WS Atkins International Limited

TITAN

PROJECT ANTEA
TRANSPORT PLANNING
STUDY

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TRANSPORT PLANNING STUDY

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1. INTRODUCTION

Titan Cement S.A. intends to develop a new cement plant in Albania with a capacity of 4,000 tons of cement per day. Figure 1 below (Locality Plan) shows the site of the plant near Burizane.

Figure 1 Locality Plan

2. OBJECTIVES FOR THE TRANSPORT STUDY

The objectives are:

i) to identify and assess issues related to the access and egress of freight and people to the cement plant site as well as local transport (within the plant site) issues; and

ii) to propose a preferred transport strategy at a broad level addressing the transport issues.

3. METHODOLOGY

The study comprises the following steps which were undertaken in close cooperation with Titan and the environmental resources:

- Survey of existing transport infrastructure (road, and rail) comprising the physical aspects (width, gradients, curvature, pavement condition, type of intersections, roadside access, speed limits, traffic flows, etc) as well as of the adjacent land uses.
- Survey of the existing transport infrastructure links and connections to the main export nodes of the country (ports, border crossings, etc).
- Collection of any information with regards proposed transport improvements in the area of the alternative sites that may have an effect on the transport generated from the plant.
- Estimate the traffic volume generated from the plant in terms of freight and people movements.
- Examine “internal” circulation issues and traffic volumes from quarry location to Plant location.
- Investigate pre-feasibility of alternative modes (road vs. rail) for the above movements.
- Develop a broad level transport plan addressing issues related to external and internal movements and infrastructure requirements.

4. EXISTING TRANSPORT SYSTEM

This section covers the existing conditions on the available relevant transport networks both on the infrastructure and the operation side as well as relative plans for improvement that may have an effect on the transport generated by the plant.

4.1 Highway Network

The wider area highway network providing access to the cement plant appears in the following Figure 2. It comprises the highway sections Tirana – Durres, Vore – Fushe Kruje, Fushe Kruje – Shkoder (new and old roads) and the connection Tirana – Fushe Kruje. Photos of these highway sections appear in Appendix C.

CEMENT PLANT ACCESS HIGHWAY NETWORK &
TURNING MOVEMENT COUNT LOCATIONS
WIDER AREA

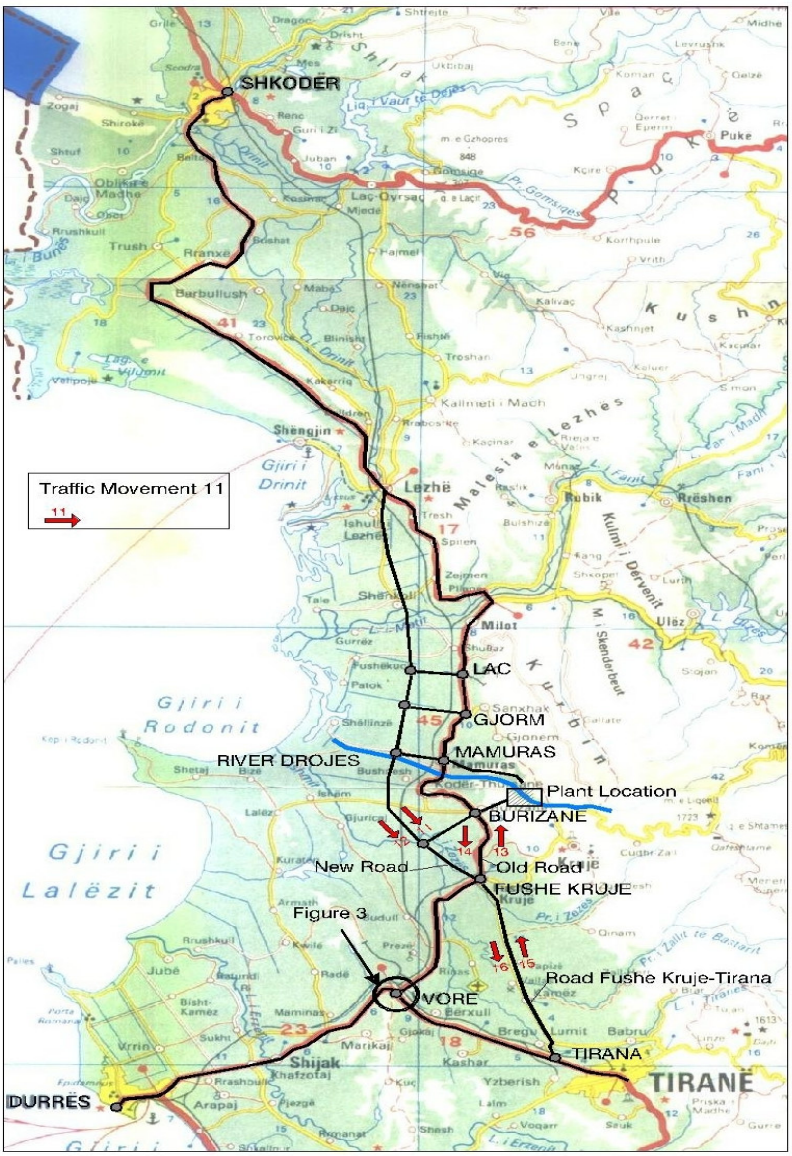

Figure 2 Cement Plant Access - Wider Area Highway Network

The riding quality and physical characteristics of the highway network have been assessed through a relevant survey which took place between 12 and 14 March 2007. Traffic volumes have been counted by observers at the locations indicated in Figures 2 and 3 during the same period.

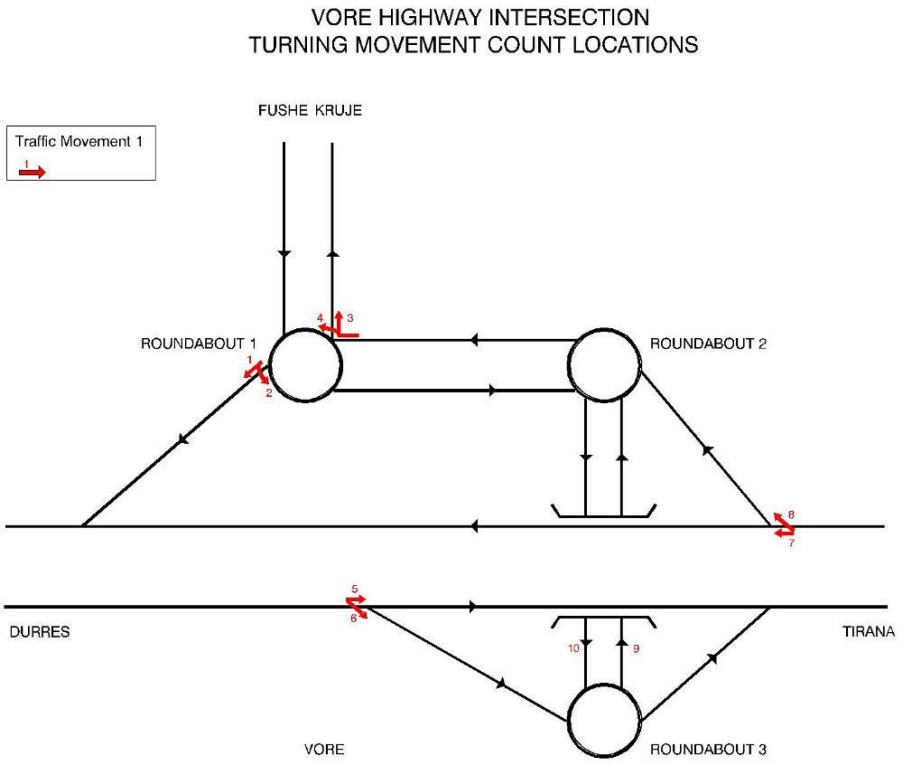

Figure 3 Vore Area – Highway network

The traffic volume survey covered the period between 06:00 to 18:00 (daylight period) and included traffic volume composition information to (among other parameters) establish the heavy vehicle traffic share participation. Summary results of the survey effort are presented below (by highway section) and in Appendix E.

Tirana – Durres

This is a two by two lane cross section separated through a New Jersey median on generally flat terrain. It generally features grade separated intersections and limited interference by road side land uses. The riding quality is generally satisfactory and high speeds are achieved on this link (higher than 100 km/hr). Traffic volumes counted reached almost 1,800 vehicles per hour and direction in the peak hour. The share of truck traffic was counted at 11% of the total traffic.

Vore – Fushe Kruje and Fushe Kruje – Shkoder (New Road)

These links feature a one lane per direction cross section with considerable interference from road side land uses. The alignment generally crosses flat

terrain and speeds are in the area of 80 - 90 km/hr. The riding quality is good as the pavements are fairly recent (4-5 years old). The traffic volumes counted reach up to 650 vehicles per hour and direction in the peak hour. The percentage of truck traffic has been measured to exceed 20% during certain hours.

Fushe Kruje – Burizane – Mamuras – Lac (Old Road)

This is part of the old national road (one lane per direction) going through most of the villages in the area. It goes through flat or lightly hilly terrain. Speeds are low in the area of 50 km/hr and the riding quality is poor hampered by badly maintained pavements especially in the road sections located within the villages. Traffic volumes have been measured not to exceed 70 vehicles per hour and direction in the peak hour. The share of truck traffic has been measured to exceed the 20% level in some instances.

Fushe Kruje – Tirana

This is part of the old national road (one lane per direction) going through many conurbations with extensive interference by road side land uses. Speeds are in the area of 60 – 70 km/hr and the riding quality is mediocre as a relative poor maintenance level has been observed on this road. Nevertheless road works for rehabilitation and maintenance were observed on the road during the period of the survey. Plans exist to improve its standards to the same level as the Fushe Kruje – Lac new road connection.

The alignment crosses generally flat terrain and carries relatively heavy traffic volumes of up to 400 vehicles per hour and direction in the peak hour. The truck traffic has been observed not to exceed the 13% level. This fact clearly indicates a preference of the heavy traffic Tirana – North to the itinerary Fushe Kruje – Vore – Tirana (New Road) despite its longer distance. This preference is explained by this connection's better geometric standards, riding quality, travel speed and safety.

The following Table 1 presents in summary form the traffic volumes surveyed (for the peak hour and by highway section):

Highway Section	Max Peak Hour Traffic (One Direction)	Max Truck Traffic Share(%)
Tirana - Durres	1800	11
Vore – Fushe Kruje	650	20
Fushe Kruje – Burizane (New Road)	650	20
Fushe Kruje – Burizane (Old Road)	70	20
Fushe Kruje - Tirana	400	13

Table 1 Traffic Volume Counts

4.2 Railway network

The central point of the Albanian rail network is the Port of Durres, on the Adriatic Sea. It basically runs in three directions: north to the Albania-Montenegro border at Hani Hotit, south to Ballshi and the Port of Vlora, and east to Pogradec, near the FYROM border. The rail network serves most residential and industrial areas (See

Figure 17 in appendix B). The railway standard adopted is of standard gauge, single non-electrified line.

The railway was developed during the period of centrally planned economy with the government placing strong restrictions on the use of other modes of transportation. Car ownership was banned and, on roads parallel to the railway, bus traffic and freight movements of trip length over 11 km were prohibited. At the time, a number of manufacturing industries and an active mining industry supplied Eastern European industries, through the railway connection with Montenegro. This connection is the only link between the Albanian railway and the rest of the European networks and it was used exclusively for freight transport.

With the political and economic changes of the 1990's the country's transportation requirements changed dramatically. There has been a rapid growth of the trucking industry, bus services and especially in private car ownership. These trends resulted in a severe reduction of the railway traffic which has been further exasperated by the closure of many state owned factories and mines.

Presently, the railway network appears to be at a derelict state (see photos in Appendix B at Gjorm Yard), nevertheless the relevant survey has shown that ample space exists at the Gjorm railroad yard (see Figures 19,20 and 21) to accommodate a transhipment facility if the railroad is chosen to form a part of the plant's import / export transport link. This yard is the closest to the cement plant point of rail access with adequate space (6 rail sidings apart from the main line and a few abandoned buildings that could be used for storage) to support the operation of unloading cement carried by trucks from the plant, storing it and further loading it to rail cars in order to take the cargo to either the Durres or the Bar ports.

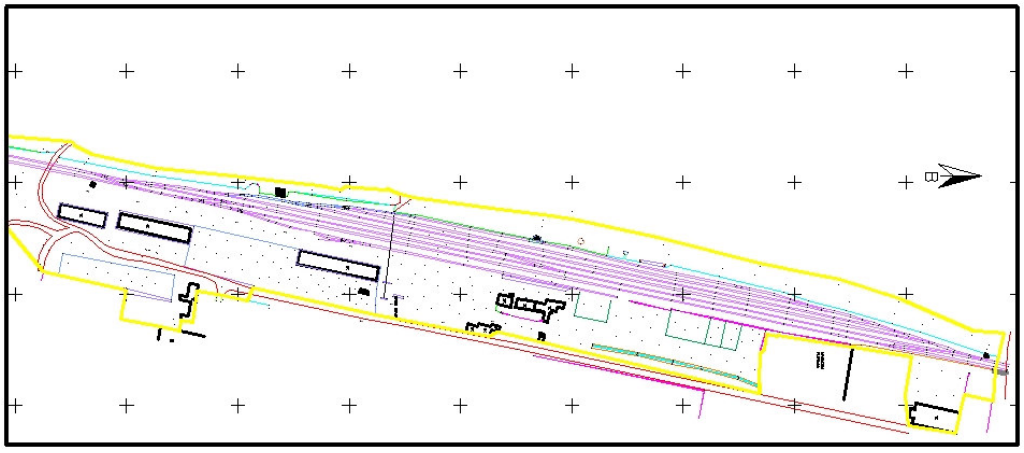

Figure 4 Gjorm Railroad Yard

Needless to say that such an operation would require a detailed survey of the rail infrastructure to be used and the execution of necessary maintenance, rehabilitation and possibly modernization works. Another requirement would be the provision of the necessary rolling stock (currently not available by the Albanian railways). These actions clearly lie outside the scope of the present study.

4.3 Port Infrastructure

The port infrastructure in the plant's greater area comprises the ports of Durres and Bar (in Montenegro). The port of Durres is much closer to the cement plant and the obvious choice to serve its needs. The port of Bar is larger and has better facilities. Nevertheless it is located much further away, compared to Durres, in a different country (Montenegro) – a fact that might create issues of import / export tariffs and additional institutional issues for the plant management to handle. Both ports are served by both road and rail (port photos are available in Appendix A – Figures 7 to 16).

At the port of Durres, freight is handled at the eastern pier. This pier has a length of approximately 420 meters (see photos), a usable depth ranging between 7.5 to 11.5 meters and it possesses enough space to serve a transhipment facility. The port's master plan (see Figure 6) provides for a considerable widening of the eastern pier in the future and further extension of the port in the same direction.

The port infrastructure at the end of the centrally planned economy period (1990s) was characterized by old technology (cranes), low output, overstaffing and poor supporting infrastructure (roads, railways etc). The current effort (according to the port's management) is to improve the relevant legal framework, to try to privatize port services, to improve the port infrastructure and the cargo handling facilities and to adopt new technologies in order to increase the cargo handling capacities and the safety and security.

Currently the upgrade of the port infrastructure is financed by the World Bank and OPEC, the PHARE program and the EIB with a total investment budget of approximately 50 million USD. This program comprises:

- Rehabilitation of port wharfs
- Rehabilitation of the wind wall and west breakwater
- Rehabilitation of storehouses
- Repairing and purchase of new cranes
- Rehabilitation of ferry terminal
- Construction of 60 m new wharf
- Feasibility study and start of construction for a container terminal
- Drainage system and paving works
- Dredging of basin and access channel

Further actions to be taken in the future include:

- Improve legal framework on ports
- Privatization of services (Concession and PPP)
- Rehabilitate railway and road connection

The port of Bar is in a better state both from the infrastructure and the access facilities point of view but, as mentioned above, much further away and in a different country. Nevertheless it is in a better position to accept cargo traffic and it can accommodate larger ships.

4.4 Plant Site Transport Infrastructure

The transport infrastructure in the immediate vicinity of the plant appears in the following Figure 5.

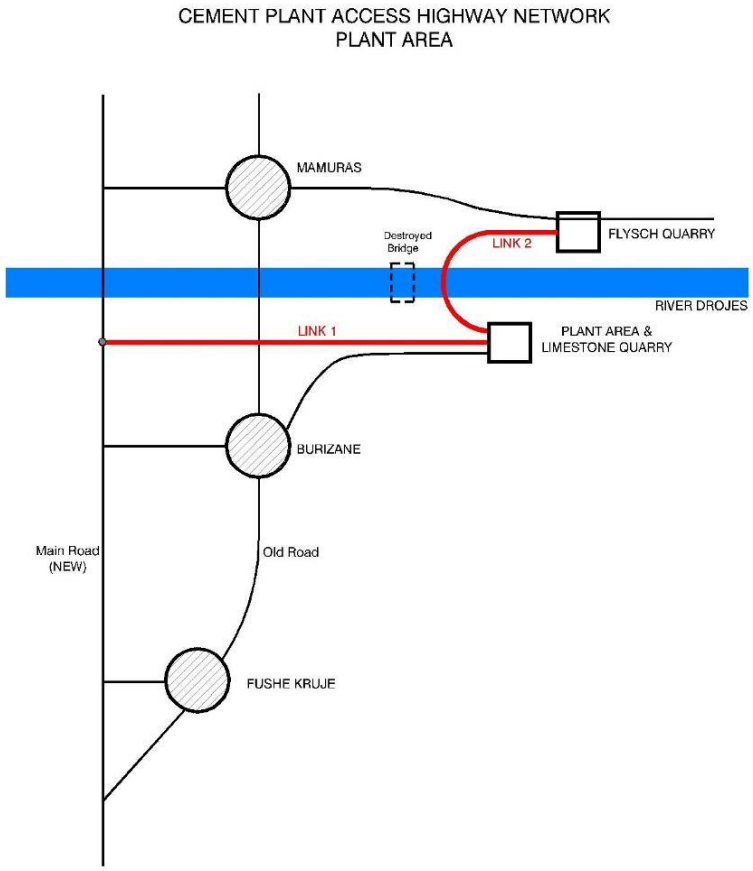

Figure 5 **Cement Plant Access – Immediate Vicinity**

Currently access to the plant area is achieved through a road that goes through the village of Burizane (see Figures 37, 38 and 39). This is clearly a difficult connection especially for heavy vehicles both from the geometric and road safety point of view. It may prove more efficient to construct a new cement plant connection directly to the Shkoder – Fushe Kruje Highway bypassing the urban areas of Burizane and Mamuras. This new connection (Link 1 in Figure 5) would directly serve the plant avoiding any interference with village traffic.

A second access to the area between the flysch and limestone quarry locations is provided through a road starting from the village of Mamuras along the northern bank of river Drojes (see Figures 40 and 41). A bridge used to connect the two river banks at that point (see Figure 35). Presently the bridge deck has been removed and the bridge structure appears insufficient to carry the necessary loads if the same bridge was to be rehabilitated. A more detailed assessment of this structure will be required if it is going to be used even as an auxiliary connection.

Alternatively a river crossing can be used further upstream (see Figures 43 and 44). At that location, a detailed assessment will be needed whether a new crossing would be necessary and technically feasible or if the plant needs can be satisfied with the existing one. In any case, a new road connecting the flysch quarry with the plant and limestone quarry areas will need to be constructed (Link 2 in Figure 5).

5. CEMENT PLANT TRANSPORT NEEDS / FORECASTS

The plant related transport needs comprise internal movements of quarry material staff traffic and external movements to bring in raw materials and ship out finished products as well as staff ins and outs for the factory operation.

5.1 Local Movements

It is estimated that approximately 300 staff will be working at the plant. It is estimated that 50% will access the plant on company buses and 50% on private cars. Assuming private car occupancy (car pooling) of 1.25, the total movements in and out of the plant (per shift) will be:

- 4 buses
- 120 private cars

In order to also accommodate visitors, future growth and other peaks the parking space available at the factory should be able to fit 200 private cars and 10 buses.

Truck traffic inside the plant will vary according to production requirements but the internal road network should be designed as to be able to accommodate demand without any problems. Truck parking spaces will be provided according to relevant needs which will be established during the plant design phase.

5.2 Longer Distance Plant Access / Egress Needs

The production of 4,000 tons of products per day will necessitate 200 movements of 20 ton trucks. In order to supply the factory with raw materials it is estimated that 2,300 tons of freight will be entering the plant per day – the equivalent of approximately 120 truck movements per day.

In total, 320 truck trips per day will be needed to adequately serve the factory in the period of full production. This figure is multiplied by 1.3 to provide for future growth and coverage of production peaks. The resulting figure comes up to 420 truck trips per day or an hourly demand of 35 truck trips (for a 12 hour period). The above figure translates to one truck movement every 2 minutes in each direction.

The following Table 2 provides the estimates for freight transport needs in and out of the port of Durres.

Port of Durres Characteristics								
Bulk Terminal								
Length	422	meters						
Draft	7.5-11.5	meters						
Approach Channel	8,5	meters	defining factor					
Max Size Ship	11,500	Dwt	~180m length		for coal, pozzolanas, cement			
Min Size Ship	10,000	Dwt	~150m length		for gypsum, cement			
Max Loading/Unloading time Bulk	5	days						
Min Loading/Unloading time Bulk	4	days		in all cases, an extra 8 hrs (0.33 days)				
Max loading time Bulk Cement	3	days		are required for documents and ship entry/departure				
Min loading time Bulk Cement	2	days		0.33				
Logistics for the Titan Cement Plant imported/exported Materials needs								
Solid Fuels	150,000	tons						
Required Ships	13.0	ships	assuming 11,500 dwt ships					
Needed berthing days	63	days	average time needed					
Other Imported Materials: 280.000t to 430.000t	280,000 to 430,000	tons						
Required Ships	28 to 43	ships	assuming 10,000 dwt ships					
Needed berthing days	135 to 208	days	average time needed					
Exported Bulk Cement	640,000	tons						

Required Ships	61.7	ships	assuming 75% 11,500 dwt & 25% 10,000 dwt					
Needed berthing days	159	days	min time needed					
Total Ships	103 to 118	}		**ships**				
Total no.of berthing days	357 to 430			**berthing days**			*98% to 118%*	
Based on the above calculations it is expected that Titan will need the exclusive use of half of the eastern berth (quays 10 & 11)								
and use of the remaining part of the eastern berth for approximately 2.5 months per year on a priority berthing basis for the								
Import / Export activities of the new Cement Plant.								
In addition, Titan would require the exclusive use of one of the two planned 15t cranes that will be installed on the berth								
Appropriate cement loading & storage facilities will be constructed by Titan at the eastern berth								

Table 2 Cement Plant Import / Export Quantities

In conclusion, the maximum traffic demand in and out of the factory is estimated to come up to 120 private cars and 40 heavy vehicles (buses and trucks) for the peak hour per direction.

6. TRANSPORT IMPACT ASSESSMENT ON SURROUNDING NETWORKS

6.1 Impacts to the Highway Network

The impacts of the additional traffic generated by the plant on the highway network vary by highway section.

The assumption is made that, if only highway transport is used to satisfy the plant needs, 20 % of this traffic will be related to areas north of Burizane and 80% to areas south of Burizane. It is further assumed that all of the south traffic will select the Vore itinerary at which point it will split to two equal parts in the directions of Tirana and Durres and other southern destinations.

The overall maximum hourly plant traffic estimated in Chapter 5 comes up to 120 private car and 40 heavy vehicle movements per hour and direction. The following Table 3 presents the estimated traffic impacts to the highway links in the wider area of the plant.

Highway Section	Max Peak Hour Traffic Increase (One Direction - %)	Max Truck Traffic Share Increase (%)
Tirana - Durres	(160 x 0.8 x 0.5) / 1,800 = 3.5	(40 x 0.8 x 0.5) / 198 < 1
Vore – Fushe Kruje	19.7	4
Fushe Kruje – Burizane (New Road)	19.7	4
Fushe Kruje – Burizane (Old Road)	0	0
Fushe Kruje - Tirana	0	0

Table 3 Plant Impacts to the Surrounding Highway Network

It appears that the impacts are negligible on all highway sections with the exception of the links Vore – Fushe Kruje and Fushe Kruje – Burizane (New Road). Of course this is partly due to the assumption that all of the plant traffic will use this itinerary to access Tirana and that no traffic is going to use local roads. Even though with this conservative assumption the links under consideration are capable of handling the additional traffic. The same holds true for the grade separated interchange at Vore and the intersection complex of Vore (see Figure 3).

It should be noted also that the above considerations take into account the construction of a new road link between the plant area and the new road Fushe Kruje – Burizane (Link 1 in Figure 5). If this link is not implemented then all of the plant generated traffic will need to be accommodated through the existing Burizane village local roads.

This is feasible from the traffic volume capacity point of view but undesirable from the road safety and traffic noise and air pollution points of view for the village inhabitants. It would also be a sub optimal solution possibly affecting the productivity of the plant.

6.2 Impacts to the Railway Network

As mentioned above, rail transport can be considered for the part of the plant production destined for export and the import of raw materials as this freight has to be transported between two very specific points (the plant and the port). The total freight quantity – candidate for rail transport - would come up to approximately 1,250,000 tons per year.

Provided that the rail infrastructure involved is rehabilitated to modern standards and appropriate rolling stock is supplied, the transport volume can easily be accommodated by the railroad yard at Gjorm, the rail network and the rail facilities at the port of Durres (and if necessary the port of Bar as well).

In general the use of railroad, if economically justifiable, is expected to have positive impacts both on the railroad and the environment. The railroad will benefit because of the necessary rehabilitation and improvements as well as from the income that will be generated for the railway company. The environment will benefit as a results of the diminishment of air pollution due to reduced truck movements.

6.3 Impacts to the Port Infrastructure

The impacts of the plant operation on the port infrastructure would be the exclusive dedication of half of the Durres Eastern Pier to the plant needs. The remaining half will also be occupied - on a priority basis - for a quarter of the year. As a result the port will receive considerable income and its infrastructure will be upgraded and modernized.

7. TRANSPORT PLAN DEVELOPMENT

The cement plant transport plan will cover both internal transportation and more importantly the access and egress of staff and freight to the factory. The following parameters are of primary influence:

Local level

- Separate plant traffic from the local traffic and road network of the villages of Burizane and Mamuras.
- Provide permanent access between the areas of the flysch quarry and the limestone quarry / plant.

Wider area

- Products to be transported inside the country will most likely use trucks as individual shipment quantities are expected to be small and spatially widely distributed.
- The ports of Durres and Bar are candidates for import / export points of access.
- If access to the plant is provided solely by trucks then the port of Durres is the most likely choice unless the use of larger ships is necessary that cannot be accommodated at this port despite the plans for upgrade and rehabilitation.
- If rail is selected for part of the access chain, then the rail yard at Gjorm is the obvious transhipment point. In that case both the ports of Durres and Bar can be used (smaller differential unit cost of transport by rail). Use of the port of Durres is the preferable option as it is closer and within the same country.

The above decisions (for the wider area and the import / export to the country section of freight) will need to be based on a detailed transport and business study that cannot be conducted at this stage due to lack of necessary data. In general though, the following alternatives are viable (from the environmental and transport point of view).

Scenario 1: Road haulage of import and export materials from plant to port of Durres.

Scenario 2: Road haulage of export materials to the rail yard of Gjorm, transhipment, access of Durres port by rail. Bulk import materials to use the opposite route and packaged goods to access plant by truck.

Scenario 3: Road haulage of export materials to the rail yard of Gjorm, transhipment, access of Bar port by rail. Bulk import materials to use the opposite route and packaged goods to access plant by truck.

Therefore the transport plan comprises the following:

1. Construct road to connect the flysch quarry with the limestone quarry and the plant area. This will involve the construction of a bridge or other type crossing of the river Drojes. Investigate the structural capability of the existing bridge frame and if adequate fit with deck and use as an auxiliary crossing.

2. Construct road link to directly connect the plant area with the main highway Shkoder – Vore avoiding the built area of the Burizane village.

3. Negotiate the necessary arrangements at the port of Durres in order to secure if possible exclusive use of the necessary infrastructure. This will entail exclusive use of half the eastern pier (two docking locations) for 75% of the year and exclusive use of the entire eastern pier for the rest. It will also involve exclusive use of one of the 15 ton cranes to be purchased by the port.

4. The port has plans to dredge the access canal and increase the usable depth inside the port. Investigate whether these plans can be compatible with the use of larger ships similar to the ones that can be accommodated at the port of Bar. If this option is technically realistic negotiate its implementation in return for the TITAN investment at the port of the necessary loading and storage facilities.

5. Investigate the feasibility of the rail option under the basic strategy that the Albanian railways will undertake the cost of rehabilitating and modernizing the necessary infrastructure to TITAN's satisfaction. TITAN in return will construct loading and storage facilities at the Gjorm yard. The space for these facilities must be provided from the railway for TITAN exclusive use. The provision of the necessary rolling stock can be negotiated between the two parties. One option might be the long term lease of the necessary cars and locomotives from manufacturers or other railways including OSE.

6. Provide adequate parking space within the plant as the staff will be accessing the site by private cars or company buses.

8. CONCLUSION

The present transport study assessed the existing transportation conditions in the immediate vicinity of the plant and its wider area focusing on the import / export transport chain.

The input / output needs of the plant have been established as well as their impact on the surrounding transport network.

The principal means of transport satisfying the plant operation are expected to be:

- Private cars and buses for staff
- Trucks for freight.

The above means will be used for all internal movements, the plant access by staff and the distribution of freight within the country.

Certain road links are proposed for construction in the immediate plant vicinity. This construction is not a prerequisite for the commencement of plant operations.

Concerning the import / export activities both the ports of Durres and Bar can satisfy the plant needs. The port of Durres is the preferable option. The port of Bar can become a secondary choice depending on the negotiations outcome with the port of Durres authorities. Use of the port of Bar could prove inefficient if it is not combined with rail use. This can only be confirmed through a detailed business plan study.

Truck access of freight to and from the port of Durres is the only viable alternative at the present time and in the short term.

The rail option (for import / export of freight) is feasible, from the environmental and the availability of space points of view, through the rail yard at Gjorm. Whether this option can actually be used will depend on the outcome of a detailed study and subsequent negotiations with the rail authorities should the outcome of this study is encouraging. This option can only be investigated as a long term solution because of the upgrade work that would be necessary on the railway infrastructure and the procurement of the required rolling stock.

All options and solutions presented above are acceptable from the environmental point of view in terms of additional traffic volumes and are technically feasible.

APPENDIX A – Durres and Bar Ports Plans and Photos

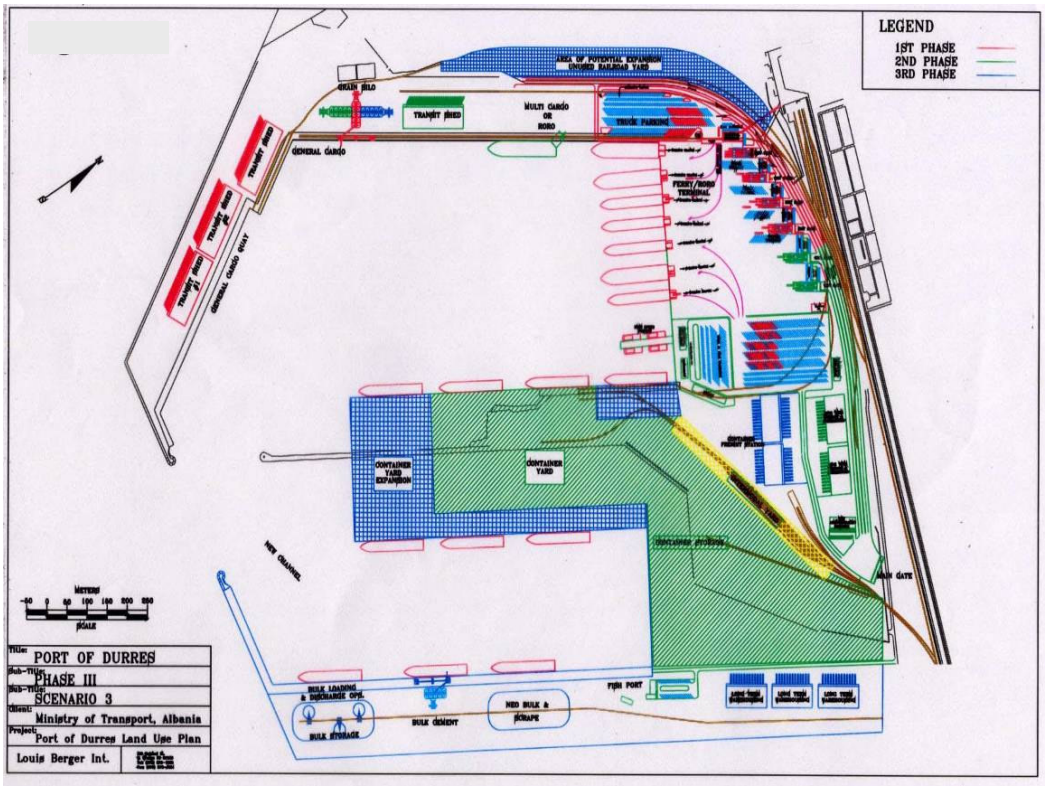

Figure 6 **Durres Port Master Plan**

Figure 7 **Durres Port – Eastern Pier – General View**

Figure 8 **Durres Port – Eastern Pier – Southern Dock**

Figure 9 **Durres Port – Eastern Pier – Space Availability**

Figure 10 **Durres Port – Eastern Pier – Loading Facilities**

Figure 11 **Durres Port – Eastern Pier – Western Dock - Rail Access**

Figure 12 **Durres Port – Eastern Pier – Rail ROW Infringement**

Figure 13 **Durres Port – Eastern Pier – Abandoned Elevated Rail line**

Figure 14 **Map of Bar**

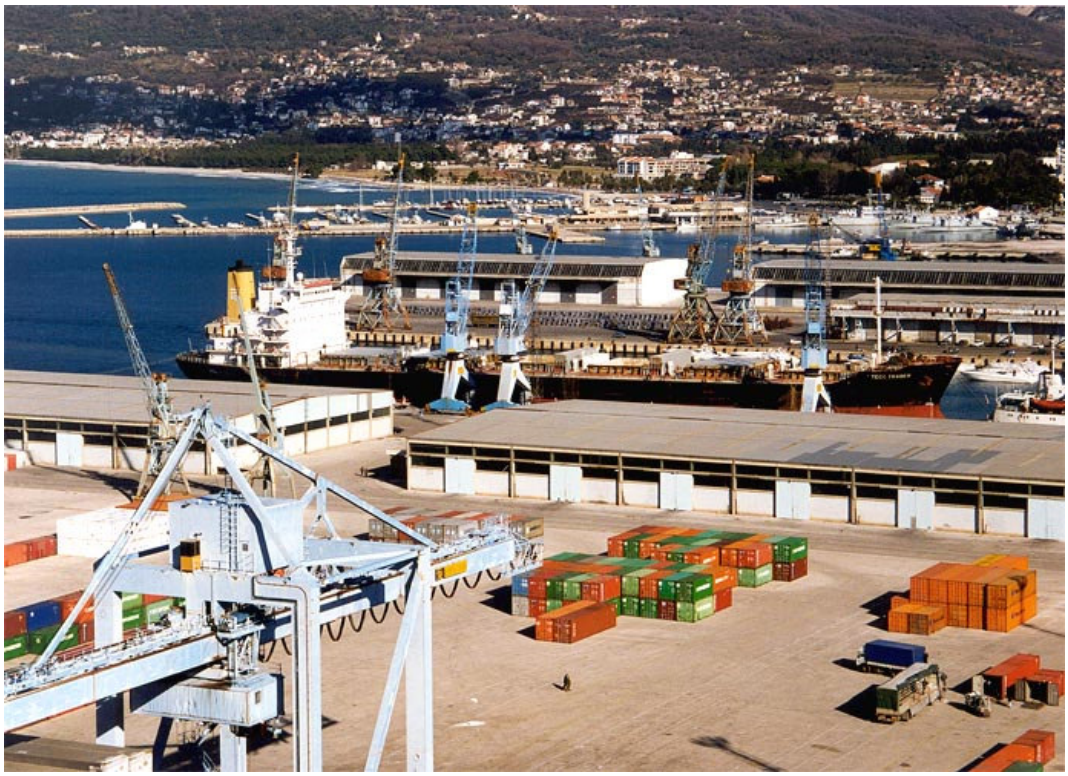

Figure 15 **Bar Port – Storage Facilities**

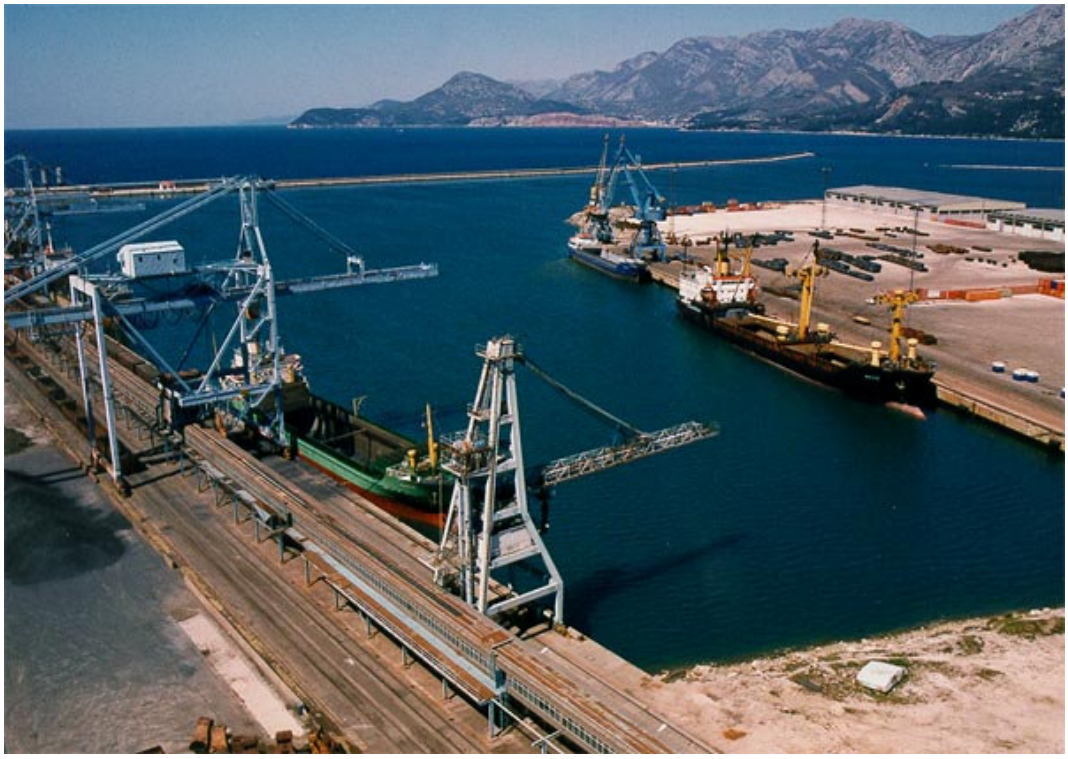

Figure 16 Bar Port – Loading Facilities

APPENDIX B - Railway Map and Gjorm Yard Photos

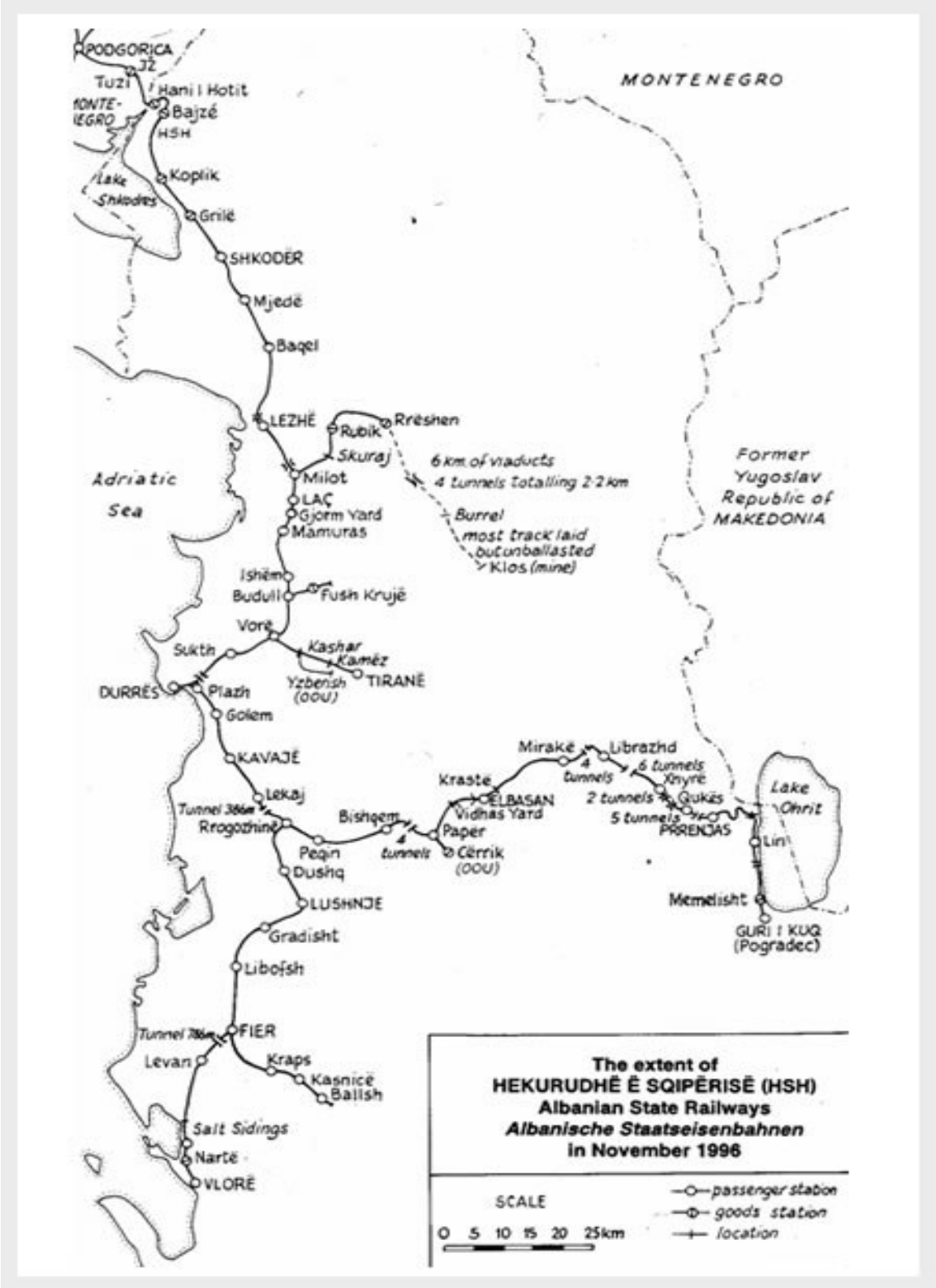

Figure 17 Albanian Railways Map

Figure 18 Gjorm Yard – Southern Access

Figure 19 Gjorm Yard – Space Availability

Figure 20 Gjorm Yard – Abandoned Facilities

Figure 21 Gjorm Yard – Rail Sidings

Figure 22 Gjorm Yard – Northern Access

Figure 23 Gjorm Yard - Turnout

Figure 24 **Gjorm Yard – Wooden Sleepers**

Figure 25 **Gjorm Yard – Concrete Bi Block Sleepers**

APPENDIX C – Wider Area Highway Network Photos

Figure 26 Road Fushe Kruje – Shkoder

Figure 27 Traffic on Road Vore - Fushe Kruje

Figure 28 **Access Road and Intersection on Road Fushe Kruje – Shkoder**

Figure 29 **Road Vore - Durres**

Figure 30 **Road Tirana – Fushe Kruje (Old Road)**

Figure 31 **Road Tirana – Fushe Kruje – Traffic Conditions**

Figure 32 Highway Vore – Tirana

Figure 33 Highway Vore - Durres

Figure 34 Vore Roundabout 1

Figure 35 Vore Roundabout 2

Figure 36 **Vore Rounabout 3 and Main Highway Underpass**

APPENDIX D – Plant Area Highway Infrastructure Photos

Figure 37 **Burizane Access Road – Unpaved Section**

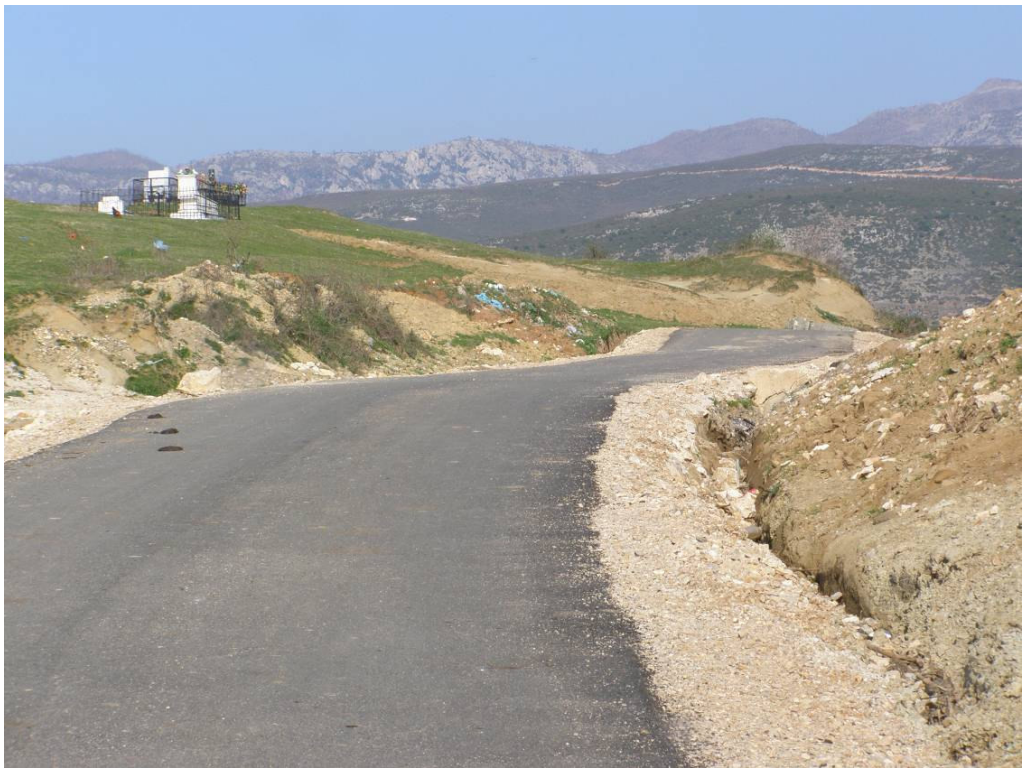

Figure 38 **Burizane Access Road – Paved Section**

Figure 39 **Burizane Road – Inside Inhabited Area**

Figure 40 **Road Mamuras – Plant Site**

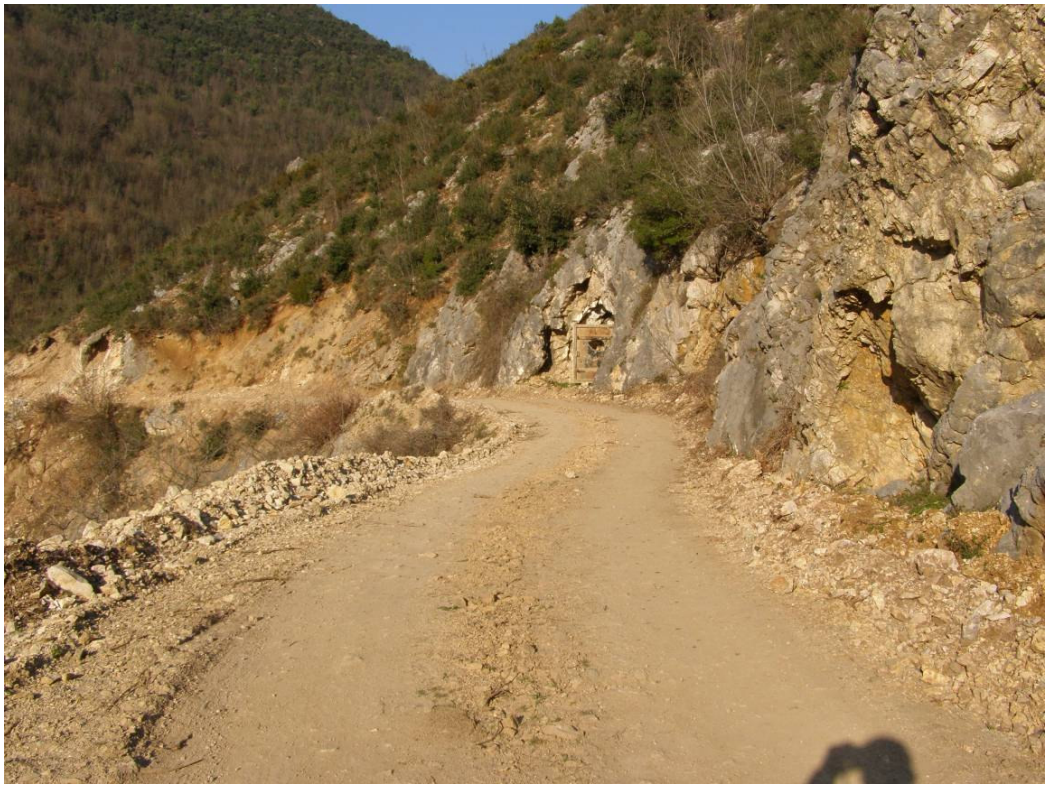

Figure 41 **Road Mamuras – Cement Plant / River Drojes Bridge Location**

Figure 42 **River Drojes Bridge – Deck Destroyed**

Figure 43 **River Crossing Location (Flysch to Plant)**

Figure 44 **Road Access to Flysch Quarry**

APPENDIX E – Turning Movement Counts

Turning Movement Counts

		1		2		3		4		5		6		7		8	
From	**To**	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies
6.00	7.00	**138**	24,6%	**122**	4,1%	**212**	15,1%	**41**	9,8%	**358**	2,8%	**118**	21,2%	**335**	6,6%	**145**	6,9%
7.00	8.00	**280**	9,3%	**205**	7,8%	**373**	13,9%	**97**	8,2%	**620**	3,7%	**247**	19,8%	**609**	5,4%	**297**	5,7%
8.00	9.00	**274**	19,3%	**187**	17,1%	**442**	13,3%	**72**	8,3%	**664**	2,0%	**244**	16,8%	**628**	7,5%	**361**	9,4%
9.00	10.00	**267**	16,5%	**229**	10,9%	**448**	16,5%	**82**	8,5%	**550**	6,2%	**267**	20,6%	**720**	9,3%	**365**	12,6%
10.00	11.00	**278**	13,7%	**203**	6,9%	**455**	19,1%	**83**	0,0%	**588**	8,3%	**276**	18,1%	**738**	8,1%	**369**	14,1%
11.00	12.00	**238**	19,7%	**213**	15,5%	**438**	14,6%	**60**	6,7%	**597**	8,5%	**255**	18,0%	**760**	8,2%	**382**	16,2%
12.00	13.00	**281**	12,5%	**252**	12,7%	**473**	11,6%	**70**	2,9%	**625**	6,1%	**360**	12,5%	**1293**	2,9%	**479**	8,1%
13.00	14.00	**277**	14,8%	**272**	6,6%	**483**	12,4%	**65**	15,4%	**637**	5,2%	**393**	8,1%	**1110**	4,1%	**442**	12,2%
14.00	15.00	**263**	13,7%	**276**	9,4%	**466**	13,1%	**57**	5,3%	**681**	7,6%	**386**	12,4%	**835**	4,2%	**328**	10,7%
15.00	16.00	**293**	10,9%	**285**	8,8%	**448**	11,8%	**63**	1,6%	**700**	5,1%	**402**	7,5%	**774**	4,8%	**289**	14,9%
16.00	17.00	**271**	11,8%	**261**	8,4%	**446**	8,1%	**53**	1,9%	**937**	3,5%	**511**	2,7%	**743**	4,4%	**311**	8,7%
17.00	18.00	**357**	7,6%	**375**	3,2%	**332**	9,3%	**81**	3,7%	**913**	2,8%	**529**	3,6%	**604**	5,6%	**225**	7,6%
Sum		**3217**	**13,8%**	**2880**	**9,0%**	**5016**	**13,2%**	**824**	**5,9%**	**7870**	**5,1%**	**3988**	**11,4%**	**9149**	**5,6%**	**3993**	**10,9%**

		9		10		11		12		13		14		15		16	
From	**To**	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies	Totals	Heavies
6.00	7.00	**137**	18,2%	**141**	3,5%	**266**	11,7%	**282**	10,6%	**46**	26,1%	**57**	5,3%	**335**	9,9%	**278**	7,6%
7.00	8.00	**236**	18,6%	**232**	7,3%	**479**	6,7%	**447**	7,8%	**54**	14,8%	**68**	19,1%	**375**	8,3%	**297**	7,7%
8.00	9.00	**250**	14,0%	**256**	15,2%	**375**	8,5%	**386**	7,8%	**43**	18,6%	**60**	15,0%	**417**	9,6%	**375**	10,4%
9.00	10.00	**276**	20,3%	**281**	15,3%	**357**	9,0%	**348**	5,7%	**41**	19,5%	**41**	17,1%	**357**	8,4%	**367**	9,0%
10.00	11.00	**266**	19,9%	**267**	13,5%	**376**	9,6%	**338**	9,2%	**46**	15,2%	**35**	20,0%	**377**	9,5%	**282**	5,7%
11.00	12.00	**245**	19,6%	**327**	18,7%	**326**	10,7%	**278**	10,1%	**40**	20,0%	**44**	11,4%	**324**	11,1%	**287**	12,5%
12.00	13.00	**272**	17,6%	**339**	12,1%	**433**	15,5%	**433**	17,8%	**37**	10,8%	**31**	19,4%	**344**	13,1%	**288**	9,4%
13.00	14.00	**243**	16,5%	**311**	10,0%	**512**	21,7%	**489**	19,8%	**45**	13,3%	**44**	9,1%	**345**	11,0%	**364**	7,1%
14.00	15.00	**240**	17,5%	**341**	11,1%	**577**	14,9%	**519**	12,9%	**43**	14,0%	**52**	19,2%	**329**	7,6%	**345**	8,7%
15.00	16.00	**260**	14,6%	**288**	13,9%	**520**	12,5%	**542**	14,4%	**55**	12,7%	**40**	10,0%	**354**	7,9%	**361**	8,0%
16.00	17.00	**274**	12,0%	**330**	6,4%	**603**	14,4%	**539**	20,4%	**42**	11,9%	**40**	5,0%	**352**	6,5%	**370**	8,1%
17.00	18.00	**267**	10,1%	**424**	4,2%	**656**	18,4%	**647**	15,9%	**71**	8,5%	**27**	18,5%	**350**	6,6%	**391**	6,6%
Sum		**2966**	**16,5%**	**3537**	**11,0%**	**5480**	**13,4%**	**5248**	**13,5%**	**563**	**15,1%**	**539**	**13,9%**	**4259**	**9,1%**	**4005**	**8,4%**