**SPLIT BY PASS – SECTION STOBREČ – DUGI RAT – OMIŠ**
**SUMMARY FOR PUBLIC DICLOSURE**

The existing national road D8 (The Adriatic Arterial Road) has been open to traffic in 1963. It is situated too near to the coast and is passing through the settlements Stobreč, Grljevac, Supetar, Jesenice, Dugi Rat and Omiš, so that it is burdened with numerous at-grade intersections, mostly of irregular geometry and lacking additional left-turn and right-turn lanes. Furthermore, ground plan elements are not homogeneous, visibility is insufficient, and the intercity and commuter traffic on the road is very high (AADT over 12,000 and ASDT over 19,000). Although the entire length of the existing road is passing through inhabited areas, there are no bus stops and no pedestrian ways provided. All these factors result in a low road capacity and low traffic safety, thus making the tourist trade development in these settlements impossible. Due to all these facts, it is necessary to construct the fast road divided into two sections: section Stobreč – Dugi Rat and section Dugi Rat – Omiš.

***Section 1: Stobreč – Dugi Rat***

This section begins with the „TTTS" intersection with circular flow and ends in km 9+950, at the beginning of the next section Dugi Rat – Omiš. The fast road includes two pavements with two traffic lanes respectively. In terms of plan view the route is following the terrain topology, avoiding the existing settlements and structures.

Three intersections are planned on this section: „TTTS" intersection in km 0+000, Intersection „Grljevac" in km ca 3+000 and Intersection „Jesenice" in km ca 9+000, as well as 5 viaducts of overall length L= ca 780 m, 2 tunnels of overall length L= ca 605m and ca 7,500 m of connecting and substitute roads, in order to connect the intersections with the Adriatic Arterial Road and to maintain the function of the existing network of local roads.

This section ends in km 9+950, at the beginning of the next section Dugi Rat – Omiš.

***Section 2: Dugi Rat - Omiš***

The beginning of this section is in km 9+950, and the route ends in km 20+250, in the connection to the existing national road D8. The length of this section is 10,300 m.

The route is passing through the hinterland of settlements Jesenice, Dugi Rat and Omiš.

The horizontal and the vertical route alignment is determined by topology of the terrain and by bypassing the inhabited areas. On the section of the route from km 9+950 to km 14+300 (Intersection „Dugi Rat") the route of the fast road includes two pavements, each pavement with two traffic lanes, From km 14+300 to the end of the section the road consists of one pavement with two traffic lanes.

The following structures are planned on this section: 2 intersections (Intersection „Dugi Rat" in km ca 13+890 and Intersection „Omiš" in km ca 19+560), 3 tunnels of overall length of ca 2,715 m, 2 viaducts of overall length ca 250 m and the bridge „Cetina" , ca 170 m long.

***Technical Elements of The Route***

Horizontal elements of the route

Plan view elements of the route of the fast road meet the criterion for calculation speed $v_{rač}$ = 80 km/h. The smallest applied horizontal radius is R = 250 m, which is equal to the minimal allowed radius. The

approach ramps of intersections are designed for $v_{rač}$ = 40 km/h, and the smallest applied radius is 45 m.

Vertical alignment of the route

Vertical alignment of the route aimed at optimal fitting of the route into the terrain of complex configuration, and in terms of calculation speed, all vertical elements were designed same as the horizontal elements – to meet the criteria for calculation speed vr = 80 km/h. The applied vertical curvature radii exceed the minimum allowed radii, and the maximal longitudinal level line grade is 5.9%.

Standard Cross Section

The width of traffic lanes is 3.25 m, and the width of marginal strips is 0.5 m. On the section of the road consisting of two pavements the central reservation is 2.5 m wide. The width of shoulders and benches ranges from 1,2 – 2. 0 m, depending on the area and on the drainage system.

The pavement structure is consistent over the entire route of the fast road:

| | |
|---|---|
| - Wearing course – split mastic asphalt SMA 11 | 3.5 cm |
| - Binding course VS 22 | 7.0 cm |
| - Bitumen impregnated bearing course, BNS 22 s A | 10.0 cm |
| - Mechanically compacted bearing course | 35.0 cm |
| Total: | 55.5 cm |

The construction of the fast road and the intense vehicle traffic will affect many natural and other factors, such as water, soil and agricultural land, flora and vegetation, wildlife, noise levels, air quality and cultural and historical heritage. In order to reduce negative impacts and provide for protection of each of these factors, the adequate protection measures need to be implemented.

**Impact on Water**

The route of the fast road Stobreč-Dugi Rat-Omiš is situated outside the water protection area, as it is not located in the catchment areas of any significant karst source important for public water supply.

Over the entire route the wastewater from the road will be controlled, gathered and treated. Wastewater from the pavement will be conducted into separators and then discharged into existing recipients, in order to protect the underground and the surface watercourses.

On the route section from km 15+800 to the end of the section the closed drainage system is planned, with additional treatment prior to discharge into recipients, due to the system of tunnels and viaducts.

**Impact on the Soil and Agricultural Land**

The construction of fast roads and the intense traffic of motor vehicles not only results in permanent loss of agricultural resources, but can also make it impossible to use the agricultural land in the impact zone. This is due to the potential pollution which must be prevented by appropriate and adequate protection measures, protection the soil against any possible pollution.

On the section of the route that is passing through agricultural land the drainage system will be designed so that the rainwater is taken outside the zone of agricultural land, thus reducing the negative impact.

**Impact on Flora and Vegetation**

The direct impact on natural flora and vegetation during road construction shall be the reduced areas of plant communities of vegetation characteristic for the respective climate and zone and the damages to the surrounding areas (access roads, storage of material, vehicles parking). Considering the size of the intervention, no major negative consequences to the composition of natural plant communities are anticipated. All surrounding areas that were included in the construction and are not a part of the road shall be rehabilitated and their original state will be restored by planting autochthonous plants.

**Impact on Wildlife**

The construction of the fast road will result in fragmentation of habitats and in separation of population, as well as in increased casualties among wild life when trying to cross from one side of the road to the other in order to meet their basic needs.

In order to maximally provide for migration of wild life from one side of the road to the other, a series of viaducts and culverts will be designed along the route (for topographic and other reasons) and these structures will also serve the function of wild life passage.

**Impact on Noise Levels**

One of the negative impacts of road construction is the increased noise level in the area surrounding the road. This impact is manifested in both construction phase and in operation phase.

The structures situated within the noise protection zone will be additionally protected from noise emissions from the road. The planned measures of noise protection include noise protection walls situated as near as possible to the noise source – along the shoulder of the road in question.

**Impact on Air Quality**

By the construction and opening for traffic of the road Stobreč - Dugi Rat - Omiš a significant portion of the traffic on the existing road D8 would be redirected to the newly constructed road. This would provide for a certain improvement of air quality in the most densely populated area along the coast, while the air quality in areas situated on higher altitudes of road route would deteriorate to a certain degree. However, according to calculations, the vehicles expected to use this road will cause concentrations of pollutants bellow the values specified in the Decree on recommended and marginal air quality values. In terms of the provisions of the Air Protection Act (Official Gazette No. 48/95) the air quality will not change, therefore the impact of the project on the air quality may be assessed as acceptable.

**Impact on Cultural and Historical Heritage**

In order to efficiently protect the cultural and the historical heritage, the optimal solution for protecting each individual location needs to be determined in cooperation with competent authorities.

The most significant structures of cultural and historical heritage in the road impact zone are as follows:

**- St. Peter's Church in Priko - (chainage16+400, 300 m on the right of the road)**

The road is passing through the tunnel in the immediate vicinity of the famous early Romanesque St. Peter's church in Priko. By ensuring that the appropriate drilling activities are performed over the entire tunnel section all hazards to the church will be avoided.

**- Starigrad (Chainage 17+800, on the tunnel centre line )**

The route of the road tunnel is passing under the fortress and if appropriate drilling and blasting operations are ensured, as well as controlled operations of heavy machines, there will be no harmful impact on the fortress.

**- Old town centre of the city of Omiš (chainage 17+700, 350 m on the right from the centre line of the road)**

The protected old centre of Omiš is situated in the indirect impact zone. The damages will be prevented by programmed and controlled drilling and blasting operations, as well as by other preventive protection measures.

**- St. Steven's (Chainage 19+150, 200 m on the left of the centre line of the road)**

In view of the fact that the location of St. Steven's Church is situated within the direct impact zone of tunnel construction, the drilling and blasting operations could present physical hazards to the site. Therefore all necessary protection measures shall be taken.

**Conclusion**

The construction of this fast road will undoubtedly affect the environment. However, the Environmental Impact Study provides for maximal available protection measures for all impact zones, in order to minimize the negative impacts.

The Environmental Impact Study additionally includes the permanent monitoring of authorized authorities and persons, as to enable emergency measures in case that the measured values of control parameters should exceed the level of recommended values as specified in applicable regulations on environmental protection.

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# ENVIRONMENTAL IMPACT STUDY
# STATE ROAD D8

# STOBREČ-DUGI RAT-OMIŠ

ZAGREB, October 2004

**TABLE OF CONTENTS**

Land use, scale 1:25 000
A.2.4.6. Excerpt from the Regional Plan of Municipality Dugi Rat
.. Terms of Land Use and Protection, scale 1:25 000
A.2.4.7. Excerpt from the Master Plan of the town of Omiš
.. Land use, scale 1:5 000
A.2.4.8. Excerpt form the Master Plan of Omiš
.. Land use restriction factors, scale 1.5000
A.2.4.9. Maps of the Construction Areas, Variant 1 and Variant 2, scale 1.25 000

**A.3. Description of the Location Environment and the Proposed Project Area Impacts**

A.3.1. Weather features of the region
A.3.3. Forests and Forestry
A.3.4. Living Communities
A.3.4.1. Flora and Fauna
A.3.5. Protected Natural Values
A.3.6. Game and Hunting
A.3.7. Landscape Features
A.3.8. Cultural-historic Heritage
A.3.9. Geologic features of terrain
A.3.10. Hydro-geologic features of the terrain

**A.4. Description of the Project**

A.4.1. Main alignment
A.4.2. Intersections, interchanges
A.4.3. Parallel roads
A.4.4. Structures
A.4.5. Road equipment and drainage
A.4.6. Relocation of utilities
A.4.7. Graphic attachments
A.4.7.1. Layout, at scale 1:25 000
A.4.7.2. Longitudinal profile 1:25 000
A.4.7.3. Normal cross section 1:100
A.4.7.4. Conceptual design of the bridge Cetina
A.4.7.5. Normal cross section of the tunnel
A.5. Cost estimates of the project
A.6. Description of public consultation prior to study development

**B. Assessment of Acceptability of the Project**

B.1. Possible impacts during preparation and construction, and during operation
B.1.1. Impacts on the soil and agricultural land
B.1.2. Impacts on Forests and Forestry
B.1.3. Impact on Flora and Fauna
B.1.4. Impact on Protected Natural Values
B.1.5. Impact on Game and Hunting
B.1.6. Impact on Landscape
B.1.7. Impact on the Air Quality
B.1.8. Impacts on the Cultural-Historic Heritage
B.1.9. Impact on the Noise
B.1.10. Impact on Water Quality

**B.2. Cost-Benefit Analysis**

B.3. Compliance of the Project with international commitments of the Republic of Croatia on trans-border environmental impacts
B.4. Proposed best alternative

**C. Environmental Mitigation Measures and Implementation Plan**

**C.1. Proposed Environmental Mitigation Measures During Construction and Operation**

C.1.1. General Mitigation Measures
C.1.2. Mitigation Measures for Soil and Agriculture

## C. ENVIRONMENTAL MITIGATION MEASURES AND IMPLEMENTATION PLAN

### C.1. PROPOSED ENVIRONMENTAL MITIGATION MEASURES DURING CONSTRUCTION AND OPERATION

#### C.1.1. General Mitigation Measures

Mitigation Measures during Project Development

1. Surfaces required for site organization (temporary disposal of building and waste material, parking area and area for machine manoeuvring, fuel reloading area) shall be designed within traffic route corridors so as to minimize negative environmental impact and damages to the surface. Therefore, already existing degraded surfaces should be used instead of creating new areas within the limits of the existing vegetation.

Mitigation Measures during Construction

1. Restrict the movement of heavy machines during construction, or use the existing road network, which shall be repaired after the completion of construction work. Design new access roads across natural vegetation cover only when there are no other solutions, and in cooperation with responsible forest management authority.
2. Classify and dispose municipal and hazardous waste in compliance with regulations, or prohibit any temporary or permanent disposal of waste material at surrounding soil.
3. All excavated material which shall not be reused for construction purposes shall be stockpiled at special locations.

#### C.1.2. Mitigation Measures for Soil and Agriculture

Mitigation Measures during Project Development

4. For the alignment section running across agricultural land, foresee drainage system t for removal of precipitation water (runoff) out of the agricultural area and discharge into the ground, while taking erosion prevention measures, if allowed by water protection requirements.

Mitigation Measures during Construction

1. Preserve agricultural areas in the vicinity of the road route much as possible.
2. Prevent unnecessary damage to trees, crowns and roots of sweet cherry and sweet chestnut trees and other ligneous plants which are parts of natural vegetation cover.
3. During earthworks, stockpile top soil separately and prevent from pollution; use later to cover slopes and central reservation or for other purposes in compliance with regulations.
4. After completion of works, restore all surfaces damaged by construction activities to their original condition or develop in compliance with landscaping design.

#### C.1.3. Mitigation Measures for Forests and Forestry

Mitigation Measures during Project Development

1. In detailed design foresee erosion control in slopes along the alignment, particularly around cuts, tunnel portals, viaduct approach roads, with the aim to prevent uprooting of trees near cuts and landslides.

Mitigation Measures during Construction

1. During construction, avoid damaging trees on the edge and their roots by careful execution of works and in compliance with stipulated measures and construction procedures.

2. Immediately after cutting of the route, establish and maintain forest order, i.e. remove tree-stumps and cut and transport all wood. Keep in mind to cut down all damaged and broken trees, to prevent spreading of any plant disease which may occur in such trees.
3. Particularly pay attention to handling highly inflammable materials and open flame during construction. Comply with all regulations and procedures for forest fire prevention.

Mitigation Measures during Operation

1. Regular implementation of forest fire protection measures.

C.1.4. Mitigation Measures for Flora

Mitigation Measures during Designing and Project Development

1. Use and adapt the existing approach roads as much as possible; design new roads by clearing natural vegetation only if unavoidable. This particularly applies to pine forests (particularly the one at approx. chainage 17+000 km and further on).

Mitigation Measures during Construction

1. When tunnelling, pay particular attention to the execution of exit portals above the river Cetina in order to prevent the destruction of habitats of some plant species endemic to Croatia.
2. During the works prevent caving in of the material at the foot of the portal. Remove any eroded material and prevent any piling up of such material at sensitive habitats along the river.

C.1.5. Mitigation Measures for Fauna

Mitigation Measures during Project Development

1. Before the commencement of works, develop the strategy for the protection of underground habitats to be applied at the moment when such habitats are found during tunnelling.

Mitigation Measures during Construction

1. Bio speleological supervision during tunnelling is mandatory
2. In case of coming across underground sites (caves), the team of biospeleologists shall identify the status of the locality and define its value as well as the required mitigation measures for underground wildlife and habitats.
3. Provide for permanent monitoring of the status of underground wildlife and habitats discovered during tunnelling (those which are considered important by biospeleologists).
4. All excavated material which shall not be reused for construction purposes, shall be stockpiled at locations foreseen for that purpose and where the environmental impact was examined.

C.1.6. Mitigation Measures for Wildlife and Hunting

Mitigation Measures during Project Development

1. Preserve the wildlife movement corridors since the fragmentation of habitats results in isolation of some population and an increase in the number of animals killed when trying to cross the road, particularly during the night.

Mitigation Measures during Construction

1. Provide for impermeable waste containers.
2. In cooperation with expert hunting authorities, wildlife movement corridors and crossings shall be identified and marked with traffic signs. All measures shall be taken to prevent damage that may arise from wildlife/vehicle collisions.
3. Establish directions and corridors for the movement of people and vehicles to protect the area from uncontrolled entries and movements across the hunting grounds.

4. In cooperation with hunting authorities, move the existing hunting facilities (high shooting stands, feeding places) to other location or replace with new ones.

Mitigation Measures during Operation

1. The road maintenance service is required to record all occurrences of roadkill in order to take additional mitigation measures on time, and prevent future damage from wildlife/vehicle collisions.
2. If the records show that the roadkill is frequent, take additional measures to prevent this by installing roadside wildlife reflectors which serve to deter the game from the road corridor.

C.1.7. Mitigation Measures for Landscape

Mitigation Measures during Designing and Project Development

1. Define the structure type for the bridge across the river Cetina in further design development, in cooperation with other experts in natural, cultural and historical sites (architects, landscape architects). Higher vertical alignment and lighter bridge structure are recommended in order to diminish its visual impact on the view of the canyon.
2. During further design development for the alignment and all approach roads, make alignment corrections, if possible, and in places where the corrections would result in keeping the integrity of agricultural land or diminishing the visual exposure of the route.
3. In the landscaping design of surfaces adjacent to the road, the original purpose and visual aspects of the land shall be taken into account. This includes preservation of as olive groves on terraces in the vicinity.
4. All embankments, cuts and tunnel portals shall be designed in natural materials, using stone or plants (use native plants or those typical for a location).

Mitigation Measures during Construction

1. Avoid additional disturbance and demolishing of terrace structures and local roads by locating the construction site only on one side of the road.
2. All temporary occupied surfaces (site location and approach roads) shall be restored to original condition or repaired according to the landscaping design.

C.1.8. Mitigation Measures for Archaeological and Cultural Heritage

After road staking out, it is necessary to check once more the entire alignment and perform minor exploratory probe surveying with the purpose of detecting archaeological localities.

1. TTTS Intersection at Stobreč (Chainage 0+100.00)

It is necessary to perform archaeological exploration in the northern section of the intersection and check other parts by trial holes to establish whether there are any new localities within the intersection area.

2. Pituntium (Chainage 5+200 to 6+200)

Since this is a dispersed settlement, use exploratory probing to find structures or graves (trenches and probes 4x4 m) .

3. Ancient Neraste (Chainage 10+900 to 11+400)

Explore the alignment in the length of 600 m by exploratory probing. Expand and focus exploration at places where archaeological traces are found.

4. Boundary wall between Narestin and Onastin (Chainage 11+450)

Explore the wall and conserve and present the edges which shall remain after road construction.

5. Starigrad

Cracks may appear on the fortress due to tunnelling and blasting in the vicinity. The facility shall be under supervision during road construction. Should the cracks appear, static stability rehabilitation and repair of such cracks shall be executed at the expense of the Employer.

6. Old core of the town of Šibenik (Chainage 17'700, 350 m to the right from the centre line of the road)

The protected old core of Omiš is located within the indirect impact zone. Tunnelling through rocks under the town fortresses (Peovica, the Romanesque fortress), may cause vibration which with adverse impacts on the fortresses and the town. Therefore, special technology shall be applied for tunnelling works and operation of heavy machines in order to decrease adverse impacts. Possible cracks and damages to monuments and buildings in the old town core shall be repaired at the expense of the Employer. The protected old core of the town of Omiš shall be under supervision during construction works.

7. Oneum (Chainage 17+900 to 18+450)

Alternative solution, which includes the construction of the tunnel below the ancient site Oneum, is the only acceptable solution from the point of view of protection of cultural monuments. The first solution is unacceptable because it will result in destruction of the ancient town core, and it includes only supervision of works.

C.1.9. Mitigation Measures for Noise

Structures located within the noise protection zone should be additionally protected from the emission from the road. Proposed mitigation measures are noise barriers placed as close to the source of noise– along the shoulder.
The barriers shall be made of materials which fit into the environment such as cut stone combined with transparent or concrete insertions, or wooden screens at places with vegetation.

Noise barriers on structures (viaducts and bridges) are generally made of UV resistant transparent material (polyacril).

C.1.10. Mitigation Measures for Water

As already stated, the area of the proposed route lies outside the water protection area and there are no active nor potentially usable potable water resources in the drainage basin. Therefore, protection criteria prescribed and regulated by the Regulations on Determination of Sanitary Measures Zone for Water Sources, published in Official Gazette no. 55, dated May 16, 2002, do not apply.

It is our opinion that in this case the criteria prescribed by the Law on Waters (Official Gazette no. 107/95) pursuant to Article 72 paragraph 2 on the adoption of the Regulations on Limit Values of Indicators, Hazardous and other Matters in Waste Waters, published in Official Gazette no. 40/99, as well as the Regulations on Amendments to the Regulations on Limit Values of Indicators, Hazardous and other Matters in Waste Waters (Official Gazette no. 6/01), should be applied in design and construction of structures.

The said Regulations, as well as amendments to the regulations, prescribe limit values of indicators and allowed concentration of hazardous and other matters in technological waste water, waste water from water treatment units before being discharged into natural collector, as well as methods for waste water testing.

It is our opinion that standards stipulated by said legislation and regulations should, among others, be used in design of runoff drainage system.

C.2. ENVIRONMENTAL MITIGATION MONITORING PLAN

C2.1. Monitoring during Construction

Monitoring of Fauna

1. During tunnelling, a permanent bio-speleological supervision is required. If of underground objects are encountered during works, works shall be suspended to allow assessment of the site by a bio-speleogogist team, who will also determine special protection measures for animals and habitats. Also, it is necessary to provide for permanent monitoring of underground fauna and habitats which were encountered during tunnelling and subsequent operation of the tunnel.

C.2.2. Monitoring during Operation, or during Traffic

Monitoring of Soil

1. It is necessary to control the concentration of heavy metals in the soil periodically (every third year). The control should at all events include sampling of surface layer at locations 25 m, 50 m and 1000 m away from road shoulder in order to identify possible pollution of surrounding soil on time. Top soil of cultivated land with crops should also be controlled for the content of heavy metals at the above mentioned road shoulder distances in order to identify possible expansion of pollution in the soil and vegetation along the traffic route and take appropriate mitigation measures.

Monitoring of Flora

1. Monitor the recovery of endemic plant habitats around tunnel portal on cliffs above the river Cetina during five years, and take additional mitigation measures, as appropriate.

Monitoring of Fauna and Wildlife

1. Monitor the frequency and places of roadkill occurrence. After one year of monitoring, it is necessary to analyse locations and classification of killed animals and introduce protection measures (installation of additional traffic signs to warn of animal crossing and other measures).

C.3. ENVIRONMENTAL POLICY OF THE PROJECT HOLDER

As a project holder, Hrvatske ceste d.o.o. promotes environmental mitigation measures within the scope of its activities. From the early phases of design development the designs incorporate all measures mandatory according to Croatian standards as well as international standards for those issues which are not regulated by Croatian standards. Special requirements for environmental protection determined in location permits and related to the construction and operation of transport facilities, as stipulated by relevant institutions, are also incorporated in designs.

C.4. ORGANIZATIONAL STRUCTURE OF THE PROJECT HOLDER

HRVATSKE CESTE d.o.o. (Croatian Roads Ltd.) is a limited liability company for administration, construction and maintenance of state roads with headquarters in Zagreb.

Its scope of activities is as follows:

- operative activities of engineering and technological integrity of public roads system according to the Strategy of Transport Development, through basic research and analysis of regional/land use planning, transport, engineering and economic issues;
- programming and planning of public roads development strategy, complete design preparation for state roads and design development including surveys and prospecting, preparation of technical documents required for location permits for motorways;
- construction of state roads (Article 11, Public Roads Law) except motorways;

- maintenance of state roads (Article 14, Public Roads Law) with the exception of motorways;
- other administration of state roads (Article 17, Public Roads Law) with the exception of motorways;
- arranging financing and financing construction of state roads, with the exception of motorways;
- protection of the environment from impacts of traffic on state roads;
- monitoring of traffic volumes and traffic flows on public roads;
- establishing and maintaining road data bank;

Other activities stipulated in the Articles of Incorporation

C.5. INVOLVEMENT OF THE PUBLIC

All activities of project development, starting from the early phase of design development, include contacts with representatives of county and local authorities. Representatives of county regional planning offices participate in the work of the panel for the environmental impact assessment. Wide public is involved during public disclosure and public hearing. Comments submitted by the public are answered by the Employer, and if justified, these comments and the resulting revisions are incorporated in the design.

The company Hrvatske ceste occasionally issues information related to a particular project, which are made available to professionals in the construction sector but also to wider public. These activities include promotional films broadcasted on national TV. Experts engaged at Hrvatske ceste also contribute in professional papers and magazines.

C.6. COST ESTIMATE FOR ENVIRONMENTAL MITIGATION MEASURES AND MONITORING

Fauna

The amount of 75,000 kunas per year should be provided for monitoring of roadkill.

Noise Protection

The costs for noise protection are estimated on the basis of data presented in previous chapters (B.1.9. and C.1.9.).

Average wall length: 130 m
Average wall height: 3.0 m
Number of locations: 87

Cost analysis is based on the price for constructed noise barrier in the amount of 620 kn/km$^2$.

87 x 130 x 3.0 x 620 = 21,036,600.00 kn

## D.1. JUSTIFICATION OF THE MOST APPROPRIATE PROJECT ALTERNATIVE

Alternative 2 of the alignment Stobreč – Omiš is more acceptable from the point of view of most environmental elements, except for the impact on fauna, namely cave fauna. Both alternatives are rated equally from the point of view of impacts on air quality.

Therefore, the selection of Alternative 2 for the road route Stobreč – Omiš, with approach roads, is recommended as more environmental-friendly, provided that the required environmental mitigation measures are taken and environmental monitoring plan implemented.

## D.2. PRESENTATION OF THE ENVIRONMENTAL IMPACT OF THE PROPOSED ALTERNATIVE

### D.2.1. Soil and agricultural land

Regarding the impact on soil and agricultural land, both proposed alternatives will run across the area of similar production and soundness capacity. Therefore, the main criterion for the assessment of less adverse impact to agricultural land and agriculture is the permanent loss of valuable agricultural land due to the construction of the road , or the change of land use. From the point of view of protection of valuable land, the alternative 2 is more acceptable than the alternative 1.

Considering the impact of the road construction project to soil and agriculture, as explained above, alternative 2 has been proposed as more acceptable for the construction of the road for the following reasons:

- Alternative 2 will result in less permanent loss of agricultural and forest land than the alternative 1.
- Alternative 2 will result in adverse road construction impact spread on the smaller segments of land, including the valuable arable land, within the 100 m corridor, in comparison to the alternative 1.
- Alternative 2 will result in less fragmentation of agricultural lots, and consequently in less impacts on the agricultural production, than in the alternative 1.
- The alternative 2 will involve less risk from soil erosion than alternative 1.

### D.2.2. Forests and Forestry

The impact to forests and forestry will primarily be reflected in permanent loss of forest land resulting from construction of access roads. This will cause the loss of forest production and influences forestry activities, leading to:

- an increase arboriculture activities because of fragmentation
- an increase in forest protection works from pests and fire
- cutting of former forest roads and their replacement
- increased forest trimming and other activities.

In addition to the loss of the production function of forests, the loss of generally useful forest functions also has considerable impact on forests and forestry.

Permanent occupation of forest land in the project area will result in the loss of 0.71 ha and 0.16 ha of state forests for alternatives 1 and 2, respectively, with the total loss of generally useful forest functions rated with 7.6 points for alternative 1. Permanent occupation of private forests will result in the loss of 25.57 ha and 24,65 ha for alternatives 1 and 2, respectively. The loss of generally useful functions of private forests has been rated with 321.0 and 304.8 points for alternatives 1 and 2, respectively.

On the basis of all presented data, it is obvious that permanent occupation of forest land, due to the construction of access roads will result in loss of 26.27 ha of forests and forest land, with the total value of generally useful functions rated with 328.6 points for the designed route according to alternative 1 or 24.81 ha of forests and forest land with the total value of generally useful functions rated with 304.8 points for the designed route according to the alternative 2.

Within the project area, the designed alignment from the chainage 16+000 to the chainage 17+500 runs across the natural reserve (protected landscape) – the river Cetina. The area is registered with the Register of natural reserves (no.127/5-1963) and includes the river Cetina canyon all the way up to the peaks surrounding it. Because the area, which in places overlaps with the natural reserve, consists mainly of naked karst, and the alignment crossing the major part of the area runs through the tunnel (particularly alignment2), the construction of the road will not endanger forest ecosystem of the area under protection.

It is safe to conclude that the construction of this road will not significantly influence areas under forest, except for those which will be lost permanently. Possible impact of traffic to forest vegetation in the immediate vicinity of the road must be monitored and timely response provided..

During construction, particular attention should be paid to handling of highly inflammable materials because the route runs across the area highly sensitive to forest fire, particularly during summer season.

Forest fire risk is classified by the degree of risk, as follows: level I (480 points and more) for high risk; level II (381 – 480) for considerable risk; level III (281 – 380) for medium risk and level IV (280 points and less) for minor risk from forest fire. Within the area of alternative 1, 48.65 ha of forests were classified as level I, 24.58 ha as level II and 6.18 ha as level III. Within the area of alternative 1, 45.71 ha of forests were classified as level I, 23.10 ha as level II and 4.70 ha as level III. These data show that special attention should be paid to fire protection measures during construction and road operation.

Besides, adverse impact may arise after putting the bypass road into operation, such as:

- emissions of noxious gasses from cars
- traffic incidents(discharge of noxious liquids, fire and similar)
- disposal of noxious waste etc.

As far as the forestry is concerned, a part of forest land on the future alignment is currently inaccessible. Approach road construction shall enable better access to those areas and, accordingly, better management and fire protection.

Based on the presented findings, it may generally be concluded that the alternative 2 is more acceptable because it will result in less loss of forest ecosystem areas, and consequently of generally useful forest functions and less fire risks.

D.2.3. Vegetation and Wildlife Communities

D.2.3.1. Flora

The proposed road route between Stobreč and Omiš is planned in the area of typical Mediterranean vegetation, mostly degraded to karst grassland on which Allepo pine grows in places. Large part of the alignment runs across anthropogenic terraces where crops used to grow (vineyards, olive grooves and kitchen gardens). Cultivated agricultural land occupies only smaller portion of the route. Rare and endemic plant species have been recorded in the canyon of the river Cetina.; therefore, it would be ideal to design alignment away from this area. It is in this location that the worst impact from the road construction is expected. In order to minimize the damage to endemic plant habitats, it is necessary to determine locations for waste disposal, car parking and fuel reloading and to use and adjust already existing access roads. Neither vegetation cover nor agricultural land in the vicinity of the road route should be damaged without valid reasons; excess excavation material (particularly from tunnel portals in the area of the river Cetina) should be built in embankments or stockpiled under supervision. Upon the completion of the construction, all waste material should be removed and access roads repaired, to enable growth of vegetation. The sensitivity of the Cetina canyon area requires monitoring during at least five years from putting the road into operation in order to monitor the endemic plant species and recovery of habitat as well as to take additional mitigation measures if necessary.

D.2.3.2. Fauna

There are various types of habitats in the wider area of Stobreč – Omiš road construction: macchia, naked karst and water habitats. Considering the diversity of habitats, there is relatively large number of animal species in the area. Based on the analysis of the inventory and distribution of fauna in the wider project area, it had been assessed that the construction and operation of the road in question will adverse impact on fauna for the following reasons:

- endangering of endemic, relict, strictly protected and protected animal species
- reduced possibility for migration of some animal populations
- reduction of the aboveground and endangering of the underground habitats at the location of road construction, or the future tunnel

Every newly constructed road, even if it is without fences, makes the communication with the individuals of the same species across the road rather difficult. In the case of the road Stobreč – Omiš , the exceptions are road sections running through tunnels and on viaducts, or bridges. The alternative 1 of the proposed Stobreč – Omiš route the construction of 6 tunnels in the total length of 2394 m, 10 viaducts in total length of 1870 m and a bridge across the river Cetina 180 m long. The location and t e length of these structures will enable the acceptable passage; and thus decrease the adverse impact of road on the wildlife in the area. According to the first alternative, on 22 % of this section length animals be able to pass to the other side of the route. Alternative 2 foresees the construction of 5 tunnels in total length of 3319 m, 7 viaducts in total length of 1175 m and a bridge across the river Cetina 170 m long. Although according to the alternative 2, Stobreč – Omiš road allows free passage of animals at 23 % of its length, this alternative is less acceptable than alternative 1 because of its impact on fauna, and particularly on cave fauna, which requires special protection measures during tunnelling.

The area of the existing habitats will be reduced by the construction of Stobreč – Omiš road. Considering the designed length of the section of 20300 m, significant adverse impact on fauna is not expected.

Because the road will be without fences, the roadkill is predictable. There will be no considerable adverse impact on bird population while adverse impact on the reptile fauna as well as small and medium mammal fauna is expected.

D.2.4. Protected Natural Values

D.2.4.1. Natural Reserves

Within the area of project construction, the designed route from chainage 16+000 to chainage 17+500 runs through natural reserve – the river Cetina. Since the area, which is included in natural reserve, consists mainly of naked karst, and the alignment crossing the major part of the area is running through the tunnel (particularly the alignment 2), the construction of the proposed road will not endanger forest ecosystem of the area under protection.

D.2.4.2. Rare and Protected Plant Species and Vegetation Complexes

The proposed project area is among the richest habitats of endemic plants in Croatia (Dinara cliffs above Omiš along the river Cetina before the river joins the Adriatic), therefore, the construction of the road is unacceptable. This area is of immense national and world value, here live species which are recorded in the Croatian and world red lists. Therefore, the area should be conserved and any human impact prevented. Plant species protected by law, exceptionally rare or highly endemic plants that live in the proposed project area are classic Croatian endemic flora and truly and exceptionally rare species. Road construction will endanger them directly. Cliffs around the Cetina river mouth are covered with some of the most valuable and most rare Croatian endemic flora: *Campanula portenschlagiana, C. pyramidalis, Portenschlagiella ramosissima, Moltkia petroea, Euphorbia Wulfenii, Iris pseudopallida*, to mention only a few.

D.2.4.3. Rare and Protected Animal Species and Habitats

In the wider construction area of the Stobreč – Omiš road, 16 strictly protected and 7 protected species of mammals were recorded; also, 79 strictly protected and 21 protected species of birds; 3 endemic, 15 strictly protected and 8 protected species of reptiles; 4 strictly protected and 5 protected species of amphibians; 5 endemic and 10 protected species of fish; one protected specie of molluscs; 6 endemic, two relict and two strictly protected species of insects; two relict species of crabs and one endemic and 6 relict species of crustaceans. This list of endemic, relict, strictly protected and protected species indicate relatively high degree of environmental sensitivity of the area.

D.2.5. Wildlife and Hunting

The proposed route alternatives have equal adverse impact. However, if protective devices (reflector mirrors) are installed, those will reduce possible perish of people and animals on the road and make it acceptable from the point of view of wildlife and hunting.

Direct loss of hunting land for alternative 1 (30 m buffer zone) is 12,707 ha and for alternative 2 12,698 ha. Therefore, alternative 2 is considered acceptable from the point of view of wildlife and hunting.

Pursuant to the Law on Hunting (Official Gazette no. 10/94, 29/99), under which hunting within 300 m from roads is forbidden, direct loss should be increased by indirect loss. Areas which, after the completion of the construction, are left outside the hunting ground (30 m buffer) reduce the hunting land by 242,761 ha.

It is necessary to bring in line hunting ground management regulations with the new calculation of hunting production land, taking into consideration wildlife protection programme outside the hunting ground, which leads to the review of hunting management and wildlife protection programme, pursuant to Article 47 of the Law on Hunting (Official Gazette no. 10/94, 29/99).

It is clear that the facility shall have considerable impact on the entire wildlife after the completion of the construction. Therefore, it would take time to restore the habitats and wildlife living there.

The possibility for traffic accidents will increase (risk to people and animals), particularly in summer season when the intensity of the traffic is higher. This will result in increased hunting ground insurance premiums.

The proposed alignment with the installed protection devices(reflector mirrors) which will result in reduced risk to people and animals, is acceptable from the point of view of wildlife and hunting.

D.2.6. Impact on Landscape

The proposed project – the road from Stobreč to Omiš, will have great impact on landscape. The impact of the bridge across Cetina and the section of the project from TTTS to the viaduct across Žrnovnica will be particularly strong. Although the bridge will be located at the most narrow part of the canyon, it is an artificial structure, and as such it completely stands out from the surrounding natural landscape and greatly influences the visual aspect of the area. Because it is impossible to fit in such structures into the surrounding landscape, the only possibility to protect the landscape is the design of smaller structures with structural and design characteristics acceptable for landscape aesthetics. The most part of the middle section of the alignment runs across cultural landscape of terraced slopes of Peruna and Mošnice where considerable impact on landscape is also expected.

The alternative 2 is considered more acceptable than the alternative 1 because a large part of the alignment runs through a tunnel.

D.2.7. Air

Construction and operation of the road Stobreč – Omiš will result in diversion of large portion of traffic from the existing D8 road to the newly constructed one. This will lead to some improvements of the air quality in the area. But the air quality at higher altitudes, where the road is planned to be constructed, will be deteriorated. Still, the foreseen number of vehicles that will run the road will probably cause,

according to calculations, concentration of pollutants which are below values permitted by the Regulations on Recommended and Threshold Values for Air Quality. According to the provisions of the Law on Air Protection (Official Gazette 48/95), the air quality in the project area will not change therefore, the project impact on air quality may be rated as acceptable.

D.2.8. Cultural and Historical Heritage

1. TTTS Intersection at Stobreč (Chainage 0+100.00)

The alignment runs across the northern part of the locality; since this is a necropolis, no route diversion is necessary.

2. Pituntium (Chainage 5+200 to 6+200)

The alignment does not run directly across this dispersed settlement but an overlap with an appertaining structure is possible.

3. Ancient Neraste (Chainage 10+900 to 11+400)
The alignment does not run directly across this dispersed settlement but an overalap with an appertaining structure is possible.

4. Boundary wall between Narestin and Onastin (Chainage 11+450)

The alignment willrun through the boundary wall and therefore a small segment of the wall will be destroyed.

5. Starigrad (Chainage 17+800, at tunnel centre line)

The fortress is located within the direct road impact zone and the tunnel runs under the fortress. Therefore, the tunnelling methods to be used in the entire stretch of the tunnel running above the town of Omiš must be appropriate in order to prevent any damage to Starigrad fortress or the old core of Omiš, which may be caused by blasting and operation of heavy machinery.
6. Old core of the town of Šibenik (Chainage 17+700, 350 m to the right from the centre line of the road)

The protected old core of Omiš is located within the indirect impact zone. A complex of walls, with the dominating Romanesque fortress of Peovica, is located on the rocky slopes above the town of Omiš. Vibrations caused by tunnelling and heavy machinery operation may seriously damage the fortress and the town because the tunnel alignment is placed in close vicinity.

7. Oneum (Chainage 17+900 to 18+450)

The alternative 1, in which the construction is proposed at the chainage near the village of Baučići, is not possible since it runs through the heart of the ancient Oneum which might lead to the devastation of the most important part of the town. The alternative 2, in which the construction of the tunnel under the locality is proposed, is entirely acceptable.

D.2.9. Water

Transportation routes generally represent permanent and active source of environmental pollution and, to a lesser extent, the pollution of underground, surface waters and coastal sea. Condensation of car exhaust fumes as well as trickling of oil on the road surface creates a layer of “concentrated” pollutants which mainly consist of hydrocarbon, phenol, heavy metals and various sulphuric and nitric compounds. In rainy season, considerable quantities of precipitation waters are collected on the road surface which dissolve and mobilize the pollutant layers.. Besides that, roads also represent potential sources of pollution, as the result of the spillage of larger quantities of oil, oil derivatives and other various toxic liquids transported by tank trucks. Accordingly, runoff should be considered polluted fluid to be collected in grease traps (oil separators) at the lowest hypsometric level of the longitudinal road section before being discharged into environment. After mechanical separation of oil fractions in grease separators, the water is discharged into the environment. Presently, little is known on the

degree of pollution of such water, however, it may be assumed that the quality of such waters does not allow their discharge into environment being it permeable karst or impermeable flysch terrain. This fact should be clarified through appropriate monitoring of quality of water discharged from grease traps, which will lead to identification of environmental risks caused by discharge of such water into the environment. Such a survey and its findings on actual condition of road runoff quality will facilitate selection of appropriate solutions for efficient environmental protection. The proposed alignment runs outside the water protection area and is located in its entirety within the flysch springs and coastal sea drainage basin, and it has been assessed that it will not have impact on the quality of potable underground waters. However, it is our opinion that there is the risk of pollution infiltration to underground layers (and, consequently, the pollution of the lower stream of the river Cetina) running through Omiš hinterland. At the other alignment sections, there is possibility of pollution of surface watercourses of Žrnovnica, Grljevački potok and other streams and, through them, the pollution of the coastal sea. There are no active potable water well areas within the drainage basin. Water supply of the entire area comes partly from Žrnovnica spring and, to a larger extent, from Cetina stream feeding water supply systems of Omiš and islands of Brač and Hvar. Water intake is in the hydrological and technical tunnel of Zakučac hydropower plant as well as within Kraljevac hydropower plant. These water supply systems are not located within the probable impact of the structure. Accordingly, the road and the engineering structures should be designed, constructed and maintained so as to preserve as much as possible class I quality of surface and underground waters, as well as the coastal sea and the environment in general.

D.2.10. Noise

The increase of noise levels in the vicinity of the road adverse impacts of the motorway construction. The impact is present both during construction and operation phases. During the construction phase, the noise is made by construction machinery and blasting, while during operation phase the noise is generated by the motorway traffic. The impact of noise during construction is temporary and limited to several months while the noise generated by the motorway traffic is permanent and continuous (24 hours per day).

In distinction from the noise during construction which is generally difficult to foresee because it depends on applied technologies, it is possible to calculate the noise generated during operation with great accuracy. Noise generated by the motorway depends on the volumes and composition of traffic and technical characteristics of the road.

According to the Regulations on Acceptable Level of Noise in Human Living and Working Environment (Official Gazette 37/90, page 840, Table 3, Zone 4), maximum allowed noise level is 50 dB during night and 65 dB during day. Because the permitted values for the night period are higher, these values were used in estimates.
Zones with the noise levels above the permitted 50 dB were estimated. At Stobreč – Dugi Rat section, the belt is 175 m wide and at Drugi Rat – Omiš section it is 130 m wide. According to all of the above, and subject to population density within the project area, it has been concluded that noise barriers/walls should be installed at the following chainages (approximately).

Section: Stobreč – Omiš

| Location | Chainage | Side | Distance | Type of protection |
|---|---|---|---|---|
| 1 – a viaduct | 1+000 | left | 30 | wall |
| 2 – a viaduct | 1+000 | right | 30 | wall |
| 3 – a group | 1+750-2+000 | right | 120 | wall |
| 4 – single | 2+170 | right | 86 | wall |
| 5 - single | 2+170 | left | 195 | wall |
| 6 - single | 3+000 | right | 85 | wall |
| 7 - single | 3+450 | right | 60 | wall |
| 8 – a group of structures | 3+150-3+400 | left | 55 | wall |
| 9 - single | 4+220 | right | 71 | wall |
| 10 - single | 4+540 | right | 78 | wall |
| 11 - single | 5+300 | right | 40 | wall |
| 12 - single | 6+050 | right | 92 | wall |
| 13- a group of structures | 6 + 300 | right | 54 | wall |

| Location | Chainage | Side | Distance | Type of protection |
|---|---|---|---|---|
| 14 - single | 6 + 400 | left | 85 | wall |
| 15 - single | 8 + 350 | right | 85 | wall |
| 16 – a group | 8+840 – 10+000 | left | 75 | wall |
| 17 – a group | 9+620 – 9+950 | right | 96 | wall |
| 18 - single | 11+385 | right | 109 | wall |
| 19 - single | 11+750 | left | 109 | wall |
| 20 – a group | 13+900 -14+285 | right | 116 | wall |
| 21 – single | 14+645 | right | 90 | wall |
| 22 – a group | 15+000 – 15+550 | right | 70 | wall |
| 23 - a group | 17+950 – 18+700 | right | 40 | wall |
| 24 – a group | 18+000 – 18+900 | left | 60 | wall |
| 25 – a group | 19+000 | right | 60 | wall |
| 26 – a group | 19+600 – 19+850 | left | 50 | wall |
| 27 - single | 20+100 | left | 95 | wall |

D.3. ENVIRONMENTAL MITIGATION MEASURES

D.3.1. General mitigation measures

Mitigation Measures during Project Development

1. Surfaces required for site organization (temporary disposal of building and waste material, parking area and area for machine manoeuvring, fuel reloading area) shall be designed within traffic route corridors so as to minimize negative environmental impact and damages to the surface. Therefore, already existing degraded surfaces should be used instead of creating new areas within the limits of the existing vegetation.

Mitigation Measures during Construction

1. Restrict the movement of heavy machines during construction, or use the existing road network, which shall be repaired after the completion of construction work. Design new access roads across natural vegetation cover only when there are no other solutions, and in cooperation with responsible forest management authority.
2. Classify and dispose municipal and hazardous waste in compliance with regulations, or prohibit any temporary or permanent disposal of waste material at surrounding soil.
3. All excavated material which shall not be reused for construction purposes shall be stockpiled at special locations.

D.3.2. Mitigation Measures for Soil and Agriculture

Mitigation Measures during Project Development

1. For the alignment section running across agricultural land, foresee drainage system t for removal of precipitation water (runoff) out of the agricultural area and discharge into the ground, while taking erosion prevention measures, if allowed by water protection requirements.

Mitigation Measures during Construction

1. Preserve agricultural areas in the vicinity of the road route much as possible.
2. Prevent unnecessary damage to trees, crowns and roots of sweet cherry and sweet chestnut trees and other ligneous plants which are parts of natural vegetation cover.
3. During earthworks, stockpile top soil separately and prevent from pollution; use later to cover slopes and central reservation or for other purposes in compliance with regulations.
4. After completion of works, restore all surfaces damaged by construction activities to their original condition or develop in compliance with landscaping design.

D.3.3. Mitigation Measures for Forests and Forestry

Mitigation Measures during Project Development

1. In detailed design foresee erosion control in slopes along the alignment, particularly around cuts, tunnel portals, viaduct approach roads, with the aim to prevent uprooting of trees near cuts and landslides.

Mitigation Measures during Construction

1. During construction, avoid damaging trees on the edge and their roots by careful execution of works and in compliance with stipulated measures and construction procedures.
2. Immediately after cutting of the route, establish and maintain forest order, i.e. remove tree-stumps and cut and transport all wood. Keep in mind to cut down all damaged and broken trees, to prevent spreading of any plant disease which may occur in such trees.
3. Particularly pay attention to handling highly inflammable materials and open flame during construction. Comply with all regulations and procedures for forest fire prevention.

Mitigation Measures during Operation

1. Regular implementation of forest fire protection measures.

D.3.4. Mitigation Measures for Flora

Mitigation Measures during Designing and Project Development

1. Use and adapt the existing approach roads as much as possible; design new roads by clearing natural vegetation only if unavoidable. This particularly applies to pine forests (particularly the one at approx. chainage 17+000 km and further on).

Mitigation Measures during Construction

1. When tunnelling, pay particular attention to the execution of exit portals above the river Cetina in order to prevent the destruction of habitats of some plant species endemic to Croatia.
2. During the works prevent caving in of the material at the foot of the portal. Remove any eroded material and prevent any piling up of such material at sensitive habitats along the river.

D.3.5. Mitigation Measures for Fauna

Mitigation Measures during Project Development

1. Before the commencement of works, develop the strategy for the protection of underground habitats to be applied at the moment when such habitats are found during tunnelling.

Mitigation Measures during Construction

1. Bio speleological supervision during tunnelling is mandatory
2. In case of coming across underground sites (caves), the team of biospeleologists shall identify the status of the locality and define its value as well as the required mitigation measures for underground wildlife and habitats.
3. Provide for permanent monitoring of the status of underground wildlife and habitats discovered during tunnelling (those which are considered important by biospeleologists).
4. All excavated material which shall not be reused for construction purposes, shall be stockpiled at locations foreseen for that purpose and where the environmental impact was examined.

D.3.6. Mitigation Measures for Wildlife and Hunting

Mitigation Measures during Project Development

1. Preserve the wildlife movement corridors since the fragmentation of habitats results in isolation of some population and an increase in the number of animals killed when trying to cross the road, particularly during the night.

Mitigation Measures during Construction

1. Provide for impermeable waste containers.
2. In cooperation with expert hunting authorities, wildlife movement corridors and crossings shall be identified and marked with traffic signs. All measures shall be taken to prevent damage that may arise from wildlife/vehicle collisions.
3. Establish directions and corridors for the movement of people and vehicles to protect the area from uncontrolled entries and movements across the hunting grounds.
4. In cooperation with hunting authorities, move the existing hunting facilities (high shooting stands, feeding places) to other location or replace with new ones.

Mitigation Measures during Operation

1. The road maintenance service is required to record all occurrences of roadkill in order to take additional mitigation measures on time, and prevent future damage from wildlife/vehicle collisions.
2. If the records show that the roadkill is frequent, take additional measures to prevent this by installing roadside wildlife reflectors which serve to deter the game from the road corridor.

D.3.7. Mitigation Measures for Landscape

Mitigation Measures during Designing and Project Development

1. Define the structure type for the bridge across the river Cetina in further design development , in cooperation with other experts in natural, cultural and historical sites (architects, landscape architects). Higher vertical alignment and lighter bridge structure are recommended in order to diminish its visual impact on the view of the canyon.
2. During further design development for the alignment and all approach roads, make alignment corrections, if possible, and in places where the corrections would result in keeping the integrity of agricultural land or diminishing the visual exposure of the route.
3. In the landscaping design of surfaces adjacent to the road, the original purpose and visual aspects of the land shall be taken into account. This includes preservation of as olive groves on terraces in the vicinity.
4. All embankments, cuts and tunnel portals shall be designed in natural materials, using stone or plants (use native plants or those typical for a location).

Mitigation Measures during Construction

1. Avoid additional disturbance and demolishing of terrace structures and local roads by locating the construction site only on one side of the road.
2. All temporary occupied surfaces (site location and approach roads) shall be restored to original condition or repaired according to the landscaping design.

D.3.8. Mitigation Measures for Archaeological and Cultural Heritage

After road staking out, it is necessary to check once more the entire alignment and perform minor exploratory probe surveying with the purpose of detecting archaeological localities.

1. TTTS Intersection at Stobreč (Chainage 0+100.00)

It is necessary to perform archaeological exploration in the northern section of the intersection and check other parts by trial holes to establish whether there are any new localities within the intersection area.

2. Pituntium (Chainage 5+200 to 6+200)

Since this is a dispersed settlement, use exploratory probing to find structures or graves (trenches and probes 4x4 m) .

3. Ancient Neraste (Chainage 10+900 to 11+400)

Explore the alignment in the length of 600 m byexploratory probing. Expand and focus exploration at places where archaeological traces are found.

4. Boundary wall between Narestin and Onastin (Chainage 11+450)

Explore the wall and conserve and present the edges which shall remain after road construction.

5. Starigrad

Cracks may appear on the fortress due to tunnelling and blasting in the vicinity. The facility shall be under supervision during road construction. Should the cracks appear, static stability rehabilitation and repair of such cracks shall be executed at the expense of the Employer.

6. Old core of the town of Šibenik (Chainage 17+700, 350 m to the right from the centre line of the road)

The protected old core of Omiš is located within the indirect impact zone. Tunnelling through rocks under the town fortresses (Peovica, the Romanesque fortress), may cause vibration which with adverse impacts on the fortresses and the town. Therefore, special technology shall be applied for tunnelling works and operation of heavy machines in order to decrease adverse impacts. Possible cracks and damages to monuments and buildings in the old town core shall be repaired at the expense of the Employer. The protected old coreof the town of Omiš shall be under supervision during construction works.

7. Oneum (Chainage 17+900 to 18+450)

Alternative solution, which includes the construction of the tunnel below the ancient site Oneum, is the only acceptable solution from the point of view of protection of cultural monuments. The first solution is unacceptable because it will result in destruction of the ancient town core, and it includes only supervision of works.

D.3.9. Mitigation Measures for Noise

Structures located within the noise protection zone should be additionally protected from the emission from the road. Proposed mitigation measures are noise barriers placed as close to the source of noise– along the shoulder.
The barriers shall be made of materials which fit into the environment such as cut stone combined with transparent or concrete insertions, or wooden screens at places with vegetation.

Noise barriers on structures (viaducts and bridges) are generally made of UV resistant transparent material (polyacril).

D.3.10. Mitigation Measures for Water

As already stated, the area of the proposed route lies outside the water protection area and there are no active nor potentially usable potable water resources in the drainage basin. Therefore, protection criteria prescribed and regulated by the Regulations on Determination of Sanitary Measures Zone for Water Sources, published in Official Gazette no. 55, dated May 16, 2002, do not apply.

It is our opinion that in this case the criteria prescribed by the Law on Waters (Official Gazette no. 107/95) pursuant to Article 72 paragraph 2 on the adoption of the Regulations on Limit Values of Indicators, Hazardous and other Matters in Waste Waters, published in Official Gazette no. 40/99, as well as the Regulations on Amendments to the Regulations on Limit Values of Indicators, Hazardous and other Matters in Waste Waters (Official Gazette no. 6/01), should be applied in design and construction of structures.

The said Regulations, as well as amendments to the regulations, prescribe limit values of indicators and allowed concentration of hazardous and other matters in technological waste water, waste water from water treatment units before being discharged into natural collector, as well as methods for waste water testing.

It is our opinion that standards stipulated by said legislation and regulations should, among others, be used in design of runoff drainage system.

## D.4. ENVIRONMENTAL MITIGATION MONITORING PLAN

### D.4.1. Monitoring during Construction

Monitoring of Fauna

1. During tunnelling, a permanent bio-speleological supervision is required. If of underground objects are encountered during works, works shall be suspended to allow assessment of the site by a bio-speleogogist team, who will also determine special protection measures for animals and habitats. Also, it is necessary to provide for permanent monitoring of underground fauna and habitats which were encountered during tunnelling and subsequent operation of the tunnel.

### D.4.2. Monitoring during Operation, or during Traffic

Monitoring of Soil

1. It is necessary to control the concentration of heavy metals in the soil periodically (every third year). The control should at all events include sampling of surface layer at locations 25 m, 50 m and 1000 m away from road shoulder in order to identify possible pollution of surrounding soil on time. Top soil of cultivated land with crops should also be controlled for the content of heavy metals at the above mentioned road shoulder distances in order to identify possible expansion of pollution in the soil and vegetation along the traffic route and take appropriate mitigation measures.

Monitoring of Flora

1. Monitor the recovery of endemic plant habitats around tunnel portal on cliffs above the river Cetina during five years, and take additional mitigation measures, as appropriate.

Monitoring of Fauna and Wildlife

1. Monitor the frequency and places of roadkill occurrence. After one year of monitoring, it is necessary to analyse locations and classification of killed animals and introduce protection measures (installation of additional traffic signs to warn of animal crossing and other measures).