TECHNICAL GUIDELINES

ENVIRONMENTAL IMPACT ASSESSMENT IN ROAD SECTOR

PUBLIC ENTERPRISE"ROADS OF SERBIA"
BELGRADE

Belgrade, December 2011

INTRODUCTION

Environmental protection issues supported by relevant documents shall be considered constantly during the preparation of both planning and technical documentation in road sector so as planning and decision making processes may contribute to preservation and upgrading of environmental quality, i.e. sustainable development.

The technical instruction has been prepared so as the environmental assessment procedure may be efficiently recognized by competent authorities and to enable documentation referring to environmental impact assessment in road sector to be performed in terms of quality. The instruction herein is designed for all target groups of users, design engineers, investors and experts in charge of environmental study assessment.

For the purpose of preparation of the instruction herein, similar national and international experiences have been used while the entire process has been shown in the context of applicable standards, technical norms and legislation. The instruction includes complete review of legislations governing the environmental protection and road sector in the Republic of Serbia. Experts in charge of assessment of environmental issues shall be familiar with and adhere to the said legislation and standards. The instruction also contains schematic overviews of relation between the Law on Planning and Construction and the Environmental Protection Law. Their mutual incompliance has been also analyzed.

The technical instruction also defines guidelines and methodological approach to be applied in environmental assessment during construction/reconstruction of national roads. Algorithm structure of methodology used in preparation of planning and technical documentation has also been shown together with environmental impact assessment in road sector.

Technical instruction offers basic guidelines referring to process of preparation of planning documentation and report on strategical environmental assessment and detailed guidelines related to procedure of preparation of technical documentation (general and preliminary designs) and environmental assessments (environmental impact assessment analyses and studies). Scope and content of the EIA study has been additionally explained from the aspect of linear structure such as road and its impact to the environment. For certain environmental parameters and road sector indicators, adequate table for results entering is shown.

The Road Manager shall be responsible for environmental protection activities fully in accordance with environmental impact assessment results (general and technical protection measures and environmental monitoring program)).

1. LEGAL TITLE, PRINCIPLES AND METHODOLOGY FOR ENVIRONMENTAL IMPACT ASSESSMENT OF ROAD SECTOR

1.1. Legal title

Preparation of planning and technical documentation in the area of road sector and environmental impact assessment of roads is laid down by numerous regulations of the Republic of Serbia, which can be classified in two groups.

The group 1 refers to regulations for preparation of planning and technical documentation. The key law for preparation of planning and technical documentation is the Law on Planning and Construction ("Official Gazette of the RS", Nos. 72/09, 81/09-modif., 64/10 US and 24/11), which regulates, inter alia, scope and contents of spatial and urban plans and technical documentation.

Pursuant to the Law on Planning and Construction, Article 22, strategic environmental impact assessment is an integral part of urban plan for special-purpose area. The Article 46 stipulates that decision on preparation of planning document shall specifically include an obligation to make or not to make the strategic environmental impact assessment.

Depending on the structure type and characteristics, the previous works include environmental protection requirements (Article 112 of the Law).

The General design specifically includes data about: micro-location of the structure; general layout of the structure; technical and technological concept of the structure; way to provide infrastructure; possible variants of spatial and technical solutions in terms of fitting into environment; natural conditions; environmental impact assessment; engineering geological and geotechnical ground characteristics from the aspect of establishing the general concept and justifiability of construction of the structure; investigations for preliminary design preparation; protection of natural and immovable cultural assets; functionality and rationality of the design concept (Article 117 of the Law).

The Final design includes elaboration of measures for prevention and mitigation of negative environmental impacts defined in the Environmental Impact Assessment Study or in the Decision on non-making the environmental impact assessment issued by the relevant authority.

The group 2 of regulations includes environmental protection legislation. Environmental impact assessment of spatial and urban plans is laid down by the Law on Strategic Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/09 and 88/10) while environmental impact assessment of technical documentation is laid down by the Law on Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/04 and 36/09).

The Law on Strategic Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/09 and 88/10) lays down the conditions, methods and procedure for environmental impact assessment of certain plans and programs (hereinafter referred to as: strategic assessment) in order to ensure the environmental protection and improvement of sustainable development through integration of basic principles of environmental protection into the procedure of preparation and adoption of plans and programs.

The Law on Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/04 and 36/09) lays down the environmental impact assessment procedure, the contents of the Environmental Impact Assessment Study, the participation of authorities and organizations concerned, the public participation, transboundary exchange of information for projects that may have significant impact on the environment of another state, supervision and other issues of relevance to environmental impact assessment.

Schematic presentation of connection between the Law on Planning and Construction (planning and technical documentation) and the Environmental Protection Laws is shown on the Figure 1-1 below.

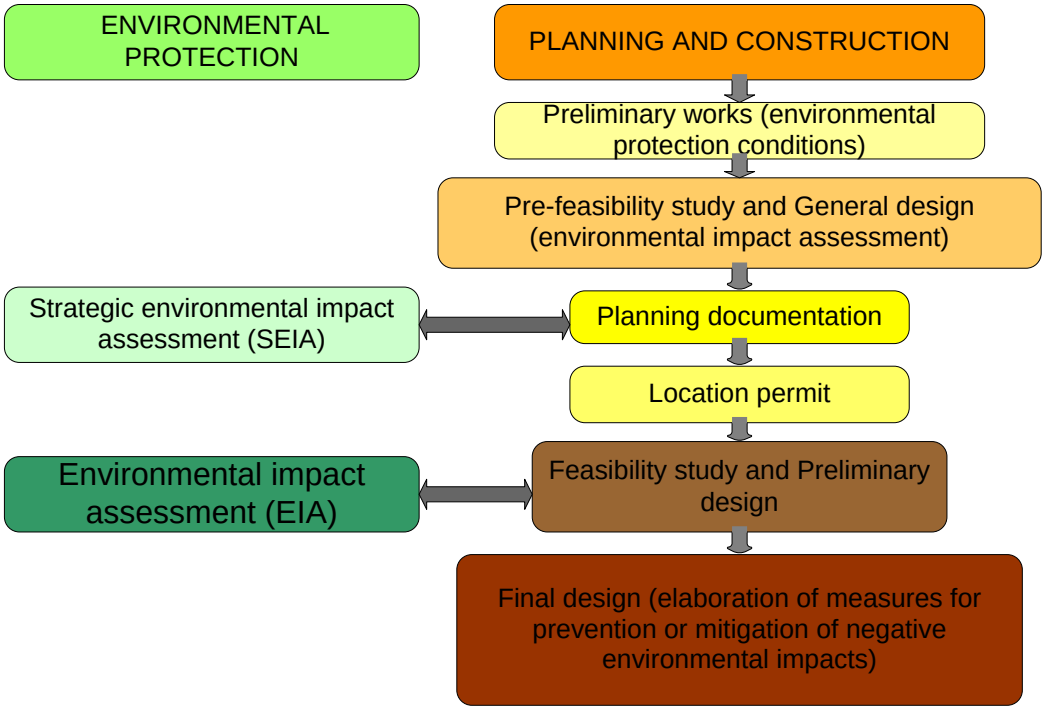

Figure 1-1 Schematic presentation of connection between the Law on Planning and Construction and the Environmental Protection Laws

List of laws and regulations in the area of environmental protection and road sector:

1. Environmental Protection Law ("Official Gazette of the RS", br. 135/04, 36/09),
2. Law on Strategic Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/09 and 88/10),
3. Law on Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/04 and 36/09 - amendments),
4. Law on Planning and Construction ("Official Gazette of the RS", Nos. 72/2009, 81/2009-modif., 64/2010 US and 24/2011);
5. Law on Public Roads ("Official Gazette of the RS", Nos. 101/05 and 123/07),
6. Law on ratification of convention on environmental impact assessment in a transboundary context („Official Gazette of the RS“, – International Convention, No. 102/07),
7. Law on air protection ("Official Gazette of the RS", No. 36/09),
8. Law on Environmental Noise ("Official Gazette of the RS", Nos. 36/09 and 88/10),
9. Law on Waste Management ("Official Gazette of the RS", Nos. 36/09 and 88/10),
10. Law on Waters ("Official Gazette of the RS", Nos. 46/91, 67/93, 53/93, 48/94, 54/96 and 101/05, Articles 81 through 96 and "Official Gazette of the RS", No. 30/10);
11. Law on Cultural Assets ("Official Gazette of the SRS", No. 71/94),
12. Law on Water Sources ("Official Gazette of the SRS", No. 27/77),
13. Law on Agricultural Land ("Official Gazette of the RS", Nos. 62/06, 65/08 and 42/09),
14. Law on Spatial Plan of the Republic of Serbia ("Official Gazette of the RS", No. 88/10),
15. Law on Forests ("Official Gazette of the RS", No. 30/10),
16. Law on ratification of convention on conservation of European wild flora and fauna and natural habitats ("Official Gazette of the RS", - International Convention, No. 102/07),
17. Law on transport of dangerous substances ("Official Gazette of the SFRY", Nos. 20/84, 27/90, 45/90, "Official Gazette of the FRY", Nos. 24/94, 28/96),
18. Law on transport of dangerous goods ("Official Gazette of the RS", No. 88/10),
19. Law on explosive materials, inflammable liquids and gases ("Official Gazette of the SRS", Nos. 44/77, 45/85, 18/89, "Official Gazette of the RS", Nos. 53/93, 67/93, 48/94),

20. Fire Protection Law ("Official Gazette of the SRS", br. 37/88, "Official Gazette of the RS", br. 53/93, 67/93, 48/94),
21. Law on Occupational Safety and Health ("Official Gazette of the RS", No. 101/2005),
22. Nature Protection Law ("Official Gazette of the RS", Nos. 36/09 and 88/10),
23. Law on National Parks ("Official Gazette of the RS", Nos. 39/93, 44/93, 53/93, 67/93, 48/94),
24. Public Procurement Law ("Official Gazette of the RS“, No. 116/08),
25. Rulebook on contents of the request for necessity of environmental impact assessment and contents of the request for defining the scope and content of EIA Study ("Official Gazette of the RS", No. 69/05),
26. Rulebook on contents of the Environmental Impact Assessment Study ("Official Gazette of the RS", No. 69/05),
27. Rulebook on public insight, presentation and public discussion about the EIA Study ("Official Gazette of the RS", No. 69/05),
28. Rulebook on work of technical committee for environmental impact assessment study ("Official Gazette of the RS", No. 69/05),
29. Rulebook on contents, appearance and method of keeping the public book of implemented procedures and taken decisions on environmental impact assessment ("Official Gazette of the RS", No. 69/05),
30. Rulebook on the register of natural resources ("Official Gazette of the RS", No. 30/92),
31. Rulebook on protection of strictly protected wild plants, animals and mushrooms ("Official Gazette of the RS", No. 5/10),
32. Rulebook on categorization of protected natural resources ("Official Gazette of the RS", No. 30/92),
33. Rulebook on acoustic zone methodology ("Official Gazette of the RS", No. 72/10),
34. Rulebook on methods for measurement of noise, contents and scope of noise measurement report ("Official Gazette of the RS", No. 72/10),
35. Rulebook on construction work safety ("Official Gazette of the RS", No. 53/97),
36. Rulebook on safety measures and standards for work in noisy rooms ("Official Gazette of the SFRY", No. 21/92),
37. Rulebook on waste categories, testing and classification ("Official Gazette of the RS", No. 56/10),
38. Rulebook on conditions and methods for collection, transport, storing and treatment of waste used as secondary raw material or for production of energy ("Official Gazette of the RS", No. 98/10),
39. Rulebook on methods for storing, packaging and labeling of hazardous waste ("Official Gazette of the RS", No. 92/10),
40. Rulebook on method and minimum number of tests of waste water quality ("Official Gazette of the RS", br. 47/83, 13/84),
41. Rulebook on hazardous matters in waters ("Official Gazette of the SRS", No. 31/82)
42. Rulebook on method for defining and maintaining sanitary zones around water supply structures ("Official Gazette of the RS", br. 92/08),
43. Rulebook on limit values, immission measurement methods, criteria for establishing the measurement points, data recording ("Official Gazette of the RS", Nos. 54/92, 30/99, 19/06),
44. Rulebook on contents of air quality plans ("Official Gazette of the RS", No. 21/10),
45. Rulebook on allowable quantities of dangerous and hazardous matters in soil and irrigation water and methods for their testing ("Official Gazette of the RS", No. 23/94),
46. Rulebook on fuel transport ("Official Gazette of the SFRY", No. 26/85);
47. Rulebook on contents of the Policy for prevention of accidents and methodology for preparation and contents of the Safety Report and Plan for protection against accidents ("Official Gazette of the RS", No. 41/10),
48. Rulebook on contents of the report on establishment of construction site ("Official Gazette of the RS", No. 31/92),
49. Rulebook on construction of plant for inflammable liquids and on inflammable liquid storing and pouring off ("Official Gazette of the SFRY", Nos. 20/71 and 23/71),

50. Rulebook on construction of fueling stations for motor vehicles and on fuel storing and pouring off ("Official Gazette of the SFRY", No. 27/71),
51. Rulebook on conditions, method and process of waste oil management ("Official Gazette of the RS", No. 71/10),
52. Rulebook on special technical and technological solutions enabling unobstructed and safe communication of wild animals ("Official Gazette of the RS", No. 72/10),
53. Decree on establishing the list of projects which require environmental impact assessment and list of projects which may require environmental impact assessment ("Official Gazette of the RS", No. 114/08),
54. Decree on protection of natural rarities ("Official Gazette of the RS", Nos. 50/93, 93/93),
55. Decree on noise indicators, limit values, method for assessment of noise indicators, disturbance and harmful environmental impact of noise ("Official Gazette of the RS", No. 75/10)
56. Decree on monitoring conditions and air quality requirements ("Official Gazette of the RS", Nos. 11/10 and 75/10),
57. Decree on limit values of air pollutants emission ("Official Gazette of the RS", No. 71/10).
58. Decree on program for systematic monitoring of soil quality, risk assessment indicators of soil degradation and methodology for preparation of remedial programs, ("Official Gazette of the RS", No. 88/10),
59. Decree on watercourse categorization ("Official Gazette of the RS", No. 5/68).
60. Decree on road and railway transport of hazardous matters ("Official Gazette of the RS", No. 53/02),
61. Decree on organization and training of civil defense units and on measures for protection and rescue of civilian population and real assets ("Official Gazette of the FRY", No. 54/94).

1.2. Principles and methodology for environmental impact assessment of road sector

Environmental protection aspect shall be considered in all phases of preparation of planning and technical documentation in the area of road sector to ensure that planning and decision-making process is aimed at environmental protection and improvement of its quality and/or sustainable development. Thanks to such approach, requests for technical protection measures and/or investment costs are reduced and problems that Employer and Designer may encounter in the next phase of documentation preparation are minimized.

In order to achieve the above-mentioned objectives, a process of road design and environmental impact assessment must be two comparative processes harmonized at all levels with explicit hierarchical structure and defined sequence of data interchange. The stated facts unambiguously show that a single methodological base with clearly defined steps for analysis of environmental protection issues shall be established.

A need for uniform methodological steps in the study of environmental protection issues originates from the necessity to fulfill main principles of compatibility, harmonization of analysis levels, hierarchical structure and successive information interchange.

Importance of compatibility principle of road design process and environmental impact assessment process is primarily related to making possible use of both process results as information in wide domains of both areas.

Need for harmonization of analysis levels is also a significant fact in terms of approach width, detail level of the existing and produced information. All analyses and conclusions must be at same detail level since only they are relevant for taking well-documented decisions and can be a starting base for further steps.

Hierarchical structure of methodological steps in documentation preparation is a starting base for proper methodological approach thus enabling adherence to defined sequence of steps and creation of base for decision making. All conclusions of the preceding phase represent obligation and starting base for each further step.
A need for uniform sequence of data interchange between the planning documentation preparation process, design process and environmental impact assessment process is conditioned by a fact that results of one process are input of the other process and vice versa. It shall be pointed out that the sequence is not arbitrary - it strictly follows the logic of both analyses and reciprocal effects.

Having in mind global nature of environmental protection issues, the basic methodological steps are defined in broader context. This context includes a spatial planning process which integrates specific planning processes which are characteristic for the road in terms of its functional requirements and specific consequences (spatial plan of special-purpose area, detailed regulation plan). A design process is defined through usual methodological steps and investment documentation preparation steps (pre-feasibility study and feasibility study).

Algorithm structure of methodological steps for preparation of planning and technical documentation and environmental impact assessment of road sector are shown on the Figure 1-2.

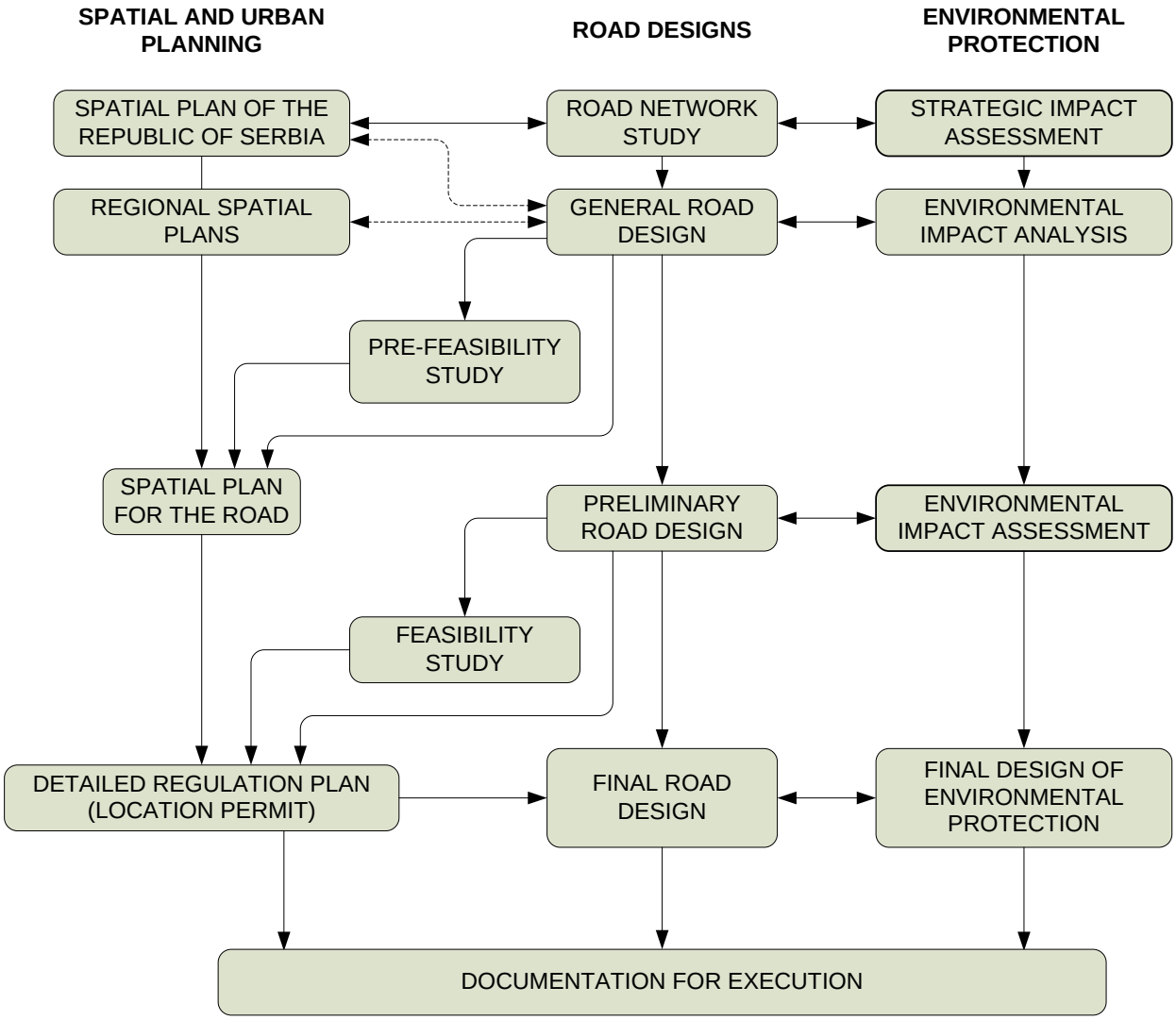

Figure 1-2. Algorithm of methodological steps for environmental impact assessment of road sector

2 ENVIRONMENTAL IMPACT ASSESSMENT IN THE RELEVANT PHASES OF ROAD LIFE CYCLE

2.1. Strategic environmental impact assessment

The strategic environmental assessment (SEA) shall be carried out for the plans, programs and strategies in the fields of spatial and urban planning or land use, agriculture, forestry, fishing industry, hunting, energy, industry, **transport,** waste management, water management, telecommunications, tourism, preservation of natural habitats and wild flora and fauna, which set the frameworks for approval of future development projects defined by regulations governing the environmental impact assessment.

Environmental impact assessment in the Republic of Serbia is laid down by the Law on Environmental Impact Assessment which prescribes conditions, methods and procedure for environmental impact assessment of certain strategies, plans and programs in order to provide for the environmental protection and improvement of sustainable development through integration of basic principles of environmental protection into the procedure of preparation and adoption of plans and programs.

SEA process consists of three phases:

1) Preparation phase includes:
   - Making decision to carry out strategic assessment;
   - Selection of the strategic assessment developer;
   - Participation of authorities and organization concerned.
2) Strategic assessment report,
3) Decision-making process which includes:
   - Participation of authorities and organization concerned;
   - Public participation;
   - Report on results of participation of authorities, organizations and public concerned;
   - Evaluation of strategic assessment report;
   - Approval of the strategic assessment report.

The strategic assessment report is the document that describes, evaluates and assesses the potential significant environmental impacts, which could result from implementation of the plan. It shall also define measures for prevention or mitigation of adverse environmental impacts. The main contents of the report (laid down by the Law on SEA, Article 12) are:

- Starting bases
  - Objectives and contents of the plan
    - Objectives of Spatial plan preparation
    - Spatial plan contents
    - Relationship with other plans and programs
  - Review of the current environment state and quality in the area covered by the report,
  - Characteristics of environmental areas that could be exposed to the impact,
  - Considered environmental protection issues and problems which were included in the plan and program and presentation of reasons for exclusion of certain issues and problems from assessment process,
  - Presentation of prepared variants related to environmental protection in the plan and program, including a variant dealing with non-realization of the plan and program and a variant dealing with the environmental protection,
  - Results of previous consultations with authorities and organizations concerned are important in terms of objectives and evaluation of possible strategic assessment effects.
- General and special objectives and choice of indicators
  - General objectives,
  - Special objectives,
  - Choice of indicators.
- Assessment of possible impacts and description of measures for mitigation of environmental impacts
  - Assessment of possible impacts,
  - Guidelines for environmental impacts.
- Guidelines for environmental impact assessment of projects and other strategic assessments.
- Environment monitoring program during realization of the plan and program
  - Environment monitoring indicators,
  - Rights and obligations of the relevant authorities,
  - Procedure for unexpected adverse impacts.

- Presentation of used methodology and difficulties in strategic assessment.
- Presentation of decision-making method, description of reasons crucial for choice of the relevant plan and program in terms of analyzed variants and presentation of method for integration of environmental issues into the plan and program.
- Conclusions reached during the preparation of strategic assessment report.
- Other data important for strategic assessment.

Description of activities in preparation of strategic impact report is shown on the Figure 2-1.

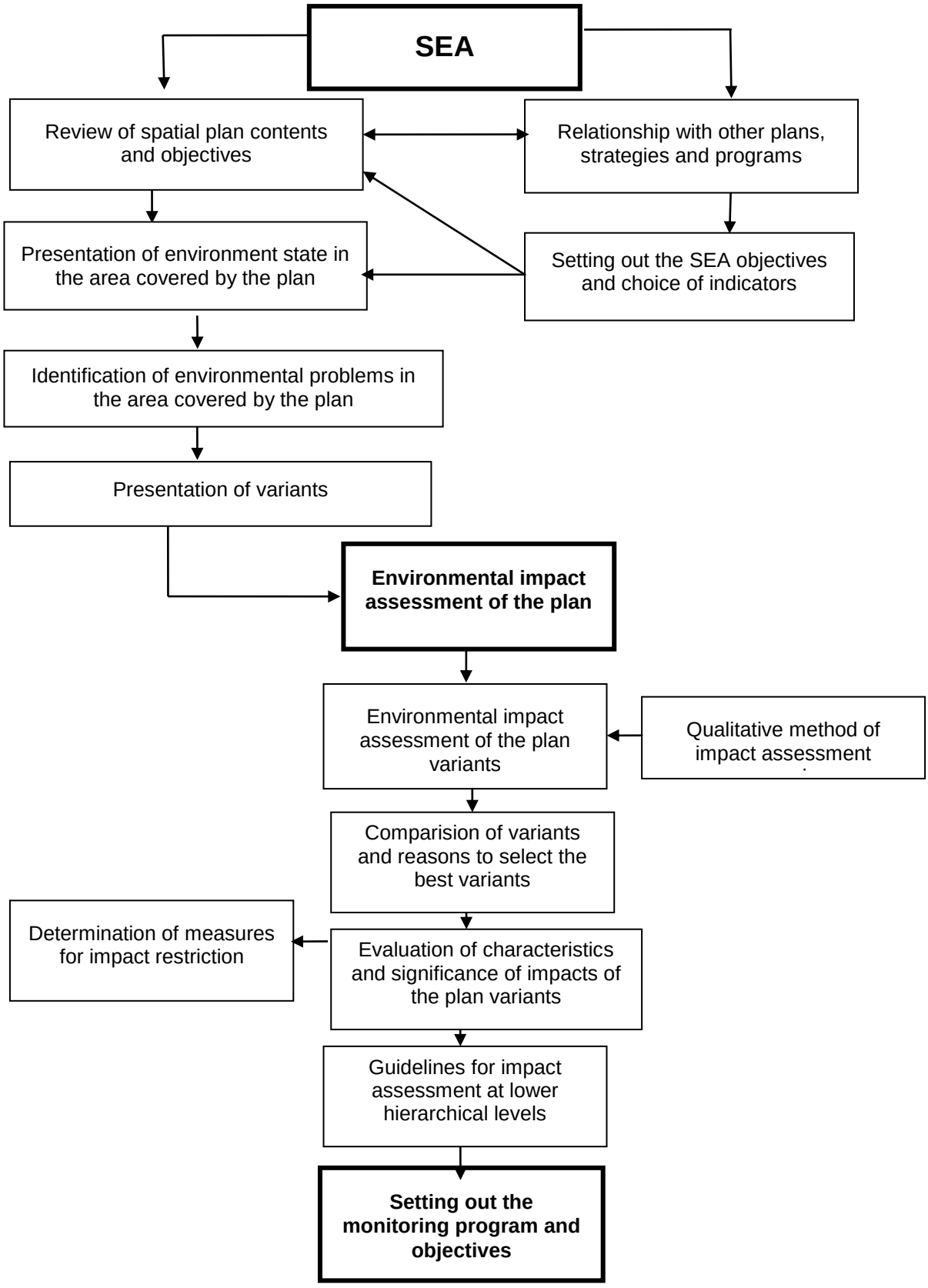

Figure 2-1 Diagram of activities for preparation of the Report on strategic environmental impact assessment

The Report on strategic assessment shall be delivered to the competent planning authority which will forward it to further procedure.

The competent planning authority shall send the strategic assessment report to the environmental protection authority, authorities and organizations concerned and request their opinion which shall be submitted within 30 days from the date of receipt of the request. Prior to sending a request to obtain the approval for the Report on strategic assessment, the competent planning authority shall engage

public for consideration of the Report on strategic assessment. The competent planning authority shall inform the public about the method and deadlines for insight into the content of the report and submission of opinions, as well as about the time and place of public debate. The public shall consider the report within the procedure of making the plans and programs available for public insight and during the public debate, as stipulated by the Law.

If the Law governing the plan adoption procedure does not provide for public insight and public debate, the competent planning authority shall order public insight and public debate by issuing the decision on plan adoption or the special decision.

The competent planning authority shall prepare the report on participation of authorities and organizations and the public concerned, which shall include all the opinions about the Report on SEA as well as the opinions given during the public insight and public debate on the plan. The competent planning authority shall submit the Report on SEA and the report on expert opinions and public debate to the environmental protection authority for evaluation. The evaluation shall be performed according to criteria specified in the Attachment II of the Law on SEA and based on that evaluation the competent environmental protection authority shall grant the approval within 30 days from the receipt of the request for evaluation. The competent planning authority cannot continue further procedure of plan adoption without having obtained the approval from the competent environmental protection authority for the Strategic assessment report.

Note: In case of plans important for the Republic (plans of infrastructure corridors, plans of special-purpose areas), the competent authority is the Republic Agency for Spatial Planning. In case of plans of local importance, the competent authority is local government (town or municipality).

2.2. Environmental impact analysis

2.2.1. Scope and contents of environmental impact analysis of road sector project

Within the preparation of technical documentation - general design of the road, the issues related to environmental protection shall be analyzed within the separate study documentation - Environmental impact assessment required by the Law on Planning and Construction, Rulebook on contents, scope and preparation method of pre-feasibility study for construction of structures and expert knowledge. Since the General design essence is selection of the optimum corridor, it is obvious that only this design level gives real chances for environmental protection.

The environmental impact analysis of the road is an integral part of technical and investment documentation (general design and pre-feasibility study). The environmental impact analysis shall be made according to the Employer's Terms of Reference which define: the relevant study objectives, legal title for study preparation, basic documents, methodological framework for study preparation, required analyses, a study presentation method, terms, choice of software tools and other conditions for study preparation.

Research schedule for the road - environmental protection relation must be synchronized with general design preparation schedule. A part of the most comprehensive analysis - preparation of topic maps of constraints - Protection zones and conditions shall precede the general design preparation and in fact it is a starting base for study preparation i.e. environmental impact analysis.

Topic maps of constraints - protection zones and conditions

Based on available documentation and investigations performed in the future road corridor, spatial constraints and protection conditions that shall be taken into consideration during road design are defined in terms of the environment and population protection. The structures, areas and complexes to be protected shall be identified and protection zones boundaries indicated on topic maps of constraints - "Protection zones and conditions":

- Urbanized and populated areas;
- Vulnerable buildings (sensitive/vulnerable buildings: child-care centers, schools, hospitals...);

- Legally protected structures and complexes (protected natural and cultural resources, denominational buildings and cemeteries);
- Water sources, water supply structures (wells, water intake structures, main pipelines and reservoirs with corresponding devices, potable water preparation plants,...) and structures for collection, channelizing and treatment of waste waters and water protection;
- Working zones (industry);
- Complexes of perennials (small forests, orchards and vineyards).

Noise suppression zone width around residential and vulnerable buildings shall be determined on the basis of forecast traffic load for the future road, noise level for different facilities prescribed by the law and other relevant parameters.

Sanitary protection zones and belts around water sources and water supply structures shall be determined according to documentation about water source yield type, structure type, water intake method, sanitary and technical development of the ground, soil structure, configuration, hydrogeological and other resources and Requirements of the relevant authorities and organizations (water-related requirements and requirements related to sanitary protection of water sources). The Rulebook on the method for determination and maintenance of sanitary protection zones around water sources precisely defines methods for determination and maintenance of area with water source which water quantity and quality is satisfactory for public water supply.

Legally protected zones of structures and complexes (protected natural and cultural resources, denominational buildings and cemeteries) are defined in accordance with the Requirements and opinions obtained from the relevant authorities and organizations (the relevant Institute for Nature Conservation and the relevant Institute for Protection of Cultural Monuments). Protection of special natural values also includes protection of characteristic representatives of particular ecosystems and outstanding biogeographic areas.

Graphic interpretation of topic maps - "Protection zones and conditions" shall be made in the basic scale of General design (1:25 000 (50 000, 10 000) with arrangement of sheets according to synthesis map. The table 2.2-1 shows the colors (AutoCAD Color Index (ACI)) indicating particular categories of environmental potentials (structures, areas, complexes and their protection zones) that should be taken into account in setting out the new road alignment. For easy reference, hatch can be Solid or ANSI31.

Table 2.2-1 Interpretation of topic maps –
colors of particular categories of environmental potentials

Environmental potential category	Color (AutoCAD Color Index (ACI))
Settlement	214
Vulnerable buildings	241
Protected natural resources	71 or 75
Archeological sites	20 or 10
Protected cultural resources	15 or 10
Denominational buildings and cemeteries	10 or red
Water sources	130
Water supply structures (wells, water intake structures...)	132
Structures for collection, channelizing and treatment of waste waters and water protection	242
Working zones (industry)	blue or 23
Forests	95 or 106
Orchards and vineyards	62 or 40
Protection zone	21

For easy reference and appraisal of environmental impacts of future road operation, the constraint zone shall be copied from the "Protection zones and conditions" map to transparent paper in the form of contour maps (suitability maps):

1. **Map of natural constraints -** shows protection zones and conditions: water sources, complexes of perennials (orchards and vineyards, small forests), protected natural resources and cultural monuments.
2. **Map of man-made constraints -** includes protection zones and conditions: settlements, vulnerable buildings, working zones, water supply structures, immobile cultural resources, archeological sites, denominational building locations and cemeteries.

The following three suitability categories were adopted on these contour maps:

- suitable areas (white) where the road can be located without any restriction;
- conditionally suitable areas (green) require implementation of technical protection measures, and
- unsuitable areas (red) represent spatial constraints under which road location is always intolerable from the environmental protection aspect.

Hatch in the form of dots is used for unsuitable areas of scale 10 and for conditionally suitable areas of scale 20.

Suitability of the area for setting out the road alignment depending on the above-mentioned contents is shown in the table 2.2-2.

Table 2.2- Suitability of the area depending on the contents

Spatially defined constraints	Conditionally suitable	Unsuitable
Settlements		
Protection zone around the settlements		
Vulnerable buildings		
Protection zone around the vulnerable buildings		
Working zone		
Protection zone around the working zones		
Water sources		
Protection zone around the water sources*		
Water supply structures		
Protection zone around the water supply structures		
Complexes of perennials (small forests, orchards and vineyards)		
Cultural resources		
Immobile cultural assets, denominational buildings and cemeteries		
Protection zone around the immobile cultural assets		
Archeological sites		

* Suitability of the area for setting out the road alignment in the sanitary protection zones and belts is defined according to the Requirements of the relevant authorities and organizations related to sanitary protection zones around the water sources and to the Rulebook on the method for determination and maintenance of the sanitary protection zones around the water supply sources.

Thanks to maps of constraints and suitabilities, setting out of road alignment was enabled with minimum environmental impacts. In addition, based on the defined suitabilities, the requirements for implementation of technical protection measures and/or investment costs can be reduced.

Environmental impact analysis of the road sector

In order to assess environmental impact of the relevant road it is necessary to analyze possible negative impacts both in road construction phase and in road operation phase and to propose measures for their prevention and elimination. All issues shall be analyzed in several wholes which include research bases, characteristics of structures, characteristics and evaluation of the current state, complex analysis of impacts in the studied corridor and environmental protection measures.

The research bases shall define all relevant factors of influence on the study research mainly related to the applicable legal provisions, spatial characteristics of the solution and research methodology. Based on the analysis of available planning documents for the studied area, the obligations imposed by them related to environmental protection and improvement shall be defined. Technical documentation prepared for the General design shall be used in elaboration of this study as information and documentary basis.

Based on the study and evaluation of the current state, the existing environmental potentials (air, water, soil, climate, flora and fauna) shall be analyzed in detail and the state assessed. The current state ("0" state) and quality of environment elements in the studied area shall be assessed according to available measurement results (Institute for Public Health, Environment Protection Agency and Republic Hydrometeorological Service of Serbia) or target measurements (noise level, air pollution, soil quality, surface and ground waters...).

Defined methodology shall be used to study issues related to noise, air pollution, contamination of surface and ground waters, soil contamination, occupancy of areas, flora and fauna, natural and cultural heritage within the environmental impact analysis of the future road. Since the future road alignment passes through the region of different development, population and protection levels (to be particularly taken into account), some segments shall be evaluated in detail from the environmental aspect. A special attention shall be paid to sanitary protection zones around the existing and potential potable water sources, protected natural and cultural resources and archeological sites located in the future road corridor. Taking into consideration the allowable values of some impacts, a comprehensive analysis shall be used to obtain relevant indicators characterizing environmental impacts of the future road. The relevant indicators for every analyzed criterion can be numerically quantified in detail only at higher analysis level which must include, among other things, a high-quality information basis in accordance with the higher design process as well as knowledge of absolute spatial relationships.

Specificity of evaluation of the future road corridor variants from the environmental aspect is reflected in the simplicity of the main objective expressed on the principle of minimum consequences. This task will be successfully performed only under condition that all real variants were compared by defined criteria (impacts) and the optimum one was chosen. There are several universal methods for evaluation of variants which are used in regular practice more or less successfully.

Based on all analyses of relevant impacts it can be generally concluded that corridors in the variants defined in the design have certain negative environmental impact. In the next design phase i.e. in the phase of Preliminary design preparation the noticed negative impacts shall be analyzed in detail and mitigation measures proposed. The relevant indicators for every analyzed criterion can be numerically quantified in detail only at higher analysis level which must include, among other things, high-quality information basis in accordance with the higher design process level as well as knowledge of absolute spatial relationships. Having in mind the above-mentioned and the applicable legislation, it can be concluded that environmental impact assessment shall be made during preparation of Preliminary design of road sector.

Graphic presentation of environmental impact assessment of the road sector is shown on the Figure 2-2.

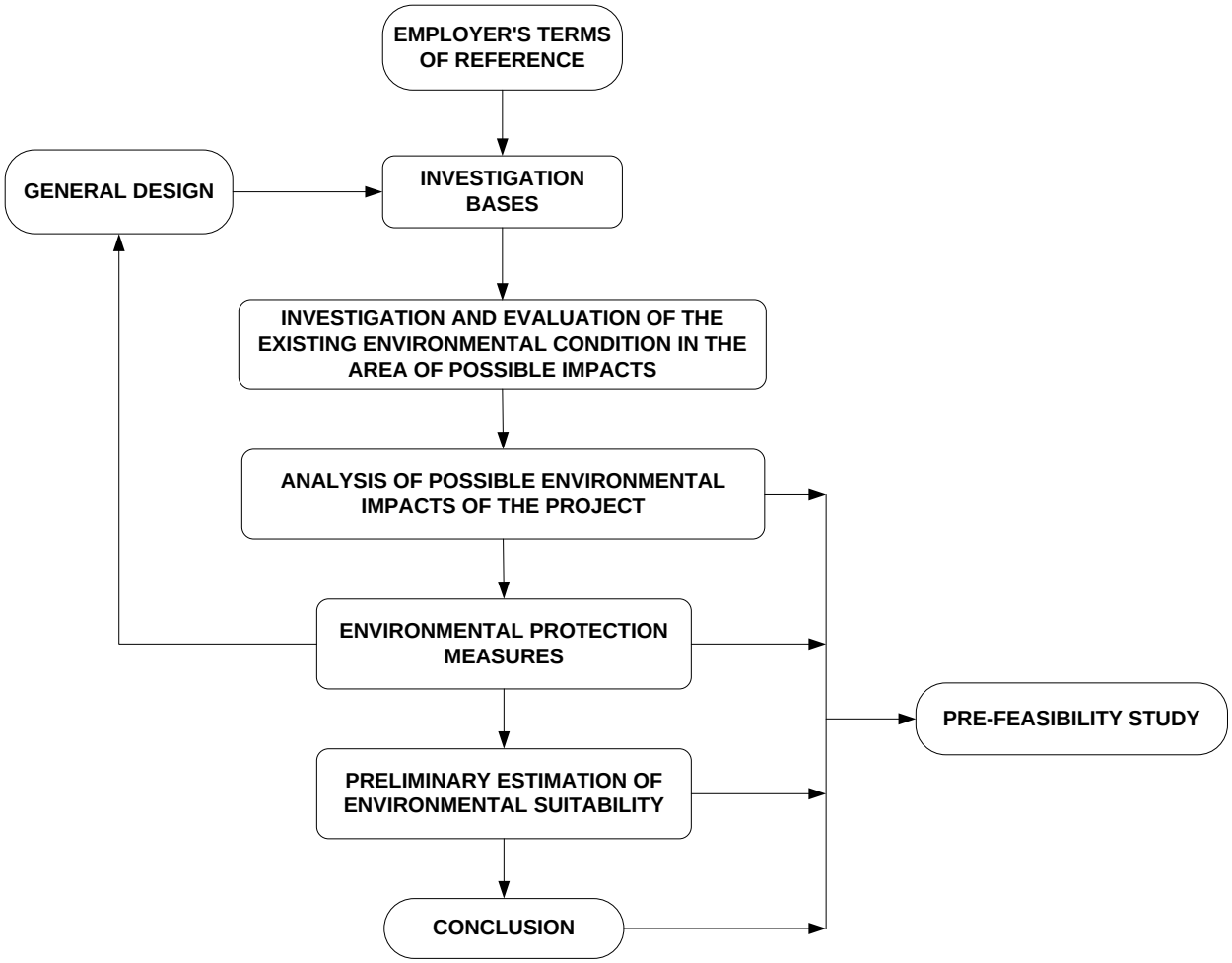

Figure 2-2 Graphic presentation of environmental impact assessment of the road sector

Table of contents for the Environmental impact analysis of the road (suggestion)

1.0. INTRODUCTION
2.0. RESEARCH BASES
- 2.1. Basic documents for study preparation
- 2.2. Initial program elements
  - 2.2.1. Spatial boundaries for investigation
  - 2.2.2. Characteristics and parameters of traffic flows
- 2.3. Legislation
- 2.4. Planning documents
- 2.5. Available technical documentation
- 2.6. Basic design documents and information basis
- 2.7. Spatial and structural road characteristics
  - 2.7.1. Cross sections
  - 2.7.2. Typical cross sections
  - 2.7.3. Limiting elements in plan and profile
  - 2.7.4. Geometric definition of variants
  - 2.7.5. Bridge structures
  - 2.7.6. Locations and concepts of interchanges (junctions)
  - 2.7.7. Locations and concepts of service facilities

3.0. STUDY AND EVALUATION OF THE CURRENT STATE
- 3.1. The existing environmental potentials (studied area)
- 3.2. Demographic characteristics

3.3. Flora and fauna
3.4. Geomorphological, geological, engineering geological and seismic characteristics
3.5. Hydrogeological characteristics
3.6. Soil characteristics in the region
3.7. Hydrographic, hydrological and climatic characteristics
3.8. Natural and cultural heritage
3.9. The existing impacts (noise, air pollution, water and soil contamination)

4.0. DESCRIPTION OF POSSIBLE IMPORTANT ENVIRONMENTAL IMPACTS

4.1. Traffic noise
4.2. Impact on air
4.3. Impact on surface and ground waters
4.4. Impact on soil contamination
4.5. Occupancy of areas
4.6. Impact on population
4.7. Flora and fauna
4.8. Microclimate
4.9. Vibrations
4.10. Natural and cultural heritage
4.11. Impact on landscaping characteristics
4.12. Possible accidents

5.0. ENVIRONMENTAL PROTECTION MEASURES

5.1. Noise suppression measures
5.2. Measures for air pollution prevention
5.3. Measures for prevention of soil, surface and ground water contamination
5.4. Measures for protection of flora and/or out forest cover
5.5. Flora protection measures
5.6. Measures for protection of cultural resources
5.7. Protection measures for accident situations

6.0. EVALUATION OF VARIANTS

6.1. Applied method characteristics
6.2. Variants, ruling criteria and relative weights
6.3. Results of calculations and analyses
6.4. Conclusion of evaluation of variants

7.0. CONCLUSIONS OF ENVIRONMENTAL IMPACT ANALYSIS
8.0. ATTACHMENT
9.0. LITERATURE

2.2.2 Environmental impact analysis of the road in the General design

Technical protection measures specified in the environmental impact analysis of the road (noise suppression structures, closed system of rainwater channelizing and treatment prior to discharge into a water receiving body, construction of passages/crossings for animals...) shall be implemented into general design and included into Priced Bill of Quantities.

2.2.3. Environmental impact analysis of the road in the Pre-feasibility study

Excerpt from the environmental impact analysis of the road is included in the Pre-feasibility study. ***The Rulebook on contents, scope and preparation method of pre-feasibility study and feasibility study for construction of structures*** *(Official Gazette of the Republic of Serbia, No. 80/05)* defines scope and contents of the environmental impact analysis excerpt. The excerpt must include the following data:

- relationship between the project and natural, cultural and historical resources;
- project impact on climate;
- project impact on surface and ground waters;
- project impact on noise generation and air pollution;
- impacts on flora and fauna;
- impacts on soil;

- preliminary evaluation of environmental suitability.

2.2.4. Verification of Environmental impact analysis of the road

After completion of environmental impact analysis (study) of the road, the managing expert shall authorize it by controlling its compliance with the terms of reference, legislation and professional standards (rules of the art) and shall verify it by his signature.

After authorization, the study shall be delivered to the Employer and/or Client. The Employer/Client shall deliver the study to the relevant reviewing committee for technical verification and based on it the report shall be prepared. Based on the report of the relevant committee, the Study may be accepted without any objection or the objections to the Design or the Study will be stated requiring subsequent reconsideration and amendments.

Based on performed technical verification, the reviewing committee's objections can refer to the Design or the Study. Regardless of objection type the following is required:

- Analysis of stated objections (which can be accepted or rejected with valid arguments);
- Amendments to the Study;
- Delivery of Study final version (amended) to the Employer/Client.

2.3. Environmental impact assessment

2.3.1. Process presentation and description

Environmental impact assessment is a preventive measure of environmental protection based on the request processing, the Study preparation, public consultations and analyses of alternative measures aimed at data collecting and foreseeing the harmful impacts of particular projects on the environment and human health, flora and fauna, soil, water, air, climate and landscape, material and cultural resources and the interactive effects of these factors, and at defining and proposing measures that may prevent, reduce or eliminate such harmful impacts having in mind the feasibility of these projects.

The Environmental Protection Law lays down the environmental impact assessment procedure, the contents of the Environmental impact assessment study, the participation of authorities and organizations concerned, the public participation, transboundary exchange of information for projects that may have significant impact on the environment of another state, supervision and other issues of relevance to environmental impact assessment.

The subject-matter of environmental impact assessment are planned projects and projects being implemented, changes in technology, reconstruction, capacity extension, suspension of operation and removal of projects that may have significant environmental impact as well as the projects implemented without the environmental impact assessment study and building permit or which are used without inspection permit.

The subject-matter of environmental impact assessment are also the projects in the fields of industry, mining, energy production, transport, tourism, agriculture, forestry, water management, waste management and utility services as well as for all projects that are planned in areas with protected natural resources and within the protected zones of immobile cultural assets.

The environmental impact assessment process for state road reconstruction and/or construction projects shall be initiated with the relevant institution by the project developer i.e. "Roads of Serbia" PE. If request submits some other person in behalf of the project developer, he shall have duly issued project developer's authorization with reference number, issuing date and signature of person authorized by the project developer.

When building permit is issued by the republic authority, the environmental impact assessment shall be made by the Ministry of Environmental Protection, Mining and Spatial Planning. When building permit is issued by the autonomous province authority, the environmental impact assessment shall be made by local government authority responsible for environmental

protection issues. The Ministry of Environmental Protection, Mining and Spatial Planning is responsible for all projects that can have transboundary impacts.

The environmental impact assessment of the road sector includes the following phases:
1) Making decision on the necessity for environmental impact assessment,
2) Defining scope and contents of the environmental impact assessment study,
3) Making decision on giving approval for the environmental impact assessment study.

The environmental impact assessment process shall be initiated by submission of REQUEST as follows:

1. **Request for making decision on the necessity for environmental impacts assessment** of regional road reconstruction and/or construction projects including the related structures except service facilities and/or projects included in the List of projects for which the environmental impact assessment may be requested– List II of the *Decree*[1]
2. **Request for defining scope and contents of the environmental impact assessment study** for projects of arterial roads, highways and roads with four or more traffic lanes or projects for reconstruction and/or enlargement of the existing road with two or less traffic lanes in order to make road with four or more traffic lanes in case that such new road or reconstructed/enlarged section has continuous length of 10 km or over including the related structures except service facilities of arterial road i.e. for the projects included in the List of projects which require environmental impact assessment – List I of the *Decree*[1] as well as for the projects included in the List II which, by decision of the relevant authority, require environmental impact assessment.

Scope and contents of the Request for making decision on the necessity for environmental impact assessment of the project and the Request for defining scope and contents of the environmental impact assessment study are defined by the Law on Environmental Impact Assessment and by the Rulebook on contents of the request for environmental impact assessment and contents of the request for defining scope and contents of the environmental impact assessment study. The Request for environmental impact assessment and the Request for defining scope and contents of the study on environmental impact assessment of the project shall be submitted on the prescribed form (Attachments 1 and 2).

Schematic presentation of environmental impact assessment process with terms for realization of particular activities laid down by the law is shown in the Figure 2-3.

[1] **Decree** on making the list of projects which require environmental impact assessment and list of projects which may require environmental impact assessment ("Official Gazette of the RS", No. 114/08)

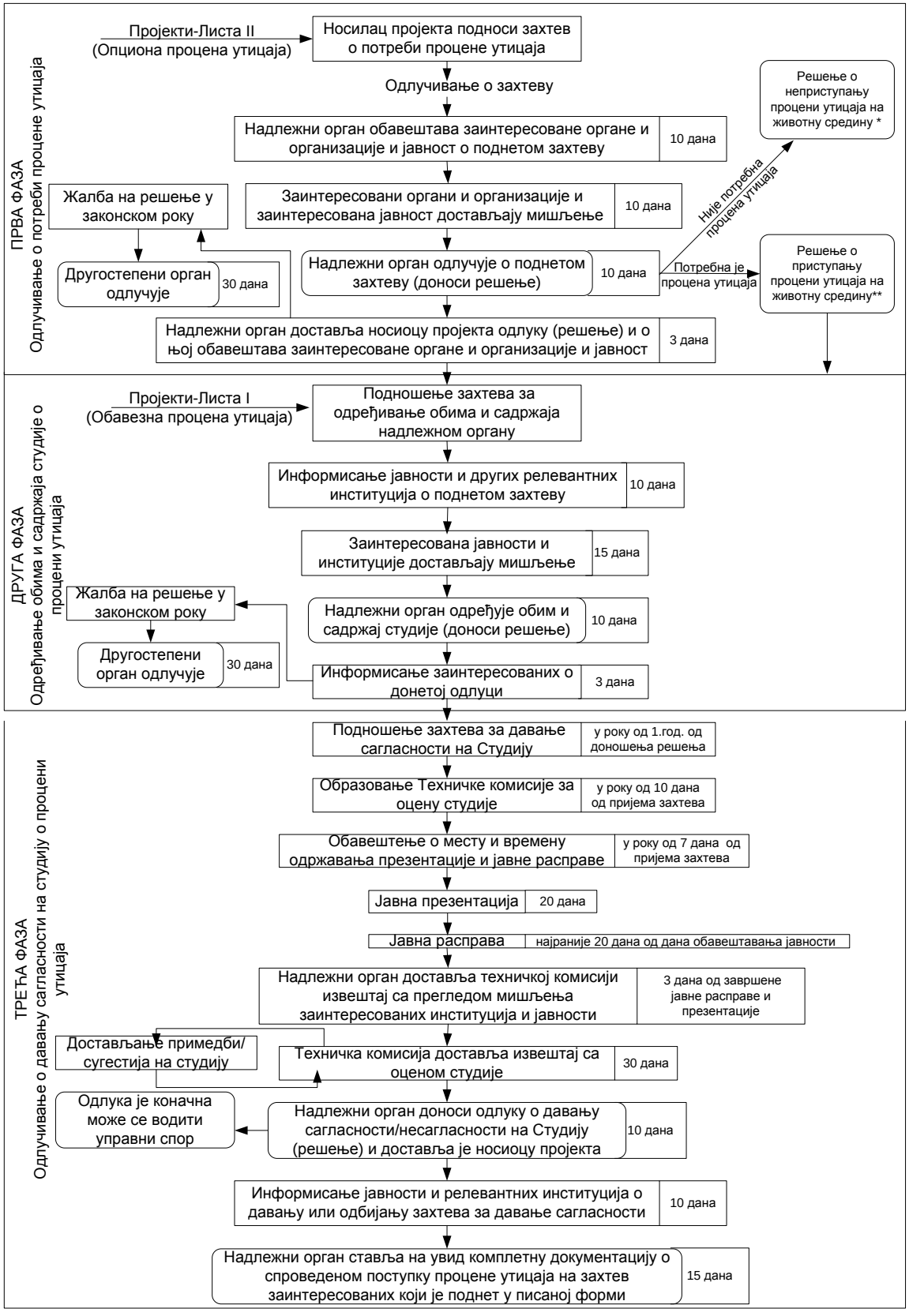

Figure 2-3. Schematic presentation of environmental impact assessment process with terms for realization of particular activities laid down by the law

Note:
* The relevant authority's decision stating that environmental impact assessment of the project is necessary can define scope and contents of the environmental impact assessment study.

** The relevant authority's decision stating that environmental impact assessment of the project is unnecessary can define minimum environmental protection requirements according to special regulations.

2.3.2. Contents of the environmental impact assessment study

Environmental impact assessment study is a document which analyzes and evaluates quality of environmental factors and their sensitivity within certain areas, the interactive effects of the existing and planned activities, foresees the direct and indirect harmful impacts of projects on environmental factors as well as measures and conditions for prevention, mitigation and elimination of harmful impacts on the environment and human health. The legal title is given in the Chapter 1.

The Rulebook on contents of environmental impact assessment study specifies the contents of environmental impact assessment study. The Decision on defining scope and contents of the study reached by the relevant authority responsible for environmental issues specifies in detail the contents of environmental impact assessment study.

The environmental impact assessment study shall contain:

1) Project developer data;
2) Description of location planned for project implementation;
3) Project description;
4) Description of main alternatives studied by the project developer;
5) Description of environment state at the location and less distant surrounding (micro and macro locations);
6) Description of possible significant environmental impacts of the project;
7) Environmental impact assessment in case of accident;
8) Description of measures envisaged to prevent, mitigate and eliminate any significant adverse environmental impact;
9) Environmental impact monitoring program;
10) Non-technical summary of data listed in points 2 - 9;
11) Data on technical deficiencies or lack of appropriate professional skills and knowledge or impossibility to obtain the relevant data.

The environmental impact assessment study shall also include main data on persons participating in its preparation and responsible person, preparation date, signature of responsible person stamped by the authorized organization which had prepared the study.

In preparation of the Environmental impact assessment study for the road sector, the appropriate solutions regarding its scope and contents were offered themselves.

Proposal for scope and contents of the Environmental impact assessment study for the road sector

1. PROJECT DEVELOPER DATA

This point shall include:

- Project developer name;
- Full name of responsible person (managing director);
- Headquarters and address of the project developer;
- Name of sector (organization unit);
- Full name of sector (organization unit) manager;
- Contact telephone number;
- Fax;
- E-mail.

2. DESCRIPTION OF LOCATION PLANNED FOR PROJECT IMPLEMENTATION

Purpose of this chapter is to provide documentary analysis of area the road will pass over. This study chapter shall give elements sufficient for environmental potential assessment.

This Study chapter shall include:

2.1. Cadastral plots (tabulated review of all cadastral plots by cadastral municipalities);

2.2. Occupancy of areas (data on needed land area in m^2 during works including description of physical characteristics and map in appropriate scale as well as the areas which will be included after project implementation);

2.3. Presentation of geomorphological, geological, hydrogeological and seismic characteristics of the soil

Soil characteristics must be analyzed having in mind that each intervention in the area, ground leveling, excavation, etc. irretrievably degrades surface ground layer. During construction works, regular road operation and accidents the soil can be contaminated thus becoming a source of air pollution and surface and ground water contamination. A significance of such approach is even higher if land in the studied corridor is used for agricultural production. The project impact assessment in these cases shall be based on imperiling the agricultural production where some emitted pollutants can enter the food chain and endanger the human health. From geomorphological (orographic) aspect, the authors of the Study shall analyze environmental factors such as: height above sea level, exposure of the ground to meteorological and other impacts, danger from erosion and sliding, etc. Hydrogeological characteristics also have important role in environmental impact assessment of the road sector. Generally, date of previous investigations such as geomechanical investigations or available data on wide area characteristics shall be used to outline hydrogeological characteristics. A similar situation is with obtaining and presenting information about soil seismicity.

2.4. Data on water supply source (distance, capacity and vulnerability of the sanitary protection zone)

In order to define possible negative impacts of the road on surface waters and/or their flow regime and quality, it is important to outline the most important watercourses which are included in the hydrographic network and located in the road alignment corridor. It is also necessary to make a list of watercourses and crossing points with the highway as well as main morphometric and hydrological characteristics. In addition to surface waters, the water supply sources and their sanitary protection zones that can be affected during road construction and operation shall be also identified. Considering that only small number of local watercourses and central water supply system in the Republic of Serbia have defined sanitary protection zones and requirements for behavior within them, for preparation of environmental impact assessment study the regulations governing this matter shall be applied, opinions and statements (does the road alignment run through sanitary protection zone?) provided by the water supply system management. If sufficient data are not available, the information shall be collected on the site.

2.5. Presentation of climatic characteristics and corresponding meteorological indicators

The main data for this item shall be obtained from the relevant institution, i.e. the Republic Hydrometeorological Service of Serbia. The following meteorological parameters are very important to asses the grouping of pollutants emitted in road construction and operation and accidents: air temperature, precipitation type and quantity, cloudiness, duration of solar insulation, fog, hail, thunder, air humidity and pressure, wind (annual and seasonal distribution of wind frequencies and speeds by directions).

2.6. Description of flora and fauna, natural resources (protected) of special value and endangered plant and animal species and their habitats and vegetation

Main data for this item shall be obtained from the Institute for Nature Conservation of Serbia depending on the project location. The Institute for Nature Conservation of Serbia defines conditions and measures for protection of nature and nature values in the process of preparation and implementation of spatial and urban plans, design documentation, baseline studies (related to forestry, hunting, fishing, water management, etc.), programs and strategies in all industries affecting the nature.

2.7. Review of main landscape characteristics

Landscape is specific quality of the environment and harmonized natural and man-made components. Road construction and operation affect and change natural wholes.

2.8. Review of immobile cultural assets

Main data for this item shall be obtained from the relevant institution i.e. from the Institute for Protection of Cultural Monuments which issues keeping, maintenance and use conditions and protection measures for immobile cultural assets located in the road corridor.

2.9. Data on population density and concentration and demographic characteristics in relation to structures and activities

The necessary information for this item shall be obtained from spatial and urban plans and from the Statistical Office of the Republic of Serbia.

2.10. Data on the existing industrial and residential buildings and infrastructure and related facilities

The most of these data shall be obtained by visiting the planned project site but information on the existing and planned infrastructure facilities and installations shall be officially obtained from the relevant utility companies.

3. PROJECT DESCRIPTION

Project description shall be very detailed to provide sufficient elements for environmental impact assessment to the authors.

3.1. Description of preliminary works on project construction

Contents of preliminary works are defined by other regulations. For road sector projects, in general it will be geodetic works and geomechanical investigations on the site.

3.2. Description of the structure and activities

This item shall include functional and technical characteristics of applied solutions, summary of technological process for road construction, volume and structure of traffic flow on the future road. Parameters which determine intensity of some environmental impacts of the newly designed road significantly depend on spatial and structural characteristics of the road and service facilities (rest areas, motels, gas stations and road maintenance bases). Spatial relations relevant to road alignment itself are defined by cross section, layout and leveling plans. The elements of these three projections and structures in the road base (bridges, interchanges) are important for all analyses involving road environmental impacts.

3.3. Energy and resources

This item shall include types and quantities of energy and power sources, raw materials and materials necessary for road construction and characteristics of propellants. The important indicators of possible environmental impacts of planned road are data on necessary resources for its construction. An impact of this parameter can be quantified by work scope and quantity of incorporated materials. The main data on necessary energy and resources for execution of key items are mostly related to required earth and pavement works and construction of service facilities. Key items for road construction shall be shown in tabulated form. Quantities of stripped topsoil and earth (excavation and installation) shall be stated as indicators of natural resources consumption.

3.4. Description of emissions

This item shall include types and quantities of gases, liquid and solid matters emitted by motor vehicles in regular traffic including its discharge into surface and ground waters, disposal to ground, emission of noise and vibrations.

3.5. Waste treatment technology

This item presents management method for waste produced in road construction phase and in subsequent phases as a result of regular operation and maintenance of road and land strip. If we take into consideration a fact that all investigations depend on design phase and design elaboration level implying an accuracy level of particular indicators, than within such analyses we must use the indicators which actually illustrate design concept characteristics. The waste produced in road construction works shall be handled by the Contractor in accordance with procedures defined in the Site

establishment report prepared according to the Law on Occupational Safety and Health and the Rulebook on contents of the site establishment report. The Site establishment report and registration of work start shall be delivered to the labor inspectorate. The Preliminary design shall be detailed enough to enable consideration of all relevant parameters necessary for preparation of Site establishment report. The Site establishment report to be prepared by the selected Contractor shall be based on the Final design of construction drawings. After selection of Contractor (when we will know what equipment is available) the Site establishment report can be prepared including precise determination of waste collection method and location for temporary storage of waste produced during construction works. At this design level it is possible to give only general procedures for waste handling produced during construction works.

3.6. Effects of analyzed technological solutions

In practice we generally have projects without technological solutions for reduction of consequences after emission of traffic pollutants.

4. PRESENTATION OF MAIN ALTERNATIVES CONSIDERED BY THE PROJECT DEVELOPER

This chapter describes main alternatives considered by the project developer including main reasons for selection of the specific solution and environmental impacts related to choice of road alignment, production process or technology, work method, location plans and draft designs, type and selection of materials, time schedule for project implementation, road operation and its suspension, construction start and completion dates, production output, pollution control, waste disposal regulations, development of approaches and roads, environmental protection responsibilities and procedures, training, monitoring, emergency plans decommission method, site regeneration and further uses. At preliminary design level, the project developer does not study alternatives for any item. The General design analyzes possible corridors of future road alignment and provides multi-criteria evaluation. At preliminary design level the designers have task to find the optimum technical solution for road alignment within the corridor chosen in accordance with the above-mentioned criteria. Topography of the area, populated area positions, water intake structures and similar limiting factors to define final position of road alignment shall be studied in detail but new variants will not be considered.

5. REVIEW OF ENVIRONMENTAL CONDITIONS ON LOCATION AND IN NEAR VICINITY (MICRO AND MACRO LOCATIONS)

This chapter shall describe environmental conditions which are likely to be exposed to significant risk due to construction and later operation of the road. These are:

5.1. Population;
5.2. Plants and wildlife;
5.3. Soil, water, air and traffic noise;
5.4. Climatic factors;
5.5. Structures, cultural heritage, archeological sites and environmental entities;
5.6. Interrelationship of the aforementioned factors.

Evaluation of the existing condition of environment shall be carried out based on all the performed analyses and tendencies of its potential modifications without construction of the planned road perceived as well as possible environmental hazards and negative impacts caused by construction and operation of the road. This evaluation shall also serve as a base for further research on quantification of possible impacts and on protection measures. Characteristics of this structure shall at all times be considered, since its impacts are likely only to increase with the time.

Description of environmental factors includes "vulnerability analysis". Vulnerable buildings (hospitals, medical centers, schools, public houses, denominational buildings) and environmental substratum shall most likely be affected by construction of this road. Therefore, apart from identifying these buildings and environmental substratum, the authors should describe them and determine their proximity from the road as a source of

pollution.

Information shall be gathered based on: the existing data (reading maps, municipal geodetic maps, conditions of the local Institute for Nature Conservation, the Institute for Protection of Cultural Monuments, "Srbijašume" PE etc.); results of the existing quality assessment of certain factors (air, soil, surface and ground waters...) performed for other purposes; target measurement, field research, spoken information collected from local population, satellite and aerial pictures, expert consultations and literature.

Based on the Publication of the Statistical Office of the Republic of Serbia, a comparative review of data regarding population on the specified area may be given against all previous official population censuses, with the latest two being the most relevant for understanding recent changes in population number. Statistical indicators can be used to show changes in population density, basic groups, population structure according to the employment factor, number of employed and unemployed population. Among the most significant indicators of socio-economical development are national income per capita, total GDP (gross domestic product) in the target area, income per employee without taxes and duties.

Number of passenger vehicles per 1000 people (cars per capita) is also among most significant indicators of economic development.

Apart from the population number and structure, GDP, national income and cars per capita, factors demanding traffic services are also production and consumption (transportation demands).

Production means industrial and agricultural production, while consumption means consumption in industry, civil engineering and individual consumption of population.

6. DESCRIPTION OF POSSIBLE SIGNIFICANT ENVIRONMENTAL IMPACTS OF THE PROJECT

Description of possible significant impacts of the project on the environment includes qualitative and quantitative account of potential changes in the environment during execution of this project, regular operation, and in emergency cases, and also an assessment whether the specific changes are of permanent or temporary character, and regarding in particular:

6.1. Air, water, soil, noise, vibrations, heat and radiation

6.1.1. Impact on air

Air pollution resulting from road traffic, as one of criteria defining relationships between the road and environment, can be successfully quantified today, regardless of the stochastic (random) character of a large number of parameters which essentially determine this occurrence (meteorological, topographic, traffic, civil engineering).

Previous analyses of waste gasses which occur as a result of operation of internal combustion engine show existence of even several hundred of harmful organic and inorganic components. Of course, such a large number of indicators cannot be processed and monitored, and there is no practical need to do so. This is so due to the fact that for most of these components there are no acceptable classifications defining their formation, and they are not all equally harmful to the environment. To that effect, all analyses referring to the air pollution issues are based on several indicators which can be expressed as numerical data with relative accuracy.

As we know, traffic flow as source of emission, with its basic parameters, represents stochastic value with well researched regularities. So the quantification of emission of air pollutants is generally possible for each period with uniform characteristics. Most of previous analyses show that the best basis for comparison of alternative solutions with regard to the

problem of air pollution are the obtained mean annual values of relevant parameters characterized as long-term concentrations. This observation significantly simplifies the important planning issues (generally related to the traffic) dealing with AADT (Annual Average Daily Traffic). Following pollutants shall be included in air pollution analysis: carbon monoxide (CO), nitrogen oxides (nitrogen dioxide - NO_2 and nitrogen monoxide - NO), sulfur dioxide (SO_2), benzene (C_6H_6), suspended particles (PM10) and lead (Pb). The increase in number of diesel engines has particularly heightened the amount of nitrogen oxides, emphasized by transition to unleaded petrol. Research has also shown that values of nitrogen oxides are often near the limit, or above it, than values of carbon monoxide, while the amount of lead has been considerably reduced through use of unleaded petrol. All of the aforementioned facts have caused that the following components of air pollution are adopted as relevant: carbon monoxide (CO), lead (Pb), nitrogen oxides (nitrogen monoxide (NO), nitrogen dioxide (NO_2)), sulfur dioxide (SO_2), benzene (C_6H_6) and suspended particles (PM10). Regardless of all the aforementioned assertions regarding problems with quantification of air pollution from road traffic and non-existent standard procedures or legal regulations, rulebooks or instructions, reliable data may still be obtained which would lead to conclusions about the negative impacts.

It should, however be stressed that quantification of air pollution resulting from road traffic can be performed through procedures of varying complexity, primarily with regard to the number of factors included into the analysis. Decision on the extent of simplification is conditioned by design specifications. When air pollution analysis is meant to serve as basis for assessment of unfavorable impacts, its presentations shall be such as to unequivocally point to the essence of the problem. Relativization and unification of emission has proved to be useful to that effect, usually as mean annual values expressed in mg/m^3.

Models have become the primary method for analysis in most air quality assessments. Modeling may provide demonstration of air quality in a certain area contrary to limitations of air quantity measured in the area (immission). It enables explicit and quantitative comparison of pollutant concentration in the air and emissions that cause them, which is the most important factor in air quality management. Models are the only available means for researching the impact of potential sources of pollution on the quality of air, or for testing scenarios of future alternative emissions.

However, there are certain difficulties when modeling method is applied:

1. Errors in input parameters of a model (emission and meteorological data) may influence the results of the model. Even if the model is a perfect process formulation, predictions shall be wrong if input data are wrong.
2. The model may not properly present the atmospheric process in question.

Use of specific models is not mandatory in our legal regulations.

Estimates of pollutant concentration in the air may also be performed on the basis of relevant meteorological data, spatial position of the road alignment and speed (direction) of the prevailing wind on the observed area. Air pollutant concentrations for AADT for the target year are calculated on the basis of data regarding frequency, speed and direction of winds from the relevant weather station. Permanent and current concentration of dominant air pollutants are calculated - CO, NO, NO_2, C_6H_6, Pb, SO_2 and PM10 at distance from 1 m to 300 m from the road edge. Charts below show overview of concentration of dominant air pollutants on specific road sections for the prevailing wind for modeling purposes.

Concentration of pollutants in the air on the road
(right side)

Concentration of pollutants (mg/m^3)	Distance from the road (m)						
	1,0	10	20	50	100	200	300
Carbon monoxide (mean)							
Carbon monoxide (max)							
Benzene (mean)							

Benzene (max)							
Nitrogen monoxide (mean)							
Nitrogen monoxide (max)							
Nitrogen dioxide (mean)							
Nitrogen dioxide (max)							
Lead (mean)							
Lead (max)							
Sulfur dioxide (mean)							
Sulfur dioxide (max)							
RM_{10} (mean)							
RM_{10} (max)							

Concentrations are shown in mg/m^3

(Left side)

Concentration of pollutants (mg/m^3)	Distance from the road (m)						
	1,0	10	20	50	100	200	300
Carbon monoxide (mean)							
Carbon monoxide (max)							
Benzene (mean)							
Benzene (max)							
Nitrogen monoxide (mean)							
Nitrogen monoxide (max)							
Nitrogen dioxide (mean)							
Nitrogen dioxide (max)							
Lead (mean)							
Lead (max)							
Sulfur dioxide (mean)							
Sulfur dioxide (max)							
RM_{10} (mean)							
RM_{10} (max)							

Concentrations are shown in mg/m^3

The calculations shown in these tables show that the predicted concentration of all the aforementioned air pollutants in the researched area are within annual limits, specified in Decree on amendments of the Decree on monitoring conditions and air quality requirements.

6.1.2. Impact on ground and surface water pollution

During execution of works on construction of highway and its subsequent operation, temporary or permanent pollution of ground and surface water may occur. This is particularly possible in cases of traffic accidents on highways when vehicles transporting oil derivatives and other hazardous substances are involved.

Impact during construction period

Pollution that occurs during the road construction period is not permanent. Upon completion of works, with implementation of adequate protective measures, these occurrences shall be reduced, and in time completely disperse.

There is a certain number of activities which, during the construction period, may cause adverse impacts on water flow and quality:

- Construction works (deep excavations, removal of topsoil, and other). These may cause disturbance in natural course of replenishment, and at the same time, removal of topsoil and creation of new basins causes muddy or otherwise contaminated water to be quickly drained into ground and also surface waters.
- Construction machinery - potential danger from leaking or accidental spilling of oil and oil derivatives, disposal of lubricants and similar waste.
- Unrestrained depositing of excavated material, accommodation of construction machines or asphalt production plant in the vicinity of surface waters.
- Usage of inappropriate construction materials.
- Unregulated drainage of waste water from worker accommodation sites, where pollution may also occur from food preparation process and toilets.

At all crossing points of highway and watercourses as well as on locations where road alignment is near watercourses, adverse impacts during construction period are possible. This is specially the case with locations where major works are planned. On all locations along the road, construction works may cause turbidity of surface watercourses, as well as their burying or contamination with various pollutants (possible leaks of lubricants from construction machinery). Application of recommended preventive measures may significantly reduce adverse impact in this sensitive area.

Impacts during operation

Basic characteristics of pollution source

Primary sources of pollution during road operation are as follows: vehicles, precipitations and dust.

During operation phase, it may well be expected that pollution of water shall result primarily from the following:

- settling of exhaust fumes;
- tire wear;
- chassis destruction and leaking of loads;
- load spilling;
- discarding of organic and inorganic waste;
- atmospheric precipitation;
- pollution brought by wind;
- dispelling through passage of vehicles.

Pollution resulting from the aforementioned occurrences may be temporary, seasonal or accidental.

Permanent pollution is primarily related to scope, structure and characteristics of the traffic flow. Permanent sedimentation of dangerous substances on road surface and service elements of the cross sections results from traffic flow, and are washed away with precipitations. Primarily, those dangerous substances come from exhaust fumes, oil and lubricants, tire and road surface wear, chassis destruction etc.

Seasonal pollution is related to specific seasons. Typical example of this kind of pollution is usage of industrial salt during winter months. This type of pollution is characterized by large concentration of sodium and calcium salts which occur in a very short period of time (spreading of salt on road surface and consequences of melting).

Accidental pollution generally occurs during transportation of hazardous materials. Most often, it is oil and its derivatives, though also vehicles transporting some extremely dangerous chemical substances sometimes break down. The main problem in these cases is that usually they are in very high concentration, and cannot be predicted neither in time or location. This results in the fact that very wide belts have to be protected, mostly in water supply areas, but often cat. I and II surface water.

Types of pollution and form of presence

In water drained from road surfaces, there is a vast number of harmful substances present, and their concentration is often above limits determined for direct discharge into watercourses. Usually those are fuel components such as hydrocarbon, organic and inorganic carbon, nitrogen compounds (nitrates, nitrites, ammonia and nitrogen oxides).
Heavy metals that may be found here are: lead (as fuel additive), cadmium, copper, zinc, mercury, chromium and nickel.

A significant part of pollutants are also solid substances of various structure and characteristics which occur in the form of residual, suspended or dissolved particles. Also substances resulting from anticorrosive agents can be registered. Special group of very cancerous substances are polyaromatic hydrocarbons (benzo-a-pyrene, fluoranthene) which are product of incomplete combustion of fuel and engine oil. Indicators of pollutants which occur either in diluted or undiluted forms are as follows: pH, electrical conductivity, suspended and residual substances, HPK, BPK, grease, oil, etc. Table 2-4 shows sources of pollutants and typical pollutants found in storm waste waters drained from the road surface.

Table 2-4 sources of pollution and typical pollutants found in storm waste waters drained from the road surface.

Pollutants	Sources of pollution
Solid particles	Road surface wear, vehicles, atmosphere and road maintenance
Nitrogen and phosphorus	Atmosphere and fertilizers
Lead	Lead as tetramethyl lead from exhaust fumes, tire wear
Zinc	Tire wear, engine oil and lubricants
Iron	Rust from vehicles, metal structures on the road (bridges, bumpers), movable engine parts
Copper	Metal protective coatings, wear of engine bearings and brushes, movable engine parts, wear of brake linings, fungicides and insecticides
Cadmium	Tire wear and pesticides
Chrome	Metal protective coatings, movable engine parts, wear of brake linings
Nickel	Diesel fuel and petrol, lubricants, metal protective coating, wear of brake linings and asphalt surfaces
Vanadium	Fuel additives
Titanium	Paint for road surface marking
Manganese	Movable engine parts
Sodium - calcium-chloride	Salts for defrosting
Sulfates	Roadbed, fuel and salts for defrosting
Oil and oil derivatives	Spraying and leaking of fuel, antifreeze, hydraulic oils, wetting of asphalt surface

Bases for determining quantity of pollutants

Basic relations of particular value for calculation of pollutant concentration can be classified as follows:

- Largest concentration of pollutants has been registered in waters drained from road surface during winter months, when spreading of salt is intensified;
- Concentration of most of the pollutants directly depends on the duration of dry period before the rain, and from traffic load. Largest concentration is registered within initial 5 - 10 min. of rainfall, to decrease rapidly;
- Concentration of suspended particles are proportional to the rain intensity with largest concentration registered during heaviest flow;
- Water loss, due to spraying during passage of vehicles does not exceed 10% of the total amount;
- Dissipation of material from road surface during dry periods, due to air currents from passage of vehicles, does not have significant impact on decrease in concentration;
- Pollution of surface water i.e. water which drains from road surface is significant, and appropriate protective measures shall be applied in certain conditions.

Degree of vulnerability of surface and ground water quality in cases of accidents cannot be quantified, since they are individual cases separated in time and space. In line with assessments stated above (and in accordance with certain number of foreign experiences[*])

[*] Literature:

an evaluation has been prepared on pollutant quantities which occur during operation of the road, for traffic loads in the project period, and the obtained results are shown in the form of a table. In the second column of the Table 2-5 quantity of pollutant during one year for relevant traffic load (8700 vehicles per year) is given. Quantities of substances emitted by motor vehicles during one year, per one hectare of road surface for relevant traffic load (8700 vehicles per year) and for estimated traffic, as well as total quantity of pollutants on highway are also shown in Table 2-5.

Table 2-5. Estimated quantity of pollutants in storm waste waters, draining from road surface, for traffic load in the designed period

Substance	Referent values (kg/ha/yr)	Emitted quantities per area unit on highway section (kg/ha/yr)	Estimated concentration of pollutants in storm waste waters from 1 ha of road surface (mg/l)	MDK[1] (mg/l)
Suspended particles	145			30
BPK_5	6,5			4,0
HPK	49			12,0
Nitrates	0,98			10
Total phosphorus	0,13			
Oil and grease	2,25			0,05
Copper	0,01			0,1
Lead	0,082			0,05
Zinc	0,079			0,2

[1] Maximum allowed concentration of pollutants for category II of watercourses.

Level of pollution of storm water is determined according to the requested category of watercourse. Recipients of waste water from highway and their categories are defined.
On the basis of spatial, engineering-geological, hydro-geological characteristics and estimated concentration of pollutants in storm waste water (shown in Table 2-5), it may be concluded whether during operation of the planned highway pollution of surface and ground waters may occur in case storm water is discharged without regulation and previous treatment.

6.1.3. Impact on soil

Soil as basic natural element represents a very complex system, susceptible to various impacts. Therefore, the complete issue of road and environment relation has been determined through relations which occur in the sphere of various impacts on soil. It should be pointed out that the soil, as a complex ecological system reacts to changes by changing its basic properties. For this reason, for each particular case numerous probable impacts have to be analyzed.

Soil degradation with regard to its impact on the environment includes several occurrences, most important being landslide and rockfall, erosion, changes in soil permeability, potential degradation of soil properties in the wider area, soil degradation due to borrow pit formation, soil degradation due to formation of dump sites, and other impacts with various impacts in the specific cases.

With regard to impact on soil, there are two important phases - road construction and operation phase.

Also, there are two aspects of degradation caused by road construction: soil pollution and soil degradation.

- Barrett, M.E., Malina, Jr., J.F., Charbeneau, R.J., Ward, G.H., 1995, Water Quality and Quantity Impacts of Highway Construction and Operation: Summary and Conclusions, Center for Research in Water Resources, Technical Report No. 266, University of Texas at Austin, Austin, TX.

In this phase, soil pollution may occur due to improper handling of oil and oil derivatives used for construction machines and other plants during road construction, cleaning of vehicles and mechanization outside envisaged and equipped areas, poor site development and other activities not executed in accordance with recommendations for technical protection during construction.

During road construction, issues related to impacts on soil (degradation) is mainly reflected in need for transport of huge amounts of construction material, and for formation of borrow pits and dump sites. Another important factor in this phase is the inevitable requirement for topsoiling of large areas. The topsoiling process is characterized by significant mechanical stabilization in the roadbed and on locations where temporary access roads are constructed, which may have impact (at particularly sensitive locations) on a whole range of soil parameters, primarily on soil permeability, air content etc.

During road operation pollution of soil shall mostly result from the following occurrences: pollution of storm water from road surface, exhaust fumes residue, organic and inorganic waste disposal, spilling of load, accumulation of particles brought by wind, dispersal due to vehicle movement.

Only elements with relatively verified regularities can be quantified with respect to pollution of soil. Among other elements, pollution is mostly related to:

- road drainage system;
- traffic load and structure of traffic flow;
- configuration of surrounding terrain and its forestation;
- pollution of soil from spraying from passing vehicles is restricted to a narrow belt along the road edge;
- spilling of material from carriageway during dry periods due to air current from passing vehicles is also restricted to a narrow belt along the road edge;
- accumulation from air is present at even few hundred meter distances; at the moment it cannot be defined, nor can any regularity be found in order to quantify this occurrence.

Concentration of particular pollutant in soil, for each particular case, is calculated according to traffic load on a road, the obtained data are compared with maximum allowed values from the Rulebook defining allowed quantities of harmful and hazardous substances in soil and irrigation water and their testing, and also from Decree on program for systematic monitoring of soil quality, risk indicators for soil degradation and methodology for preparation of remedial programs.

6.1.4. Noise level

Noise in an environment is an unwanted, detrimental sound in the open area, caused by human activity, including noise from vehicles, road, rail or air transportation, and industrial plants and activities requiring an integrated permit.

Relative sound volume is expressed in decibels [dB]; a ratio in decibels is ten times the logarithm to base 10 of the ratio of two power quantities. Reference value of sound pressure equals 20 μPa. Threshold of perception of an average human varies from 0 to 120 dB. Intensity of 0 dB is threshold of perception, and that of 120 dB is a threshold of pain and causes permanent damage to hearing. In practice, noise level varies from 30 dB in a quiet room to 90 dB near road with heavy traffic.

Hearing frequency range of a young adult is between 20 and 20.000 Hz. Human hearing is less sensitive to very low and very high frequencies, and is most sensitive in the range between 400 and 4.000 Hz. To account for this during measurements, we apply weighting filters. A-weighting **is** frequency weighting which roughly equals loudness contour of 40 dB, which represents response of human hearing to very low and medium sound volume. Noise levels measured by A-weighting are marked as dB(A).

Generally, noise with same intensity will create more disturbance on higher frequencies than on lower ones. Impulse noise creates more disturbance than unvaried noise. Tonality, resulting from concentrated energy on one frequency, also increases disturbance.

Sources of noise
Source of noise can be any emitter of unwanted or detrimental sound resulting from human activity. It can be any device, tool, means of transportation, installation, technological procedure, electrical and acoustic device. Source of noise can be any moveable and stationary object which under certain circumstances emits noise, as well as outdoor and indoor facilities for sport, play, dance, shows, concerts, music events, restaurants, garages, parking lots etc.

Levels and properties of noise produced by road traffic depends on a large number of parameters, such as: traffic flow structure, speed of vehicles and their age, behavior of drivers, type of road surface, surrounding ground and inclination of the road.

Noise parameters
Noise indicator - is acoustic (physical) scale for the description of environmental noise in correlation with a harmful effect. The indicator is expressed in A-weighted decibels dB(A).

$L_{eq}(A)$ - A-frequency-weighting equivalent continuous sound level.

$L_F(A)$ - Fast time weighting sound pressure.

$L_{Fmax}(A)$ - The maximum level with A-weighted frequency response and fast time weighing. This is the most recognizable environmental noise identified in the course of measurements. It is also used in correlation with other noise parameters (L_{eq}(A) for example) to show that the individual noise event does not exceed the defined limit.

$L_{peak}(C)$ - Maximum C-weighted peak sound pressure level. It is used to estimate the possible damage of human hearing as a result of exposure to short-term high-level noise.

SIL, PSIL - SIL (Speech Interference Level) is the arithmetic average of sound pressure levels at 500 Hz, 1 KHz, 2 KHz and 4 KHz. PSIL (Preferred Speech Level) is the arithmetic average of sound pressure levels at 500 Hz, 1k Hz and 2 kHz. It is used to estimate how the background noise interferes with the speech.

Rating noise level ($L_{Aeq,T}$) - The equivalent continuous A-weighted sound pressure level referring to the specified time interval (T_{ref}) plus (L_{dod}), if required. This level is significant basis for estimation of noise monitoring for particular situation.

- *Estimation level (L_n)* - Together with A-weighted equivalent continuous sound pressure [L_{eq}(A)], the following is added: sound level(L_{dod}) and relevant time interval, if there is a difference in time interval (T) and reference time interval (T_{ref}).
- *Addition to noise level (L_{dod})* - Additive value in dB(2-6) when estimating the special characteristics of noise in the course of defining the estimation level.
- *Sound exposure level (L_{AE})* - Sound exposure level (SEL) is a standardized measure of a single sound event expressed in A-weighted decibels that takes into account all sound above a specified threshold limit at least 10 decibels below the maximum level. All sound energy in the event is integrated over one second. The reference value of sound pressure is 20µPa.
- $L_0(A)$ - Basic sound level is the lowest A-weighted sound level expressed in dB measured on single spot during the measuring session as a result of distant noise. This parameter is often taken to represent "calm" period.

- $L_{10}(A)$ - The A-weighted sound pressure level expressed in dB which is exceed for 10% of a specified time period T. This parameter is frequently used for road traffic noise.
- $L_{90}(A)$ - The A-weighted sound pressure level expressed in dB which is exceeded for 90% of a specified the time period T. This parameter is often taken to represent the background noise level and characterized the "phone" level when testing noise as a result of operation of industrial facilities.
- $L_{95}(A)$ - The A-weighted sound pressure level expressed in dB which is exceeded for 95% of a specified time period T. This parameter is often taken for cumulative distribution of the basic sound level.
- $L_{r,LT}(A)$ - Long-term average A-weighted sound pressure level is an indicator of outdoor noise per zones. $L_{r,LT}(A)$ is relevant A-weighted sound level expressed in dB and measured at the distance r (radius) from the noise source during the long period of time LT (long time) [for example: for day LT=16 h, for evening LT=4 h and for night LT=8 h] computed according to the representative 15-minute time basis (reference time-T_{ref}) for the taken time samples [minimum one in every hour of certain time period (day, evening and night], corrected due to tone components, impulses and meteorological parameters, if any.

Assessment - A method that is used for calculation, prediction or measurement the noise indicators (sound pressure level) or related noise-generated adverse impacts. Basic noise indicators to be used for preparation of noise strategic maps are as follows:

- L_{den} (noise indicator for day-evening-night) - noise indicator that describes disturbances caused by noise within the 24-hour period;
- L_{day} (daily noise indicator) - indicator that describes disturbances caused by noise within the period from 6:00 AM to 18:00 PM;
- $L_{evening}$ (evening noise indicator) - noise indicator for the period from 6:00 PM to 22:00 PM;
- L_{night} (night noise indicator) - noise indicator that causes sleep disturbances from 22:00 PM to 6:00 AM.

Explanation of terms

Measurement-duration interval (T) - Time period required for measurement of noise level.

Reference time-interval (T_{ref}) - Time referring to the rating noise level.

Statistical distribution of sound level - Statistical distribution of sound level may be read/calculated by using the adequate device and/or computer program. Such distributions identify the sound level to be exceeded over a given period of time.

Silent facade - Facade of a building that in the course of monitoring of the relevant noise source is characterized with value L_{den} at the height of (4.0 ± 0.2) m measured from the ground level and value lower for 20 dB 2 m identified on the facade front. When noise is to be measured for the purpose of noise mapping and exposure of building to noise should be also defined, other heights (1.5 m minimum from the ground level) may be used.

Acoustic zoning - Determination of noise indicator limit value for different areas according to their purpose. The acoustic zone is an area characterized with uniform noise indicator limit value.

Noise map- Map representing the existing and/or designed situation of noise emission in a given area expressed in harmonized noise indicators. The most common data to be included in the noise map are: exceedance of allowable values, estimated number of people exposed

to certain noise levels, estimated number of apartments, schools, and hospitals exposed to certain noise indicator values within the studied area.

Noise limit value - Noise limit value is the highest allowed value of noise indicator (limit value). Limit values may be different for different noise sources, different acoustic zones as well as different closed and opened spaces where people can stay.

Sound protection - Sound protection is a set of measures providing weaking of sound transferred from one space to another, as well as measure to reduce noise generated from devices and installations inside the structure. Sound protection also means a set of measures conducted in an outer space influencing reduction of noise level for spreading sounds. Sound protection is performed by projecting and setting of sound insulation constructions and measures of noise reduction.

Sound isolation - Sound isolation is a feature of a building construction to prevent transmission of sound energy from one space to another, as much as possible. Sound isolation may be against air or structural sound and is to be performed by applying the relevant architectural-construction measures that will prevent sound transmission from one space into another.

Action plans for environmental noise protection are prepared for the purpose of management of environmental noise and include relevant protection measures to be applied in a case of exceeding of limit values.

Noise testing - Computation and mapping

Computation and mapping of noise shall be carried out by using the adequate software package in strict compliance with the European Commission Directive No. 2002/94/EC (Environmental Noise Directive), Guidelines on Revised Interim Computation Methods No. 2003/613/EC, European Commission Assessment of Exposure to Noise - Good Practice Guide, Directive IPPC 96/61/EEC and Framework for the Verification of Environmental Noise Calculation Software - ACOU107.

Computation of basic indicator values shall be performed according to temporary methods proposed in Attachment 3, Decree on noise indicators, methods for noise indicator assessment, and adverse noise environmental impacts.

Preparation of input data and computation itself shall be performed according to technical instructions required by the adequate selection method. Regardless to the selected method the following shall be obtained:

- Input data shall be capable to describe situation during the year before computation;
- Input data should not be older than 3 years;
- Older input data may be used after being updated;
- Digitalized ground model shall have horizontal accuracy of 1.5 m (in areas characterized with small height differences horizontal accuracy shall be greater);
- Allowable standard error in the course of computation shall not be greater than 0.5 dB(A);
- Provisions stated in Article 15, Rulebook on Content and Methods Governing the Preparation of Strategic Noise Maps and Their Presentation to the Public shall be strictly observed;
- Colors referring to noise levels in graphical part shall be in accordance with the Attachment 1, Rulebook on Content and Methods Governing the Preparation of Strategic Noise Maps and Their Presentation to the Public.

In the course of computation and mapping of noise, structural approach will apply. Problem shall be identified, model and relevant input data defined so as valid output data may be obtained. In the course of gathering and processing of input data they should be analyzed in the respect of completeness, accuracy, adjustment with computation model and demands.

In a case the required data are not available, final edition issued by the European Commission Working Group Assessment of Exposure to Noise - Position Paper - Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure may be used.

6.1.5. Vibrations

Basic methodological computation procedures

Vibration impact generated by road traffic to humans and structures may be identified by indicators which for designed solution and specific sections are to be computed in a function of relevant parameters that characterized emission and transmission in relation to the previously defined limit values.

Construction phase

Where vibrations are concerned the construction phase is characterized with vibrations generated by machines operating along the road that is being built. The organization of the construction of a linear structure such as this one is characteristic of construction machinery operation in a larger area, which makes it impossible to intervene and protect the environment from the impact of vibrations. Exposure to this impact is time limited, temporary and of minor intensity.

Phase of use

In order to estimate negative impact of vibrations generated by traffic it would be necessary to define indicators that will enable creation of such an estimation fully in accordance with local characteristics. Velocity of vibrations (mm/s) may be used as relevant indicator for all analyses within the previously performed investigations.

The magnitude of vibrations depends on characteristics of traffic flow, characteristics of pavement surface, characteristics of the ground and other physical characteristics identified during transmission from the source to the receiver. The standard model used for calculation understands regular velocity of vibrations at the edge of the outer traffic lane in the form of:

$$V = a \times W^{b} \quad \text{(mm/sec)}$$

where:

V - Velocity of vibrations in mm/sec,

W -Characteristic of relevant traffic flow,

a, b - Constants depending on unevenness of pavement.

Weaking of vibration magnitude with distance is determined on the basis of the formula:

$$V = (Vo / \sqrt{d}) \times e^{-\alpha d}$$

where:

Vo - Velocity of vibrations at the edge of pavement,

d - Distance,

α - Damping coefficient.

For the purpose of calculation in real situation, coefficients (a) and (b) are adopted as values that characterize pavement surface as even as defined in a relevant standard relating to the surfacing of flexible pavement structures on arterial roads. Real values for damping coefficient are adopted for characteristic cross sections as a function of soil properties.

6.1.6. Heat and radiation

Heat and electromagnetic radiation shall not be studied in the environmental impact analysis.

6.2. Impact on the health of population

Road traffic mostly affects the population not only in central city zones but in areas concentrated around suburban arterials (arterial, regional and local). Road motor vehicles generate exhaust gases that affect the air quality thus representing significant environmental pollutants. Exhaust pipe fumes generated by engines with internal combustion contain different amounts of CO, NO_x, SO_2, carbonhydrohide, lead and suspended particles.

Exhaust pipe fumes generated by engines with internal combustion contain different amounts of carbon-monoxide, carbon-dioxide, nitrite and other gasses. These gases penetrate the organism through the respiratory tract, thus causing damage especially to the respiratory system. Possible consequences of gas poisoning can be pulmonary edema, bronchitis and bronchopneumonia. Only in cases of extremely high concentrations of these gases there may be damaging effects to other organs in the organism (in acute poisoning by carbon monoxide the result is death or coma accompanied by diffuse damage to the cerebrum, carbon dioxide causes depression of the respiratory centre). Pollution of soil and water by dangerous and toxic substances may be also expected in a case of accident.

Residents in the studied area shall be exposed to different temporary impacts spatially restricted during the road construction. They will be exposed to vapors of polycyclic aromatic hydrocarbons (PAH) while spreading the asphalt courses.

In the course of operation of the future road, negative impacts of noise, vibrations and aero pollution that will affect the population health may be expected as well as increased concentration of lead in organisms as a result of lead emission, impact to vulnerable population groups (children and older people) as a result of high concentration of lead in air, soil and food.
Assessment of road impacts to population health is very complex task concerning the fact that comprehensive investigations have not been performed yet and therefore adequate data are not available.

Institute of Public Health of Serbia "Dr Milan Jovanović Batut" is a health institution engaged in *activities of general interest in promotion of health in Serbia*[2]. The institute systematically gathers data on population, birth, incidence, death, environmental factors and their impact to peoples health. Data gathering through the network established between the Institute of Public Health and other institutes in Serbia are regulated by laws and based on statistical researches, health protection records and protection of population against infectious diseases. This data base is of general importance and may be approached from the Data Presentation System (DPS). The basic purpose of the system herein is to present available statistics by geographical areas through the user-friendly geographical form. The system is a unique tool that can provide quick and easy access to large amounts of collected statistical data and facilitate their use. The first version of DPS has been developed in the early 1990s for the WHO European “Health for All” database. The database was created as off-line version and later placed on the WHO web site (see www.euro.who.int/HFADB). Many countries have also started to use DPS to facilitate access and use of data from the data of national health statistics. DPS was further developed by experts of the Institute of Public Health of Serbia in order to facilitate the use of health indicators for decision making, supervision and management of health systems at both national and local levels. In this respect, the DPS is a simple and effective tool for improving national health information system that makes the collected data available to all interested parties. The additional value of DPS is that the feedback from the user improves the availability and quality of data.

The data presentation system of health indicators in the Republic of Serbia contains eight sets of indicators referring to the following fields:

[2] Health indicators in the Republic of Serbia (http://www.batut.org.rs/download/zdravstveni_pokazatelji_rs.html)

• Demography and related socio-economic indicators;
• Mortality;
• Morbidity;
• Life styles;
• Environment;
• Health resources;
• Use of health service;
• Health of mothers and children.

6.3. Impact on climatic parameters

Construction and future use of the highway will have no significant impact on meteorological parameters and climatic characteristics in the studied area and therefore shall not be separately considered. At the same time, microclimate of the certain location may be affected by particular structures and these influences analyzed.

6.4. Impact on flora and fauna (ecosystem)

Analyses and researches to be carried out should indicate whether endangered plant and animal species may be identified within the planned corridor.

Flora

The most pronounced impact on the flora in the monitored area is generated as a consequence of land acquisition. This impact is felt along the whole length of the road, as this is the land of favorable reproductive properties. Quantification of influences on flora is only possible by delineating areas with complete loss of vegetation, those with altered vegetation and areas with autochthonous vegetation under certain influences.

Fauna

Modern traffic infrastructure such as highways and railway lines cause multiple negative impacts to the life world. These impacts may be direct and/or indirect and thus identified in the course of construction and further in operation. Although intensity and consequences of negative impacts are specific for every particular animal species, general effects may be manifested as stated below:

- Direct destruction of habitats;
- Degradation of habitat quality along the arterial;
- Fragmentation of habitat, change of form and geometry,
- Cutting of ecological and traditional migration corridors;
- Difficult approach to vital habitat segments;
- Fragmentation of populations due to barrier effect of the road and inability of permanent and undisturbed communication;
- Increased hunting pressure and enhanced poaching due to easy approach;
- Possible killing of animals on open road;
- Disturbed regime of surface and ground waters;
- Accumulation of liquid and solid, chemical and related waste;
- Increased light and sound pollution of the area around the arterial.

Consequences of these negative impacts are as follows: disturbance of natural life cycles of many animal species, change of behavior, decreased ecological elasticity and fading of local population, modification of composition and structure of animal habitats as a result of avoidance of the road which result in significantly improved biological diversity on all levels (genetic, spatial and ecosystematic).

Impacts on aquatic animals (aquatic invertebrates, fishes, amphibians, aquatic birds)

Traffic infrastructure often crosses over the water streams thus representing physical obstacles for animals that live in a water. Stormwater runoff and waste water are usually

contaminated with organic pollutants (oil derivatives and polyaromatic hydrocarbons) and heavy metals (lead, cadmium). In a case of traffic accidents the said contamination may be increased and affect all water-borne animals (aquatic invertebrates, fishes, amphibians, aquatic birds).

Impact on amphibians (Amphibia)

Amphibians (Amphibia) live part of their life cycle in water and part on land (broods, summer and winter habitats). Winter habitats may be contaminated by organic and non-organic pollutants if drainage system of the road is not properly designed. All environmental factors constituting the studied area are also significant for the life of amphibians. Since traffic infrastructure usually cuts the natural movement corridors of amphibians these animals are often killed trying to cross the road. Human activities in the area are also significant considering construction and operation of roads and therefore protection measures are necessary to be provided in the course of construction of new arterials or reconstruction of the present ones. Problem referring to amphibians and roads (re)construction requires an integrated approach. The public shall be permanently informed so as the adequate solutions may be found and these animals protected (through identification of so-called black spots-short sections of road where many individual animals are killed).

Impact on reptiles (Reptilia)

Reptiles are considered to be threatened specie. Countless numbers of reptiles are being run over and killed when they attempt to cross the road especially in warmer areas where this animals mostly live. The increased death of reptiles on road is often the result of their thermo-regulation considering the fact that they depend on environmental temperature. These animals use open spaces without vegetation (including road surface) to catch the sun for warmth especially in spring and morning. Some lizards and snakes also come to road to feed with insects.

Impact on birds (Aves)

Although birds comparing to other animal species have no significant difficulties in crossing the traffic infrastructure, they may also be faced with certain severe obstacles. Collisions between birds and vehicles are frequent as well as bird deaths resulting from collisions with man made structures such as safety barriers and noise suppression walls. The particular problem are transparent noise suppression panels placed in certain areas to provide drivers and passengers sightseeing of landscape.

Aquatic birds may also be affected by waste runoffs (spillage of oil derivatives and other related contaminants in a case of accidents).

Lot of birds are also affected by vehicle head lights. Therefore head lights that emit directed light above the horizontal level is preferable.

Mammals (Mammalia)

Construction of traffic infrastructure also affects mammals in different segments of their population. Mammals need relatively huge habitats since it is the only way to preserve certain number of species capable for life.

Their primary and relatively homogenous habitats are divided into smaller segments as a result of construction and operation of traffic infrastructure. Such fragmentation results in small isolated local populations which result in negative effect for their life capability.

In separated small populations, adequate social and sexual structure can not be developed which further increases the possibility for extinction of certain species. Obstacles disable movement of species which result in overpopulation in certain areas while other areas

remain unpopulated. Mating between animals in closer relationship is also increased among isolated populations. Inbreeding has negative impact to genetic structure and increases the chances of offspring being affected by recessive genes of both parents. Therefore, the second generation is mostly affected by loosing of genetic potential which may further result in significant loss of genetic diversity. Considering everything mentioned above, in the course of construction of traffic infrastructure, special attention should be paid to provide minimum passage for animals over the traffic infrastructure.

In the course of design, multiple positive effects resulting in preservation of greater areas within the basic habitats should be taken into account.

Big mamals are especially sensitive to destroying and separation of their habitats. Considering the fact that habitats of predators are small they require wide and compact areas for short-term survival of local populations.

6.5. Impact on population (demography, concentration and migration)

The social aspect of construction and use of the planned road is related to investigation of possible impacts on a number of features such as population, their property and content in settlements. For the purposes of this study the term population understands demographic and social and economic make-up and the term settlement the already built funds that cover the exiting settlements along the route.

Judging from the interest of social groups that will use this space and facilities, newly constructed road may have twofold effect upon the socio-economic environment and economic development of the studied area. The population can be divided into two interest groups. One constituted of users of the road for transport of goods and passengers and the other, owners of the land on which the new road will be constructed.

Assessment of demands for transport services is based on assessment of increment of social and economic indicators, i.e. population growth, employment, motorization, gross domestic product, production and consumption of settlement in gravitational area.

In addition to social and economic indicators, impacts also include impact to population health that include aero-pollution and noise impacts to population of the studied area.

6.6. Purpose and use of areas

Data on the present purpose and use of land shall be shown graphically on the map entitled: Purpose and use of the land. Map shall be derived from aero-photogrammetric surveying and geodetic layout plans prepared for the purpose of Preliminary design and printed 1: 5000 in scale. In the course of map preparation, applicable planning documents shall be used, such as spatial and urbanistic plans (Spatial Plan of the Republic of Serbia, Regional Spatial Plan, Municipality Spatial Plan, and Spatial Plan of Special Purpose Areas).

Data shall be obligatorily classified.
For example: Category entitled as "Meadows" shall also include smaller greenery groups. Category "Arable Land" shall also include areas under one-year crops. Areas under vineyards and orchards are classified as multi-year crops. Forests cover areas above the quality class 6.
According to content variability, the following criteria shall apply: favorable, conditionally favorable and unfavorable. Favorable area are those prevailing in the studied location. Conditionally favorable areas are those areas slightly represented on the studied location (areas under forest vegetation). Unfavorable areas are settlements, cemeteries, religious structures and other.

6.7. Impact on utility infrastructure (accessibility)

The utility infrastructure on the studied area is referring to hydro-technical infrastructure, gas pipe lines, energetic and heating infrastructure, telecommunication and traffic networks, utility facilities, and other. Adequate analyses whether the new arterial will be in collision with the existing utility infrastructure shall be performed fully in accordance with terms and conditions obtained from competent institutions.

6.8. Impact on natural goods and immobile cultural heritage

6.8.1. Natural heritage

Relevant assessment referring to possible impacts on protected natural goods and areas covered by the Decree on Ecological Network along the road corridor shall be prepared. Use of area, natural resources and protected natural heritage is defined by relevant terms issued by the Institute for Nature Conservation of Serbia fully in accordance with the submitted application. If the applicant fails to commence the works and related activities within the 2 (two) years from the date of obtaining the decree, new terms shall be obtained.

6.8.2. Immobile cultural heritage

Cultural heritage is the legacy of physical artifacts and intangible attributes of general importance that enjoy special protection defined by the Law on Cultural Heritage. Dependent on physical, cultural and historical properties cultural heritage may be classified as follows: monuments of culture, spatial cultural-historical units, archeological findings and memorable places - immobile cultural heritage; artistic and historical artifacts, archive material, film material and rare books - mobile cultural heritage. Dependent on importance, cultural heritage may be classified into the following categories: cultural heritage, cultural heritage of great importance and cultural heritage of extraordinary importance.

Relevant assessments shall be performed to analyze impact of the future road to immobile cultural heritage within the studied road corridor. This assessment shall include direct impact of the project to the integrity and visual harmony of a particular monument. In terms issued by competent Institute for Protection of Cultural Heritage in addition to identification of immobile cultural heritage in the road corridor, possible impact and adequate protection measures will be considered.

6.9. Impact on landscape characteristics of the area

For the purpose of quantification of relation between road structure and landscape the following partition methodology will apply (morphology, vegetation, surface water, structures and appearance).

7. ENVIRONMENTAL IMPACT ASSESSMENT IN ACCIDENTS

Due to different subjective and objective reasons, in the course of traffic operations accidents may cause negative impacts not only to traffic participants but to the environment as well. This especially refers to freight vehicles transporting hazardous substances that due to uncontrolled spillage or vapor may cause contamination of soil, surface and ground waters in the vicinity of the studied structure. For the purpose of control of these accidental situations, properties of dangerous substances shall be identified, preventive measures planned and adequate steps taken for elimination of possible consequences.

This section contains overview of hazardous substances to be transported by the studied road section together with assessment of quantities and accident hazard.

8. MEASURES TO PREVENT, REDUCE AND IF POSSIBLE REMOVE ANY MAJOR ENVIRONMENTAL IMPACT

This section includes protection measures to be taken for the purpose of preventing, reducing and possible removing of any major environmental impact. Technical protection measures to

be developed on the next level of preparation of technical documentation, i.e. within the Final design shall be clearly separated.

Measures are as follows:

8.1. Environmental protection measures defined by the law and other regulations (regulative measures)
8.2. Protection measures in accidental situations
8.3. Plans and technical solutions for environmental protection
8.4. Other protection measures.

9. ENVIRONMENTAL MONITORING PROGRAM ME

Environmental monitoring programme along the corridor of the future road enables obtaining information important for taking of adequate protection measures to prevent or minimize the further degradation of the environment and establish the system for early warning.

Design of the monitoring system defines monitoring program for every particular environmental component, relevant legal basis referring to sampling and monitoring, methods, sampling points, sampling time, sampling duration and duration of monitoring.

Global purposes of monitoring are obtaining data for creation of policy for environment management and maintenance of environmental quality. The purpose of quality maintenance is to be in accordance with necessities within the given time period required for the respective environmental parameter.
The end purpose of the monitoring is maintenance of environmental quality fully in accordance with the obtained information so as adequate protection measures may apply.

The final purpose of the monitoring is transfer of information to any possible user fully in accordance with the quality of certain environmental parameters.

The environmental monitoring programme shall include as follows:

9.1. Environmental situation prior to commencement of project on locations where environmental impact is expected

Environmental overview shall contain the data obtained by measurements, i.e. surveying of so-called "zero state" prior to commencement of the project on the particular location where negative environmental impacts are to be expected.

9.2. Parameters on the basis of which adverse environmental impacts may be defined

Certain parameters are to be monitored since according to these parameters adverse impacts may be defined and certain pollutants identified and quantified..

9.3. Locations and frequent measurement of defined parameters

Defining locations, method and frequency of measurement of defined parameters shall be performed fully in accordance with relevant regulations and standards. Measurements of certain environmental media shall be performed only by certified laboratories.

9.4. Monitoring of air

The purpose of air quality monitoring is to establish long-term trends of air pollution in order to establish the degree of upgrading/deterioration of air quality in settlements along the future road corridor. Based on the results obtained in air monitoring the following will be also enabled:

- Risk assessment for peoples health;
- Risk assessment for other environmental elements;
- Development of mathematical model referring to dependence of traffic load emission and weather conditions.

A program of air quality monitoring shall be developed gradually. In the first phase, the following pollutants shall be measured:

- Carbon monoxide (CO) and
- Nitrogen dioxide (O_2).

If the results of the measurements point to limit overruns, the list of pollutants shall be expanded and the following concentrations measured:

- Sulphur dioxide (SO_2);
- Hydrocarbons (C_XH_Y) and
- Lead (Pb).

Each measuring point shall be provided with the following data:

- Direction, velocity and intensity of wind
- Air temperature
- Air humidity
- Atmospheric pressure
- Precipitation
- Visibility
- Quantity of clouds
- Type of clouds
- Insolation

A network of air quality measuring points shall be spread in all settlements in the impact zone of the future road. In order to carry out measuring of pollutants in the air emitted by motor vehicles in the exploitation phase of the future road it is mandatory that all measuring points be set up in the same manner as that is the only way to ensure obtaining verified data on spatial distribution spread of air pollution in the impact zone.

The Code on limit values, measuring methods of emission, criteria for setting up measuring points and Record data, among other things prescribe criteria for setting up measuring points. The number and locations of measuring points in the network of measuring points depend on the density and time distribution of pollutants in the air. Measuring points shall be allocated based on the area in which the quality of air is investigated, on the distribution and types of sources of pollution, population density, orthography of the terrain and meteorological conditions. As there are no relevant data for determining an exact number and locations of measuring points it is suggested that preliminary measurements are made in the exploitation phase of the future road, and only after that exact locations for measuring points be allocated.

In allocating points for measuring air quality the following conditions shall be met:

- The measuring point shall be representative for the area selected in the general plan,
- The measuring point shall be set up in such a way that it supplies data that can be compared to the data from other measuring points in the network,
- Certain physical requirements must be satisfied. A final selection of locations for measuring points shall be made based on a compromise of all of the above conditions.

In the first phase of monitoring which is supposed to last 5 years it will be necessary to conduct air quality monitoring periodically (1 month per season) because in order to establish trends in air pollution measuring data for at least five consecutive years are necessary. Only in case the results of periodic measuring point to the necessity of further air quality measurements continuous air quality measurements shall be conducted i.e. enter the second phase of monitoring.

9.5. Monitoring of waters

9.5.1. Monitoring of waste waters (effluents)

The national regulations governing control of the quantity and quality of waste waters (effluent) prior to their release/discharge into recipients shall not apply to quality control of the treated runoff. Depending on climatic factors, volume and structure of traffic, effluent composition varies in one hydrologic year. Besides, contrary to the majority of European countries, we do not have emission standards. Thus, in this particular case, only the impact of the future road use on the quality of water in recipients can be monitored based on emission standards.

9.5.2. Monitoring of surface waters (recipients)

The goal in measuring the water quality in recipients is to identify the effect of waste water treatment on the water quality in recipients and to indirectly control the output of the runoff treatment system.

Selection of parameters to be monitored

The following data shall be obtained by sampling:

- Change of color;
- Visible waste matters;
- Presence and kind of odor;
- Air temperature and
- Other characteristic observations.

The following parameters shall be determined in laboratory based on the knowledge of the kind of pollutants in runoff from the road in use:

- HPK,
- $BPK_{5,}$
- pH,
- temperature of water,
- electrical conductivity and
- total grease and oil content

Defining water quality by SWQI index

The Serbian Environmental Protection Agency has developed set of environmental indicators referring to water. The indicator is based on the water quality index methodology thus grouping physic-chemical and microbiological water quality parameters into one composite surface water quality indicator - Serbian Water Quality Index (SWQI). Ten parameters (oxygen saturation, BPK_5, ammonium, pH value, total nitrogen, orthophosphates, suspended matters, temperature, electrical conductivity and E.Coli) represent surface water quality that are summarized as one index on a 0-100 scale. The descriptive indicator corresponding to an appropriate range of SWQI values has been defined as: very poor, poor, good, very good and excellent.

Since every of ten above stated parameters does not have similar influence on the final overall water quality, each parameter has an appropriate weight (w_i) and number of points threaten the quality. By summarizing values of $(q_i \times w_i)$ sum of 100 will be obtained as ideal summary of all parameters quality. If data related to certain parameter quality is lacking, value of arithmetically measured *WQI* is corrected by multiplying the index with value *1/x*, where *x* is sum of arithmetically measured weights of available parameters. Indicators of surface water quality obtained by method *Serbian Water Quality Index* are obtained by comparing quality indicators according to our classification and original method *WQI* (Table No. 2-6)(Decree on Classification of Interrepublic Watersheds, International Waters and Coastal Waters).

Table 2-6. Comparison of quality indicators according to our classification and *WQI method*

Serbian Water Quality Index					
Parameters	**Maximum**	**MDK**	**MDK**	**MDK**	**MDK**

(Unit of measurement)	value				
	qi x wi	***I* class**	***II* class**	***III* class**	***IV* class**
Oxygen saturation (%)	18	90-105 -	75-90 105-115	50-75 115-125	30-50 125-130
BPK_5 (*mg/l*)	15	2	4	7	20
Ammonium (*mg/l*)	12	0.1	0.1	0.5	0.5
pH value	9	6.8-8.5	6.8-8.5	6-9	6-9
Total nitrogen oxides (*mg/l*)	8	10.05	10.05	15.5	15.5
Orthophosphates (*mg/l*)	8	0.005	0.01	0.01	0.01
Suspended matters (*mg/l*)	7	10	30	80	100
Temperature (^oC)	5	-	-	-	-
Electrical conductivity (µ*S/cm*)	6	-	-	-	-
E.Coli (MPN in 1000 *ml*)	12	2.000	100.000	200.000	200.000
$\sum(q_i \times w_i) = WQI$	100	85 - 84	69 - 71 74 - 71	44 - 48 56 - 52	35 - 36 51 - 46

Surface water quality that corresponds to class I according to our Decree by *WQI* method belongs 84-85 points, class *II* 72-78 points, class *III* 48-63 points and class *IV* 37-38 points. The adopted values are for the *WQI* = 0 - 38 very poor, *WQI* = 39 - 71 poor, *WQI* = 72 - 83 good, *WQI* = 84 - 89 very good and *WQI* = 90 - 100 excellent.

Indicators of surface water quality are classified according to their purpose and degree of purity and stated in Table 2-7.

Table 2-7. Classification of surface waters by *Serbian Water Quality Index*

WQI*-MDK *class I		***WQI*-MDK *class II***	***WQI*-MDK *class III***	***WQI*-MDK *class IV***
100 - 90	89 - 84	83 -72	71 - 39	38-0
Excellent	Very good	Good	Poor	Very poor

Surface water quality indicators (*SWQI*) are stated in colors on waterstream maps thus denoting relevant control profiles as stated below:

	Numerical indicator	**Descriptive indicator**	Color
Serbian Water Quality Index	100 - 90	Excellent	
	84 - 89	Very good	
	72 - 83	Good	
	39 - 71	Poor	
	0 - 38	Very poor	
	No data available*		

* Measurements were not performed or inadequate number of parameters for computation of *SWQI*

Locations, methodology and frequency of measurements

The monitoring program for surface water quality in recipients in the studied road corridor shall include minor streams and land improvement canals not covered by systematic monitoring performed by RHMZ (Republic Hydrometeorological Service of Serbia).

Samples shall be taken upstream and downstream from the point of discharge of runoff from separators. Sampling procedure and technique shall be defined in a protocol between the interested parties so that the samples taken at different locations and by different operators are always representative and comparable.. This protocol shall also deal with the equipment, sampling procedure, preparation of samples, conservation and storage.

9.5.3. Monitoring of ground waters

Testing of quality of both surface and ground waters on the territory of the Republic of Serbia is carried out according to the Program stated in the Decree on Systematic Testing of Water Quality issued by the Serbian Government at the beginning of every year taking into account that all criteria have been met. The program defines scope, type and frequency of water quality testing. Level and quality of ground water of the shallow aquifer

is monitored by the Republic Hydrometeorological Service of Serbia while deeper aquifers are monitored by relevant company engaged by the Ministry competent for geological activities. Monitoring of quality of tap water is entrusted to the Institute of Public Health on the studied area.

Systematic monitoring of properties of both surface and ground waters is performed through network of hydrological stations specialized for water quality and includes as follows: sampling, physical/chemical, biological/bacteriological and radiological analyses of water so as water quality indicators may be identified. According to the Water Framework Directive 2000/60/EC monitoring of ground waters provides data on quantity and chemical status of ground waters.
Monitoring of ground waters is performed by taking and analyzing water samples from piezometers. The purpose of piezometer is to determine hydrogeology and provide water samples and to monitor movement of pollutants.

The monitoring of the quantity status means, before all, the monitoring of the ground water table. The monitoring of the chemical status, as defined in the modern European approach is subdivided into surveillance and operational monitoring procedures, similar to surface waters. The ground water table monitoring and the surveillance chemical monitoring shall be undertaken in the first phase, while the required operational monitoring may depend on the analytical results of pressures and impacts (risk assessment).

The operational chemical monitoring procedure shall be initiated if a study of the results points to an adverse impact on the quality of ground water during road use and road maintenance. The supervising monitoring includes monitoring of chemical status of main and other parameters and it is performed according to directive. Ground water samples shall be subjected to an analysis of the following main indicators: dissolved oxygen, pH value, nitrates (NO_3^-), ammonia (NH_4^+), electrical conductivity. In addition to main indicators ground water samples shall be also tested to indicators that point out to possible impact caused by the structure in the course of operation: heavy metals (Pb, Cu, Ni, Cd), total content of oil and grease, chlorides (Cl^-), sulphates (SO_4^{-2}) and consumption $KMnO_4$.

If water monitoring planes a software package for modeling to be used, selection of parameters may be extended according to requirements of the selected package.

9.6. Monitoring of soil

The purpose of monitoring of soil quality is to preserve the natural good, i.e. to enable production of healthy food and stabile crops. One of protection measure for soil preservation is continuous monitoring of all changes in soil and especially monitoring of dangerous and hazardous substances.

Monitoring of soil quality - objectives

The purpose of soil monitoring is improvement of conditions for soil use and it means taking samples, performing measurements and processing data on fertility of soil and factor of soil contamination particularly with heavy metals. Soil contamination may result in diminishing of total loss of numerous soil functions and may indirectly influence water contamination. Soil contamination that exceeds the limit value may result in a number of consequences, such as pollutants entering the food chain and bearing risk for the health of people, as well as on the ecosystem as a whole. Local contamination is a consequence of local actions such as industrial plants and solid waste disposal. Diffusive soil contamination is reflected in sedimentation of air pollutants (PAH, PCB, SO_2, NO_x, heavy metals). Soil contamination may also be a result of waste waters and contaminated water disposal. Diffusive soil contamination can also result from the disposal of waste, waste sludge and final products in the process of waste water treatment. The consequences of the above ways of soil contamination are reflected in the loss of organic matter,

development of various pathogenic organisms, more intense erosion, salinity and acidity of soil.

Selection of parameters to be monitored

Apart from the basic parameters and indicators of soil quality (pH value, organic carbon content, capacity of ionic changes in cations, conductibility, dry matter content, distribution and density of particles) it is necessary to conduct monitoring of special pollutants i.e. the total concentrations of the following elements: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), led (Pb), zinc (Zn), phosphorus (P) and nitrogen (N).

Measuring points, method and frequency of measurement of determined parameters

Monitoring of road soil quality shall be conducted in the zone 100 m from the road edge, i.e. in the zone of possible impact.

The first and the most important step in the analysis of soil quality is sample taking. The manner in which a sample is taken does not influence only the reliability of measurements but also the conclusions on the quality of analyzed soil. Once taken a sample can hardly be reproduced in the sense of its physical and chemical properties. For example, any second sample taken at the same point may not be identical to the first sample. The depth at which samples are taken depends on land use, as well as influences on that land. In cultivated land samples are taken from the depth of 0-30 cm and 30-60 cm, respectively. Each sample is placed in a PVC container, agitated and stones and plant residues are removed. A sample prepared in this way is put in a PVC bag, labeled and transported to a laboratory.

Testing of dangerous and hazardous substances in soil and water for irrigation purposes will be performed by certified organization engaged by the Ministry of Agriculture. The organization shall inform the Ministry on testing results.

Preliminary testing of soil quality in the road area shall be performed 5 years minimum and sampling shall be carried out once in three months. After preliminary testing, plan of detailed investigations shall be prepared. Therefore place for samples taking shall be defined. Number of samples depends on preliminary tests and soil to be tested.

9.7. Noise monitoring

Noise measurement will be performed fully in accordance with standards: SRPS ISO 1996-1 and SRPS ISO 1996-2. Measuring places/points will be selected according to the required task and fully in accordance with provisions stated in the applicable Rulebook on Noise Measurement Methods, Content and Scope of Noise Measurement referring to methods of noise measurements and items 4.3.1 and 4.3.2, JUS U.J6.090:1992 Standard. In the course of measurement, special attention should be paid on allowable conditions under which the measuring device is designed to operate, according to manufacturers technical instructions. See Item 4.4, JUS U.J6.090:1992 Standard. During noise measurement, the equivalent A-weighted permanent sound level and duration in specified time interval shall be defined. The standard noise level at the place of measurement shall be also measured and its effect to measurement results defined. Then, it should be defined whether the measured noise contain impulses, tones or other related acoustic information (Item 4.5, JUS U.J6.090:1992 Standard). The obtained values and defined facts will be used as basis for defining the relevant noise level which is supposed to be the most important indicator of noise at one particular place that shall be compared with the defined values fully in accordance with the Attachment 2 stated in Decree on noise indicators, limit values, methods for defining noise indicators, disturbance and adverse nose effects in the environment. The relevant noise level will be used as basis for

estimation of noise at single point and compliance with defined values (Item 4.10, JUS U.J6.090:1992 Standard).

Estimation and comparison of results obtained in measurement shall be performed by hand or by applying the relevant program. Estimation shall be performed by comparison of basic noise indicators and/or ruling noise level with maximum allowable values, i.e. limit values of noise indicators.

- For confided spaces (buildings): according to Table 2, Attachment 2 of the Decree on noise indicators, limit values, methods for defining the noise indicators, disturbances and adverse effects of environmental noise;
- For open spaces (outdoor spaces): according to Table 1, Attachment of the Decree on noise indicators, limit values, methods for defining the noise indicators, disturbances and adverse effects of environmental noise and JUS U.J6.205:1992 Standard.

10. NON-TECHNICAL SUMMARY

Should contain short summary of data stated in the section 2-9 of the Study.

11. STUDY DEFICIENCIES

This section also contains data on technical deficiencies or lack of relevant technical knowledge or incapability to obtain the relevant data.

2.3.3. Decision on obtaining approval for the EIA Study

The Project Developer ("Roads of Serbia" PE) shall submit to the competent authority the application for the EIA Study approval together with the EIA study. The Project Developer shall submit the application for an approval within one year from the date of receipt of the final decision on the scope and content of the EIA Study.

The competent authority shall make the EIA Study available to public and arrange for a public presentation and debate on the Study. The Project Developer shall participate in the public presentation and debate on the EIA Study. Procedures referring to public inspection, presentation and debate together with their deadlines are stated in the Rulebook on procedure of public inspection, presentation and public consultation about the EIA Study. Once the public debate has been completed, the competent authority shall submit to the Project Developer opinions of interested parties together with proposals for amendments of the EIA Study.

The competent authority shall establish a Technical Commission for the purpose of the EIA Study evaluation. After consultations and public inspection, the competent authority shall submit to the Technical Commission the EIA Study together with systematized report on opinions of interested parties and organizations and the public concerned and report on the completed impact assessment procedure. The Technical Commission shall evaluate the suitability of the measures envisaged to prevent, reduce or eliminate the likely harmful effects of the project on the environment at the specific site and its vicinity during the construction and operation of the project in a case of accidents and upon the termination of the project operation. The Technical Commission may require that the Project Developer make certain modifications and amendments to the submitted EIA Study within a certain time limit. The Technical Commission shall submit the report with the evaluation of the EIA Study and the proposed decision to the competent authority within 30 days from the date of receipt of the documentation from the competent authority.

The competent authority shall inform the authorities, organizations and the public concerned about its decision to grant the approval for the EIA Study. The notice shall contain: the content of the decision, the main reason for the decision, the most important measures that the Project Developer shall undertake in order to prevent, reduce or eliminate adverse effects.

The Project Developer and the public concerned are entitled to initiate the administrative court proceeding against the decision of the competent authority.

3. DOCUMENTATION REQUIRED FOR ENVIRONMENTAL IMPACT ASSESSMENT

Pursuant to the Law on Environmental Impact Assessment, the Project Developer shall submit the following documentation for the EIA Study.

Together with application on EIA, the following documents shall be also submitted:

- Excerpt from the applicable planning document (information on location), i.e. verified urbanistic design or act on urbanic terms for construction of the studied structure (location permit);
- Conceptual design or Preliminary design, i.e. excerpt from the Preliminary design,
- Graphical overview of both micro and macro locations;
- Terms and approvals of other competent authorities and organizations obtained fully in accordance with the law;
- Evidence on payment of republic administrative fee;
- Other related evidences upon the request of the competent authority.

Together with application for defining scope and content of the EIA Study the following documentation shall be submitted:

- Excerpt from the applicable planning document (information on location), i.e. verified urbanistic design or act on urbanic terms for construction of the studied structure (location permit);
- Conceptual design or Preliminary design, i.e. excerpt from the Preliminary design,
- Graphical overview of both micro and macro locations;
- Terms and approvals of other competent authorities and organizations obtained fully in accordance with the law;
- Evidence on payment of republic administrative fee;
- Other related evidences upon the request of the competent authority.

Together with application for obtaining approval to the EIA Study the following documents shall be submitted:

- Minimum 3 (three) copies of the study in paper and electronic forms,
- Decision of the competent authority from the previously phase of the procedure.

Application for defining the scope and content of the assessment of the **present environmental situation** shall be submitted in a form which is in compliance with requirement for defining the scope and content of the EIA Study. The similar documentation shall be also submitted. Instead of Conceptual design or Preliminary design, as-built drawing shall be submitted.

4. REPORTING WITHIN THE ENVIRONMENTAL IMPACT ASSESSMENT

Participation of public and consultations with all interested groups is of significant importance for the impact assessment since it represents the valuable source of data on alternative solutions to be considered, important effects caused by the project and relevant protection measures.

Risk of conflicts after completion of the study and possible extension of procedure may be prevented by timely providing of important information. This procedure shall also provide transparence in working of state authorities, encourage responsibilities in the course of decision-making and enable citizens to enable their right to participate in the decision-making process as well as "right to justice".

Law on Environmental Impact Assessment provides participation of public, interested parties, organizations and other entities in all phases.

Decision making on the application for a decision on the need for an impact assessment

The competent authority (Ministry of Environment, Mining and Spatial Planning/Province Secretariat for Environment and Sustainable Development) shall inform the authorities, organizations and public concerned about the submitted application for a decision on the need for an impact assessment within 10 days from the date of receipt of the complete application.

The notice shall contain in particular the information on: Project Developer, title, type and site of the planned project, place and time when it will be possible to obtain the insight into the data, information and documentation contained in the project developers application, nature of the decision to be made by the authority on the submitted application and the title and address of the competent authority..

The Project Developer, the authorities and organizations and the public concerned may submit their opinions within then days from the date of receipt of the notice.

The competent authority shall decide on the application within ten days from the expiry of the period required for submittance of opinion taking into account the opinions of the authorities, organizations and the public concerned.

The competent authority shall deliver the decision to he developer and inform the authorities, organizations and the public concerned about such decisions within three days from the date on which the decision was made.

The competent authority may also define the scope and content of the EIA Study. If impact assessment is not required, the competent authority may define minimum environmental protection measures fully in accordance with other legislation.

The Project Developer and the public concerned shall be entitled to file a complaint against the decision of the competent authority on the application for a decision on the need for an impact assessment.

Scope and content of the EIA Study

The competent authority (Ministry of Environment, Mining and Spatial Planning/Province Secretariat for Environment and Sustainable Development) shall inform the authorities, organizations and public concerned about the submitted application for a decision on the need for an impact assessment within ten days from the date of receipt of the complete application.

The interested authorities and organizations as well as the public concerned may submit their opinions on the application within 15 days from the date of accepting the notice.

The competent authority shall bring the decision on scope and content of the EIA study taking into account specificities of the design and location as well as submitted opinions within 10 days from the date of expiry of deadline for submitting the opinion of interested authorities and public concerned.

The competent authority shall submit to the Project Developer decision on application for necessity for impact assessment and inform all interested authorities, organizations and the public concerned within three days from the date of bringing decision.

The Project Developer and the public concerned may appeal against the decision of the competent authority regarding decision for defining scope and content for the EIA Study.

Decision on the EIA Study approval

The competent authority shall make the EIA Study available to public and arrange presentation and debate on the Study. The public debate shall be hold in premises of the relevant local

authority in charge of environmental issues on which territory the studied project will be realized. At the same time, public discussion shall be also hold in premises of the Ministry of Environment, Mining and Spatial Planning/Province Secretariat for Environmental Protection and Sustainable Development and relevant local authorities on which territory the project will be realized. The competent authority shall inform the Project Developer, authorities, organizations and the public concerned about the time and venue for public consultations, presentation and debate on the EIA Study. The public debate shall be organized not earlier than 20 days from the date of information. The Project Developer shall participate in public presentation and debate on the EIA Study.

The Technical Commission shall evaluate the EIA Study together with the systematized report on the consultations of the authorities, organizations and the public concerned.

The competent authority shall inform the authorities, organizations and the public concerned about its decision to grant the approval for the EIA Study or to refuse the application for approval for the EIA Study within then days from the date of adoption of the decision. The notice shall contain:

- The content of the decision;
- The main reasons for the decision;
- The most important measures that the Project Developer shall undertake in order to prevent , reduce or eliminate adverse effects.

The applicant and the public concerned are entitled to initiate the administrative court proceeding against the decision of the competent authority.

Although competent authorities and Project Developer have shown great effort in realization of this procedure, interesting of public as a rule is increased when personal interests are in question (possible threat to proprietary rights) as well as in cases of engagement of non-government organizations and/or political groups. Results of this process cannot be evaluated to be completely satisfactory. Additional information should be provided for the publics (content and application of new environmental regulations, importance of this regulations to their rights).

Good examples from other countries have shown that in addition to environmental protection and protection of peoples health, social and economic factors of the project should be also analyzed and following issues reconsidered: persons who are temporary residents on the studied area, special social categories of population, politicians, non-government organizations private sector, media representatives, scientific workers, direct and indirect project users and other.

Moreover, practice in other countries has also shown that the following shall be provided so as successful consultation may be obtained:

1. All interested individuals, authorities and organizations shall be identified;
2. Enough information about the Project and affected areas shall be provided;
3. Relevant information procedure shall be performed:
    - Announcement by media and other means of public information,
    - Information of local government authorities,
    - Printing of pamphlets and brochures containing information together with invitation for participation,
    - Distribution of questionnaires in order to collect information and propositions (in a case of great number of interested persons and organizations),
    - Organization of special public meetings-forums, groups for project presentation (in a case of complex subjects and great number of interested),
    - Creation of team that shall monitor the consultation procedure (in a case of complex project, all issues shall be considered in early phase),

- Publishing of draft of the Study for the purpose of checking the adopted solutions prior to final phase and other;

4. Clarify to the participants that the purpose of consultations is not promotion or "selling" the project;
5. Provide enough time for consultations and consideration of suggestions and opinions;
6. Consider all suggestions and provide answers to all comments and remarks not recognized.

5. PROCUREMENT OF ENVIRONMENTAL IMPACT ASSESSMENT IN ROAD SECTOR PROJECTS

The Public Procurement Act shall lay down the conditions and regulate methods and proceedings for the purchase of goods and services and the contracting of construction works and services in cases where the client is a government body, organization or agency or a legal entity as stipulated by this Law; this Act shall regulate the method of recording contracts and other data concerning the public procurement as well as the methods of protection of rights of the bidders; this Act shall regulate the establishment of the Public Procurement Agency as an organization responsible for performing professional activities concerning the public procurement; this Act shall regulate other matters concerning the public procurement.

The procedure for the award of low-value public procurements under this Act shall be a procedure that will include procurement of goods, services or works whose estimated value is less than the value defined in the annual budget of the Republic of Serbia. The low-value public procurement procedure is defined by the Code on Low-Value Public Procurement Procedure and for issues not covered by this Code relevant provisions stated in the Public Procurement Act shall apply.

The Client shall launch the low-value public procurement procedure by bringing the decision in written form. The decision shall contain elements specified in the above-mentioned Code. At the same time, the Client shall bring decision on establishment of commission for the purpose of procedure. The commission shall be composed of president and two members.

In low-value public procurement procedure, the Client shall invite via mail, fax or e-mail a minimum three possible bidders to submit their offers. The Client may accept the most favorable offer even if he has received only one offer prepared according to the given instructions. For the purpose of publishing in the "Official Gazette RS", the Client shall announce the public procurement contract and suspend the procurement procedure.

The low-value public procurement procedure will apply when the estimated value of the public procurement is for 20% higher from the top limit for which clients are not obliged to apply provisions stated in the Public Procurement Act. The procedure shall also apply due to efficiency, emergency or other reasons that could not be predicted, escaped or eliminated.

Special records shall be kept on public procurements fully in accordance with the Public Procurement Act and Rulebook on Method on Keeping Records on Public Procurements governing the method of keeping the records and content of reports.

EIA study may be prepared by legal person and/or entrepreneur if registered for designing, engineering and preparation of studies and analyses. The legal person and or/ entrepreneur will form a multi-disciplinary team composed of individuals qualified for analysis of every and each environmental element. A person qualified for preparation of the EIA Study shall have adequate university degree and minimum five years of working experience in the relevant field or title of responsible design engineer. The Processor shall be expected to have enough experience for execution of services related to EIA study in road sector as well as services for preparation of instructions, manuals and guidelines in the EIA sector.

The Processor shall have the following basic qualifications:

- Previously successful experience in realization of similar contracts;
- Enough financial capabilities for financing of all preliminary activities required for successful and timely execution of contract;
- Enough personnel of adequate qualifications, specializations and experience;
- Adequate space and equipment for realization of contractual services.

Within the offer, the Consultant shall submit summarized CVs for key personnel.

6. ADDITIONAL ACTIVITIES

The road manager is responsible for implementation of environmental protection activities as a result of road project assessment not only during the preparation of technical documentation (Final design), but during the road construction and operation.

Pursuant to the Environmental Protection Act, the Environmental Impact Assessment Study shall include as follows: description of measures planned for the purpose of prevention, minimizing and elimination, if possible, of any significant environmental impact. The road manager shall implement environmental protection measures stated in the EIA Study or Decision on Absence of Environmental Impact. The planned environmental protection measures will be developed in the next phase of the preparation of technical documentation within the Environmental Protection Design, i.e. in the phase of preparation of Final design fully in accordance with provisions stated in the Law on Planning and Construction.

The road manager is responsible for implementation of monitoring program defined in the EIA Study.

CONTENT OF APPLICATION FOR MAKING THE DECISION ON NECESSITY OF ENVIRONMENTAL PROTECTION

1. **Data on the Project Developer**
   Name, registered office, address, telephone, fax, e-mail.

2. **Description of location**
   Sensitivity of the environment in the studied area that may be exposed to negative impact of the project in the terms of:
   a) The existing land use;
   b) Scope, quality and regenerative capacity of natural resources in the studied area;
   v) Absorption capacity of natural area with a special attention to swamps, coastal areas, mountain and forest areas, specially protected areas (natural and cultural heritage) and densely populated areas.

3. **Description of project characteristics**
   a) Project size;
   b) Possible accumulation with other related effects;
   v) Use of natural resources and energy;
   g) Waste formation;
   d) Pollution and inconvenience;
   đ) Risk of accidents especially in a terms of used substances/techniques fully in accordance with the applicable regulations.

4. **Main alternative solutions**
   The Project Developer shall present the main alternative solutions together with the most important reasons that govern the decision making taking into account the environmental impact.

5. **Description of environmental factors that may be affected**
   Description of environmental factors that may be affected by the project realization are stated below:
   a) Population
   b) Fauna
   v) Flora
   g) Soil
   d) Water
   đ) Air

e) Climate
ž) Structures
z) Immobile cultural heritage and archeological findings
i) Landscape and
j) Interrelation between the above-mentioned factors.

6. Description of possible environmental impacts

Possible environmental impacts:
a) Scope (geographic area, population exposed to risk)
b) Type of impact
v) Size and complexity of the impact
g) Probability
d) Duration, frequency and probability of impact.

7. **Description of measures planned for the purpose of prevention, minimizing or elimination of any significant negative environmental impact**

SHORT DESCRIPTION OF THE PROJECT

No.	Question	YES/NO Short description of the design	Will it have significant consequences? YES/NO and why?
1	2	3	4
1.	Execution/suspension of works will cause physical changes to the studied location (topography, land use, riverbed displacement)?		
2.	Will execution of works and further operation imply use of natural resources such as land, water, materials or energy, especially non-recoverable resources?		
3.	Will the project imply use, storage, transport, handling or production of substances/materials that may affect peoples health or environment or cause concern due to present or possible risks to human health?		
4.	May solid waste be expected during the project realization or in the phase of operation?		
5.	Will hazardous substances be released or any other hazardous substances identified during the project development?		
6.	Will the project cause noise/vibrations, heat energy or electromagnetic radiation?		
7.	Will the project cause risk of land/water contamination as a result of pollutants leakage into the ground, surface/ground water?		
8.	Will any accident risk that may affect the environment/human health be identified during the execution of works?		
9.	Will the project development cause social changes, for example in demography and traditional way of life?		
10.	Are there any other factors to be analyzed (development that may affect the environment, the existing/planned activities to be performed on the studied location)?		
11.	The studied location or its vicinity is under protection of international/national law due to its ecological, landscape, cultural or any other recognized value?		
12.	Any specific location such as swamp, water stream, mountain or forest that may		

	be affected by the project is identified in the vicinity of the studied area?		
13.	Any specific location populated with protected flora and fauna species (for the purpose of migration, wintering and other) that may be affected by the project is identified in the studied area?		
14.	Ground/surface waters that may be affected by the project development are identified in the studied area?		
15.	Will special areas or areas characterized with significant ambient value be identified on the project location and/or in its close proximity?		
16.	Will the project location be intersected with roads and/or structures to be used for recreation or other structures that may be affected by the project development?		
17.	Will roads that may affect the environment be identified on the studied location or in its close proximity?		
18.	Will the project occupy the location to be visible to great number of people?		
19.	Any place of historical/cultural significance that may be affected by the project is identified on the studied location?		
20.	The project will occupy the undeveloped area that will suffer loose of green areas as a result of project development?		
21.	On the studied location or in its close proximity land will be use for houses, gardens and other private purposes, industrial/commercial activities, recreation, for public utilities, agricultural production, forest, tourism or other related activities that may be affected by the project development?		
22.	Will special plans for future land use that may be affected by the project be developed for the studied area?		
23.	Is significant population density may be expected on the studied area or in its close proximity?		
24.	Any specific structure such as hospitals, schools, public utilities that may be affected by the project development are to be identified on the studied location or in its close proximity?		
25.	Any significant area characterized with rare resources such as ground/surface water, forests, agricultural, fishing, hunting and other related areas that may be affected by the design development is identified on the studied area or in its close proximity?		
26.	Any area already affected by pollution or other environmental impact may be identified on the studied location or in its close proximity?		
27.	The studied project location may be affected by earthquakes, settlements, landslides, erosion, flood or return climate factors (for example: temperature difference, fog, strong winds) and cause environmental problems?		
Summary of characteristics referring to the project and location together with indication of necessity for preparation of the EIA Study:			

Project Developer

Signature Seal

REQUIREMENT FOR DEFINING THE SCOPE AND CONTENT OF THE EIA STUDY

1. **Data on the Project Developer**
   Name, registered office, address, telephone, fax, e-mail

   1a) Location description

2. **Project description**
   (a) Description of physical project characteristics and conditions referring to land use in the phase of construction and regular operation
   b) Description of main characteristics of the production process (procedure and quantity of material to be used);
   (v) Estimation of type and quantity of expected waste substances and emissions as a result of regular operation.

3. **Overview of main alternative solutions**

4. **Description of environmental factors that may be affected by the project development are as follows:**
   (a) Population
   (b) Fauna
   (c) Flora
   (d) Soil
   (e) Water
   (f) Air
   (g) Climate
   (h) Structures
   (i) Protected natural goods, immovable cultural heritage and archeological findings
   (j) Landscape

5. **Description of possible significant environmental impacts**
   (b) Use of natural resources:
   (c) Emission of pollutants, inconvenience and waste elimination:

   Description of methods used in the course of EIA:

6. **Description of measures for the purpose of prevention, minimizing or removal of any significant environmental impact**

7. **Non-technical summary for information from 2 – 6.**

8. **Data on possible difficulties** (technical deficiencies or lack of adequate professional knowledge) identified by the Project Developer.

PART I

PROJECT CHARACTERISTICS

No.	*Question*	*YES/NO*	*Which characteristics may be affected by the Design and how?*	*May consequences be important and why?*
1. Will execution/suspension of works require activities that will cause physical changes at the studied location (topography, land use, displacement of riverbeds, etc.)?				

1.1	Permanent or temporary change of land use, surface layer or topography including increment of intensity of use?			
1.2	Clearing of the existing land, vegetation or structures?			
1.3	New land use?			
1.4	Preliminary works, boreholes for example, soil testing?			
1.5	Construction works?			
1.6	Bringing location into satisfactory state once the Project has been completed?			
1.7	Temporary locations for construction works or accommodation of civil engineering staff?			
1.8	Ground structures, constructions/earth works including intersection of linear structures, backfilling or excavations?			
1.9	Underground works including mining works and tunnel excavation?			
1.10	Works on land drying?			
1.11	Sludge removal?			
1.12	Industrial and finishing production processes?			
1.13	Structures for storage of goods and materials?			
1.14	Structures for treating/storage of solid waste or liquid effluents?			
1.15	Structures for long-term accommodation of workers?			
1.16	New road, railway line or river transport in the course of construction/operation?			
1.17	New road, railway line, air transport, water transport or other related infrastructure including new or modified directions, stations, harbors, airports, other?			
1.18	Closing/dislocating of the present transport routes/ infrastructure that will result in traffic changes?			
1.19	New/dislocated pipe lines?			
1.20	Construction of dams, culverts regulations and other related changes in water streams and/or aquifers?			
1.21	Crossings over water stream?			
1.22	Pumping out/transfer of water from ground/ surface sources?			
1.23	Changes in water streams or on surface that affect drainage/dewatering systems?			
1.24	Transport of personnel/materials for the purpose of construction?			
1.25	Long-lasting works on dismantling, total suspension/resumption of works?			
1.26	Current activities during the total suspension that may affect the environment?			
1.27	Inflow of people into the area, temporary or permanent?			
1.28	Introduction of new animal and plant species?			
1.29	Loss of autochthonous species or genetic and biological diversities?			
1.30	Other?			

2. Will facilities planned by the Project require use of natural resources such as soil, water, materials or energy, especially non-recoverable resources?				
2.1	Soil, undeveloped/agricultural?			
2.2	Water?			
2.3	Minerals?			
2.4	Stone, gravel, sand?			
2.5	Forest and wood use?			
2.6	Energy, including electrical energy and liquid fuels?			
2.7	Other resources?			

3. Does the Project imply use, storage, transport, handling or production of substances/materials that may affect the human health/environment or cause concern due to possible risk to human health?				
3.1	Does the project imply use of substances/materials toxic/hazardous to human health/environment (flora, fauna, water supply)?			
3.2	Will the Project cause changes in disease outbreaks or affect the carrier of decease (for example, diseases transmitted by insects or water born spread disease)?			
3.3	Will the Project have influence to population welfare?			
3.4	Are there especially vulnerable population groups that might be affected by the Project, for example, hospital patients, old people?			
3.5	Other causes?			
4. Will solid waste be formed in the course of execution of works or after completion?				
4.1	Top soil, stockpiling area for the top soil or mining waste?			
4.2	Urban waste (from apartments or commercial waste)?			
4.3	Dangerous or toxic waste (including radio-active waste)?			
4.4	Other industrial waste?			
4.5	Product surplus?			
4.6	Waste sludge or other sludge as a result of effluent treatment?			
4.7	Construction waste or debris?			
4.8	Surplus of machinery and equipment?			
4.9	Contaminated soil or other material?			
4.10	Agricultural waste?			
4.11	Other type of waste?			
5. Does the project development imply releasing of contaminated substances or any other hazardous and toxic substances into air?				
5.1	Emissions from stationary or mobile sources for combustion of fossil fuels?			
5.2	Emissions from production processes?			
5.3	Emissions from handling materials including storage and transport?			
5.4	Emissions from construction activities including plants and equipment?			
5.5	Dust/unpleasant odors as a result of handling with materials, including construction materials, sewage and waste?			
5.6	Emissions as a result of waste burning?			
5.7	Emissions due to burning of waste on the open area (for example, cut-off material, construction remnants)?			
5.8	Emissions from other sources?			

6. Will project development cause generating of noise and vibrations, heat energy or electro-magnetic radiation?				
6.1	Due to equipment, for example, machinery, ventilation facilities, crushers?			
6.2	From industrial or similar processes?			
6.3	Due to construction works and removal of civil engineering and other structures?			
6.4	From explosions or pile driving?			
6.5	From construction machinery or traffic?			
6.6	From lighting system or from cooling system?			
6.7	From electro-magnetic sources (includes effects produced by the closet sensitive equipment and people)?			
6.8	From other sources?			
7. Will project development affect the soil or water as a result of releasing of contaminated substances to soil or sewage, surface and ground water?				
7.1	Due to handling, storage, use or leaking of hazardous or toxic substances?			
7.2	Due to lacking in sewage system or other fluents (treated and untreated) into water or soil?			
7.3	Settling of contaminated substances released into air, soil or water?			
7.4	From other sources?			
7.5	Is there long-lasting risk due to contaminated substances from the above-mentioned sources?			
8. Will project development cause accident risk that may affect the environment or human health?				
8.1	From explosions, leaking, fire, etc. during storage, handling, use or production of hazardous or toxic substances?			
8.2	Due to reasons beyond limits standard for environmental protection, for example due mistakes in pollution control system?			
8.3	Due to other reasons?			
8.4	Due to natural disasters (for example, flood, earthquakes, landslides, etc.)?			
9. Will the project development cause social changes, for example in demography and traditional way of life?				
9.1	Changes in population structure, age, social groups?			
9.2	Displacement of inhabitants or demolishing houses/settlements/public structures in settlements such as schools, hospitals, social facilities?			
9.3	Immigration of new inhabitants/formation of new communities?			
9.4	Increased requirements referring to habitation, education, health protection?			
9.5	Establishment of new work places in the course of construction/operation or loss of work places?			
9.6	Other causes?			
10. Are there other factors to be reconsidered such as further development that may affect the environment or cumulative influence together with other present or planned activities on the location?				
10.1	Will the Project cause further development that may affect the environment such as increased inhabitation, new roads, new development of accompanied industrial capacities, etc.?			

10.2	Will the Project cause development of related structures that may affect the environment, for example: – Supporting infrastructure (roads, electrical supply, solid waste or waste water treatment); – Development of settlements; – Exctrative industry; – Supply; – Other?			
10.3	Will the Project cause further use of location which will affect the environment?			
10.4	Will the Project enable development according to the similar model in future?			
10.5	Will the Project have cumulative effects due to vicinity of other present or planned projects with similar effects?			

PART II
Characteristics of the wider area planned for Project realization

For every Project characteristic stated in the text below, one should reconsider whether one of the below environmental components may be affected by the Project.

QUESTION:	**Will some of environmental characteristics on the studied location or in its close proximity be affected by the Project?**
QUESTION:	**Does the Project occupy the location visible to most of people?**
QUESTION:	**Whether the Project occupy the undeveloped location which will result in loss of green areas?**
QUESTION:	**Is location planned for the Project is to be used for certain private or public purposes, for example:**
QUESTION:	**Are there plans for future land use at the studied location or in a close vicinity that may be affected by the Project?**
QUESTION:	**Are there densely populated areas on the location or in its close vicinity that might be affected by the Project?**
QUESTION:	**Are there sensitive areas at the location or in its close proximity that might be affected by the Project:**
QUESTION:	**Are there areas at the location or in its close vicinity characterized with significant/poor resources that might be affected by the Project:**
QUESTION:	**Are there areas already contaminated areas that might be affected by the Project?**
QUESTION:	**Is there any possibility for location to be affected by earthquake, settlement, landslide, erosion, floods or extreme climate conditions such as temperature differences, fog, strong winds that may affect the environment?**
QUESTION:	**Is it possible that the releasing as a result of the Project will affect the environment:**
QUESTION:	**Is it possible that the Project will affect the availability/sufficiency, on both local and global levels:**
QUESTION:	**Is it possible that the Project will affect the human health and community welfare:**

Project Developer

Signature Seal

Bibliography:

1. Deo 1: Priručnik za procenu uticaja na životnu sredinu u sektoru puteva, Sumarni deo, Javno preduzeće "Putevi Srbije", Beograd 2009.godine.
2. Deo 2: Priručnik za procenu uticaja na životnu sredinu u sektoru puteva, Metodologija, Javno preduzeće "Putevi Srbije", Beograd 2009.godine.
3. Deo 3: Preporuka o metodologiji za procenu ekoloških efekata u okviru procene uticaja na životnu sredinu, u procesu projektovanja puteva i železnica, Javno preduzeće "Putevi Srbije", Beograd 2009.godine.
4. S.Tošović, A.Vesić, Procena uticaja projekata na životnu sredinu, Druga stručna konferencija "Inženjerske aktivnosti i obaveze u zaštiti životne sredine", Beograd 2005.god.
5. M. Gucić, Iskustva u primeni novih propisa o zaštiti životne sredine, , Druga stručna konferencija "Inženjerske aktivnosti i obaveze u zaštiti životne sredine", Beograd 2005.god.
6. Uputstvo za procenu uticaja vetroelektrana na životnu sredinu, UNDP Serbia i Ministarstvo životne sredine i prostornog planiranja Republike Srbije, Beograd 2010.god.
7. SMJERNICE ZA PROJEKTOVANjE, GRAĐENjE, ODRŽAVANjE I NADZOR NA PUTEVIMA, PUT I ŽIVOTNA SREDINA, Fakulteta za gradbeništvo Fakulteta v Ljubljani i DDC Consulting & Engineering Ltd., Sarajevo/Banja Luka 2005.god.
8. V.Anđus, M.Maletin: Metodologija projektovanja puteva, Građevinski fakultet Univerziteta u Beogradu, Beograd 1993.god.