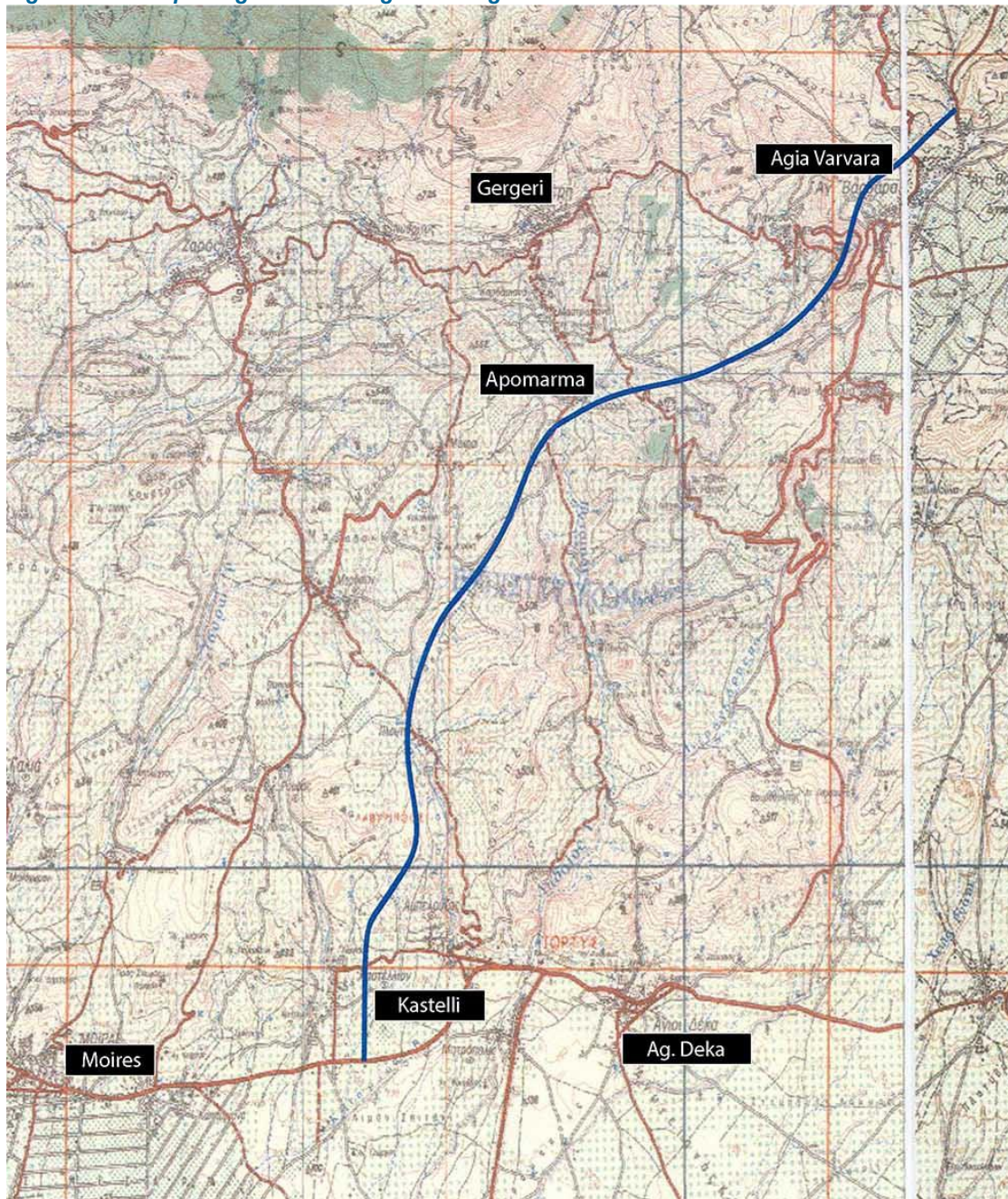
The project dossier is overall complete and complies with the EC Regulations. The information provided is consistent with Art. 40 Reg. 1083/2006, Annex XXI and Commission Regulation 1828/2006. It is in any case worth noting that the application dossier omits to include the EIA compliance declaration. Although the EIA process for this project was undertaken in 2002-2003 and consultations are included, the application form does not provide the EIA compliance declaration document and does not specify whether an extension would be required. The application dossier includes some inconsistencies regarding the information included in the application form and the related annexes, which have been commented in this report, depending on their relevance to the scope of the analysis. In the event another application form/dossier will be requested, we suggest asking the applicant and beneficiary to submit a consistent application dossier.

2 PROJECT STRATEGY AND OBJECTIVES

2.1 Strategic Objectives of the Project

The investment under appraisal is a "bridge project" with the Third Community Support Framework and relates to the completion of the construction of a 15.73 km highway segment located between *Ag. Varvara* and *Ag. Deka (Kastelli)* at the Centre of the Island of Crete in the Heraklion Regional Unit. This road infrastructure bypasses the *Heraklion – Messara Road Axis* (National Road 97), between the two mentioned municipalities.

Figure 1 Map of *Ag. Varvara – Ag. Deka* segment



Source: Annex III, Application Dossier

The *Heraklion – Messara Road Axis* represents the major vertical road corridor in Crete (North-South direction) interconnecting the Northern Road Axis of Crete (*BOAK*) to the Southern Axis of Crete (*NOAK*).

Figure 2 Road Works (2007-2013 ERDF – Improvement of Accessibility)



Source: <http://www.mindev.gov.gr/wp-content/uploads/2012/08/28-8-%CE%A7%CE%91%CE%A1%CE%A4%CE%97%CE%A3-%CE%9F%CE%94%CE%99%CE%9A%CE%A9%CE%9D-%CE%95%CE%A1%CE%93%CE%A9%CE%9D.jpg>

The three axes together represent the Trans European Transport Network road infrastructure in the island. The implementation of the major project under assessment is thus firstly required and justified to ensure continuity in the operation and use of the TEN-T network. The road will also improve accessibility between Southern Crete and Heraklion, the city Airport and Port.

Figure 3 TEN-T network in Greece and Crete



Source: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/evalstrat_tran/greece.pdf

The project is included under the Priority Axis A – A' - *Οδικές Μεταφορές - Διευρωπαϊκό Και διαπεριφερειακό Οδικό Δίκτυο Περιφερειών Αμιγούς Στόχου Σύγκλισης* – of the 2007-2013 ERDF Regional Operational Programme (*Ενίσχυση της Προσπελασιμότητας*). The project is deemed to contribute to the realization of specific objectives 1 and 2 of the Priority Axis A – *Η αποπεράτωση των τμημάτων των οδικών αξόνων ΠΑΘΕ, Εγνατίας, Ιόνιας Οδού, Τρίπολης - Καλαμάτας/Σπάρτης και η ολοκλήρωση τμημάτων του ΒΟΑΚ-ΝΟΑΚ και κύριων νησιωτικών οδικών αξόνων των Περιφερειών αμιγούς στόχου σύγκλισης, η κατασκευή των οποίων ξεκίνησε την περίοδο 2000-2006, and – Η περαιτέρω ανάπτυξη των Διευρωπαϊκών και των Διαπεριφερειακών οδικών αξόνων των Περιφερειών αμιγούς στόχου σύγκλισης, των τροφοδοτικών αξόνων τους και των συνδέσεων με κομβικά σημεία / πύλες της Χώρας.*

The specific objectives of Priority Axis A are consistent with the first general objective of the Operational Programme "*Improvement of Accessibility*", namely "*Improving accessibility of the country areas through the development of a Trans-European road network including connections with the main gates of the country (border stations and ports), and the development of the national and regional road network, while ensuring environmental protection*".

The implementation of the project will contribute to the following national and regional strategies and priorities as identified in the application dossier (CBA report, page 73):

- General Objective 13 of the 5th Thematic Priority (2007-2013 NSRF) - *Η ανάπτυξη και ο εκσυγχρονισμός των φυσικών υποδομών και των συναφών υπηρεσιών του συστήματος μεταφορών της χώρας;*
- 2007-2013 NSRF Regional Strategy - *Ενίσχυση της ανταγωνιστικότητας και ανάδειξη της ελκυστικότητας της αναπτυξιακής χωρικής ενότητας Κρήτης και νήσων Αιγαίου, σε συνθήκες αειφόρου ανάπτυξης.*

The project is finally coherent with the following transport infrastructure development priorities (application form, page 12):

- Contribution to National Transport Policy;
- Improvement of accessibility in southern Crete, promoting economic activity in the Island, primarily tourism and agriculture;
- Mitigation of intraregional and interregional disparities;
- Contribution to the development of the Heraklion Region;
- Improvement of the mobility of the resident population and tourists, reducing travel time and costs as well as traffic accidents and environmental pollution.

2.2 Project description

The major project under appraisal relates to the completion of the construction of a 15.73 km long new alignment road segment, bypassing the *Heraklion – Messara Road Axis* (National Road 97), in the Regional Unit of Heraklion (Crete), between *Ag. Varvara and Ag. Deka (Kastelli)*.

The new road will consist of one lane plus one emergency lane per direction, for total width of 12.5 m. The infrastructure works encompasses three tunnels, five bridges, one interchange, one junction, and the settlement of secondary roads. In addition the project includes all necessary expropriations, network utilities and archaeological surveys costs. The implementation of the project was divided into two operational works:

- *Agia Varvara - Apomarma* of 7.824 km length;
- *Apomarma - Agioi Deka (Kastelli)* of 7.906 km length.

The *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara* is part of the wider project “*Heraklion – Ag. Deka – Viannos – Ierapetra – Pachia Ammos Road Axis*” of 150 km length. Only 16 km are currently operational while *Heraklion – I/C Gournes* and *Ag. Varvara – Ag. Deka* segments are under construction (of 22 km total length). The remaining sections of the Road Axis (about 112 km) is at the design stage. Section B.4.1 (b) – page 5 of the application form – presents the project’s current status.

The table below summarizes the units of analysis adopted in the preparation of the application dossier; which are acceptable.

Table 1 Units of analysis

Engineering works including technologies	<i>National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete</i>
Procurement and contracting	<i>National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete:</i> <ul style="list-style-type: none"> • Contract for Road Works (Ag. Varvara – Apomarma sub-section), Date March 30 2007, Reference N° 2007/S 63-076536 • Contract for Road Works (Apomarma – Ag. Deka sub-section), Date February 21 2008, Reference N° 2008/S 36-048953
Development consent and environmental certifications	For EIA and Natura 2000 related procedures, the unit of analysis is the whole <i>National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete</i> project.
Infrastructure management and operation	Whole <i>National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete</i> managed and maintained by the Department of Technical Works of Crete Regional Authority.
Economic and financial analysis	<i>National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete</i>

2.3 Functional objectives of the project

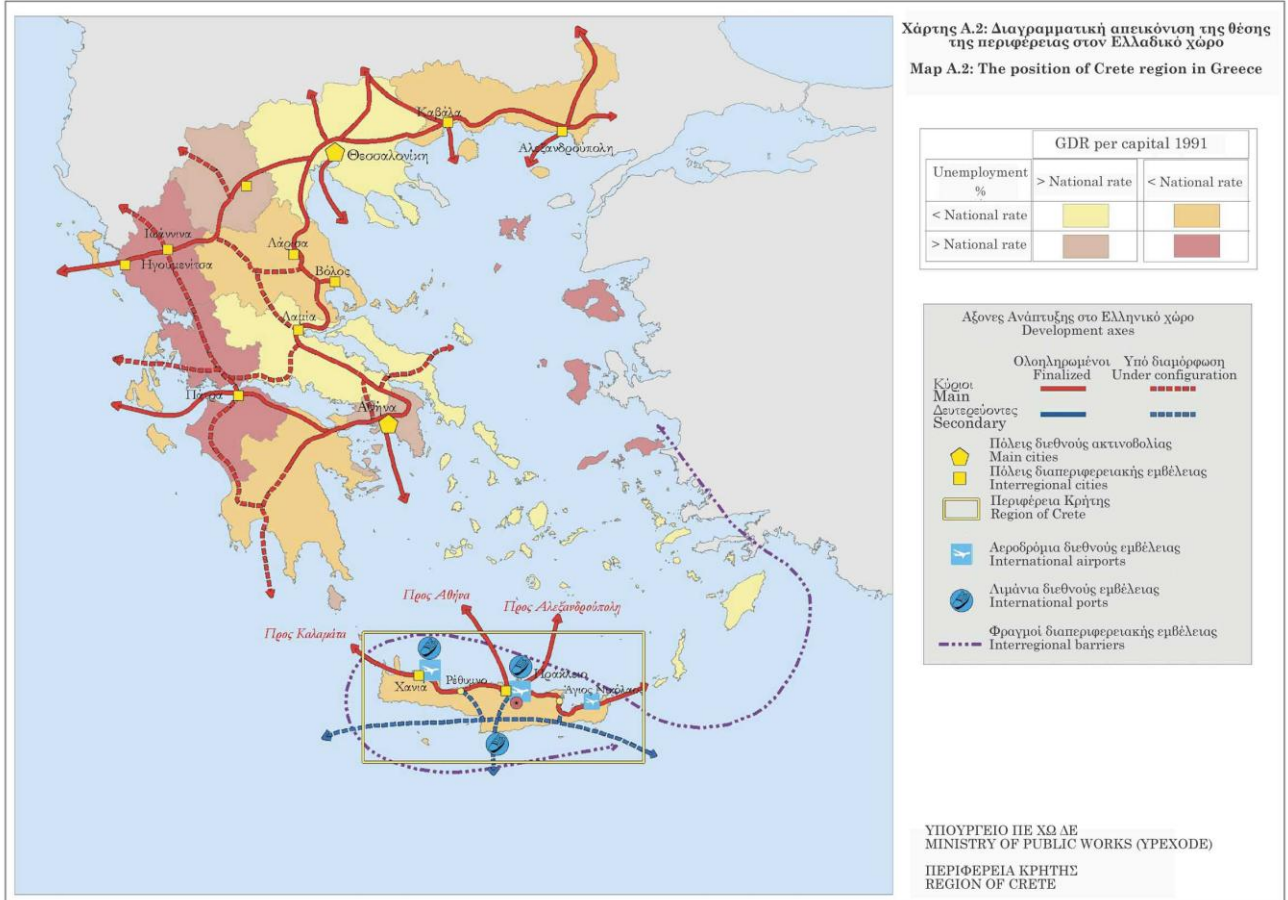
The *Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment* project is considered strategic for the social and economic development of the southern territories of the Heraklion Regional Unit. According to the application form it is expected to improve accessibility in the area, also supporting the development of the agricultural and touristic activities of the districts located in the Southern part of the region.

In addition, users from southern territories will access more quickly the activities and services located in the city of Heracklion as well as the city Airport and Port. The direct objective of the project is to improve the mobility of the resident population and the tourists, by reducing travel times and costs. The project is also deemed to reduce environmental pollution and road accidents.

It is indeed worth noting that the existing road presents very poor geometric and operational features resulting in poor accessibility and road safety conditions. The hinterland and southern part of Crete are indeed isolated from the North which is more prosperous. Worth adding that the national and international gateways to Crete are located on the northern coast, the new proposed road improving connectivity to Greece and the European Union.

Figure 4 shows to this respect how the incoming/outgoing traffic from the South is expected to cross the Region to reach the Northern part of Heraklion and the rest of Crete – thus confirming the functional relevance of the project.

Figure 4 The position of Crete Region in Greece



Source: <http://www.ypeka.gr/LinkClick.aspx?fileticket=KdJxqNBjBRc%3d&tabid=514&language=el-GR>

The total investment is expected to contribute to the strategic and functional objectives as indicated in the application form pages 12 to 13, as well as to the achievement of the targets of the Priority Axis A, identified with reference to its quantitative output and result indicators:

- The output indicator of Priority Axis A "Improvement of Accessibility - Construction of National Roads" with a base indicator of 25.3 km and a target of 367 km;
- The result indicator of Priority Axis A "Improvement of Accessibility - Travel Time" with a base indicator of 02:18 hours and a target of 01:23 hours.
- The result indicator of Priority Axis A "Improvement of Accessibility - Accessibility" with a base indicator of 29 km/ h and a target of 48 km/ h; and
- The result indicator of Priority Axis A "Risk" – with a base indicator of 0.816 deceased/100*10⁶ vehicle-km and a target of 0.568 deceased/100*10⁶ vehicle-km.

The application assumes that the population living in the Heraklion Regional Unit (304,270 inhabitants) and Crete Region (621,340 inhabitants) is directly benefiting from the project considering that the *Heraklion – Messara Axis* is the most important connection axis of Northern and Southern Crete, which is an acceptable assumption.

The application form – page 11 – provides the population trend for the area presenting a 4.5% positive population growth between 2001 and 2011. This trend is also verified by the Census published by the Greek Statistics Department (*Ελληνική Στατιστική Υπηρεσία*)¹.

¹ <http://www.statistics.gr>

Table 2 Total Population in Crete – 1981 - 2001

Regional Unit	POPULATION			POPULATION CHANGE		
	1981	1991	2001	% 1981-1991	% 1991-2001	% 1981-2001
HRAKLEIO	243,622	264,906	292,489	8.74	9.94	20.06
LASITHI	70,053	71,279	76,319	1.75	6.25	8.94
RETHYMNO	62,634	70,095	81,936	11.91	12.64	30.82
CHANIA	125,856	133,774	150,387	6.29	10.97	19.49
CRETA REGION	502,165	540,054	601,131	7.55	11.31	19.71
TOTAL GREECE	9,740,417	10,259,900	10,964,020	5.33	6.86	12.56

Source: http://www.crete.gov.gr/index.php?option=com_attachments&task=download&id=3212&lang=en

Table 3 Permanent Population in Crete – 2011 Census

	2011				2001
	Total	Male	Female	Pop Density (pop/sq km)	Total
Crete Region	621,340	308,760	312,580	74.54	594,368
Regional Unit Heraklion	304,270	150,810	153,460	115.20	291,225
Municipality Heraklion	173,450	85,210	88,240	709.08	
Municipality Arhanon-Asterousion	16,650	8,300	8,350	49.39	
Municipality Viannou	5,500	2,730	2,770	24.83	
Municipality Gortynas	15,710	7,910	7,800	33.80	
Municipality Maleviziou	24,710	12,440	12,270	84.65	
Municipality Minoa Pediadas	16,810	8,430	8,380	42.21	
Municipality Faistou	24,360	12,140	12,220	59.30	
Municipality Chersonisou	27,080	13,650	13,430	99.50	
Regional Unit Lasithi	75,690	37,610	38,080	41.52	75,736
Regional Unit Rethymno	85,160	41,900	43,260	56.92	78,957
Regional Unit Chania	156,220	78,440	77,780	65.75	148,450

Source: http://www.crete.gov.gr/index.php?option=com_attachments&task=download&id=3212&lang=en, http://www.statistics.gr/portal/page/portal/ver-1/ESYE/BUCKET/A1602/Other/A1602_SAM06_TB_DC_00_2001_14_F_GR.pdf

It is also worth noting that the Regional Unit of Heraklion contributes to 48.4% of the island's GDP, while the agricultural area of Heraklion constitutes 54.1% of the island's and 6.02% of the country's total agricultural area (2009 data). To this respect it is worth adding that most of the agriculture of Crete is concentrated in the hinterland and southern territories of Crete, which are also visited by numerous tourists during the summer period.

The application also considers that tourists (foreign and domestic) visiting the Region are indirectly benefiting from the project. According to the application form (page 11) 373,131 overnight stays of domestic tourists and 6,000,023 overnight stays of foreign tourists were recorded in the Regional Unit of Heraklion (2010), that account for 28.2% and 45.6% respectively of the total overnight stays in Crete and for 2.1% and 14.1% in the country. Similar are also the data published for year 2009².

In addition, according to 2009 data published by the Greek Statistics Department, the primary sector constitutes 4.94% of the economy in the Regional Unit of Heraklion, the secondary sector (including mining, manufacturing and construction) representing 16.60% of the regional economy and the tertiary sector (trade and services) amounting to 78.46%; thus confirming the project is not only generating benefits to agriculture and tourism, rather to the wide economy and society of the region and island.

On the basis of the above considerations the description of the investment's functional objectives is deemed satisfactory.

² <http://digilib.lib.unipi.gr/dspace/bitstream/unipi/5081/1/Gnafakis.pdf>

2.4 Consistency with Other Union Policies

The sources for the financing of the project are detailed at Section D.2.3 of the application form. The project is included for funding under Axis A of the Operational Programme "Improvement of Accessibility" by Decision no. 4212/20-09-2010 of the General Secretary for Public Works. The project is also included in the Public Investment Programme (PIP), according to Decision No. 488114/ΔΕ-6021/27-11-10 of the Ministry of Development, Competitiveness and Shipping.

The sources for the financing of the *Completion of the construction of Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete* are detailed at pages 39 to 40 of the application form.

The co-financing rate adopted in the application form is 85%, consistently with the 2007-2013 Operational Programme.

As already stated at Section 2.1 above, the investment under appraisal concerns the remaining construction works for the completion of the *Construction of Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete*. All previous works were co-financed by the 3rd CFS. Section Θ.1 of the application form – page 40 to 42 – adequately presents the co-financing certification procedures under the 3rd CFS. According to the CBA report (page 37) the project's initial design studies and surveys (preparatory works) were also co-financed by the 2nd CFS and public funds.

The completion of *Heraklion - Messara axis* will finally contribute to the national and European transport strategies, as it will enhance the completion of the TEN-T Network in Crete.

The project is consistent with the policies concerning environmental protection due to the identified construction techniques (page 36 of the application form). An environmental impact monitoring programme will also be implemented after completion of the construction works, at the operational stage – See Sections ΣΤ.3 to ΣΤ.6 of the application form.

The publicity measures, described at page 42 of the application form are in line with the requirements of the EU regulation. It is stated that the contractor is responsible for the project's publicity. Yet their costs are not specified, although these are deemed to be included in the construction costs.

3 TECHNICAL FEASIBILITY, PROJECT COSTS AND DEMAND ANALYSIS

3.1 Technical Feasibility

3.1.1 Feasibility Study

According to the application form, Section D.2.1. *Τεχνική Πρόοδος*, page 18, all technical and design studies had been completed since 2006 when the construction of the project started. The *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment at Heraklion - Crete* project started to be planned in 1996.

During the first (exploratory) feasibility study, six alternatives of the *Ag. Varvara – Ag. Deka (Kastelli) segment* were examined and analysed with a common starting point north of the existing *Ag. Varvara Road*, where the construction of a junction was already designed. All the alternative solutions were less preferable than the selected, since they either had a direct negative impact on the archaeological site of Gortyna or were longer or had poorer geometric features. The comments in the application form – pages 15 to 16 – relating to the description of the project alternatives considered in the studies are sensible.

The analysis of the demand and traffic is commented at Section 3.3 below.

3.1.2 Technical Concept

Considering both the existing and future average annual daily traffic (AADT) on the corridor – equalling 4,641 and 7,921 vehicles respectively at the years 2010 and 2040 – the proposed solution – consisting of one lane plus one emergency lane per direction road segment – is appropriately dimensioned under the operational/functional stand point.

The solution of constructing a new alignment road, parallel to the existing one is also functionally appropriate considering the orography of the territory where the existing road is located and its configuration. In these terms the *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara* is reasonably expected to improve accessibility to and from the city centre, the Airport and the Port of Heraklion. Compared to the existing road the new alternative will reduce travel times and costs, environmental pollution and risks of road accidents.

The application dossier provides details of the road infrastructure, including the size and dimension of the proposed segments, interchanges, bridges and tunnels and adequately describes the types and quantity of works such as excavation, paving, asphalt works, planting, electromechanical works, signs-safety works and drainage works, etc. This information on the technical structural arrangement is considered sufficient to conclude that the project is technically sound regarding the proposed solutions and construction techniques.

3.1.3 Environmental assessment

Environmental Impact Assessment. The investment under assessment belongs to the category of works included under Annex 1 of EIA Directive. An Environmental Impact Assessment process was undertaken on this basis and its related procedures completed for the whole investment (*National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment at Heraklion - Crete*).

The Authorities consulted during preparation of EIA programme were:

- The Regional Unit of Heraklion (Environmental Protection Department);
- The Regional Authority of Crete;
- The Ministry of Cultural Heritage (Archaeology Department);

- The Ministry of Agriculture (Environmental Protection Department);
- Municipality of Ag. Varvara.

The application dossier includes all the relevant consultations (Annex I) as well as the non-technical summary of the EIA was correctly included in the documentation available – See Annex I of the application dossier.

The final EIA compliance declaration was not however provided. Given that the application form (Section ΣΤ.3.1.2.) states the official protocol for the EIA development consent was undertaken, and a compliance declaration issued by the Ministry of Environment, Energy & Climate Change/Special Office for the Environment (Υπουργείο Περιβάλλοντος, Ενέργειας και Κλιματικής Αλλαγής/ Ειδική Υπηρεσία Περιβάλλοντος – 131171/23.05.2003), we assume that the EIA declaration for the project was mistakenly omitted from the application dossier. We suggest confirming with the Applicant and the Beneficiary the availability of the mentioned EIA compliance declaration and/or of any subsequent certificate either extending its validity or amending it.

The costs for the identified preventive and mitigation measures have been estimated to be equal to the 17% of the investment; which we deem reasonable considering the planned technical works. Details are provided at Section ΣΤ.6 of the application form.

The *polluter pay principle* applies indirectly through the payment by users of annual circulation taxes as described at page 32 of the application form.

Strategic Environmental Assessment. The application form redirects to the SEA report developed for the 2007-2013 ERDF regional operational program *Ενίσχυση της Προσπελασιμότητας*. A link to the site of the 2007-2013 ERDF related SEA report is provided in the application form, although not specifically including the details of the project under assessment³.

Natura 2000. A certificate from the national environmental authority – Υπουργείο Περιβάλλοντος, ενέργειας και κλιματικής αλλαγής – Γενική Διεύθυνση Περιβάλλοντος has been enclosed to the application form (Annex I) stating that the project will not cause significant impacts on Natura 2000 sites.

The application dossier includes a certificate issued in 2012 (Protocol No.: 203483) – Annex 1 – whereas the application form – page 35 – states that the certificate was issued in 2006 (Protocol No.: 10420). We understand that the application is not updated to this respect.

B.3.1.3 Recommendations and suggestions

The application dossier omits to include the EIA certificate for the project. The EIA process for this project was undertaken in 2002-2003 and the application form does not specify whether an extension would be required. The application dossier includes some inconsistencies relating to the dates of the Natura 2000 certificate. These omissions and inconsistencies should be clarified or amended, as appropriate.

³ <http://www.epep.gr/content/enviromental-study>

3.1.4 Project implementation scheme and time schedule

The project is not going to be implemented as a public private partnership. After its completion it is going to be operated and managed by the Regional Authority of Crete/ Department of Technical Projects.

Two separate contracts were signed for the construction of the *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka (Kastelli) segment*.

- Contract for Road Works (Ag. Varvara – Apomarma sub-section), Date March 30 2007, Reference N° 2007/S 63-076536;
- Contract for Road Works (Apomarma – Ag. Deka sub-section), Date February 21 2008, Reference N° 2008/S 36-048953.

According to Table D.1 (page 17) and Section D.2.4 (page 19) of the application form, the implementation status of the project is currently in progress. Table 4 below, shows the real and planned “start” and “completion” dates of the project phases.

Table 4 Project calendar

Project Phase/Contract		Start	Completion
1	Feasibility Studies	01/06/1996	28/04/1998
2	Cost benefit analysis (including financial analysis)	02/10/2012	01/12/2012
3	Environmental Impact Assessment ▪ Ag. Varvara – Ag. Deka Segment	15/05/2002	23/05/2003
4	Design Studies ▪ Ag. Varvara – Apomarma sub-section ▪ Apomarma – Ag. Deka sub-section	10/07/2003 10/07/2003	22/12/2006 31/03/2006
5	Preparation of Tender documentation ▪ Ag. Varvara – Apomarma sub-section ▪ Apomarma – Ag. Deka sub-section	02/04/2007 30/08/2006	03/04/2007 02/09/2006
6	Expected launch of tender procedure: ▪ Ag. Varvara – Apomarma sub-section ▪ Apomarma – Ag. Deka sub-section	03/04/2007 02/09/2006	29/05/2007 23/10/2006
7	Land acquisition ▪ Ag. Varvara – Apomarma sub-section ▪ Apomarma – Ag. Deka sub-section	05/05/2006 05/03/2004	31/12/2015 31/12/2015
8	Construction phase/ Contract ▪ Ag. Varvara – Apomarma sub-section ▪ Apomarma – Ag. Deka sub-section	16/01/2008 14/02/2007	31/12/2015 28/06/2013
9	Operational phase	01/01/2016	31/12/2040

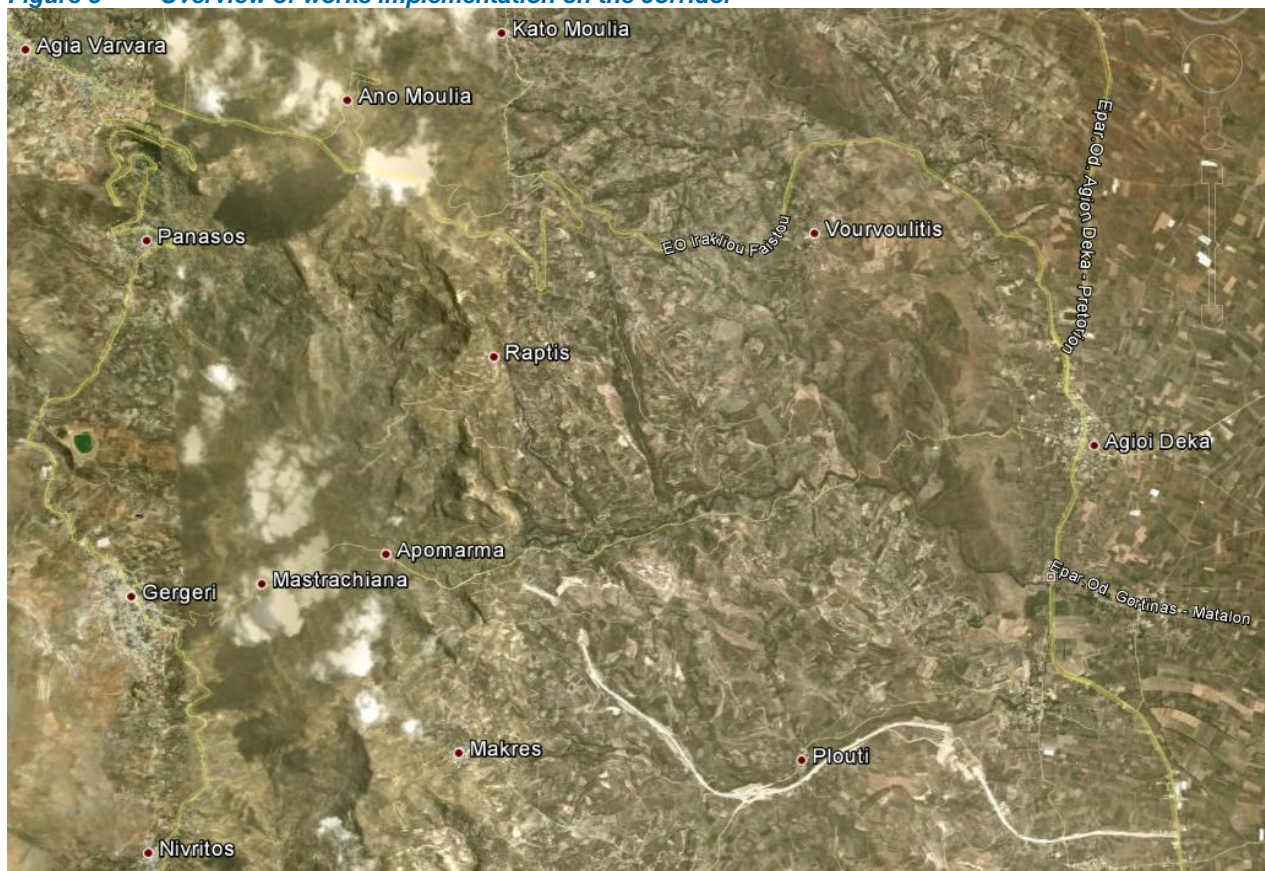
Source: Application Form, pages 17 to 18

The application dossier, Annex IV, provides two detailed time schedules (GANTT charts) for the construction works in the two sub-sections respectively. Although all the works are properly included and detailed, the time schedule presents some inconsistencies when comparing it to the one in the application form (Section D.1), regarding the construction works for both the sub-sections. According to the annexed time schedules the completion date of construction is 31/12/2012, whereas the works are now expected to be terminated by 2015.

Section Ø.5 of the application form (page 43) describes the details of the two contracts signed for the implementation of the project.

Regarding the *Apomarma – Ag. Deka* sub-section, this is already at an advanced stage of construction (See figure overleaf).

Figure 5 Overview of works implementation on the corridor



Relating to the *Ag. Varvara – Apomarma* sub-section, the application form – Section B.5.1, page 12 – states that its construction is paused due to serious landslides that occurred in the project area. Specifically regarding this happenings and the implementation of this sub-section, it is reported that all the relevant surveys and studies have already been completed and the award of an additional contract to restore the damages caused by the landslides and finalise the construction works is expected immediately. Considering that the construction of the *Ag. Varvara – Apomarma* sub-section is scheduled to end at 31/12/2015, we do not see risks of timely completion for the construction works.

According to the application form, Section D.2.2 (page 18), all the necessary decisions concerning land acquisition have been issued and the acquisition of the land is progressing. In addition to this, the procedures required by the relevant Archaeology Departments for the preservation of the archaeological heritage have also been fulfilled.

B 3.1.4. Recommendations and suggestions

The proposed time-table is acceptable and there should be limited risk regarding the completion of the construction works by end of year 2015. This will mostly depend on 1) the timely and successful completion of the land acquisition programme currently in progress; 2) commence of the construction works regarding the *Ag. Varvara – Apomarma* sub-section, which are currently paused due to landslides occurred in the project area; and 3) the project works will not change and all EIA related procedures are completed and updated (See Section 3.1.4).

The application dossier shows some minimal inconsistencies between the time-tables of the construction works for both the sub-sections presented respectively in the application form and Annex IV. We understand however that the application form is more updated than the Annex.

3.2 Project costs

The application dossier – Table H.1 – states the costs for the *National road axis Heraklion – Messara: Completion of the construction of the Ag. Varvara – Ag. Dekka segment* are € 130.581.806.93 (including VAT). This value is consistent with the one presented at Section B.4.2 of the application form (division of construction works).

Table 5 *Table H.1*

	Description	Total Project Cost (EUR '000)	Non-eligible Project Cost (EUR '000)	Eligible Project Cost (EUR '000)
1	Planning and Design Expenditures			
2	Land	13,255	3,028	10,227
3	Building and Infrastructure	94,399	20,665	73,734
4	Installations and Equipment			
	Utilities and Archaeological surveys	1,610	0,00	1,610
5	Contingency			
6	Revisions			
7	Technical Assistance			
8	Publicity			
9	Supervision			
10	Sub-total	109,264	23,693	85,571
11	Vat	21,317	4,616	16,702
12	TOTAL	130,582	28,308	102,273

Source: Application Form (page 38)

The CBA report (page 78) presents the total project cost in current prices including VAT (€ 182,613,082.66) consistently with what described at Section B.4.2 of the application form (division of construction works).

From the analysis of the application dossier it is not clear whether this total investment costs already includes the costs for the works needed to restore the damages caused by the landslides occurred in the project area and interrupting the construction works of the *Ag. Varvara – Apomarma* sub-section. This should be clarified by the Applicant and Beneficiary and the costs considered in the analysis as appropriate.

It is worth noting that design and surveys cost (€ 1,790,696.55) is not included to the aforementioned project cost because it was already co-financed by the Structural Funds under the 2nd and 3rd CSF periods (CBA report, page 78).

The costs for planning (design and surveys cost), as specified in the CBA report, correspond to approximately 1% of the project value, which is acceptable.

As already commented at Section 3.1.3 above, the costs for the identified preventive and mitigation measures have been estimated to be equal to the 17% of the investment; which we deem reasonable considering the planned technical works. The Archaeological surveys and works related cost provided in the application form (page 36) is consistent with the one included in the CBA report (page 84) and is deemed acceptable.

The drainage works and the tunnels construction costs are not detailed in the CBA report, however we assume that these are included in the construction works costs. The application dossier also provides the breakdown of the costs per different type of categories (See Table 6 overleaf) and gives the details of the share of works funded by the 3rd CFS and the ERDF respectively.

Table 6 *Division and Distribution of costs*

Ag. Varvara – Ag. Deka Segment							
Description		Total Budget		3 rd CFS Budget		ERDF Budget	
		Cost (EUR)	Progress	Cost (EUR)	Progress	Cost (EUR)	Progress
TEAM A	Excavation	10,406,755.97	100.00%	5,299,735.90	50.93%	5,107,020.07	49.07%
TEAM B	Technical Works	74,321,411.34	100.00%	25,361,053.65	34.12%	48,960,357.69	65.88%
TEAM C	Paving	2,509,240.73	100.00%	328,166.28	13.08%	2,181,074.45	86.92%
TEAM D	Asphalt	2,965,560.07	100.00%	0.00	0.00%	2,965,560.07	100.00%
TEAM E	Signs - Safety	1,244,425.58	100.00%	3,035.34	0.24%	1,241,390.24	99.76%
TEAM F	Traffic Signs	883,078.86	100.00%	0.00	0.00%	883,078.86	100.00%
TEAM G	Electromechanical works (tunnels)	2,585,625.04	100.00%	0.00	0.00%	2,585,625.04	100.00%
Construction Works		94,916,097.59	100.00%	30,991,991.17	100.00%	63,924,106.42	67.35%
Other construction costs (GE & OE18%, Contingency, Revision, etc.)		35,701,906.90	100.00%	8,727,703.51	24.45%	26,974,203.39	75.55%
Studies - Research		3,501,000.00	100.00%	0.00	0.00%	3,501,000.00	100.00%
Total		134,119,004.49	100.00%	39,719,694.68	29.62%	94,399,309.81	70.38%
VAT		28,517,107.31		7,546,741.99		20,970,365.32	
Total of Construction Works (with VAT)		162,636,111.80	100.00%	47,266,436.67	29.06%	115,369,675.13	70.94%
Other							
Expropriation		17,798,911.95	100.00%	4,543,829.58	25.53%	13,255,082.37	74.47%
Utilities (before VAT)		1,613,445.37	100.00%	103,649.01	6.42%	1,509,796.37	93.58%
VAT		366,946.48		19,693.31		347,253.16	
<i>Total Utilities with VAT</i>		<i>1,980,391.85</i>	<i>100.00%</i>	<i>123,342.32</i>	<i>6.23%</i>	<i>1,857,049.53</i>	<i>93.77%</i>
Archaeology		197,667.04	100.00%	97,667.04	49.41%	100,000.00	50.59%
Total of Construction Works (without VAT)		153,729,028.85	100.00%	44,464,840.31	28.92%	109,264,188.55	71.08%
VAT		28,884,053.79		7,566,435.30		21,317,618.48	
Total of Construction Works (with VAT)		182,613,082.64	100.00%	52,031,275.61	28.49%	130,581,807.03	70.51%

Source: Application Form, page 9

The unit cost per km for the *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*, totalling 15.73 km, is higher than €10 million – which is considered high for this type of infrastructure. However this is in our opinion due to the inclusion of the following technical works: three tunnels, five bridges, one interchange, and one junction as well as the settlement of secondary roads.

B.3.2. Recommendations and suggestions

The information provided regarding the project costs is overall acceptable. The cost of the road project subject of analysis is deemed high: this is probably due to the type and size of the works constructed as part of the investment (three tunnels, five bridges, one interchange, and one junction) and the settlement of secondary roads. This assumption could be confirmed by mean of provision of the cost details by type of infrastructure.

From the analysis of the application dossier it is not clear whether this total investment costs already includes the costs for the works needed to restore the damages caused by the landslides occurred in the project area and interrupting the construction works of the *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*. This should be clarified by the Applicant and Beneficiary and the application for funding amended accordingly.

3.3 Demand analysis

The results of the demand analysis are presented under item Γ.1.1 of the application form. More detailed information both relating to the *do something* and *do nothing* scenarios is presented in the CBA report, Chapter 3, pages 91-98 and its related Annex (II).

The time horizon of the demand analysis extends to 2040 in order to include 30 years (including the construction phase); this assumption is in line with the requirements of the 2008 DG REGIO CBA Guideline.

Under the methodological stand point, the demand on the corridor was estimated using an econometric model that utilises linear regression to describe the relationship between a dependent variable – in this case the traffic on the road expressed in Annual Average Daily Traffic - AADT – and multiple independent variables by mean of a mathematical function.

The independent variables used for the creation of econometric models is the historical evidence of population, GDP (at various levels such as national, departmental, regional), tourist overnight stays and fleet of vehicles. Annex II of the CBA report (pages 140 to 174) presents in detail the adopted methodology for the estimation of traffic flows. Table 9 presents the socio-economic variables used in the model, for period 2011 to 2040.

Table 7 *Estimates of socioeconomic variables*

Year	Population in Regional Unit of Heraklion	GDP in Regional Unit of Heraklion	Fleet of Vehicles in Regional Unit of Heraklion	Overnight stays in Crete
2011	301,245	4,913	263,603	16,869,328
2012	302,977	4,500	293,334	17,285,098
2013	303,720	4,264	306,872	17,706,396
2014	304,360	4,238	320,768	18,133,224
2015	304,898	4,310	335,022	18,565,580
2016	305,333	4,421	349,634	19,003,466
2017	305,666	4,486	364,605	19,446,880
2018	305,896	4,529	379,934	19,895,824
2019	306,023	4,574	395,621	20,350,296
2020	306,047	4,618	411,666	20,810,298
2010	305,969	4,663	428,069	21,275,828
2022	305,789	4,709	444,831	21,746,888
2023	305,505	4,755	461,950	22,223,476
2024	305,119	4,801	479,428	22,705,594
2025	304,631	4,848	497,264	23,193,240
2026	304,040	4,895	515,458	23,686,416
2027	303,346	4,943	534,011	24,185,120
2028	302,550	4,991	552,921	24,689,354
2029	301,651	5,089	572,190	25,199,116
2030	300,649	5,188	591,817	25,714,408
2031	299,545	5,289	611,802	26,235,228
2032	298,338	5,392	632,145	26,761,578
2033	297,028	5,498	652,847	27,293,456
2034	295,616	5,605	673,906	27,830,864
2035	294,101	5,714	695,324	28,373,800
2036	292,484	5,826	717,100	28,922,266
2037	290,764	5,939	739,234	29,476,260
2038	288,941	6,055	761,727	30,035,784
2039	287,016	6,173	784,577	30,600,836
2040	284,988	6,294	807,786	31,171,418

Source: CBA report, page 160

The model was calibrated with the available AADT data (1986 to 1995) and first validated using 1998 AADT data. For the purposes of this application, the results were subsequently updated in 2012 by mean of a 24 hour traffic counting campaign, also adjusting the model to accommodate the effects of the economic and financial crisis not considered in the initial model based on findings and assumptions derived from the outdated study Έρευνα και απογραφή προέλευσης - προορισμού στην Κρήτη και προβλέψεις κυκλοφορίας έως το έτος 2020, TRADEMCO.

Traffic forecasts for *Agia Varvara - Agioi Deka* corridor are presented at Table 8 and Table 9 respectively for the *do nothing* and *do something* scenarios. The first year of full operation of the new alternative will be 2016, therefore the forecasts until 2015 do not differ between the two scenarios.

Table 8 *Traffic flows for the existing Agia Varvara - Agioi Deka - Kastelli Road Segment (do nothing scenario)*

Year	Rate of Change	AADT	Two wheelers	Vehicles	Buses	2-axle heavy vehicles	3-axle heavy vehicles	Multi-axle heavy vehicles	Annual Traffic
2010	2.74%	4,641	11,511	1,492,741	12,877	69,847	10,536	96,576	1,694,088
2011	0.66%	4,672	11,587	1,502,530	12,961	70,305	10,605	97,210	1,705,198
2012	0.88%	4,713	11,688	1,515,720	13,075	70,922	10,698	98,063	1,720,167
2013	1.37%	4,777	11,849	1,536,490	13,254	71,894	10,844	99,407	1,743,738
2014	1.90%	4,868	12,074	1,565,684	13,506	73,260	11,050	101,296	1,776,870
2015	2.12%	4,971	12,330	1,598,925	13,793	74,816	11,285	103,446	1,814,594
2016	2.19%	5,081	12,601	1,634,019	14,096	76,458	11,533	105,717	1,854,423
2017	2.06%	5,185	12,860	1,667,690	14,386	78,033	11,770	107,895	1,892,635
2018	1.99%	5,289	13,116	1,700,887	14,672	79,587	12,005	110,043	1,930,310
2019	1.97%	5,393	13,375	1,734,439	14,962	81,157	12,241	112,214	1,968,387
2020	1.95%	5,498	13,636	1,768,346	15,254	82,743	12,481	114,407	2,006,868
2010	1.94%	5,605	13,901	1,802,609	15,550	84,346	12,723	116,624	2,045,753
2022	1.92%	5,712	14,168	1,837,228	15,849	85,966	12,967	118,864	2,085,041
2023	1.90%	5,821	14,437	1,872,202	16,150	87,603	13,214	121,127	2,124,733
2024	1.89%	5,931	14,710	1,907,533	16,455	89,256	13,463	123,412	2,164,829
2025	1.87%	6,042	14,985	1,943,220	16,763	90,926	13,715	125,721	2,205,329
2026	1.85%	6,154	15,263	1,979,263	17,074	92,612	13,969	128,053	2,246,234
2027	1.84%	6,267	15,544	2,015,663	17,388	94,315	14,226	130,408	2,287,544
2028	1.82%	6,382	15,827	2,052,419	17,705	96,035	14,486	132,786	2,329,258
2029	1.90%	6,503	16,128	2,091,397	18,041	97,859	14,761	135,308	2,373,494
2030	1.88%	6,625	16,431	2,130,786	18,381	99,702	15,039	137,856	2,418,196
2031	1.87%	6,749	16,738	2,170,588	18,724	101,565	15,320	140,431	2,463,367
2032	1.85%	6,874	17,048	2,210,805	19,071	103,446	15,604	143,033	2,509,008
2033	1.84%	7,000	17,362	2,251,438	19,422	105,348	15,890	145,662	2,555,122
2034	1.82%	7,128	17,678	2,292,489	19,776	107,268	16,180	148,318	2,601,709
2035	1.81%	7,257	17,998	2,333,958	20,133	109,209	16,473	151,001	2,648,772
2036	1.79%	7,387	18,321	2,375,848	20,495	111,169	16,768	153,711	2,696,313
2037	1.78%	7,519	18,647	2,418,160	20,860	113,149	17,067	156,449	2,744,332
2038	1.77%	7,652	18,977	2,460,896	21,228	115,148	17,369	159,214	2,792,832
2039	1.75%	7,786	19,310	2,504,058	21,601	117,168	17,673	162,006	2,841,816
2040	1.74%	7,921	19,646	2,547,646	21,977	119,208	17,981	164,826	2,891,284

Source: CBA report, pages 93 to 94

Future traffic flows on the new road *Agia Varvara - Agioi Deka* (Kastelli) include only the diverted traffic from the existing road to the new alternative. The analysis considers that 97% of light vehicles and buses and 100% of trucks will divert to the new road, taking into account that this road operates mainly as a connection between the Northern and Southern territories of Crete. The remainder 3% of light vehicles will continue to use the existing road.

Table 9 Traffic flows for the new Agia Varvara - Agioi Deka - Kastelli Road Segment (*do something scenario*)

Year	Rate of Change	AADT	Two wheelers	Vehicles	Buses	2-axle heavy vehicles	3-axle heavy vehicles	Multi-axle heavy vehicles	Annual Traffic
2016	2.19%	4,944	12,223	1,584,999	13,673	76,458	11,533	105,717	1,804,601
2017	2.06%	5,046	12,474	1,617,659	13,954	78,033	11,770	107,895	1,841,787
2018	1.99%	5,146	12,723	1,649,860	14,232	79,587	12,005	110,043	1,878,450
2019	1.97%	5,248	12,974	1,682,406	14,513	81,157	12,241	112,214	1,915,504
2020	1.95%	5,351	13,227	1,715,296	14,797	82,743	12,481	114,407	1,952,951
2010	1.94%	5,454	13,484	1,748,531	15,083	84,346	12,723	116,624	1,990,791
2022	1.92%	5,559	13,743	1,782,111	15,373	85,966	12,967	118,864	2,029,023
2023	1.90%	5,665	14,004	1,816,036	15,666	87,603	13,214	121,127	2,067,649
2024	1.89%	5,772	14,268	1,850,307	15,961	89,256	13,463	123,412	2,106,668
2025	1.87%	5,880	14,535	1,884,923	16,260	90,926	13,715	125,721	2,146,080
2026	1.85%	5,989	14,805	1,919,885	16,562	92,612	13,969	128,053	2,185,886
2027	1.84%	6,099	15,077	1,955,193	16,866	94,315	14,226	130,408	2,226,086
2028	1.82%	6,210	15,352	1,990,847	17,174	96,035	14,486	132,786	2,266,680
2029	1.90%	6,328	15,644	2,028,655	17,500	97,859	14,761	135,308	2,309,727
2030	1.88%	6,447	15,938	2,066,863	17,829	99,702	15,039	137,856	2,353,228
2031	1.87%	6,568	16,236	2,105,471	18,162	101,565	15,320	140,431	2,397,185
2032	1.85%	6,689	16,537	2,144,481	18,499	103,446	15,604	143,033	2,441,601
2033	1.84%	6,812	16,841	2,183,895	18,839	105,348	15,890	145,662	2,486,475
2034	1.82%	6,936	17,148	2,223,714	19,182	107,268	16,180	148,318	2,531,811
2035	1.81%	7,062	17,458	2,263,939	19,529	109,209	16,473	151,001	2,577,610
2036	1.79%	7,189	17,772	2,304,573	19,880	111,169	16,768	153,711	2,623,873
2037	1.78%	7,317	18,088	2,345,615	20,234	113,149	17,067	156,449	2,670,602
2038	1.77%	7,446	18,408	2,387,069	25,592	115,148	17,369	159,214	2,717,799
2039	1.75%	7,577	18,731	2,428,936	20,953	117,168	17,673	162,006	2,765,467
2040	1.74%	7,709	19,057	2,471,219	21,318	119,208	17,981	164,826	2,813,606

Source: CBA report, page 95

The analysis also assumes that the annual rate of traffic growth remains the same between the two scenarios, meaning that no induced demand is generated by the new infrastructure. According to the CBA report (page 94) this additional demand would be minimal and the conservative assumption of non considering it in the forecasts is aimed at reflecting the effects of current economic and financial crisis.

For the CBA purposes we understand from the CBA that the comparison between the *do something* and *do nothing* scenarios is based on the benefits to the users deriving from using a shorter, more rapid and safer alternative, resulting in travel time and costs savings, less air pollution and less accidents (See Section 4.2 below). The CBA report (page 45) provides the comparison between the two road alternatives in terms of length and average speed. On the basis of the information available (See also Table 10 below) we consider the definition of the *do nothing* and *do something* scenarios is reasonable and acceptable.

Table 10 Operational Characteristics of the two road alternatives

Road Segments	Length (km)	Cross-Section	Average Speed (km/h)	Time		Average Speed (km/h)	Time	
				Hours	Minutes		Hours	Minutes
				Light Vehicles			Heavy Vehicles	
DO NOTHING SCENARIO								
Agia Varvara - Agioi Deka	14.6	2X1, width 7.00- 7.54	51	0.2878	17.27	39	0.3725	22.35
Agioi Deka - Kastelli	4.3		71	0.0605	3.63	55	0.0783	4.7
Agia Varvara - Kastelli	18.9		0.3483	20.9	0.4507	27.04		
DO SOMETHING SCENARIO								
Agia Varvara - Apomarma	7.82	2x1+ Em. Lane width 12.50	74	0.1057	6.34	57	0.1368	8.21
Apomarma - Kastelli	7.91		74	0.1069	6.41	57	0.1383	8.3
Agia Varvara - Kastelli	15.73		0.21	12.75	0.28	16.51		
INCREMENTAL APPROACH								
Agia Varvara - Kastelli	3.17	5.5	23	0.138	8.15	18	0.17	10.53

Source: CBA report, page 45

Specifically regarding the calculation of the benefits, we also understand that at least during the recent 2012, 24 hours counting update, travel times were appropriately measured as illustrated at Figure 6 overleaf, probably in support of such an exercise. We also assume the 97% of the diverted traffic was identified on the basis of the survey and traffic counting. This should however be confirmed with the Applicant and Beneficiary.

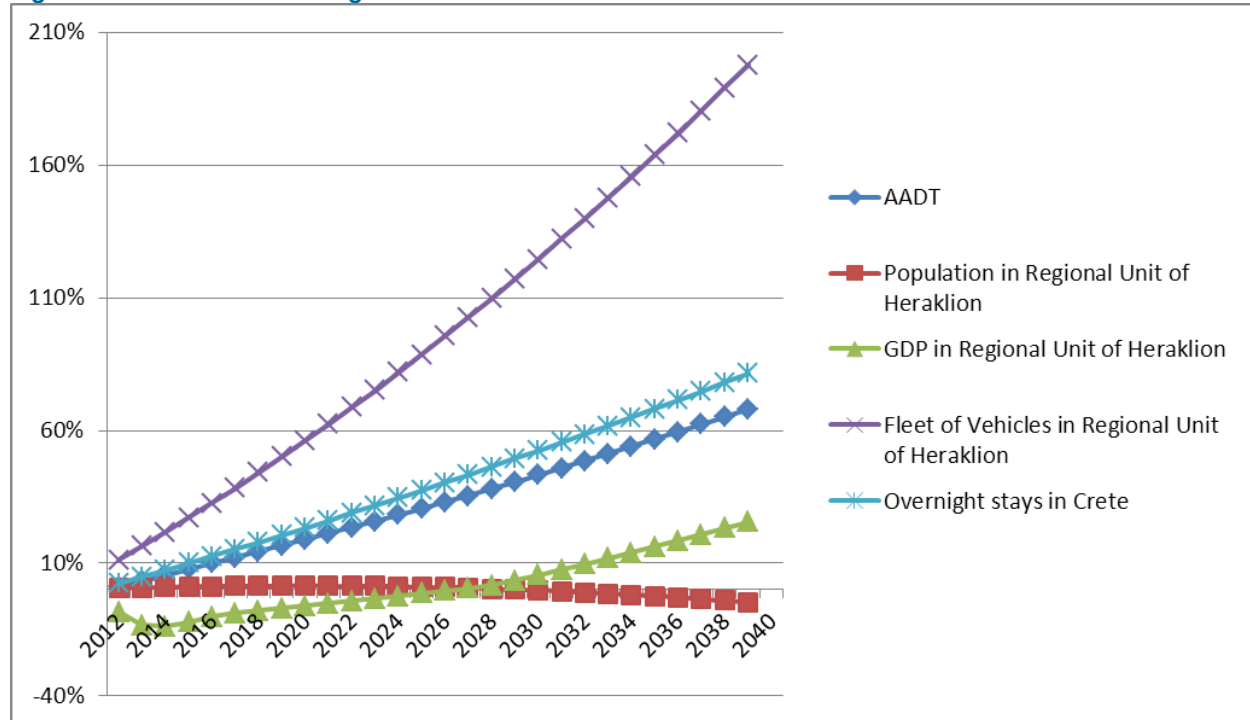
Figure 6 Traffic points (measuring travel times)



Source: CBA report, page 155

Figure 7 below shows the assumptions and results of the model illustrating the future trends for the traffic (AADT) and the variables considered in the analysis. The traffic is expected to increase by 70% over the period of analysis. The overnight stays are expected to grow more than the traffic and particularly the fleet of vehicles is expected to grow by 200%.

Figure 7 Model variables growth rates



Source: LeighFisher Limited

The model was not provided as part of the application dossier and although overall sensible under the methodological stand-point, it is not possible understanding the exact relationship between each of the variables included and the effect in the growth and variation of each of them on the corridor traffic. This was also not explained in quantitative terms in the application dossier.

From the graph it is however possible understanding that the growth in the fleet is crucial and basically driven by a growth in the number of domestic and international tourists visiting the island, given that the population trend is expected to decline.

The use of the overnight stays instead of the number of tourists – i.e. using the number of tourists' arrivals at the three Island's airports – is not entirely understandable. Also not entirely clear is the use of overnight stays for the whole Crete whereas the other variables relate to the Heraklion Regional Unit.

In our opinion the results of the demand analysis may be over-estimated. In order to confirm the reliability of these results we would suggest asking the Applicant and Beneficiary to provide the results of the model for the *do nothing* scenario, one table showing the results using the socio-economic data for the Heraklion Regional Unit territory and one table using the socio-economic data for the whole Crete. The number of overnight stays should possibly to be replaced or accompanied by the total number of domestic and international tourists' arrivals.

In addition to this, for the period of analysis, the evolution of the motorization index (vehicles/1000 inhabitants) for the residents resulting from the model for both Crete and the Heraklion Regional Unit should be provided, as well as the evolution in the vehicle rental fleet either per 1,000,000 tourists arrivals or 1,000,000 overnight stays for Crete and the Heraklion Regional Unit.

In absence of the availability and provision of such information, and with reference to the comments at Section 4.2.6 below, we recommend undertaking a risk analysis reducing by 15% the demand growth, as also suggested by results of the sensitivity analysis included in the CBA report. Although the Applicant and Beneficiary comment these results as not relevant, on the basis of the considerations in this Section we are of the opinion that this exercise would be beneficial to confirm the robustness of the positive results of the socio-economic analysis.

The following comments are also worth adding with reference to the reliability of the updated model results, confirming our comments on the reliability of the demand analysis:

- The 2012 counting undertaken to update the model took place between Thursday 12.00 and Friday 13.00. A 24 hours period counting is not reliable to estimate the AADT on the road. It is also usually not common to consider Friday in traffic surveys, since it is considered a non-typical day. The only typical period for a reliable traffic observation analysis is normally 3 days – Tuesday to Thursday. No explanation for the selection for the reference period was provided;
- The explanation of the calibration of the model is also not entirely satisfactory. The base year demand was estimated using the traffic counting results. Yet the CBA report (page 23, Annex II.3) provides the annual AADT for the period up to 1995; these figures are actually higher than the ones estimated for the subsequent years, 1998 and 2012, and we may thus consider the proposed value as reliable. However by calculating the ratio between the AADT and the total annual traffic (See also Tables 8 and 9) we find that the annualisation factor applied is 365. This parameter is usually lower – around 260, reflecting that the traffic composition differs per period of the week and season. Furthermore the CBA report (page 24, Annex II.3) assumes a positive growth of 0.87% per year between 1998 and 2012, based on the analysis of the historical trend (1998 AADT = 4,300 compared to 2012 AADT = 4,822). Actually the selection of this entire period is questionable as traffic probably grew until 2008 or 2009 and then declined due to the financial crisis. As a consequence the values of 2012 may have included a reduction in traffic rather than an increase.
- The historical data for Gross Domestic Product (GDP) for the whole country and for the Regional Unit of Crete were derived by the Greek Statistics Company covering the period 1986-2011. The projected GDP was estimated from official forecasts of the International Monetary Fund (IMF), the company Ernst & Young and the Medium Term Fiscal Strategy 2013-2016 of the Ministry of Finance until the year 2017. A constant average annual growth equal to 3.5% was assumed for years 2018 to 2028 and equal to 4.5% for the years 2019-2040. These rates result to an increasing GDP after year 2020, which is a rather optimistic assumption considering the deep recession in Greece;

B.3.3. Recommendations and suggestions

The results of the demand analysis may be over-estimated. In order to confirm the reliability of these results we would suggest asking the Applicant and Beneficiary to provide the results of the model for the *do nothing* scenario, one table showing the results using the socio-economic data for the Heraklion Regional Unit territory and one table using the socio-economic data for the whole Crete. The number of overnight stays should possibly be replaced or accompanied by the total number of domestic and international tourists' arrivals.

In addition to this, for the period of analysis, the evolution of the motorization index (vehicles/1000 inhabitants) for the residents resulting from the model for both Crete and the Heraklion Regional Unit should be provided, as well as the evolution in the vehicle rental fleet either per 1,000,000 tourists arrivals or 1,000,000 overnight stays for Crete and the Heraklion Regional Unit.

In absence of the availability and provision of such information, and with reference to the comments at Section 4.2.6 below, we recommend undertaking a risk analysis reducing by

15% the demand growth, as also suggested by results of the sensitivity analysis included in the application dossier. Although the Applicant and Beneficiary comment these results as not relevant, on the basis of the considerations in this Section we are of the opinion that this exercise would be beneficial to confirm the robustness of the positive results of the socio-economic analysis.

In the definition of the *do something* scenario it is assumed that 97% of the demand will be diverted from the existing road to the new infrastructure. We assume this percentage was estimated based on the survey and counting campaigns undertaken as part of the demand analysis related activities. We suggest confirming this with the Applicant and Beneficiary. In the event this was not the case, this assumption should be compared with the results of the surveys, and a sensitivity test (and if appropriate a corresponding risk analysis) should be undertaken for any relevant difference.

4 COST BENEFIT ANALYSIS

As mentioned in the CBA report included in the project dossier, the CBA analysis has been developed according to the following guidelines:

- European Commission Directorate General Policy “*Guide to Cost Benefit Analysis of Investment Project*”, July 2008;
- HEATCO Developing Harmonised European Approaches for Transport Costing and Project Assessment, 2006. Final Report. IER, Germany;
- IMPACT, Handbook on estimation of external costs in the transport sector, Version 1.1, 2008.

The CBA financial and economic analysis are consistent in terms of benefits generated by the whole investment costs and are not limited to the road infrastructure works under appraisal but consider the whole *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment* construction works which began during the 3rd CFS, as mentioned at Section 2.4 above. The expenditures for the project’s initial design studies and surveys (preparatory works) co-financed during the 2nd CFS were also considered.

Concerning the time plan assumptions, according to the application form (§ D.1), the project will be completed by 2015 and the operational phase is expected to start in 2016 (full first operating year) consistently with the CBA financial and socio-economic analysis.

Also, forecasts regarding the financial and economic analysis have been carried out over a period of 31 years (2010-2040), including the construction period, in line with the recommendations the EC proposes in its 2008 CBA Guide. This specifies indeed that for the majority of the road infrastructure projects the time frame for the analysis should be 30 years, including the construction phase. It is worth noting to this respect that the construction period for the investment under appraisal started in 2008, two years before the first year of analysis.

Regarding the general approach to the CBA, the *do-nothing* scenario implies that the current situation is maintained over time without the *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment* project. The financial and socio-economic analysis are based on an incremental approach accordingly to the EU 2008 Guidelines.

4.1 Financial analysis

The accountancy unit is the Directorate for Road Projects (*Διεύθυνση οδικών έργων – Δ1*), which is the Beneficiary of the EU funds and the owner of the infrastructure. This approach is consistent with the recommendations of the *Guide to cost-benefit analysis of investments projects, European Commission Evaluation Unit, DG Regional Policy, 2008*.

The analysis considers 2010 as the base year of the project and the discount rate is 5.0%, which is acceptable.

The financial analysis is based on the following general assumptions:

- The time horizon for the analysis is 31 years including 5 years of construction (2010-2040), and the financial analysis is performed at 2011 constant prices;
- Since the construction period started in 2008, the investment costs occurred before the base year; these costs were thus updated to 2010 (using a correct 5% discount rate);
- The residual value of the investment seems correctly calculated and is equal to the 39.74% of the initial investment at 2011 constant prices, which seems reasonable also considering the expected 65-year project life, namely 35 years more than the appraisal horizon (CBA report, page 86).

Moreover, the following project cash out-flows have been considered in the financial analysis:

- Investments costs, as included in the application form. These costs comprise the financial investments in the current and previous 3rd CFS programming periods, also including the preparatory costs sustained during the 2nd CFS;
- Operating costs, including only ordinary and extraordinary maintenance, as there are no personnel, technology or admin costs related to tolling operations;

The prices in the Financial Analysis include VAT in the calculation of the cash-flows since the Beneficiary does not transfer VAT (EC Regulation 1685/2000). Also, all values are based on the incremental cash flows at 2011 constant prices.

4.1.1 Cash out-flows

The CBA report considers the investment costs for the whole *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment* project. According to the CBA report (page 139), the total construction cost is € 195.65 million, with VAT; however Table E.1.2 of the application form shows a different value of € 188.48 million which is also indicated as total construction cost at 2011 constant prices including VAT (See also CBA, page126). This inconsistency should be clarified and the Financial Plan or the application form revised.

The present value of the investment cost is equal to € 180.86 million (CBA report, page 139), consistently with the application dossier.

The ordinary and extraordinary maintenance costs are included in the cash out-flows. The maintenance costs are adjusted at 2011 prices and derived from other Greek CBA Studies for road projects (mainly Egnatia Motorway CBA Studies) and estimates from the *Northern Axis of Crete Authority*, which is the department responsible for the maintenance of the project. These costs are split as follows:

- Ordinary maintenance costs, which include works such as maintaining planting, forfeitures, cleaning of roads, parapets, traffic lights, etc., pipelines drainage etc.;
- Extraordinary maintenance costs, which include the asphalt renewal every 10 years, horizontal traffic signalization every 2 years, extraordinary maintenance of bridges and tunnels, etc.

The cost of ordinary maintenance is estimated at 396,774 €/ year and the cost of extraordinary maintenance is 373,136 €/ year for the entire road segment. Thus the total maintenance cost is € 769,910 every year, except for the first year, for which the operating costs were correctly considered only in part (€ 384,955).

Based on these assumptions the total cost of road maintenance, per year, as presented at page 139 of the CBA report, is considered acceptable.

The present value of the total operating costs was correctly calculated at € 7.82 million.

4.1.2 Cash in-flows

The project is not generating any annual revenue, given that the road is not tolled. The residual value has been correctly included in the analysis and it is equal to € 74,898,173 corresponding to 39.74% of the investment costs at 2011 constant prices. We are of the opinion that this assumption is adequate, also given that a well-maintained road will still be functional at the end of the CBA period of analysis.

4.1.3 Funding Gap and Financial Indicators

The project is not revenue generating, therefore the funding gap method is not applicable and correctly considered equal to 100% (§ E.1.2 of the application form).

The financial performance indicators are calculated based on the whole project investment cost, without taking into account the EU contribution, according to the EU guidelines. The relevant calculations are presented at Table 7.13 of the CBA – page 139 –, at 2011 constant prices. The values of all the project cash flows include taxes, in contrast with the socio-economic calculations which should exclude taxes (in line with the 2008 DG Regio Guidelines). Finally, the FNPV (financial net present value) results in a negative value of 172,173,157.

4.1.4 Financial Sustainability

The financial sustainability was not presented in the application dossier. According to the CBA report (page 124), since the project is not generating any revenue, the financial analysis of the return on capital which includes the EU Contribution was not necessary and thus the IRR(K) was not calculated due to the negative cash flows.

4.1.5 Public Contribution Viability

As described in the application form, the project (*National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment*) was previously financed by 3rd CFS funds (€ 43,524,865.59). The specific investment under appraisal (*National road axis Heraklion – Messara: Completion of the construction of Ag. Varvara – Ag. Deka segment*) has already received a partial funding by ERDF amounting to € 33,069,267.61 (Section H.2.3, page 40 of the application form).

Regarding the determination of the EU contribution (€ 86.9 million), Table H.1 seems correct – eligible costs include VAT since it is non-reimbursable. Total project costs included at Table H.1 are not consistent with those presented at Table E.1.2 of the application form and in the financial analysis of the CBA document. This is due to the fact that Table E.1.2 and the CBA report present the investment costs for the whole project (*National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment*) including the planning costs that were co-financed by the Structural Funds Budget of the 2nd and 3rd CFS periods, whilst Table H.1 refers only to the costs for the works under appraisal (*National road axis Heraklion – Messara: Completion of the construction of Ag. Varvara – Ag. Deka segment*); this assumption is appropriate.

The EU financial assistance is deemed to accelerate the implementation of the project and considered essential since the project could not be implemented without EU contribution. This is due to the critical shortage of national public funding and the difficulties for Greece to access the financial markets. Also Table H.2.1 of the application form seems reliable and the co-financing rate adopted (85%) is consistent with the ERDF 2007-2013 Operational Programme.

B.4.1. Recommendations and suggestions

Although some information included in the application dossier documentation is not consistent, the results of the financial analysis are acceptable.

More in detail our analysis shows the following incongruences and inconsistencies which were to be corrected, although the way they are presented do not impact on the calculation of the Funding Gap (and therefore on the calculation of the EU co-financing rate):

- The application dossier could benefit from inclusion of the financial sustainability to improve the quality of the financial analysis and facilitate its assessment.
- The application dossier is not consistent in what regards the investment costs presented at Table E.1.2 of the application form; these should be the same ones included in the Financial Plan of the CBA report (€ 195.65 million);

4.2 Socio-economic analysis

The socio-economic analysis is based on the following main assumptions:

- The social discount rate is 5.5% which is acceptable according to the 2008 EU CBA Guidelines which suggest using this rate for the evaluation of projects in the Convergence Regions;
- In addition to the project costs from the financial analysis, the CBA also includes the users' benefits, whose values have been calculated based on the following studies:
 - *HEATCO Developing Harmonised European Approaches for Transport Costing and Project Assessment, 2002;*
 - *IMPACT - Handbook on estimation of external costs in the transport sector, Version 1.1, 2008;*
 - *Έρευνα και απογραφή προέλευσης - προορισμού στην Κρήτη και προβλέψεις κυκλοφορίας έως το έτος 2020, TRADEMCO;*
 - Other Greek CBA Studies for road projects (mainly Egnatia Motorway CBA Studies).
- An incremental approach for the calculation of the benefits has been properly adopted, based on the comparison of two alternatives – the project (*do something*) and the business as usual (*do-nothing*) scenarios;
- All values in the socio-economic analysis are expressed at 2011 constant prices. These were converted from current prices by using Greek CPI index for the past years and the "Midterm framework for fiscal strategy" (October 2012) estimates for the next years until 2016;
- All economic cash flows before 2010 (base year of the analysis) are also discounted with and summed up to the 2010 values; all benefits are correctly expected starting from 2016, which is the first year of the operating phase.
- The economic residual value has been correctly included in the analysis, totalling €49,119,590, which seems sensible.

The users' benefits considered are as follows:

1. Travel time savings;
2. Vehicle operating costs savings;
3. Reduction of accidents;
4. Reduction of externalities;

The value of travel time savings is by far the largest benefit supporting the case for this investment (72.5% of the total benefits). Then the vehicle operating costs savings correspond to the 24.2% of the total economic benefits; safety and reduction of externalities totalling only a percentage of around 1%.

The overall quality of the information describing the methodology is satisfactory and adequate.

4.2.1 Conversion of market to accounting prices

According to the 2008 EU CBA guidelines, socio-economic prices of inputs and outputs to be considered for the CBA should be net of VAT and of other indirect taxes. Also, financial cash flows should be converted from market to accounting prices, in order to reflect the social opportunity cost of inputs and outputs.

The socio-economic analysis includes the cash out-flows derived from the financial analysis properly excluding VAT. Then the appropriate conversion factors were estimated for the resulting financial costs. The shadow wage of labour costs was calculated in accordance with the relevant algorithm specified in the DG Working Document n° 4 and reflects the real

opportunity cost for labour. Considering the unemployment rate in the region of Crete, in 2011, and the rates of security and taxes, the shadow wage was calculated at 49.23% of the corresponding financial wage.

The remaining of the financial cost was converted by using a Standard Conversion Factor (SCF). A tax rate equal to 20% was used to calculate the direct taxes (part of the economic cost).

Finally, the economic cost of the project was calculated separately per each category of costs (construction, expropriations, utilities and networks, archaeological surveys and design) and then weighted reflecting the contribution of each cost to the total investment cost. The weighted conversion factor was calculated at 64.69% for the correction of the financial investment costs (including VAT), at 2011 constant prices. The CBA report (pages 113 to 115) adequately presents the methodology for the calculation of the conversion from market to accounting prices. The application form – page 25 – actually shows a slightly different conversion rate of 65.28%; this may be due to the fact either the application form or the CBA were not updated. We suggest confirming this with the Applicant and Beneficiary and amend the application dossier accordingly.

The analysis also includes the socioeconomic costs of the project maintenance which are calculated by using a conversion factor of 65.58% that is deemed appropriate.

4.2.2 User benefits and costs

Travel Time Savings

A significant benefit from the road project is the travel time savings as a result of the reduction of distance and increase of the average vehicle speed. The reduction of this time is calculated based on trip purposes and by multiplying the number of the road users per the incremental travel time.

The traffic composition per trip purpose for 2011 is provided at Table 11 below.

Table 11 Traffic Composition per trip purpose

	Trip Purpose	Vehicle Classification		
		2 Wheelers	Light Vehicles	Buses
National Citizens	Work purpose	14.61%	46.72%	46.72%
	Non Work purpose	41.11%	41.21%	41.21%
Foreigners	Work purpose	11.61%	6.41%	6.41%
	Non Work purpose	32.67%	5.66%	5.66%

Source: CBA report, page 102

Table 12 Values of Time in the HEATCO guidelines

VOT	€, 2011/hour	
	National Citizens	Foreigners
Work purpose	19.46	31.82
Non Work purpose	38.4% of VOT for work purposes	

Source: CBA report (based on the HEATCO Guidelines), page 102

The value of passenger travel time is considered to differ substantially between National Citizens and Foreigners, due to the prosperity and wages gap between Greece and other European countries (especially considering the current financial crisis). The adopted value of time is acceptable.

According to the data presented in the CBA report (page 103) the weighted value of travel time per hour and per type of vehicle is correctly calculated based on passengers' vehicles occupancy (at 2011 constant prices):

Table 13 Weighted Value of Time

Vehicles Category	Vehicles Occupancy	'Weighted' Value of Time
2 - wheelers	1.42	19.30 €/h
Light Vehicles	1.85	27.57 €/h
Buses	25	372.54 €/h

Source: CBA report, page 103

In addition, the CBA also includes an estimation of the *Value of time for freight trips* that has been based on the HEATCO study and equals to 3.407 €/t/h (2011 prices). Considering that the average load factor per vehicle is estimated at 10 tons, the value of time for freight trips equals to 34.07 €/vehicle/hour.

Travel time savings are calculated only taking into account the diverted traffic from the existing road sub-sections to the new road segment. The travel time savings are presented in the following table.

Table 14 Travel Time Savings (€, 2011)

Ag. Varvara – Ag. Deka segment			
2 wheelers	Light Vehicles	Buses	Heavy vehicles
Travel Time costs (do nothing scenario)			
6.7239	9.6018	167.9173	15.3552
Travel Time costs (do something scenario)			
4.1036	5.8600	102.4798	9.3713
Incremental Travel Time Savings			
2.620	3.742	65.438	5.984

Source: CBA report, page 21

The *travel time savings* benefit is estimated to be equal to € 253.6 million which corresponds to a present value of € 93.8 million (See also the application form, page 27).

The values and assumptions adopted to estimate the travel time benefits are acceptable; however by replicating the results of the calculation of the travel time savings related benefits – using the methodology described in the CBA report, See Table 15 and Table 16 overleaf – we are not able to obtain the same amount – €253,600,000. More in detail, by adopting same demand, occupancy coefficients and VoT values assumptions, we get a rather much lower amount of benefits.

On the basis of the information provided in the application dossier and our replication attempt, travel time savings related benefits may be over-estimated. We suggest confirming the results with the Applicant and Beneficiary; a replicable input-output dataset showing the formulas adopted for the calculation of the benefits should be provided.

As commented at Section 3.3 above the demand analysis may also be over-estimated, resulting in a non reliability of the calculation of the socio-economic benefits, including travel time savings.

Table 15 Travel Time Savings – LeighFisher Recalculation Attempt

YEARS	LIGHT VEHICLES							HEAVY VEHICLES						TOTAL TRAVEL TIME SAVINGS		
	VEHICLES (PER YEAR)			TRAVEL TIME SAVINGS = Vehicles * Incremental Time Saving (0.138 - See Table 10) * Weighted VoT (See Table 13)				TOTAL LIGHT VEHICLES	VEHICLES (PER YEAR)			TRAVEL TIME SAVINGS = Vehicles * Incremental Time Saving (0.17 - See Table 10) * Heavy Vehicles VoT (See Table 14)			TOTAL HEAVY VEHICLES	
	2-Wheelers	Light-Vehicles	Buses	2-Wheelers	Light-Vehicles	Buses	2-axle heavy vehicles		3-axle heavy vehicles	Multi-axle heavy vehicles	2-axle heavy vehicles	3-axle heavy vehicles	Multi-axle heavy vehicles			
2016	-378	92,258	796	-1009	351,773	41,012	391,776	6,611	997	9,141	38,448	5,798	53,162	97,408	489,184	
2017	-386	115,129	993	-1030	438,979	51,162	489,110	7,728	1,165	10,685	44,944	6,775	62,141	113,861	602,971	
2018	-393	134,140	1,157	-1049	511,467	59,611	570,029	8,665	1,307	11,980	50,393	7,601	69,673	127,667	697,696	
2019	-401	145,916	1,259	-1070	556,368	64,867	620,164	9,263	1,397	12,807	53,871	8,125	74,482	136,478	756,642	
2020	-409	149,612	1,291	-1092	570,460	66,515	635,884	9,483	1,431	13,111	55,151	8,322	76,250	139,723	775,607	
2021	-417	149,606	1,290	-1113	570,437	66,464	635,788	9,530	1,438	13,178	55,424	8,363	76,640	140,427	776,215	
2022	-425	148,092	1,277	-1134	564,665	65,794	629,324	9,508	1,434	13,147	55,296	8,340	76,460	140,096	769,420	
2023	-433	148,346	1,280	-1156	565,633	65,949	630,426	9,570	1,444	13,232	55,657	8,398	76,954	141,009	771,434	
2024	-442	149,420	1,289	-1180	569,728	66,412	634,961	9,669	1,458	13,369	56,232	8,479	77,751	142,463	777,423	
2025	-450	150,484	1,298	-1201	573,785	66,876	639,460	9,769	1,474	13,507	56,814	8,572	78,553	143,940	783,400	
2026	-458	151,539	1,308	-1222	577,808	67,391	643,976	9,869	1,488	13,646	57,396	8,654	79,362	145,411	789,388	
2027	-467	152,584	1,316	-1247	581,792	67,803	648,349	9,969	1,503	13,784	57,977	8,741	80,164	146,883	795,232	
2028	-475	153,619	1,325	-1268	585,739	68,267	652,738	10,069	1,519	13,922	58,559	8,834	80,967	148,360	801,098	
2029	-484	154,653	1,350	-1292	596,544	69,555	664,808	10,256	1,547	14,181	59,646	8,997	82,473	151,116	815,924	
2030	-493	159,330	1,374	-1316	607,514	70,792	676,990	10,446	1,576	14,444	60,751	9,166	84,003	153,920	830,910	
2031	-502	162,251	1,399	-1340	618,652	72,080	689,392	10,639	1,605	14,710	61,874	9,334	85,550	156,758	846,149	
2032	-511	165,218	1,425	-1364	629,965	73,419	702,020	10,834	1,635	14,980	63,008	9,509	87,120	159,636	861,657	
2033	-521	168,232	1,451	-1391	641,457	74,759	714,825	11,033	1,664	15,254	64,165	9,677	88,713	162,556	877,381	
2034	-530	171,295	1,477	-1415	653,136	76,098	727,820	11,233	1,694	15,532	65,328	9,852	90,330	165,510	893,330	
2035	-540	172,542	1,488	-1441	657,891	76,665	733,115	11,350	1,712	15,693	66,009	9,957	91,267	167,232	900,346	
2036	-549	173,787	1,499	-1465	662,638	77,232	738,404	11,467	1,729	15,855	66,689	10,055	92,209	168,953	907,358	
2037	-559	175,027	1,510	-1492	667,366	77,799	743,672	11,584	1,747	16,018	67,370	10,160	93,157	170,686	914,359	
2038	-569	176,264	6,521	-1519	672,082	335,977	1,006,541	11,702	1,765	16,181	68,056	10,265	94,105	172,425	1,178,966	
2039	-579	177,498	1,531	-1545	676,788	78,881	754,123	11,820	1,783	16,344	68,742	10,369	95,053	174,164	928,287	
2040	-589	178,730	1,542	-1572	681,485	79,447	759,360	11,940	1,801	16,508	69,440	10,474	96,006	175,920.59	935,281	
TOTAL	-11,960	3,877,372	38,446	-31923.51	14,784,152	1,980,826	16,733,054.04	254,007	38,313	351,209	1,477,241	222,819	2,042,543	3,742,603.14	20,475,657	

Table 16 Travel Time Savings – LeighFisher Recalculation Attempt – Summary Table

Assumptions LIGHT VEHICLES							
Vehicle categories	Total Vehicles	Vehicle Occupancy	User's per Vehicle category	Incremental time saving	'WEIGHTED' Value of Time	Benefits per vehicles category	Total Benefit Passengers' vehicles
2-Wheelers	-11,960	1.4	-16,983	0.138	19.3 €/h	-31,854	16,733,054
Light Vehicles	3,877,372	1.9	7,173,138		27.57 €/h	14,784,152	
Buses	38,446	25.0	961,150		372.54 €/h	1,980,826	
Assumptions HEAVY VEHICLES							
Vehicle categories	Total Vehicles			Incremental time saving	Value of Time	Benefits per vehicles category	Total Benefit Passengers' vehicles
2-axle heavy vehicles	254,007			0.17	37.04 €/h	1,477,241	3,742,603
3-axle heavy vehicles	38,313					222,819	
Multi-axle heavy vehicles	351,209					2,042,543	
TOTAL TRAVEL TIME BENEFIT							20,475,657

Vehicle Operating Cost Savings

The CBA document calculates the vehicles operating costs for the *do-nothing* and *do-something* scenarios in order to estimate the benefit generated from the operational costs reduction.

The unit operational costs are calculated based on data published by the Ministry of Public Works for each vehicle category and for specific speed limits, as illustrated at Table 4.9 of the CBA report (page 105). The cost per vehicle category and the vehicle-kilometre value are calculated from previous Feasibilities Studies for Greek Road Projects and then evaluated at 2011 constant prices, based on variations in the general price index. The operational costs of vehicles are calculated including fuel, lubricants, tires, vehicle maintenance, depreciation and salaries, without taxes and duties.

Operational costs savings are only calculated for the diverted traffic vehicles from the existing road sub-sections to the new road segment. The Vehicle Operating Cost Savings are presented at Table 17 below.

Table 17 Vehicle Operating Cost Savings (€, 2011)

Ag. Varvara – Ag. Deka segment		
Light Vehicles	Buses	Heavy vehicles
Vehicle Operating Cost (do nothing scenario)		
4.508	19.066	17.660
Vehicle Operating Cost (do something scenario)		
3.358	13.857	13.702
Incremental Vehicle Operating Cost Savings		
1.151	5.209	3.958

Source: CBA report, page 106

The Vehicle Operating Cost Savings represents the 24.2 % of the total benefits. The calculation methodology is overall acceptable and the values included in the CBA seems reasonable, although these are also based on the results of the demand analysis, which as commented at Section 3.3 above may be over-estimated.

Reduction of accidents

The reduction of accidents is estimated at € 3,580,403. The calculation for fatal and injured people was based on the historical data from the Greek Statistics Company (for the Regional Unit of Heraklion) and from the Police estimates (accidents occurred in the specific sub-sections). For the forecast of accident rate the historical data were considered together with the Average Annual Daily Traffic series and the road segment length. The cost per accident is calculated in accordance with the HEATCO Guidelines (€ 966,984 at constant 2011 prices).

Finally, the calculation methodology of this benefit considers only the vehicle-kilometre savings and not the fluctuation of accidents rate resulting from the improved geometrical and operational characteristics of the segment. This is a rather conservative assumption and the methodology is considered overall acceptable.

4.2.3 External benefits estimation

The external users' benefits include only the reduction of environmental pollution (with vehicle-generated pollutants PM2.5, NO_x, SO₂, O₃) and not the noise and greenhouse reduction (expressed tonne CO₂ equivalent). This is due to the short length of the segment (approximately 16 km) and taking into account that the segment bypasses non-urban areas. This assumption is reasonable in our opinion and also confirmed by an expected reduction of the traffic congestion and at the same time an increase in the total speed of vehicle flows in the road network.

As it is described in the CBA, the implementation of the project will produce environmental cost savings (generated only by the diverted traffic on the new segment), due to the reduced road length and to the improved geometrical and operational characteristics of the road segment.

The unit costs for estimating total environmental costs are in line with the values suggested by IMPACT study (2008), taking into consideration the inflation and the traffic composition for the *Agia Varvara - Agioi Deka* road segment.

The environmental cost per vehicle for the *do-nothing* scenario is € 0.148 whilst it is estimated to be € 0.1033 for the *do-something* scenario, at 2011 constant prices.

The evaluation of the environmental externalities amounts to only 0.5 % of the total benefits (€ 1,881,193). The calculation methodology is clearly provided and the values included at Table 4.16 (page 110) of the CBA report seem reasonable, although these are also based on the results of the demand analysis, which as commented at Section 3.3 above may be over-estimated.

4.2.4 Effects on employment and other non-monetized effects

The application form (table E.2.4) presents the estimation of the number of jobs created by this project. It is expected that the project will generate approximately 350 equivalent man-years of employment only during the construction phase. The calculation of the direct impact on employment is included in the CBA report (page 118) and is based on the Directive of the Greek Directorate of Investments and Development (*Σχέδιο οδηγιών για την εκτίμηση της απασχόλησης που δημιουργείται κατά την υλοποίηση των έργων των επιχειρησιακών προγραμμάτων του ΕΣΠΑ*). No quantification of indirect impact on employment is included in the application dossier. The economic benefits associated to the creation of employment were not considered in the CBA.

Some other non-monetized benefits included in the application dossier are:

- Support regional economic development by making the region more attractive as a tourist destination and a place to live and work.
- Increasing the local GDP by supporting economic development;
- Reducing unemployment during the construction and the operation period.

4.2.5 Economic performance indicators

The results of the economic analysis are presented at Section E.2.3 (page 27) of the application form and are positive – B/C ratio is equal to 1.14, ERR is equal to 6.83%, and the economic net present value (ENPV) shows a positive amount of € 17.513 million – thus suggesting that the project is producing added value for society. The robustness of these positive results should however be confirmed either by providing the additional information requested with reference to the results of demand analysis which may be over-estimated (as commented at Section 3.3 above) or by undertaking a risk analysis assuming a reduction in the traffic growth rate by 15% annually (as suggested by the sensitivity analysis included in the CBA report).

In addition to this, it is worth noting that the project tends to be marginally beneficial for a 6.5% discount rate, also resulting in a negative ENPV.

The CBA dossier also includes the socio-economic analysis for the whole *Heraklion - Messara axis* considering the same assumptions. Since the result of the socio-economic analysis is still positive, we don't have any concern on this. Although this adds value to the application for funding, it is worth noting to this respect that the benefits deriving from the implementation of the *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Deka segment* do not depend on the completion of the other segments of the entire corridor. Based on the assumptions adopted to define the do something and do nothing scenarios as summarized at

Section 3.3 above, no incremental traffic is generated and only the demand diverted from the existing corridor is considered.

4.2.6 Risk assessment and sensitivity analysis

A sensitivity analysis is included in the application form, in line with the 2008 EU CBA guidelines. The sensitivity analysis allows the determination of the 'critical' variables or parameters of the socio-economic assessment. The critical variables are those variables or parameters for which a relative variation of 1% around the central estimate produces a corresponding variation of not less than 1% (one percentage point) in the ERR and not less than 5% in the ENPV.

In the case of the *National road axis Heraklion – Messara: Construction of the Ag. Varvara – Ag. Dekka segment* project, the results of the sensitivity analysis show that all variables considered are critical, except for the maintenance costs.

According to the sensitivity analysis, the ENPV variation is critical in the cases of:

- Increased Construction Cost by 65%;
- Reduction of Traffic Growth Rate by 15% per year;
- Reduction of Diverted Traffic vehicles by 20%;
- Reduction of Value of Time by 20%
- Reduction of Unit Vehicle operating cost by 75%.

The application form (pages 29 to 30) comments that these fluctuations are not plausible and that the project will continue to be economically viable, even if the variable change significantly.

We agree with this consideration, except for the demand analysis in relation to which we would suggest undertaking the risk analysis assuming a reduction in the traffic growth rate by 15% annually, unless additional information as detailed at Section 3.3 above is provided in support of the confirmation of the reliability of the results of the demand analysis.

B.4.2. Recommendations and suggestions

The methodology and assumptions adopted for the calculation of the economic benefits of the project is sufficient and appropriate to a full comprehension of the results. However, the following aspects should be considered:

- The weighted conversion factor presented in the CBA report is 64.69% whereas in the application form – page 25 – a rate of 65.28% is given. This may be due to the fact either the application form or the CBA were not updated. We suggest confirming this with the Applicant and Beneficiary and amend the application dossier accordingly;
- A confirmation/clarification on the calculation of the travel time savings related benefits should be requested;
- A risk analysis should be undertaken assuming a reduction in the traffic growth rate by 15% annually (as suggested by the sensitivity analysis included in the CBA report) unless additional information as detailed at Section 3.3 above is provided in support of the confirmation of the reliability of the results of the demand analysis.

5 KEY FINDINGS AND CONCLUDING REMARKS

5.1 Key questions for project appraisal

(a) Is the application dossier complete?

The project dossier is complete and complies with the EC Regulations. The information provided is consistent with Art. 40 Reg. 1083/2006, Annex XXI and Commission Regulation 1828/2006. It is in any case worth noting that the application dossier presents some inconsistencies regarding the information included in the application form and the related annexes and relating to the project time-schedule and particularly the EIA related information. These incongruences have been commented in this report. It is here assumed that the information in the application form is the most updated one and that the referred inconsistencies are probably due to the fact that the application form have been updated since its original preparation. In the event another application form/dossier will be requested, we suggest asking the applicant and beneficiary to submit a consistent application dossier.

(b) Does the project meet the expected strategic and functional objectives?

The *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*, also including the works subject of the major project under appraisal, is expected to be a beneficial one for the population living in Crete and the tourists visiting the island. Under the functional standpoint the investment – providing a shorter, more rapid and less dangerous road infrastructure alternative to the existing road – will reduce travel times and costs as well as air pollution and road accidents [See § 2].

(c) Is the project consistent with the EU policies?

The project is overall consistent with EU policies. The project under appraisal is a "bridge project" with the Third Community Support Framework – 3rd CSF. More in detail, the whole project (*Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*) was already co-financed under the 3rd CFS. The project's initial design studies and surveys (geological, etc.) were also co-financed during the 2nd CFS. We thus suggest cross-checking the results of previous submitted and already approved applications for funding [See § 2.4].

(d) Is the project technically sound?

The project is technically sound regarding the proposed solutions. It is also technically sound in what respect its functional characteristics either regarding the existing and future demand [See § 3.1.2].

The proposed time-table is acceptable and there should be limited risk regarding the completion of the construction works by end of year 2015. This will mostly depend on 1) the timely and successful completion of the land acquisition programme currently in progress, 2) commence of the construction works regarding the *Ag. Varvara – Apomarma* sub-section, which are currently paused due to landslides occurred in the project area; and 3) the project works will not change and all EIA related procedures are completed and updated [See § 3.1.4 and recommendation and suggestions box B.3.1.4].

The application dossier omits to include the EIA certificate for the project. The EIA process for this project was undertaken in 2002-2003 and the application form does not specify whether an extension would be required. The application dossier includes some inconsistencies relating to the dates of the Natura 2000 certificate. These omissions and inconsistencies should be clarified or amended, as appropriate [See § 3.1.3 and recommendation and suggestions box B.3.1.3].

(e) Are the project costs reasonable?

The information provided regarding the project costs is overall acceptable. The cost of the road project subject of analysis is deemed high: this is probably due to the type and size of the works constructed as part of the investment (three tunnels, five bridges, one interchange, and one junction) and the settlement of secondary roads. This assumption could be confirmed by mean of provision of the cost details by type of infrastructure [See § 3.1 and § 3.2 and recommendation and suggestions box B.3.2].

From the analysis of the application dossier it is not clear whether this total investment costs already includes the costs for the works needed to restore the damages caused by the landslides occurred in the project area and interrupting the construction works of the *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*. This should be clarified by the Applicant and Beneficiary and the application for funding amended accordingly. [See § 3.1 and § 3.2 and recommendation and suggestions box B.3.2].

(f) Are the results of the demand analysis acceptable?

The results of the demand analysis does not seem entirely reliable and may be over-estimated. Due to the impact of these results on the calculation of the socio-economic benefits additional information should be requested to the Applicant and beneficiary in support of the proposed traffic forecasts. In absence of the availability and provision of such information, and with reference to the comments at Section 4.2.6 below, we recommend undertaking a risk analysis reducing by 15% the demand growth, as also suggested by results of the sensitivity analysis included in the CBA report See § 3.3 and § 4.2.6 and recommendations and suggestions boxes B.3.3 and B.4.2].

(g) Are the results of the Financial Analysis acceptable?

Despite some inconsistencies between the application form and the CBA report, the results of the financial analysis are acceptable [See recommendations and suggestions box B.4.1].

(h) Is the value of EU contribution correctly estimated?

The project is not revenue generating, therefore the funding gap method is not applicable. The amount of the EU contribution is correctly estimated [See § 4.1.4].

(i) Are the foreseen socio-economic benefits likely to be attained?

The benefits may be over-estimated, due to the adoption of over-optimistic demand assumptions. The results of the calculation of the travel time savings related benefits should also be confirmed/clarified by the Applicant and Beneficiary [See § 4.2.4 and recommendations and suggestions box B.4.2].

(j) Are the results of the Cost Benefit Analysis acceptable?

The robustness of the positive results of the socio-economic analysis should be confirmed either by providing the additional information requested with reference to the results of demand analysis which may be over-estimated or by undertaking a risk analysis assuming a reduction in the traffic growth rate by 15% annually (as suggested by the sensitivity analysis included in the CBA report) [See § 3.3 and § 4.2.6 and recommendations and suggestions boxes B.3.3 and B.4.2].

5.2 Concluding remarks

The *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*, also including the works subject of the major project under appraisal, is reasonably expected to be a beneficial one for the population living in Crete and the tourists visiting the island. The results of the socio-economic analysis seems also supporting this consideration showing that the project is producing added value for society.

The application is however not entirely satisfactory due to some inconsistencies in the application dossier and the need for clarifying the results of the demand analysis which may be over-estimated, undermining the reliability of the positive results of the socio-economic analysis.

Before approving the financing of the project we would suggest the Commission confirming with the Applicant and Beneficiary the following aspects and amend/revise the application, accordingly:

- The high cost of the road project subject of analysis, including the work part of the major project under appraisal, are due to the type and size of the works constructed as part of the investment (three tunnels, five bridges, one interchange, and one junction) and the settlement of secondary roads;
- The total investment costs already include the costs for the works needed to restore the damages caused by the landslides occurred in the project area and interrupting the construction works of the *Construction of the Ag. Varvara – Ag. Deka (Kastelli) Segment of the National Road Axis Heraklion-Messara*;
- All the EIA related documentation is valid and available;
- The robustness of the positive results of the socio-economic analysis is to be proved by either additional information confirming the reliability of the results of demand analysis; or the results of a risk analysis assuming a reduction in the traffic growth rate by 15% annually, as suggested by the sensitivity analysis included in the CBA report. A confirmation/clarification on the calculation of the travel time savings related benefits should also be requested to this respect.

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