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# *A. BASIC INFORMATION*

## *I. PROPOSER'S BASIC DATA*

### *1. Name*

National Motorway Company, joint-stock company

### *2. ID No.*

35 919 001

### *3. Registered Office*

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### *4. CONTACT INFORMATION OF AUTHORIZED REPRESENTATIVE OF THE CLAIMANT*

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## 5. CONTACT INFORMATION OF AUTHORIZED PERSON FOR PROVISION OF RELEVANT INFORMATION ON THE PROPOSED ACTIVITY AND PLACE OF CONSULTATION

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# *II. BASIC INFORMATION ON THE PROPOSED ACTIVITY*

## *1. Name*

**D4 Highway, Jarovce - Ivanka North**

## *2. Purpose*

The extent of the highway network and expressway network in Slovakia was approved by the Decree of the Government of the Slovak Republic No. 162 "New Project of Construction of Highways and Expressways" in 2001, which defined the highway network consisting of highways D1, D2, D3 and D4 and a network of expressways R1, R2, R3, R4, R5 and R6 with possible other expressway routes in the distant future outlook and Resolution of the Government of the Slovak Republic No. 523 "Updated New Project of Construction of Highways and Expressways" in June 2003, which extended the network of expressways by expressway route R7. Government Resolution No. 882/2008 dated 3 December 2008 regulates highway route D4, expressway route R1, specifies in more detail and supplements the expressways by another expressway route R8.

The highway network is under UV no. 882/2008 defined by the following sections:

- D1 – Bratislava (Petržalka – interchange with D2) – Trnava – Trenčín – Žilina – Prešov – Košice – national border SK / Ukraine,
- D2 – national border CZ / SK Kúty- Malacky – Bratislava - national border SR / HU,
- D3 – Žilina – Kysucké Nové Mesto – Čadca – Skalité national border SK/PL,
- D4 – national border Austria /SK - Bratislava - D2 interchange Jarovce - interchange Rovinka - interchange with D1 Ivanka pri Dunaji North - interchange with road II/502 - interchange with road I/2 - interchange with D2 Stupava South - national border SK/Austria.

The total planned length of highways is about 705 km.

The expressway network is under UV no. 882/2008 defined by the following sections:

- R1 – Trnava – Nitra – Žarnovica – Žiar nad Hronom – Zvolen – Banská Bystrica – Ružomberok,

- R2 – Trenčín interchange D1 – Prievidza – Žiar nad Hronom –Zvolen – Lučenec – Rimavská Sobota – Rožňava – Košice,
- R3 – nat. border HU / SK Šahy – Zvolen – Žiar nad Hronom – Turčianske Teplice – Martin – Kraľovany – Dolný Kubín – Trstená – nat. border SK/PL,
- R4 – nat. border HU/SK – Milhosť – Košice – Prešov – Giraltovce - Svidník – nat. border SK/PL,
- R5 – nat. border CZ/SK Svrčinovec – interchange with D3,
- R6 – nat. border CZ/SK Lysá pod Makytou – Púchov,
- R7 – Bratislava – Dunajská Streda – Nové Zámky – Veľký Krtíš – Lučenec,
- R8 – Nitra – Topoľčany – Partizánske – interchange with R2.

The total planned length of expressways is about 1,160 km.

For the future perspective, in accordance with the Slovak Spatial Development Perspective (KURS 2001) it can be considered further completion of expressway network with road routes:

- Bratislava – Senec – Sereď,
- Kapušany – Ubľa – nat. border SK/Ukraine,
- D1 – Hlohovec – Nitra – Nové Zámky – Komárno – nat. border SK/HU,
- Lučenec – Fiľakovo – nat. border SK/HU,

The concept of highway construction in Slovakia was accepted and incorporated in the conclusions of the II. Pan-European Conference in Crete held in 1994 and the III. conference in Helsinki in 1997 under which the TEN project (before Slovakia's accession to the EU it was called TINA project) in Slovakia consists of the principal and complementary network. The principal network is formed by three Cretan - Helsinki traffic corridors:

- corridor IV. (D2) – Berlin/Norimberg – Praha – Kúty – Bratislava – Budapest – Istanbul,
- corridor Va. (D1) – (Terst) – Bratislava – Žilina – Košice – Užhorod – (Ľvov),
- corridor VI. (D3) – Gdaňsk – Katovice – Skalité – Žilina.

The complementary network consists of two north-south corridors:

- Central corridor (R3) – Martin – Turčianske Teplice – Zvolen – Šahy – nat. border SK/HU – Budapest,
- Eastern corridor (R4) – Rzeszów – Vyšný Komárnik – Prešov – Košice – Milhosť – nat. border SK/HU – Miskolc.

It is obvious that it is justified to consider the highway network in TEN central network routes, because this network is in principle compatible with major transport corridors in Slovakia and the expressway network supplementing the highway network with more internationally and nationally important road transport links in the north - south and west - east direction, including TEN additional corridors.

D4 highway is a road link of existing D1 and D2 in the southern, eastern and northern part of Bratislava, while the affected area is also in terms of transport relations and linkages within the region of the "Great Bratislava" very complicated due to the rapid development of the subregion and constantly changing activities and functions in this extremely attractive area where the fixing of transport requirements and links to existing road system is very crucial. In addition to the D2 and D1 highway linking D4 will be a major international interconnection between Slovakia and Austria with transport links to Hungary and the Czech Republic.

At present, D4 is in operation from the A/SK border to the interchange of D4 with D2 Jarovce in the length of 2.7 km and half profile of D4 Záhorská Bystrica - Devínska Nová Ves is under construction (Stupava South interchange) in the length of 3.2 km.

D4 in Jarovce - Ivanka section is under current technical documentation (Feasibility and effectiveness study for D4, Dopravoprojekt 2009) the 1st section of D4, currently being prepared, while the entire D4 section is divided according to the documents as follows:

- Section I. Jarovce - Ivanka North
- Section II. Ivanka North - Záhorská Bystrica
- Section III. Záhorská Bystrica - Devínska Nová Ves
- Section IV. Devínska Nová Ves - nat. border SK/A

In terms of the foregoing, the purpose of the proposed activity in addition to improving conditions for international and domestic transit traffic is to increase the flow, speed and safety of all road users with reduction of the negative impacts of the existing road transport on the environment, particularly in relation to the significant environmental burden of urban area and the region of the "Great Bratislava."

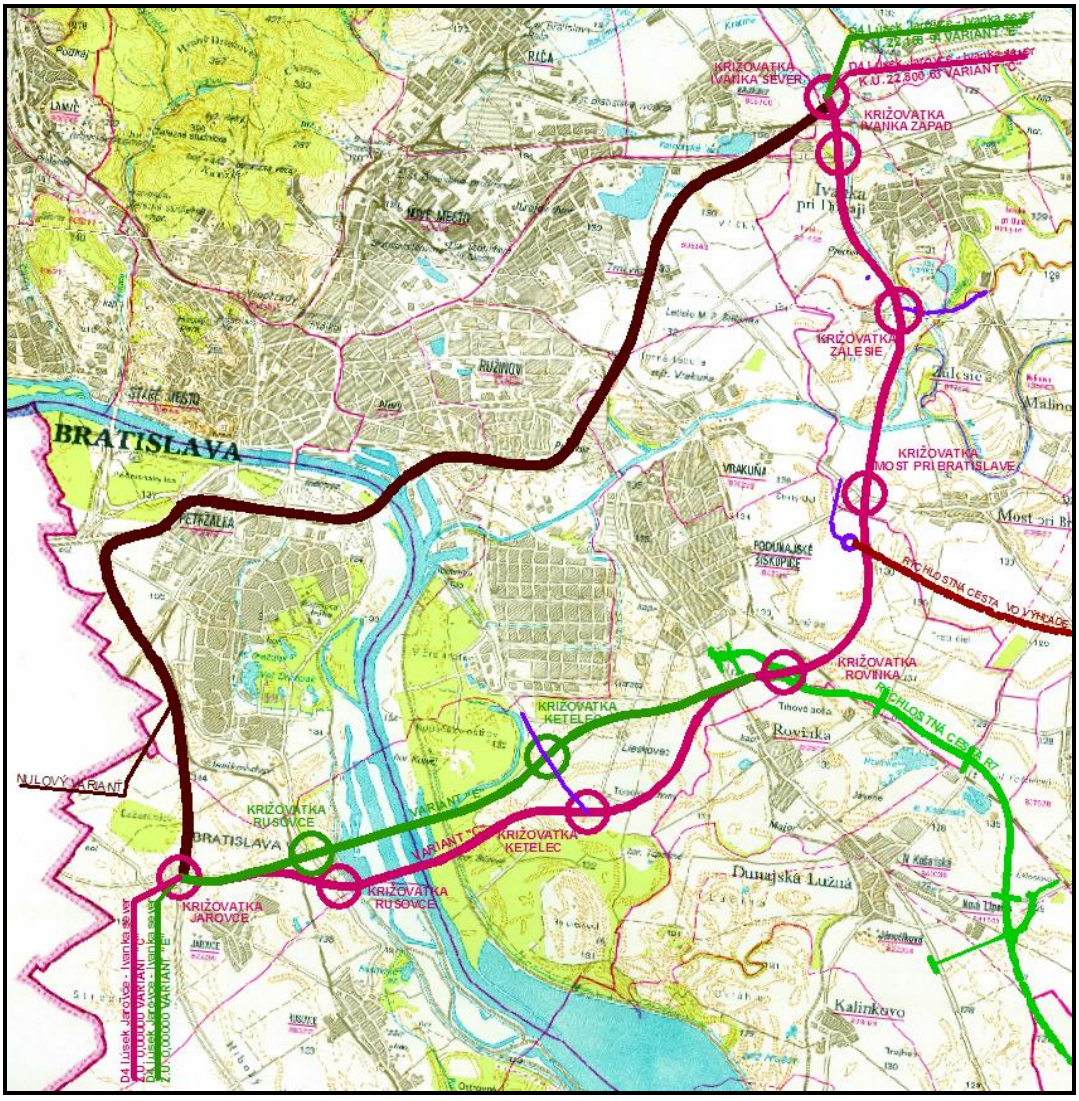
## 3. User

Public structure managed by the National Motorway Company, a.s.

## 4. Location

| | |
|---|---|
| Place: | Bratislava – district of Jarovce, Rusovce, Podunajské Biskupice, Vajnory, Most pri Bratislave, Ivanka pri Dunaji |
| Cadastral area: | Bratislava – district of Jarovce, Rusovce, Podunajské Biskupice and Vajnory, Most pri Bratislave, Ivanka pri Dunaji - Farná, Ivanka pri Dunaji, |
| Territorial District: | Bratislava, Senec |
| Region: | Bratislava |

## 5. General overview of placing the proposed activity




## 6. Reason for placing at the relevant location

A large part of the area affected by the proposed D4 highway is formed by Bratislava. Its communication system consists of roads with national and supra-municipal importance - D1, D2 and D4, 1st class trhough roads (I/2, I/61, I/63) 2nd class road sections (II/502, II/505, II/572) and other 3rd class roads. Bratislava is also the crossroad of major European routes - E65, E75, E58 and it is passed by the routes of Pan-European multimodal corridors

- C IV Berlin - Prague - Kúty - Bratislava (with links to Vienna), highway Bratislava branch - nat. border SK/HU (Rusovce) - Budapest and railway branch Bratislava - Nové Zámky - Štúrovo - nat. border SK/HU - Budapest,

- C Va Terst - Bratislava (with connection to Vienna) - Žilina - Košice - Uzhgorod and Žilina - connecting corridor VI (north - south) - Čadca - Katowice - (Warsaw) - Gdansk,

- C VII Danube (for river - shipping transport)

and current planned highway network under construction will become a part of these corridors.

The road network in the Bratislava territory and its surroundings is currently characterized by high growth of car traffic congestion, not only urban but also transit one. The importance of the need to address transport - road infrastructure, and constant verification of the road effectiveness in terms of the Slovak road network development, is described by characteristics of Bratislava and its surroundings. These are:

- Bratislava is the capital and largest city in Slovakia,
- it is located in an eccentric position relative to the entire national territory that is the south-western part near nat. borders with Austria and Hungary,
- Bratislava is a strong source and objective for car traffic, high traffic load at the entrance to the city is due to strong dependence of the population in surrounding municipalities to the capital city, where an important part of their jobs, training and other activities is carried out,
- this trend is further reinforced by the relocation of the urban population to rural settlements for higher quality of housing, particularly in the south-east and east of Bratislava, but also in other parts of the Bratislava region,
- despite the fact that the most part of its territory is flat, SW part of the Small Carpathians extends to the central part of the city, which divides the city into two parts,
- another major barrier is the Central European river of Danube.

Bratislava road network and the entire Bratislava region is heavily burdened, while many sections of the basic Bratislava communication system is already highly congested in capacity. One of the negative consequences of this situation is the high number of accidents. The newly opened sections of D1 (Port bridge - Senecká street) are section with the highest car crash rate within the national average.

In the territory affected by D4, the traffic trends have a negative impact on the existing road network, which is to meet the required standards. Its inadequacy to existing transport requirements is demonstrated by capacity problems on the road I/63 entering Bratislava from Šamorín, on the road II/572 in direction from Most pri Bratislave, on the road I/61 in the direction from Senec, on D1 in the direction from Trnava . Mentioned 1st and 2nd class roads are overloaded in rush hours on a daily basis, and the duration of the rush hours is extending during the day. The most significant problems can be seen on the road I/61 and I/63, which is even on the territory of the Dunajská Lužná and Rovinka led on through roads of the municipalities. The big issue is joining these roads from side roads.

In order to avoid problems at the entrance to Bratislava, many drivers seek alternative routes via lower class roads, thus burdening the local road network of surrounding towns and villages loaded for many years. Traffic problems also arise in some sections of the existing highway network. Transit traffic directed until D1 from Trnava passes directly the area of the town and is cut into different directions behind Port bridge and Vienna route. For the lack of capacity of Bratislava communication network the highway network is used by the source and target traffic moving from the eastern edge of Bratislava to the west and vice versa. This causes extra traffic load especially in the area before the Pont Bridge, after the bridge and joined roads via Petržalka. After completion of D1 Vienna Route - Port Bridge through Petržalka and the joined section of D2 via Sitina tunnel the attractiveness of this route has even increased.

Construction of D4 greatly helps out the above traffic problems. Its contribution will be mainly to divert transit traffic to Austria and Hungary as well as in diffusion of transport to the city radial roads. Although the highway is to serve primarily transit traffic, in this specific area it will greatly facilitate the operation of the affected area. If D4 is not implemented, it can be expected in a short time the need for solution of transit transport conduct directly throughout the territory of Bratislava - however, this task in the existing communication system offers only the route through the Port bridge via Petržalka, already congested by source - target traffic from the city area and its immediate surroundings.

Regardless of D4 it will be necessary to launch the capacity solution of the road I/61 from Senec to the entrance to the city as soon as possible (SSC IVSC Bratislava prepares extending of the road I/61 for category C 22.5 / 80). In a very short time, it can also be expected the collapse of the through road I/63 through Rovinka and Dunajská Lužná down to Šamorín, corresponding to the issue of the need to build the R7 expressway. It is thus clear that all upcoming investments - road relocation I/61, R7 expressway, D4 highway, are justified. It can be stated that the zero state in the route D2 interchange Jarovce - interchange D1 / D2 (Pečňa) - D1 Vienna Road - Port Bridge and D1 Mierová - Senecká road is already on the edge of capacity load, and projected traffic plan expects further increasing traffic load in the following period.

Construction of a new section of D4 highway which will take over the entire transit connections through Austria - Košice, Hungary - Košice and Brno - Košice, is the only conceptual solution to this problem, while D4 will have a significant impact on solving traffic problems in the affected part of the Bratislava region and in the city of Bratislava as such.

## 7. Dates of Commencement and Completion of the Construction and Operation of the Proposed Works

| | |
|---|---|
| Commencement of construction: | 2012 |
| Completion of construction and putting into operation: | 2015 |
| Completion of works: | not defined |

## 8. Brief description of technical and technological solutions

The territory of D4 in the section of Jarovce - Ivanka is plain, bounded on the south-west by D2 and in the north by D1 as fundamental elements defining the section of D4 and connection points to the existing highway network. The affected areas are:

- territory north of the city district of Bratislava (CD BA) - Jarovce and Rusovce on the right bank of the Danube, connecting D4 to D2 at elevated junction (MUK) of Jarovce,
- inundation area of the Danube including the river itself
- south of the Slovnaft, a.s. between CD BA - Podunajské Biskupice and Rovinka,
- area between the Bratislava Airport and the village of Most pri Bratislave,
- territory between the Bratislava Airport and villages of Zálesie and Ivanka pri Dunaji along the Šúrsky channel.

The D4 route is designed to respect the existing realities and development tendencies of Bratislava, Bratislava Airport and Rovinka, Most pri Bratislave, Zálesie and Ivanka pri Dunaji, as well as significant protected areas. These are mainly the following:

- minimize interference of the structure in a protected area near the Danube River (PLA Danube floodplains, PR Danube islands, PR Gajc, PR Kopáčsky island and protected areas of European importance NATURA 2000), whilst the territory of Jarovské arms is intended to be enlisted as the protected area of European importance NATURA 2000 .
- possibility to build rowing and canoeing tracks on Jarovské arm and land use for recreation and sports,
- shipping site on the Danube River,
- respect for the Ketelec gravels exploitation south of Slovnaft, a.s.,
- protection against groundwater pollution (Rye Island),

- respect for the area at the intersection of D4 and road I/63, which is extremely loaded with technical infrastructure (ZSE facilities, pipelines, oil pipelines and many more)
- respecting development plans of the Bratislava Airport consisting in:

    - the airport plans shortly to extend the runway from 13 to 31 to a total length of 3,600 m and shift the Little Danube river-basin to a new location, while it is necessary to respect existing protection zones of runway 13-31 in the design of D4 highway, which is conducted at the level of the current field,
    - the airport plans to build a parallel runway 13L - 31R for the future, which must book a territory, while protection zones of the airport runway will be the same as for runway 13-31, while during construction of runway 13L - 31R the former agricultural farm will be closed in the area of Prucká sihoť, suggesting that at the intersection of D4 highway with the protection zones of transition areas of the airport it is not necessary within the construction of highway to build the "Zálesie" tunnel, however, D4 highway should be kept within the recess so as to respect protection zones of runway 13L - 31 R,
    - Runway 04-22 will not be expanded in the future.

D4 in the section of Jarovce - Ivanka North was based on the comments to the Plan, respectively in terms of the specific requirements set out in Assessment range, technically resolved in the Feasibility and effectiveness study processed in September 2009 by Dopravoprojekt, a.s., while in addition to the basic options "A" purple and "B" red, which have been designed in Plan in accordance with Act No. 24/2006 Coll. (Geoconsult, spol. s.r.o. in December 2007), further options "C" red, "D" blue (tunnel option) and "E" green were solved.

Solutions of the new D4 options resulted from the following comments and requests for Option "A" and "B" proposed in the Plan, resp. referred to in the specific requirements of Assessment range issued the Ministry of Environment for further assessment of D4 section of Jarovce - Ivanka North, namely:

1. When passing D4 over the Danube considerable intervention in protected areas. Intervention in nature reserve of Gajc and nature reserve of the Danube islands, which consist of valuable habitats of floodplain forest and steppe habitats, affects the PKA Danube floodplains, the systems of European importance Natura 2000 and part of the sites protected by the Ramsar Convention, intervention also means affected elements of regional and provincial TSES. Therefore there is a request to search for other, new options of crossing over the Danube River, where the intervention in protected areas would be lower. It is required to examine the possibilities of routing D4 via tunnel under Danube.
2. Consider the possibility of extending the D4 six-lane in the section from the intersection with D2 ("Jarovce" elevated interchange) to D1 ("Ivanka - North" EI).
3. In terms of the bridges over the Danube and Little Danube it is advisable to deal with the pedestrian, respectively cycling linking of existing trails.
4. As a solution of R7 expressway, Bratislava prefers Option A, which is consistent with the LUD Bratislava. Option C of R7 is not acceptable for Bratislava due to its outlet into the congested road I/63 (Biskupická radial). Most of the other affected municipalities and authorities is for Option C of R7.
5. "Ivanka - North" elevated interchange to be designed as a full clover leaf interchange.
6. "Rovinka" EI requirement to supplement the interchange branch of D4 (Petržalka) to the road I/63 (towards Šamorín).
7. Worries for exceeding the permissible noise load in "Zálesie" and "Ivanka" tunnels, worries for flooding the tunnels in the event of dam breakage of Šúrsky channel.

8. Resolve routing of D4 near the Bratislava Airport and airport beacon in cooperation with the Civil Aviation Authority.
9. Examine the possibility of connecting feeder of Zálesie to the D4 highway with a complete entrance and exit from the highway.

From the above observations the Feasibility and effectiveness study has reviewed and consequently taken into account the following:

1. New options of crossing D4 with the Danube and crossing Natura 2000 protected area (0.0 to 11.0 km of D4)
    a. option "C" (by viaducts) - red
    b. option "D" (via tunnel under the Danube) - blue
    c. option "E" (by viaducts) - green
2. In the section from "Rusovce" EI for "Ivanka - West" EI it was recommended to build the D4 highway in category D 33.5/120, with four-lane width arrangement in the 1st stage, i.e., with the broader central line so as to allow the prospective expansion of the six-lane highway towards the axis (it is questionable to leave a margin for 6-lane already from "Jarovce" EI, i.e. from the D2 highway).
3. Accepted in the design of bridges with Option C and E.
4. R7 expressway was not part of the study, but in the present study it was considered the D4 highway with both options of R7 (i.e. Option "A" and Option "C"), as the MoE in its Final opinion did not recommend the final option for the R7 expressway (both options are environmentally equivalent). However, by letter of 8 September 2009, the Minister of Transport, Posts and Telecommunications of the Slovak Republic Ing. Vážny ordered to continue with the preparation and construction of the R7 expressway in the section Bratislava - Dunajská Lužná in Option "C" - green.
5. Accepted in the proposal of "Ivanka - North" EI.
6. It was proposed to change the form of "Rovinka" EI, connection of road I/63 and interchange branches is designed with a large roundabout. Based on the assessment, the proposed interchange will be appropriate in terms of capacity for prospective transport requirements as uncontrolled.
7. The meeting held on 6 April 2009 with representatives of the Bratislava Airport concluded that "Zálesie" and "Ivanka" tunnels that were designed in Option "A" and "B", need not be built. When designing the placement of D4 within the airport, the D4 highway in new options (C, D, E) is routed at the level of the current field so as to respect existing protection zones of Runway 13-31. D4 will be conducted in a channel (in the sealing bath) so as to respect the protection zones in the area of intended parallel runway 13L - 31R Runway 04-22 is not projected for expansion in the future, this runway is to be used out (as the aircraft during take-off and landing are flying over populated territory of Ivanka pri Dunaji). There is request for exemption from the protection zones for this runway. Protection against traffic noise of D4 will be provided using noise barriers at 19.3 to 21.5 km of D4 to the right.
8. Resolved - routing of D4 within the Bratislava Airport was adjusted (Option "C") following an agreement with representatives of Bratislava airport. Design according to the initial Option "A" is not feasible in the place of crossing the Little Danube regarding collision of vertical routing of D4 with protection zones of runway 13-31 respecting min. height of the

lower edge of the highway bridge over the Little Danube level $Q_{90}$(requirement of the Slovak Water Management Enterprise).

9. As part of the feasibility study, the possibility of connection of Zálesie feeder to the D4 highway as a complete intersection has been reviewed. This would be technically possible in Prucká sihoť, on the other hand, the basic conditions for the construction of the highway connector are not met, because in that area there is no 1st or 2nd class road or an expressway, which could be connected to the D4 highway, and also the conditions of required outlook traffic load are not met. For the above reasons, it is not recommended to build "Zálesie" EI and "Zálesie" highway feeder road within the construction of D4. However, it is recommended to book a territory for the construction in perspective in case of an extensive urbanization in the cadastral area of Zálesie, Ivanka pri Dunaji and surrounding villages, and it could significantly exceed the capacity of existing 3rd class roads even despite the operation of D4, R7 and a four-lane road I/61, when it is expected that they will no longer be transit routes through municipalities as it is at present and this should lead to an improvement in the transport situation in the affected municipalities compared to the present. At the same time, the criteria for building a highway feeder are to be met in terms of amount of traffic load and it capacity utilization.

Based on the foregoing, the original designed Option "A" purple and "B" red set out in the Plan, it can still be considered as one of the options only in the section from 0.0 to 12.0 km of D4, i.e., in the section with equal highway route of D4 in both options. Strong reservations against this option have been made in the section of crossing over the Danube in view of the substantial intervention in protected areas on both banks of the Danube (Nature Reserve of Gajc, nature reserve of Danube islands, PLA Danube floodplains, the systems of European importance Natura 2000, part of the sites protected by Ramsar Convention). For this reason the highway route in the Feasibility study was partially modified in the section 2.0 to 5.0 km to the Option "C", respectively a new route of the highway was designed via tunnel Option "D" and the option with viaduct "E", but in a different position as Option "C".

The solution in the section from 12.0 to 20.0 km in Option "A" purple set out in the Plan currently is not appropriate in terms of horizontal conduct of the route for proposed speed $v_n$ = 120 km/h (R=1000 m is inadequate under the new STN 73 6101/O1) and the solution is also unacceptable in terms of the interests of the Bratislava Airport (the need to respect the airport protection zones). According to the conclusions of the meeting of Bratislava Airport it is not necessary to build "Zálesie" and "Ivanka" highway tunnel on D4. For these reasons this option in the section from 12.0 to 20.0 km was abandoned. The initial Option "B" red was in the context of the present study modified in the section from 12.000 km to final section in Option "C" to suit the design speed $v_n$ = 120 km/h, to respect the interests and protection zones of the airport and requirements of the Slovak Water Management Enterprise at the intersection of D4 with the Little Danube, the solution has abandoned the "Zálesie" and "Ivanka" tunnel that was replaced by open channel in a sealed tub in the section 17.5 to 19.0 km.

**Exploration of possible routing of D4 under the Danube**

Within the scope of the assessment Ministry of Environment ordered the claimant NDS, a.s. to examine the possibility of routing the highway under the Danube to minimize impacts on the protected areas of national and European systems. This requirement was examined from technical, environmental, transport and economic aspect within the Feasibility and effectiveness study of the D4 using Option "D".

The technical design of the tunnel Option "D" is the following:

The beginning of the section of this option from "Jarovce" EI to 1.0 km is designed the same way as in Option "C", the route of the D4 highway is crossed by the railway track of Bratislava - Rusovce via elevated junction (sub-road), from "Rusovce" EI it continues in a straight line via *"Danube" tunnel in the length of 2.550 km* below Jarovské arm and underneath the main flow of the Danube River, more to the north than the Option "C". From "Ketelec" EI, at 7.195 km of D4 the route continues under the Option 'C' to "Ivanka - North" EI where it ends connecting to the D1 highway. Total length of Option "D" is 22,660.69 km.

The tunnel route is designed by two separate routes of highway strips, one for each tunnel tube. Horizontally, the route is due to the nature of crossed obstacle conducted straight forwardly. The spacing of the axes of the tunnel tubes means two diameters, i.e., 24 m. D4 is designed for the tunnel in category 2T 7.5 (four-lane), other sections of the tunnel are designed the same as in Option "C".

The tunnel formed by two tubes, south and north, will be operated in one-way basic mode. Both tunnel tubes are divided into sections built by tunnel boring and the bored sections built in open construction pit at both portals, which will subsequently be buried. The lengths of the sections and the total lengtsh of the tunnel tubes are shown in the table below.

| Tunnel section | North tunnel tube | South tunnel tube |
|---|---:|---:|
| Excavated tunnel at the west portal | 180 m | 180 m |
| Bored tunnel | 2,140 m | 2,140 m |
| Excavated tunnel at the east portal | 230 m | 230 m |
| TOTAL | 2,550 m | 2,550 m |

Based on the total length of 2,500 m, the tunnel under STN 73 7507 is classified as medium (length < 3,000 m), which derives several aspects of its technical solution.

Vertical conduct is influenced by the "Danube" tunnel design. Draft vertical conduct is based on location of the beginning and end of the bored sections outside the inundation (flood) area of the river with the need for a minimum overburden of the tunnel at site of the tunnel boring start. Vertical conduct of both tunnel tubes is defined by longitudinal gradient in the amount of 1.86% in the descent from the west portal and gradient in the amount of 2.90% in the ascent towards the east portal. The height arch in the middle of the tunnel has a radius of 30,000 m. Vertical solution also affects the solution of elevated crossing of D4 with railway track of Bratislava (Petržalka) - Rusovce - Hungary, where D4 is led underneath the track and to design "Rusovce" EI whose branches are located in the recess with the necessary sealing bathtubs. From 7.195 67 km of D4 the route continues in the same vertical conduct as Option C red.

*Nature of the obstacle*

The obstacle for the tunnel is the Danube River, respectively its inundation area. The current river bottom is at minimum lift elevation of about 101.30 m above the seal level based on the measurements. However, given the continuous sedimentation of river sediments and subsequent deep-sea dredging by river basin administrator, this is not a constant value but rather varying in time. In addition to the river bed itself, the tunnel crosses other related water areas, arms and water sports pool. The bottom of these water areas is not in critical position. Location of definitive tunnel portals and also portals for tunnel boring is limited by inundation dykes and parallel conducted of seepage channels. Location of portals for tunnel boring is outside the inundation area of the river.

When discussing the proposed option with the river administrator, SVP, OZ Danube Basin requires to secure the tunnel so that in the event of possible flooding it shall not represent privileged water way in to inundation areas.

In the Feasibility and effectiveness study of D4 highway, technical, environmental, transport and economic criteria were compared related to proposed new viaduct options "C" and "E" with tunnel option "D", while the tunnel option "D" was based on the above evaluation criteria assessed as the least favourable. Its advantages are summarized as follows:

- the smallest range of tree felling
- does not interfere with PLA Danube floodplains, PR Danube islands, protected area of European importance and protected bird area of NATURA 2000 on the right bank of the Danube,
- does not interfere with PR Gajc and PR Kopáčsky island on the left bank of the Danube, in the narrowest point it minimally interferes with the PLA Danube floodplains, protected area of European importance and protected bird area NATURA 2000, it has therefore the least intervention in protected areas
- D4 is conducted outside the territory intended for sport and recreation (Jarovské arm)

Its disadvantages are summarized as follows:

- this option is extremely demanding in construction and technical aspect (tunnel under the Danube and in the sealed bathtubs in highly watered gravel environment),
- connecting cycling and walking routes between the two banks of the Danube and the peninsulas of Jarovské arm is not possible
- only a four-lane highway layout in the tunnel under the Danube is possible (from traffic point of view the highway in six-lane arrangement is good) and it can not be expanded in the future to the six-lane road,
- in the event of a catastrophic floods over the existing flood protection it needs to deal with closure of the tunnel
- tunnel may have an adverse effect on the groundwater flow with potential secondary effect on flora and fauna in protected areas
- eastern portal outlet extends to the edge of the PLA Danube floodplains, protected areas of European importance and protected bird area NATURA 2000 and will also be a barrier for migrating animals
- reduced speed in the tunnel shall increase pass-by time with regard to possible collisions and traffic jams in the transition between a 3-lane arrangement of the highway (in one way) before and behind the tunnel into 2-lane layout (in one way) in the tunnel
- the option has the highest capital costs, is about 300-350 mil. euros more expensive than other options
- it has high operation and maintenance costs due to tunnel section
- does not demonstrate a financial return and does not reach the minimum economic value (IRR is below 5.5%)

In addition to the above disadvantages, the tunnel option brings the following risks of impact of construction on the rock mass and hydrogeological conditions:

- changes in flow and a changes in the hydrodynamic groundwater conditions in fluvial sediments around the sealed building pits, increasing the flow rate may cause suffosion in sediments and thus changes in the entire watered environment,
- the impact of the rock environment of fluvial sediments will be the case of recovery measures implemented before tunnel boring in the case of injection of gravel sediments, which, however, especially in the basal zones of sediments, will be significantly difficult due

to the high permeability, using chemical injection (as an effective means to immediate reduction of permeability) it may change the chemical composition of groundwater in the vicinity of water resources,
- impact on the geological environment includes digging of construction pits due to changes in pressure field around pits and in the pit bottom, digging may cause elevation of the pit bottom,
- the risk in construction of sealed pits and tunnel boring using a TBM is a change in the thickness of the fluvial sediments due to deep erosion, and the occurrence of boulders and boulder gravels at the base of gravel,
- the risk of tunnel boring means also stronger thickness of positions of watered sands in the strata of Neogene sediments with the possibility of strained groundwater levels, possible groundwater aggression.
- compared to construction of sealed pits, the building and foundation of bridge pillars has minimal impact on the groundwater regime and the rock mass than other options.

The final comparison of options in terms of their technical and transport solution, environmental impacts and economic routing of D4 section in Jarovce - Ivanka north states in the Feasibility and effectiveness study recommended optimal option "E" green (viaduct in the route of the tunnel option).

Based on the above documents it was agreed during initial negotiation with the representatives of the claimant NDS, a.s. Bratislava that the Assessment Report on the D4 section in Jarovce - Ivanka north, after considering the possibility of routing the highway in a tunnel under the Danube and in line with the recommendations of the Feasibility and effectiveness study, will compare in addition to the zero option also following options:

- **"C" red - modification of options "A" and "B" listed in the plan**

- **"E" green - alternative proposal (viaduct) of crossing over the Danube along the route of the tunnel option recommended in the Feasibility and effectiveness study of D4 highway**

BRIEF DESCRIPTION OF THE PROPOSED OPTIONS

The relevant section of the route of D4 Jarovce - Ivanka north is connected to the end of the D4 highway section nat. border SK/A - D4 and D2 Jarovce interchange. Then it passes through the cadastral are of Jarovce and Rusovce, crosses the railway line no. 132 Bratislava Petržalka - Rusovce and road I/2, it passes on the bridge over the Danube and continues through cad. area of Podunajské Biskupice in north-easterly direction. Bypassing the urban area of the village of Rovinka from the west in the area between the village and Slovnaft, it crosses the road I/63 and the railway track no.131 Bratislava - Komárno, then the west bypass of the village of Most pri Bratislave, crossing the road II/572 and the Little Danube. Along the Šúrsky channel to the north and it continues in the area between Bratislava Airport and the village of Zálesie and Ivanka pri Dunaji to the intersection with the road I/61. The last section from the intersection with road I/61 continues after crossing the railway line no. 130 Bratislava - Galanta to the D1 highway, where is the end of the section in the proposed intersection of D4/D1 Ivanka north.

**In terms of relation of D4 highway and R7 expressway in the section of Bratislava - Dunajská Lužná it should be noted that the investment preparation of the expressway of this section is completed in the first stage (technical study, plan and Assessment Report, Final opinion), while under written decision of the Ministry of Transport, Posts and**

**Telecommunications the further preparation of R7 in the section of Bratislava - Dunajská Lužná in Option C green is carried out (see the documents part).**

Description of the proposed options contains data taken from the Feasibility and effectiveness study.

**Option C red**

*Horizontal design*

The section begins at "Jarovce" EI where the D4 highway joins D2. The route continues north of the city district Bratislava - Jarovce, it crosses the railway track Bratislava - Rusovce through the bridge, road I/2 and right bank of the Danube, passes the southern edge of Jarovské arm and planned rowing course, vertically to the bridge over the Danube and its left-hand barrier. On the right bank of the Danube it passes by the nature reserve (NR) Danube islands and the NATURA 2000 protected area (Ostrovné lúčky). On the left bank of the Danube it passes the viaduct through NR Gajc (but at its narrowest point) and protected landscape area (PLA) Danube floodplains, which are part of NATURA 2000 protected sites (Biskupické Luhy). Negative impacts of D4 passage through this territory will be eliminated by the D4 routed on viaduct up to 5.545 km.

On the left bank of the Danube D4 passes south of the gravel mining site Ketelec where the elevated junction will be placed with the planned urban collecting road from Prístavná street, led west from Slovnaft, a.s. There is designed a large double-sided parking area "Rovinka" at 9.250 km of D4.

The highway route at 10.884 km of D4 crosses the road I/63 as elevated junction. The proposed "Rovinka" EI with the R7 expressway and the highway feeder to the road I/63 is designed at 11.750 km of D4. D4 highway continues through railway track Bratislava - Dunajská Streda north of Most pri Bratislave, which in the future should cross the new, prospective expressway of Bratislava - Vlčkovce (in terms of NDS objectives) and road II/572 as elevated junction. Linking the two roads with D4 will be made through the collector strips in one elevated interchange of Most pri Bratislave.

D4 route continues before landing-takeoff runway RWY 13-31 of Bratislava Airport and crosses the Little Danube with a bridge. In this section D4 is led in the recess so as to respect the protection zones of extended airport runway 13-31. D4 highway then passes the bridge over future water are of Zelená Voda (the western edge of the mining area). Currently, D4 would not intervene in the mining area of approx 70 m and if over the next two to three years the mining was carried out in its intended scope, then D4 highway would cross the newly created lake in the length of about 140 m (over the bridge).

Then the D4 route goes east from the former agricultural farm in the area of Prucká sihoť (away from airport). At the intersection with the planned runway 13L-31R the D4 highway is conducted in the recess of about 6.8 to 7.2 m below ground level, so that (in the construction of runway 13L-31R) the completion of a highway through the "Zálesie " tunnel is possible.

D4 route continues in a low embankment on the right bank, along Šúrsky channel, while respecting its protection zones, crosses the road I/61 as elevated junction, prospective communication between local part of Tanieriky and Sakoň, then it crosses the railway track Bratislava - Galanta as elevated junciton and ends at the connection to the D1 highway in the "Ivanka - north" EI. **Total length of Option "C" is 22,800.63 km.**

*Vertical design*

Vertical design of D4, in addition to the relief of existing flat terrain, is designed with natural and artificial obstacles. At the beginning of the route, the vertical design is intended by existing position of "Jarovce" EI.

After bridging the railway track Bratislava (Petržalka) - Rusovce - Hungary and road I/2, the route logically bridges Jarovské arm and the Danube, in the range of which the height of the route is determined by both-sided barrage (consider leaving a minimum free height of 2.50 m above the right-sided barrage, 4.20 m above the left-sided barrage and required shipping space on the main river).

Seemingly long routing of D4 behind bridging the Danube above the existing ground level is to allow (after the construction of bridges) animal migration across the new highway. Quite a high amount of bridges is designed to mitigate the adverse effect of dividing the road in fauna that occurs within the protected site.

Terms of level passage of the D4 highway route over railways and roads, set by the relevant standards, are respected throughout the region.

At the intersection of D4 highway with the prospective expressway and road II/572 ("Most pri Bratislave" EI) the D4 highway is conducted at ground level, prospective R and road II/572 is conducted by bridges over D4.

Particularly difficult situation, significantly affecting the vertical design of the D4 route is in the Bratislava Airport section, in local planning extending of the existing runway 13-31 and at the intersection with a forward-looking parallel runway 13L-31R. The need to respect the protection zones of the landing and take-off space of the runways has affected the height design of D4, particularly at runway 13L-31R, where the D4 highway is conducted in the groove. In the future, the D4 highway in the section crossing the runway will be covered in the form of the tunnel within the construction of runway 13L-31R.

According to the representatives Bratislava Airport it is necessary to respect the following:

- The airport plans to extend the runway 13-31 to a total length of 3,600 m and is also considering the relocation of the Little Danube to the new position. When designing the D4 highway, which is conducted at the current ground level, it is necessary to respect existing protection zones of RWY 13-31.

- In the future it is planned to build a parallel runway 13L - 31R, which requires to reserve a territory. Protection zones of the airport runway will be the same as with runway 13-31. During the construction of runway 13L - 31R the former agricultural farm will be cancelled in the area of Prucká sihoť. At the intersection of D4 highway with PZ of transition airport areas it is not required to build "Zálesie" highway tunnel, D4 must be led within the recess so as to respect protection zones of runway 13L - 31 R.

- Runway 04-22 is not projected for expansion in the future, this runway is to be used out (as it passes the populated territory of Ivanka pri Dunaji). It is recommended to request an exception from protection zones of RWY 04-22.

The D4 route is in the area of the intersection with runway 04-22 of the above reasons, vertically conducted in the low embankment above the current ground level (it counts with an exemption from PZ of RWY 04-22). The regulation of the Ministry of Transport of 10 June 2009 the construction of "road I/61 Bratislava - Senec" will be led in its current vertical conduct and D4 it will be led by a bridge over the road I/61.

End of the section based on the request of the claimant NDS, a.s. was technically resolved so that the proposed D4 highway routing in this option underneath D1 was vertically reviewed and designed over D1 regarding the problems with high water table in the original proposal (difficult objects - sealed bathtub). Description of the technical solution is in the next part.

**Option E green**

*Horizontal design*

The beginning of the section from "Jarovce" EI to 1.0 km is designed the same way as in Option "C", the route of the D4 highway is crossed by the railway track of Bratislava - Rusovce via elevated junction (bridge), from "Rusovce" EI it continues in a straight line over Jarovské arm and the main flow of the Danube River on a bridge 2.722 km long. From 4.851 km the route passes north of the planned gravel mining site Ketelec where the elevated junction will be placed with the planned urban collecting road from Prístavná street, led west from Slovnaft, a.s. There is designed a large double-sided parking area "Rovinka" east from Lieskové at 8.700 km of D4. The route continues under option C to "Ivanka - North"EI from the road I/63 bridging at 10.245 km of D4. **Total length of Option "E" is 22,168.94 km.**

The route of option "E" passing the territory of the Danube does not interfere with NR Danube islands and protected area of European importance Natura 2000 on the right bank of the Danube, does not interfere with NR Gajc and NR Kopáčsky ostrov on the left bank of the Danube, in the narrowest point with minimum intervention in the protected area of Danube floodplains and the protected area of European importance NATURA 2000. Negative impacts of the D4 highway passing this territory will be eliminated by conducting the D4 highway on viaduct until 5.110 km, with a bridge for animals at 5.225 km, which will enable wildlife migration via elevated road above D4 and ensure interconnection of biking trails and routes for pedestrians on both banks of the Danube with the peninsula of Jarovské arm and thus its greater use for the sports and recreation. Compared to option C, the bridge on D4 over the Danube is placed further from the existing houseboats on Jarovecké arm and allows expanding gravel mining in "Ketelec" area in south-easterly direction.

*Vertical design*

Vertical conduct is similar to Option "C", where the vertical design of the route in the section of the Danube bridging is determined by both-sided barrages and desired shipping space on the main flow of the Danube.

*Width arrangement*

According to valid STN 73 6101 it is sufficient for the projection period in this section of D4 to apply width arrangement - a four-lane where the recommended range of traffic volumes in the territory not for building-up is from 18,000 to 60,000 vehicles / 24 h. According to the assessment of individual traffic sections, D4 highway capacity will meet the traffic demands of the projection period in the four-lane width arrangement. Given the potential for the development of Bratislava and its surroundings, as well as the position of the highway ring on the outer edge of the city, we recommend:

- from "Rusovce" EI to "Ivanka - West" EI to build the D4 highway in category D 33.5/120 (100), with four-lane width arrangement in the 1st stage, i.e., with the broader central line so as to allow the prospective expansion of the six-lane highway towards the axis (it is questionable to leave a margin for 6-lane already from "Jarovce" EI, i.e. from the D2 highway).

- in the section between "Ivanka - West" EI, "Ivanka - North" EI, where it is necessary to build collector strips because of the small distance between these interchanges, we propose to build the D4 highway in category D 26.5/120 (100), i.e. in the four-lane width arrangement.
- to purchase lands for broader use (future six-lane) already in the first stage and critical civil structures (bridges, bathtubs, ...) to be implemented for the final layout, that would significantly save costs in the financial outlook for the widening the D4 highway to 6-lane.

Better economic indicators (IRR, returns, ...) can be achieved in the construction of D4 in the section of four-lane width arrangement, on the other hand, if it was necessary to additionally expand D4 to six-lane, it would mean higher additional costs (construction costs and the cost of the land e.g. in 30 years they will certainly not be lower than they are now) and for certain construction projects, for example on a bridge over the Danube, or in sealing bathtubs unless it is counted in advance, then the extension will not be able to be technically feasible.

Overview of basic indicators of D4 highway in the section of Jarovce - Ivanka, north for options C and E according to documents of the Feasibility and effectiveness study are shown in the following table:

| Indicator | m.u. | Option | |
|---|---|---|---|
| | | "C" red | "E" green |
| Total length of route | km | 22,800 63 | 22,168 94 |
| Bridges on D4 | km | 6.110 | 6.139 |
| Cubic capacity of embankments | $m^3$ | 3,559,232 | 3,149,955 |
| Cubic capacity of excavations | $m^3$ | 549,215 | 561,044 |
| Road relocations | | | |
| 1st class | km | 0.786 | 0.438 |
| 2nd class | km | 0.618 | 0.708 |
| Field, purposeful, bypasses etc. | km | 22.382 | 23.124 |
| Elevated interchanges | pc | 6 | 6 |
| Bridges on D4 | m | 6,110 | 6,139 |
| Bridges over D4 | m | 830 | 830 |
| Bridges on roads outside D4 | m | 865 | 879 |
| Tunnels | m | 0 | 0 |
| Sealed bathtubs | m | 1,330 | 1,330 |
| Noise barriers | m | 7,600 | 9,250 |
| Parking areas | pc | 1 | 1 |
| Fencing | m | 32,600 | 30,872 |
| IRR | % | 6 | 6 |
| Costs construction part excl. VAT | € | 624,529,483 | 646,615,144 |
| Total costs excl. VAT | € | 843,561,884 | 887,804,782 |

Given the total balance of earth works with a significant lack of embankment earth we assume that the anticipated excavation will be used for embankments, while depositing the excavation probably will not be necessary and will be directly imposed in the highway route in the embankment.

BRIEF DESCRIPTION OF RELATED STRUCTURES

## ***Interchanges***

*Option C (red)*

- *Jarovce interchange* is built as a form intersection of highways D2 and D4. The proposed continuation of D4 raises the need to complete the right bridge on D4 over D2, what will need to slightly reshape the branches linked to the new right part of the D4 highway.

- *Rusovce interchange* - intersection of D4 with road I/2 (2.859 km of D4). The interchange is designed as an elevated deltoid-shaped interchange. Connecting road I/2 is in the form of two circular interchanges. The proposed four-lane width arrangement of road I/2 passes south of the intersection smoothly into the existing width arrangement (approx. Cat. 9.5/60), as the traffic load in this profile will be significantly lower from the load above the intersection.

- *Ketelec interchange* - it is designed south of Ketelec at the point where currently gravel mining is carried out, while mined areas are continuously covered with various materials (mostly redundant earth for the wide surroundings). The recultivation of the land to its original height and quality will be part of the planned mining. Interchange is designed in the shape of a clover leaf (for option A of R7). Given that option A of R7 will not be implemented under the valid decision of Ministry of Transport, the interchange must be adjusted only to the crossing of D4 with planned urban road led from Prístavná street west from Slovnaft, a.s. (extension of Bajkalská street).

- *Rovinka interchange* - interchange of D4 and Option C of R7 is clover-shaped with collectors. Interchange is designed with respect for the territorial interests (area of production of coated bituminous mixtures Strabag), protection zones of utilities (HV lines, oil pipeline, pipelines), crossing of related roads with utilities. The direct connection of D4 with the road I/63 will not be solved by the interchange. This connection, and the connection of R7 to the road network, will be implemented in this option from Rovinka interchange through feeder of Podunajské Biskupice, which connects to I/63 by elevated tubular junction before the Podunajské Biskupice distribution point.

- *Most pri Bratislave interchange* - D4 crossing the forward-looking expressway and intersection with road II/572 at 14.597 and 15.632 km. Interchange with the forward-looking expressway (R) is designed in the shape of a tubular junction, with road II/572 as the deltoid-shaped intersection. Both of these intersections are linked to D4 highway through the collector strips. Small roundabouts are designed on the road II/572.

- *Zálesie outlook intersection* - crossing located at 18.797 km of D4 as an elevated deltoid-shaped junction. All traffic directions can be ensured in the interchange. The mutual distance between "Zálesie" EI and "Ivanka - West" EI is only about 1.32 km, while the minimum allowable distance is 2.5 km according to STN 73 6101. It would require an exemption from the STN 73 6101, art. 9.3. Interchange is not part of the technical design of the D4 highway.

- *Ivanka - West interchange* - D4 intersection with the road I/61 at 21.774 km is designed as an incomplete clover leaf intersection. D4 Highway is led by the bridge over road I/61, the link is through the collector strips, which will be connected to the nearest "Ivanka - North" interchange.

- *Ivanka - North interchange* - D4 intersection with D1 at 22.800 km is designed as a clover leaf intersection. D4 Highway is led through sub-road underneath the D1 highway.

Interconnection with D1 is designed through the collector strips on D4 to D1 collector strips to be extended to six-lane.

*Option E (green)*

- *Jarovce interchange* is built as a form intersection of highways D2 and D4. The proposed continuation of D4 raises the need to complete the right bridge on D4 over D2, what will need to slightly reshape the branches linked to the new right part of the D4 highway.

- *Rusovce interchange* - D4 with the road I/2 is designed as an elevated deltoid-shaped interchange. Connecting road I/2 is in the form of two circular interchanges. The proposed four-lane width arrangement of road I/2 passes south of the intersection smoothly into the existing width arrangement (approx. cat. C 9.5/60), as the traffic load in this profile will be significantly lower from the load above the intersection. The interchange branches are kept in embankments.

- *Ketelec interchange* - crossing is designed in the area of Ketelec. Interchange is designed in the shape of a clover leaf (for option A of R7). Given that option A of R7 will not be implemented under the valid decision of Ministry of Transport, the interchange must be adjusted only to the crossing of D4 with planned urban road led from Prístavná street west from Slovnaft, a.s. (extension of Bajkalská street).

- *Rovinka interchange* - interchange of D4 and Option C of R7 is clover-shaped with collectors. Interchange is designed with respect for the territorial interests (area of production of coated bituminous mixtures Strabag), protection zones of utilities (HV lines, oil pipeline, pipelines), crossing of related roads with utilities. The direct connection of D4 with the road I/63 will not be solved by the interchange. This connection, and the connection of R7 to the road network, will be implemented in this option from Rovinka interchange through feeder of Podunajské Biskupice, which connects to I/63 by elevated tubular junction before the Podunajské Biskupice distribution point.

- *Most pri Bratislave interchange* - D4 crossing the forward-looking expressway and intersection with road II/572 at 14.597 and 15.632 km. Interchange with the forward-looking expressway (R) is designed in the shape of a tubular junction, with road II/572 as the deltoid-shaped intersection. Both of these intersections are linked to D4 highway through the collector strips. Small roundabouts are designed on the road II/572.

- *Zálesie outlook intersection* - crossing located at 18.797 km of D4 as an elevated deltoid-shaped junction. All traffic directions can be ensured in the interchange. The mutual distance between "Zálesie" EI and "Ivanka - West" EI is only about 1.32 km, while the minimum allowable distance is 2.5 km according to STN 73 6101. It would require an exemption from the STN 73 6101, art. 9.3. Interchange is not part of the technical design of the D4 highway.

- *Ivanka - West interchange* - D4 intersection with the road I/61 at 21.774 km is designed as an incomplete clover leaf intersection. D4 Highway is led by the bridge over road I/61, the link is through the collector strips, which will be connected to the nearest "Ivanka - North" interchange.

- *Ivanka - North interchange* - D4 intersection with D1 at 22.800 km is designed as a clover leaf intersection. D4 Highway is led through sub-road underneath the D1 highway. Interconnection with D1 is designed through the collector strips on D4 to D1 collector strips to be extended to six-lane.

## Alternative solution of the D4 and D1 highway junction of Ivanka North

D4 highway crossing the D1 highway according to the Feasibility and effectiveness study is designed under the existing D1 embankment body with partially embedded D4 highway below the ground level due to observance of standard head clearance - Option C. In this way, it is necessary to build D4 in the sealed bathtub in the length of about 600 m because of the high water table.

NDS, a.s., the claimant, regarding unfavourable hydrogeological conditions in that section of highway (the need to build a sealed bathtub due to high ground water level and other anti-flood measures), developed in the course of the Assessment Report processing an optional technical design for routing D4 in the affected region (Ivanka north interchange). The optional design of D4 routing is based on modifying vertical conduct of the D4 highway over the D1 highway - option C1, while the necessary adjustment to the level line also affects the following section of D4 Ivanka north - Záhorská Bystrica.

The option was prepared in the technical study "D4 highway, Ivanka north interchange with the D1 highway, optional solution", drawn up by our company in April 2010. Modification of option "C" of D4 in the section has been temporarily marked as **option "C1"**, while the vertical routing modification of the highway touches option "C" at km 21.250 - cad. area (22.800 643) in the section of Jarovce - Ivanka north and options 2a resp.7a and 2b, resp.7b at 0.0 to 0.575 km of Ivanka north - Záhorská Bystrica.

The technical design for levelling vertical arrangement is conditional upon crossing traffic routes, railway track and headroom cross sections. In accordance with STN 73 6101 art. 6.14.6 on the length of the linear slope between the height arcs in opposite direction, the change in levelling at the beginning of the section shifted by 65 m while complying with exception from the protection zone of RWY 04-22.

D4 crosses the road I/61 at 21.774 km, which belongs to the selected road network for large-size transport with minimal gabariti of 5.20 + 0.15 m. Subsequent crossing with overlook road between local part of Tanieriky and Sakoň at 22.184 km with the underpass cross section of min. 4.80 + 0.15 m. Highway passes over the railway of Bratislava - Galanta at 22.370 km with a height of cross section of 7.50 m. The last crossing within the area is crossing the D1 highway at 22.800 km with minimum underpass height of 5.20 + 0.15 m.

In proposing changes to the vertical levelling, it was respected widening of the road I/61 to four-lane and complementing D1 with parallel roads on both sides. The scheme of the intersection in option C1 and the longitudinal profiles of the options C and C1 are listed below.

In the above conditions, a change in vertical levelling was proposed that meets STN 73 6101 for the design category of highway D 33.5/120. At 21.840 to 22.350 km the vertical levelling is reduced by an average of 2 m. In the next section, the vertical levelling is led by bridge over the D1 highway, thereby it excludes building of sealing bathtub below the water table. Construction and installing pillars will have a minimal effect on the groundwater regime.

**The modification of vertical levelling of D4 in the section concerned (D4 crossing Ivanka north with D1) will have a positive impact on the overall technical and environmental solutions of D4 Jarovce - Ivanka north in option "C1". In principle, the sealing tub is excluded underneath the D1 highway, thereby eliminating the need to use groundwater during construction and overall impact on the system, the quality and flow and also consuming construction technologies to be excluded (diaphragm walls), in expecting a significant conflict with D1 and its limited operation. The proposed modification will added a bridge over the D1 highway (without affecting the natural body of D1 and limits to its operation), partly however it increases the land use due to the need to build higher**

**embankments and increase the claim for filling material, the difference, however, in view of the general land use and material balance for the entire section of D4 is negligible.**

***Road drainage***

*Option C (red)*

Sewerage of highway is designed prospectively for 6-lane road. The designed rainwater sewers will be built across the whole highway section, traced in its middle dividing strip.

In addressing the issue of the road sewerage, given the nature of the area, there have been considered various conceptual options for drainage of rainwater as follows:

- Highway section from the Jarovce interchange until 0.800 km to the seepage devices
- Highway section from 0.800 to 2.200 km (bridge) through discharge pipeline into the Jarovské arm
- Highway section bridge - 6.000 km through discharge pipeline into the Danube
- Highway section from 6.000 to 14.100 km into seepage devices
- Highway section from 14.100 to 19.100 km through discharge pipeline into the Little Danube
- Highway section from 19.100 to 22.800 km through discharge pipeline into the Šúrsky channel
- Drainage of right and left parking area through ORL to seepage devices is individually designed.

Rainwater drained from the road must be pre-treated in oil separators with the purification degree of 0.1 mg/l NEL at the outlet that will be placed in the (off) road embankment. ORL separators are designed in the concrete version equipped with overflow settling tank to capture solids at the inlet. Another part of oil separators are tanks to capture hydrocarbons while the tanks are equipped with sorption filters. The sewer pipeline is designed from centrifugally cast fiberglass, which ensures perfect and permanent waterproof features, in the dimensions of DN200 to DN1000 mm. Sizing the sewer pipeline is at 15 minute rain intensity with frequency of p = 0.5 for i = 142 l/s/ ha. Regarding the proposed height course of the highway route and flatness of the area, the water outflow is ensured by an independent pumping stations (PS) or SPS system in a row, according to the requirements of the territory, respectively the outfall.

Adjacent watercourses, respectively infiltration into the ground are designed as recipients. For Šúrsky channel, it will need to adjust the amount of water discharged which is limited to it. Therefore the discharged rainwater will be retained in the retention tanks (RT), and further discharged through the flow control valve with the amount determined by the administrator of the flow. Due to the low groundwater level the tanks will be constructed of the concrete pieces. The rainwater will be drained from the tanks through pumping stations further into the adjacent watercourses linking the pipeline through outlet objects in the type-like designs.

After specifying the options of water outfall in the section of 0.500 to 2.200 km and 4.850 to 21.600 km it will be needed to revise pipe dimensions and capacity of pumping stations in the next stage of documentation. Following this fact, it may occur adjustment of the values on the discharge tubes.

Table of oil separators (ORL) and pumping stations (PS):

| ORL marking | Stationing (km) | Drained section (km) | Design flow to the ORL (Q in l/s) | Pumping station/pumped capacity (l/s) | Water inlet |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| ORL 1 | 0.550 | 0.000 - 0.800 | 300 | - | soak |
| ORL 2 | 1.400 | 0.800 - 2.200 | 550 | PS 1 | for ORL 3 / Jarovské arm |
| ORL 3 | 2.500 | 2.200 - 4.200 | 800 | - | Jarovské arm |
| ORL 4 | 5.700 | 4.200 - 6.000 | 700 | PS 2 | Danube |
| ORL 5 | 6.850 | 6.000 - 7.750 | 800 | PS 3 | soak |
| ORL 6 | 8.400 | 7.750 - 9.000 | 500 | - | soak |
| ORL 7 | 9.900 | 9.000 - 10.800 | 700 | PS 4 | soak |
| ORL 8 | 11.600 | 10.800 - 12.300 | 600 | - | soak |
| ORL 9 | 12.800 | 12.300 - 13.350 | 400 | - | soak |
| ORL 10 | 13.500 | 13.350 - 14.100 | 300 | - | soak |
| ORL 11 | 15.250 | 14.100 - 15.500 | 550 | PS 5 | Little Danube |
| ORL 12 | 16.200 | 15.500 - 16.850 | 550 | PS 6 | Little Danube |
| ORL 13 | 16.900 | 16.850 - 19.100 | 900 | PS 7 at 17.750 km | Little Danube |
| ORL 14 | 19.650 | 19.100 - 19.750 | 250 | PS 8 / 50 | through RT into Šúrsky channel |
| ORL 15 | 20.250 | 19.750 - 20.500 | 300 | PS 9 / 100 | through RT into Šúrsky channel |
| ORL 16 | 21.250 | 20.500 - 22.150 | 600 | PS 10 / 100 | through RT into Šúrsky channel |
| ORL 17 | 22.800 | 22.150 - 22.800 | 500 | PS 11 / 100 | through RT into Šúrsky channel |
| ORL 18 | 9.250 | parking area Rovinka, on the left | 300 | - | soak |
| ORL 19 | 9.250 | parking area Rovinka, on the right | 300 | - | soak |

Note: RT - retention tank

***Other sewage:***

In the "Ivanka - West" interchange, it will produce crossing D1 with the existing rainwater discharge pipe from the pumping station PS 2 during construction. It is a pipeline that drains rainwater from the area of the Senecká highway interchange, lying on the road I/61, about 1,600 m west of the "Ivanka - West" intersection. DN 400 pipeline of PE pipes, passing across the interchange, will be treated off the road linking the existing outlet object to Šúrsky channel. Estimated length of the relocation of the pipeline is 400 m. Relocation of the discharge pipeline has been the subject to design in the construction of extension of the road I/61 Bratislava - Senec.

*Option E (green)*

Sewerage of highway is designed prospectively for 6-lane road. The designed rainwater sewers will be built across the whole highway section, traced in its middle dividing strip.

In addressing the issue of the road sewerage, given the nature of the area, there have been considered various conceptual options for drainage of rainwater as follows:

- Highway section from the Jarovce interchange until 0.800 km to the seepage devices
- Highway section from 0.800 to 4.150 km (bridge) through discharge pipeline into the Jarovské arm
- Highway section from 4.150 to 7.300 km through discharge pipeline into the Danube
- Highway section from 7.300 to 14.100 km into seepage devices
- Highway section from 14.100 to 19.100 km through discharge pipeline into the Little Danube
- Highway section from 19.100 to 22.800 km through discharge pipeline into the Šúrsky channel
- Drainage of right and left parking area through ORL to seepage devices is individually designed.

**After specifying the options of water outfall in the section of 0.500 to 2.200 km and 4.850 to 21.600 km it will be needed to revise pipe dimensions and capacity of pumping stations in the next stage of documentation. Following this fact, it may occur adjustment of the values on the discharge tubes.**

Table of oil separators (ORL) and pumping stations (PS):

| ORL marking | Stationing (km) | Drained section (km) | Design flow to the ORL (Q in l/s) | Pumping station/pumped capacity (l/s) | Water inlet |
|---|---|---|---|---|---|
| ORL 1 | 0.550 | 0.000 - 0.800 | 300 | - | soak |
| ORL 2 | 1.400 | 0.800 - 2.200 | 550 | PS 1 | for ORL 3 / Jarovské arm |
| ORL 3 | 2.450 | 2.200 - 4.150 | 800 | - | Jarovské arm |
| ORL 4 | 6.100 | 4.150 - 7.300 | 1,200 | PS 2 | Danube |
| ORL 5 | 8.000 | 7.300 - 8.200 | 350 | PS 3 | soak |
| ORL 6 | 8.700 | 8.200 - 10.100 | 750 | PS 4 | soak |
| ORL 7 | 10.800 | 10.100 - 12.300 | 600 | - | soak |
| ORL 8 | - | - | - | - | - |
| ORL 9 | 12.800 | 12.300 - 13.350 | 400 | - | soak |
| ORL 10 | 13.500 | 13.350 - 14.100 | 300 | - | soak |

| | | | | | |
|---|---|---|---|---|---|
| ORL 11 | 15.250 | 14.100 - 15.500 | 550 | PS 5 | Little Danube |
| ORL 12 | 16.200 | 15.500 - 16.850 | 550 | PS 6 | Little Danube |
| ORL 13 | 16.900 | 16.850 - 19.100 | 900 | PS 7 at 17.750 km | Little Danube |
| ORL 14 | 19.650 | 19.100 - 19.750 | 250 | PS 8 / 50 | through RT into Šúrsky channel |
| ORL 15 | 20.250 | 19.750 - 20.500 | 300 | PS 9 / 100 | through RT into Šúrsky channel |
| ORL 16 | 21.250 | 20.500 - 22.150 | 600 | PS 10 / 100 | through RT into Šúrsky channel |
| ORL 17 | 22.800 | 22.150 - 22.800 | 500 | PS 11 / 100 | through RT into Šúrsky channel |
| ORL 18 | 8.750 | parking area Rovinka, on the left | 300 | - | soak |
| ORL 19 | 8.750 | parking area Rovinka, on the right | 300 | - | soak |

Note: RT - retention tank

***Other sewage:***

In the "Ivanka - West" interchange, it will produce crossing D1 with the existing rainwater discharge pipe from the pumping station PS 2 during construction. It is a pipeline that drains rainwater from the area of the Senecká highway interchange, lying on the road I/61, about 1,600 m west of the "Ivanka - West" intersection. DN 400 pipeline of PE pipes, passing across the interchange, will be treated off the road linking the existing outlet object to Šúrsky channel. Estimated length of the relocation of the pipeline is 400 m. Relocation of the discharge pipeline has been the subject to design in the construction of extension of the road I/61 Bratislava - Senec.

## ***Bridges***

The range and number of bridges in the section is subject to horizontal and vertical conduct of D4 highway in different options. The proposed bridge structures are processed in detailed tables in textual annexes to this report, indicating the location of the bridge, the bridge diagram, description, type of the support structure, the angle of the crossing, bridge fields span, the combined length, width, useful width and surface of the bridge.

Bridges are designed for a load class A except for bridges on field and forest paths, which are designed for a load class B. The support structure of the bridge on the highway is designed in most cases from bar fabrications up to 42 m fields span. For aesthetic purposes, the support structure of the bridge over the highway is designed as a monolithic prestressed.

*Crossing D4 with the Danube*

Bratislava, the capital city of Slovakia, stretches along both banks of the Danube, the European river, and on the left bank of the Morava river, on which two districts of Devin and Devinska Nova Ves are spread, as their suburbs. Bratislava including its suburbs is situated immediately on both banks of the Danube on a stretch of about 18 km and its associated parts are currently linked with

5 road bridges and one railway bridge, which is part of the highway bridge in the port area. All bridges have been constructed no to influence water flow, besides local dams due to bridge pillars placed right in the flow.

Construction of Gabčíkovo Water Dam with levels in Čunovo and Gabčíkovo, and construction of Hrušov reservoir in Slovakia practically solved the protection of areas on both banks of the Danube, on the right bank to embankment of road ramp to the old bridge at 1 868.140 km and on the left bank within the reservoir the left-side embankment to the harbour pool, respectively a closing object (a new one) on the Little Danube was adjusted. Dams of Hrušov - Dunakiliti reservoir have been designed and built to the design flow in Q100 with an elevation of 1.5 m (requirement of the Danube Commission in developing Common contractual plan). In 2008 it launched local bank flood protection of Bratislava (currently already built), which provides for the protection of historic centre and other selected sections of the passage of big water, that is most often in the late spring and summer months, or as a result of ice regimes on the Danube.

Cruise on the Danube is of European importance. It is still up to date also planned waterway along the Morava River in the framework of linking the Danube - Oder - Elbe.

Water course administrator SVP, OZ Danube river basin requires at bridging the Danube of about 1,860 km and the inundation area to respect the following:

- height of lower bridge at the fairway must respected the min. navigational height. The flow administrator provides the designer with basic information about the position of the fairway, navigable waterway and navigational height. The data form the starting basis for the design parameters of the bridge.
- position of the designed pillars in the area behind the dikes must respect the protection zone 10 m from the foot of the slope of a protection dike until the pillar structure, respectively 10 m from the seepage canal bank line and the actual flow. Pillars must not be located in the body of the dam or in the profile of the seepage canal.
- pillars in the inundation area and in the actual flow profile of the Danube must have the appropriate hydraulic shape. Not to situate the pillars to the foot of the river bed. No obstacle can be in the navigable waterway in the width of 120 m.
- the positioning of the pillars of the proposed bridges will require an assessment of their installation and reinforcement. In the next project phase it is necessary to assess the impact of dams on the course of backwater levels in the building of the bridge
- for the optimal design of the bridge it would be appropriate to repair Biskupické arm partly with option E. The length of the adjustment is proposed to 150 m. The original riverbed is necessary to be filled up, the length of about 100 m.

Based on these requirements the bridging has been designed as follows:

**Option C** addresses the bridging of the Danube through a bridge with the length of 722+370+665+1,002=2,759 m (obj.203). The bridge consists of four expansion units. DC1 (Jarovce viaduct) and DC4 (Biskupice viaduct) are monolithicaly prestressed beam bridges built with technology of eject partly on support scaffolding and expansion unit DC3 that bridges the Danube River using double pylone suspended semi-harp system (see text and illustration annex). Range of the main field is 361 m.

**Option E** addresses the bridging of the Danube via a bridge with the length of 852+825+633=2,310 m. The bridge consists of three expansion units. DC2 support structure is designed as a steel girder bridge reinforced in the longest two fields (L = 210 m - rowing course

and L = 315 - Danube) through Langer system arcs in the symmetrical level (see text and illustration annex). The transversal arrangement of bridges is identical to the solutions set out in the option C.

There is also a cycleway and pedestrian path on these bridges allowing access to the recreation area in the area between dams. Such methods bridging the river Danube only suggest possible solutions of the bridge across the Danube from a variety of possible solutions. Access for pedestrians and cyclists to the bridge over the Danube from the existing bike trails and paths is designed with a pair of ramps in three places.

*Crossing D4 with the Little Danube*

At 16.80 km of D4 a bridge over the Little Danube is designed. The Little Danube was once one of the arms of the Danube. At present, both banks are adapted to the trapezoidal profile. The watercourse serves as the recipient for waste water drainage (WWTP Vrakuňa, Slovnaft and others). The flow starts with abstraction, not flood flows. Level flow regime is subordinated to the procedures of closing object at the inlet. In place of a stream crossing and bridging the max. operational level was set up at Q = 60 $m^3.s^{-1}$.

The infiltration of water from the Little Danube in the surrounding terrain is very small by these observations, the Little Danube bed is quite sealed against water ingress by chemical and other waste materials. For this reason it is not recommended to intervene in the flow profile.

The current position of the course does not meet certain security requirements of air traffic of the Bratislava Airport. Part of technological equipment is placed on the existing bridge over the river. Flow relocation is necessary for the planned shift of runway 13-31 by 400 m. The length of the proposed relocation of the Little Danube is about 3,265 m, and the length of the abandoned bed is about 2,100 m. The relocation of the Little Danube is not part of the construction of the D4 highway, it is the intention of the Bratislava Airport. In terms of water managers it would be ideal to firstly resolve the flow shift in terms of airport plans and respect for the highway route and only then propose the final position of the bridge.

The technical design of the bridge and its location is in accordance with those requirements.

*Crossing D4 with the railway track*

D4 motorway route crosses the following railway lines:

- track no. 132 Bratislava - Rusovce in cad. area of Jarovce,
- track no. 131 Bratislava - Dunajská Streda in cad. area of Podunajské Biskupice,
- track no. 130 Bratislava - Galanta in cad. area of Farná,

At various intersections it should be taken into account the following specifications, which were discussed with RRO (Railway Regulatory Office):

a) track no. 132 Bratislava - Rusovce in cad. area of Jarovce. The highway passes the single-track electrified railway. In bridging the railway it needs to take into account the expected double-track railway tracks. The bridge must be built up with anti-touch barrier. Height of cross-section shall be 7,500 mm.

b) track no. 131 Bratislava - Dunajská Streda in cad. area of Podunajské Biskupice, The highway passes over the single-track non-electrified railway. In bridging the railway it needs to take into account the overlook railway electrification. The ledge arrangement of the bridge must be enable building a anti-touch barrier in case of electrification of the track. Height of cross-section shall be 7,500 mm.

c) track no. 132 Bratislava - Galanta in cad. area of Farná, The highway passes over the double-track electrified railway. The bridge must be built up with anti-touch barrier. Height of cross-section shall be 7,500 mm.

Horizontal and vertical conduct of bridges is closely associated with the proposed road passing the bridge. Bridge type, its length and range of fields is further dependent on the nature of bridging barriers, terrain and geological conditions. The basic division of bridges and their names in the study are based on the relationship placing the main road or junction branch led on the bridge. The main road in this part of the study in different options are options of R7. Overview of bridges in terms of the location of the main road is as follows:

**D4 – Option C**

| | | |
|---|---|---|
| a) | Bridges on D4 with length of < 50 m | 53.0 m |
| b) | Bridges on D4 with length of 50 - 100 m | 654.0 m |
| c) | Bridges on D4 with length of < 100 m | 5,403.0 m |
| d) | Bridges over D4 with length of < 50 m | 0.0 m |
| e) | Bridges over D4 with length of > 50 m | 830.0 m |
| f) | Bridges on roads outside D4 | 865.0 m |

**D4 – Option E**

| | | |
|---|---|---|
| a) | Bridges on D4 with length of < 50 m | 53.0 m |
| b) | Bridges on D4 with length of 50 - 100 m | 716.0 m |
| c) | Bridges on D4 with length of < 100 m | 5,370.0 m |
| d) | Bridges over D4 with length of < 50 m | 0.0 m |
| e) | Bridges over D4 with length of > 50 m | 830.0 m |
| f) | Bridges on roads outside D4 | 879.0 m |

Design of each of bridges in the proposed options is mentioned in the text and image attachments.

## ***Water management measures***

According to Decree no. 211/2005 Coll. of the MoE, the important water management watercourses are the Danube under Bratislava at 1,708.2 to 1,850.2 rkm and above Bratislava at 1,872.7 to 1,880.2 rkm, the Little Danube and Šúrsky channel throughout the entire section. Within Gabčíkovo Water Dam, there is a seepage canal of Janíkov dvor - Jarovce - Rusovce - Čunovo. The water facilities are respected within the technical design of the D4 highway. Description of the technical solution overcoming the Danube, seepage channels, inundation areas of the Danube and the Little Danube is mentioned in the previous section (bridges).

Šúrsky channel according to the administrator´s data SVP, OZ Danube Basin, Management of internal waters of Šamorín was built to drain all the watercourses flowing down from the Little Carpathians. But the mouthed streams were not protected against alluviation, so the channel became sludgy over time. Mouth of Vajnorský waste then required the deepening of the channel. The flow is now regularly maintained, there is a sporadic tree stand on the banks, river bed is overgrown with aquatic plants. D4 highway route is situated near the channel by digging groove (sealing bathtub). The flow administrator requires for ensuring the maintenance and protection of the channel to keep min. 10 m, and in exceptional cases 5 m wide operating strip from the foot of the dam until D4 highway.

## ***Noise control measures***

The feasibility and effectiveness study of the proposed D4 highway the following noise control measures are proposed (PHS - noise barriers):

***Option C***

- PHS on D4 at 0.000 to 2.000 km on the right, height 3 m, absorbing by the highway, protecting the built-up area of Jarovce. The total length of 2,000 m, of which 75 m for bridge.
- PHS on D4 at 2.900 to 4.600 km on the right, height of 2 m, reflective. It protects recreation area of Jarovecké arm. The total length of 1,700 m, barrier is on the bridges in its entire length.
- PHS on D4 at 2.900 to 4.600 km on the left, height of 2 m, reflective. It protects recreation area of Jarovecké arm. The total length of 1,700 m, barrier is on the bridges in its entire length.
- PHS on D4 at 19.300 to 21.500 km on the right, height 4 m, absorbing by the highway. Protecting the built-up area of Zálesie and Ivanka pri Dunaji. The total length of 2m200 m, is routed on highway ground construction.

***Option E***

- PHS on D4 at 0.000 to 1.800 km on the right, height 3 m, absorbing by the highway. Protecting the built-up area of Jarovce. The total length of 1,800 m m, of which 75 m for bridge.
- PHS on D4 at 2.500 to 4.600 km on the right, height of 2 m, reflective. It protects recreation area of Jarovecké arm. The total length of 1,700 m m, of which 1,643 m for bridge.
- PHS on D4 at 2.500 to 4.600 km on the left, height of 2 m, reflective. It protects recreation area of Jarovecké arm. The total length of 2,100 m m, of which 1,643 m for bridge.
- PHS on D4 at 7.500 to 8.550 km on the right, height 4 m, absorbing by the highway. Protecting the built-up area of Lieskové, suburb of Podunajské Biskupice. The total length of 1,800 m m, of which 75 m for bridge.
- PHS on D4 at 19.300 to 21,500 km on the right, height 4 m, absorbing by the highway. Protecting the built-up area of Zálesie and Ivanka pri Dunaji. The total length of 2m200 m, is routed on highway ground construction.

PHS are designed in terms of the Feasibility study in the following table:

| Option | Designed noise barriers | Height (m) | Length (m) | |
|---|---|---|---|---|
| C | PHS on D4 at 0.000 - 2.000 km on the right | 3.0 | 2000.0 | 7600.0 |
| | PHS on D4 at 2.900- 4.600 km on the right | 2.0 | 1700.0 | |
| | PHS on D4 at 2.900- 4.600 km on the left | 2.0 | 1700.0 | |
| | PHS on D4 at 19.300- 21.500 km on the right | 4.0 | 2200.0 | |
| E | PHS on D4 at 0.000 - 1.800 km on the right | 3.0 | 1800.0 | 10000.0 |
| | PHS on D4 at 2.500- 4.600 km on the right | 2.0 | 2100.0 | |
| | PHS on D4 at 2.500- 4.600 km on the left | 2.0 | 2100.0 | |
| | PHS on D4 at 7.500- 8.550 km on the right | 4.0 | 1800.0 | |
| | PHS on D4 at 19.300- 21.500 km on the right | 4.0 | 2200.0 | |

***Preparation of the area***

***Preparation of the area suggests to remove all vegetation from the area of permanent land use and surfacing for the establishment of construction yards. Handling strips in the current flat area are not designed, particularly with regard to minimization of agricultural land use, interference in the territory which is the subject of conservation. The landscaping will consist of humus removal, storage of redundant humus to inter-deck and its subsequent treatment to re-use for the road humification. For larger bridge structures it is considered the establishment of construction yards (material dumps), all within the area of permanent land use. In case of the agreement with the users (e.g. with agricultural organizations, municipalities, etc.) it will be also possible to use other suitable surfaces.***

## ***Landscaping and alternative planting***

Landscaping on the road and interchange branches will be multifunctional in order to protect slopes of terrestrial body against erosion, reduce the negative impact of transport on the nature and environment (to capture emissions and partly noise) and integrate the road in the landscape. Road embankment slopes and areas of the interchange branches will be covered with concentrated bush planting and group plantings of various species of trees to create a continuous green compact mass with the varied colour and heigh structure. Central dividing strip areas will be covered with grass and its central part will be planted with a continuous line of green bush. At the same time, a suitable bushy planting to lead animals under the bridge will be designed in places of animal migration along the fencing. Detailed selection of tree species will be performed in the next stage of project documentation, taking into account local climatic and soil conditions, the original native species and overall landscape. Hillside and other area humification and grassing is included in the cost of the lower structure of the relevant road. The landscaping range in different options of D4 highway is shown in the following table:

| Option | C | E |
|---|---|---|
| Landscaping ($m^2$) | 589,497 | 623,365 |
| Alternative planting (€) | 342,250.00 | 332,752.00 |

## ***Fencing***

D4 highway will be fenced in its entire section. All fencing will be made of plastic-coated wire mesh, with support steel elements. At the airport fencing it is considered a wooden fence of lath (proximity of radio navigation equipment makes the use of metal fencing impossible).

- Option C length of about 38,900.00 m
- Option E length of about 38,100.00 m

## ***Access roads to the construction site, construction yards and dumps***

Access to the individual building parts (highway, feeder, bridges), respectively to the construction yards, dumps and surfaces for the building equipment during construction will be secured by access roads on existing roads that will be prepared for the expected load (hard surface, or field road or local road extension) and further along the route of the unfinished highway.

- Detour on the road I/2 at "Rusovce" EI - During the construction of "Rusovce" elevated interchange it will be necessary to build a temporary detour on the road I/2. Width arrangement of the detour is designed in category C 7.5/50, length of the detour will be approximately 430 m.

- Detour on the road I/63 at "Rovinka" EI - During the construction of "Rovinka" EI, including adjacent finishing of the road I/63, it will be necessary to build a temporary detour, parallel to the existing road. Free width of the detour will be 7.00 m, which corresponds to the width

of the lanes of 3.00 m, with guide strips width of 0.50 m. The detour will be about 560 m long.

- Detour on the road Podunajské Biskupice - Miloslavov at 12.811 km of D4 - The detour is necessary due to the elevated crossing of D4 highway. Width arrangement of the detour is designed in category C 7.5/50, length of the detour will be approximately 375 m.

- "Most pri Bratislave" detour - During construction of relocations of road II/572 and II/06359, it will be needed to build detours. Width arrangement of the detour is designed in category C 7.5/50, total length of the detour will be approximately 700 m.

*Access roads to the construction site* - within the construction of the D4 highway it will be necessary to provide access of construction machinery to the construction site, especially to large objects construction sites, such as bridges, intersections, etc.. In principle, it is expected that all public roads will be used as main access routes to get the direct access to the construction site, while prospective suppliers of works will keep on moving along the route, along the surfaces of the permanent land use of the structure. The site will be divided in some parts by means of difficult or costly surmountable obstacles.

Some tertiary roads belonging to different entities can be used as access routes to the construction site. The condition of these roads typically requires treatment (repairs of the road cover, construction of a new road, extending the road, etc.).

There is an indicative plan for the development of temporary tertiary roads for the construction of the D4 highway:

- access road to the bridge over the Danube on the right bank of the river
  - access from the road I/2 at "Rusovce" interchange continuing via tertiary road of the Danube catchment area

  to the right-hand protective dike, then on the new road parallel to the dike and in the route of the existing road along the right bank of Jarovské arm, length of about 1,000 m
- access road to the bridge over the Danube on the left bank of the river
  - access from the road I/63 via any of the tertiary roads around Slovnaft, then along the route of the existing field road or forest road to the left-hand seepage channel of the water dam, length of treatment about 3,900 m
- access road to the relocation site of the Little Danube
  - access from the road II/572 to construction site on the right side of the current flow, length of treatment about 600 m

- access road to the construction site to the south and north of the D1 highway
  - access from the road I/61 opposite to the area of METRO, a.s. via a field road to the highway, length of treatment about 1,600 m

The envisaged access road treatments are indicative, further processing of the documentation will provide further analyses of the issue and it will especially be negotiated with the relevant authorities and organizations.

Construction yards in the area are considered at "Rusovce" interchange, Rovinka parking area, "Most pri Bratislave", "Ivanka - West" and Ivanka - North" interchanges with the area of 29,265.8 $m^2$.

Only temporary humus dumps are considered during the construction. These will be addressed in the vicinity of construction yards.

## ***Parking areas***

***"Rovinka" a large two-sided parking area*** is designed for the section of the highway - a site for large parking area was determined on both sides of the D4 highway on undeveloped territory in the section between Ketelec interchange and D4 highway crossing with the road I/63.

- Location of parking area for option C - D4 stationing 9.0 to 9.5.
- Location of parking area for option E - D4 stationing 8.5 to 9.0.

The proposed parking area capacity on one side is the following:

- total area 53,130 $m^2$
- paved areas and roads for cars 3,370 $m^2$
- paved areas and roads for trucks 12,840 $m^2$
- pavements 2,330 $m^2$
- greenery 21,040 $m^2$
- area for hospitality establishments 6,980 $m^2$
- area for fuel station 6,570 $m^2$
- number of stationing
  - for cars 60
  - for trucks 60
  - for busses 10

# INDUCED INVESTMENTS

## Road relocations and modifications

In terms of the placement of the D4 highway into the area, it will need to modify existing road system so as to maintain its function and not to have limited access to lands. The following range of necessary adjustments and relocations will be required for D4 options:

| Option | Road relocation (modification) name | Category | Length in m |
|---|---|---|---|
| C | Road relocation III/00246 in Jarovce | C 7.5/50 | 708 |
| | Road reconstruction I/2 at Rusovce interchange | C 22.5/70 | 473 |
| | Field road relocation at 6.386 km | P 4/30 | 670 |
| | Field road relocation at 8.049 km | P 6/40 | 560 |
| E | Road relocation III/00246 in Jarovce | C 7.5/50 | 708 |
| | Road reconstruction I/2 at Rusovce interchange, at 2.420 52 km of D4 | C 22.5/70 | 341 |
| | Field road relocation at 5.895 km | P 4/30 | 340 |
| | Road relocation at 8.304 km of D4 | P 6/40 | 320 |
| C, E | Tertiary road relocation north of the "Rovinka" interchange | P 6/40 | 320 |
| | Tertiary road relocation at 12.811 km | C 7.5/50 | 650 |
| | Road relocation II/503 in "Most pri Bratislave" interchange | C 7.5/50 | 708 |
| | Field road relocation at 16.909 km on the left side of the Little Danube | P 4/30 | 300 |
| | Zálesie highway feeder | C 11.5/80 | 2236 |
| | Access road relocation to PD at 19.100 km | P 6/40 | 330 |
| | Tertiary road relocation at 20.383 km | P 6/40 | 450 |

## Relocations and adjustments to water mains

Each route is given in the tables by the proposed option:

| Option | Water mains relocation (modification) name | DN (mm) | Length (m) |
|---|---|---|---|
| C | water mains at 2.300 km | 2 x 1400 | 2 x 180 |
| | water mains at 8.170 km | 800 | 150 |
| | water mains at 12.750 km | 1000 | 150 |
| | water mains at 14.400 km | 1000 | 100 |
| | water mains at 14.700 km | 500 | 650 |
| E | water mains at 2.150 km | 2 x 1400 | 2 x 180 |
| | water mains at 8.850 km | 800 | 150 |
| | water mains at 12.750 km | 1000 | 150 |
| | water mains at 14.400 km | 1000 | 100 |
| | water mains at 14.700 km | 500 | 650 |

## Modification to the existing sewer

The length and position (stationing) following the route concerned is given in the following table:

| Option | Sewer relocation (modification) name | DN in mm | Length in m |
|---|---|---|---|
| C | Future area for Ivanka - West interchange | 400 | 400 |
| E | Future area for Ivanka - West interchange | 400 | 400 |

## Meliorations

Part of the construction of the proposed D4 route is crossing the existing irrigation pipelines, therefore the design is applied to relocate and protect them.

| Option | Name of modified meliorations | DN in mm | Length in m |
|---|---|---|---|
| C | 0.400 - 1.250 km | 150 | 250 |
| | | 200 | 250 |
| | | 400 | 250 |
| | 1.300 - 3.050 km | 150 | 500 |
| | | 200 | 1000 |
| | | 400 | 1600 |
| | 6.000 - 13.000 km | 150 | 900 |
| | | 200 | 1100 |
| | | 250 | 1000 |
| | | 400 | 1200 |
| | | 600 | 500 |
| | 13.000 - 23.000 km | 150 | 1500 |
| | | 200 | 1900 |
| | | 250 | 2100 |
| | | 400 | 1600 |
| | | 600 | 800 |
| E | 0.400 - 1.250 km | 150 | 250 |

| | | | |
|---|---|---|---|
| | | 200 | 250 |
| | | 400 | 250 |
| | 6.000 - 13.000 km | 150 | 900 |
| | | 200 | 1100 |
| | | 250 | 1000 |
| | | 400 | 1200 |
| | | 600 | 500 |
| | 13.000 - 23.000 km | 150 | 1500 |
| | | 200 | 1900 |
| | | 250 | 2100 |
| | | 400 | 1600 |
| | | 600 | 800 |

## ***Relocations and adjustments of gas pipelines***

Length, profiles and stationing in contact with the gas pipelines are shown in the table below:

| Option | Gas pipeline relocation (modification) name | DN in mm | Length in m |
|---|---|---|---|
| C | 2.220 km | 100 | 300 |
| | - DN 200 protector | 200 | 50 |
| | 10.450 and 10.500 km | 500 | 2 x 400 |
| | - DN 800 protector | 800 | 2 x 50 |
| | 12.250 km | 200 | 150 |
| | - DN 400 protector | 400 | 50 |
| | 15.700 km | 90 | 250 |
| | - DN 200 protector | 200 | 50 |
| | 21.400 km | 500 | 300 |
| | - DN 800 protector | 800 | 50 |
| | 2.280 km | 100 | 400 |
| E | - DN 200 protector | 200 | 50 |
| | 9.600 km | 500 | 2 x 400 |
| | - DN 800 protector | 800 | 2 x 50 |
| | 12.250 km | 200 | 150 |
| | - DN 400 protector | 400 | 50 |
| | 15.700 km | 90 | 250 |
| | - DN 200 protector | 200 | 50 |
| | 21.400 km | 500 | 200 |
| | - DN 800 protector | 800 | 50 |

## ***Relocations and adjustments to oil pipelines***

The scope of the proposed adjustment is shown in the following table:

| Option | Oil pipeline relocation (modification) name | DN in mm | Length in m |
|---|---|---|---|
| C | 10.770 km | 500 | 0.0 |
| | DN 700 protector | 700 | 50.0 |
| | 10.775 km - Družba oil pipeline | 500 | 0.0 |
| | DN 700 protector | 700 | 50.0 |
| E | 10.770 km | 500 | 0.0 |
| | DN 700 protector | 700 | 50.0 |
| | 9.810 km - Družba oil pipeline | 500 | 0.0 |
| | DN 700 protector | 700 | 50.0 |

## Relocations and adjustments of product pipelines

The scope of the adjustment is shown in the following table:

| Option | Product pipeline relocation (modification) name | DN in mm | Length in m |
|---|---|---|---|
| C | 10.705 km | 250 | 0.0 |
| | DN 500 protector | 500 | 50.0 |
| | 10.730 km | 250 | 0.0 |
| | DN 500 protector | 500 | 50.0 |
| | 10.745 km | 300 | 0.0 |
| | DN 500 protector | 500 | 50.0 |
| | cable line - 10.725 km | | |
| | DN 500 protector | 500 | 50.0 |
| E | 9.790 km | 250 | 0.0 |
| | DN 500 protector | 500 | 50.0 |
| | 9.800 km | 250 | 0.0 |
| | DN 500 protector | 500 | 50.0 |
| | 9.805 km | 300 | 0.0 |
| | DN 500 protector | 500 | 50.0 |
| | cable line - 9.795 km | | |
| | DN 500 protector | 500 | 50.0 |

## HV line relocations

| Option | HV line relocation name | Length in m |
|---|---|---|
| C | 22 kV HV line relocation - at 1.735 km | 300 |
| | 22 kV HV line relocation - at 2.505 km | 600 |
| | 22 kV HV line adjustment - at 2.780 km | 800 |
| | 22 kV HV line adjustment - at 6.820 km | 400 |
| | 22 kV HV line relocation - at 10.220 km | 300 |
| | 22 kV HV line relocation - at 10.720 km | 300 |
| | 22 kV HV line relocation - at 10.725 km | 300 |
| | 22 kV HV line relocation - at 10.850 km | 400 |
| | 22 kV HV line relocation - at 11.950 km | 300 |
| | 22 kV HV line relocation - at 12.800 km | 400 |
| | 5 x 22 kV HV line relocation - at 12.950 - 13.100 km | 1500 |
| | 2 x 400 kV HV line relocation - at 10.920 km | 600 |
| | 1 x 400 kV HV line relocation - at 10.960 km | |
| | 1 x 110 kV HV line relocation - at 13.210 km | 500 |
| | 22 kV HV line relocation out of "Most pri Bratislave" interchange - at 15.550 km | 500 |
| | 22 kV HV line relocation out of "Most pri Bratislave" interchange - at 15.550 km, connection for TS | 200 |
| | 22 kV HV line adjustment 2 x connection for TS "Prucká sihoť" at 19.700 | 500 |

| | | |
|---|---|---|
| | km | |
| | 22 kV HV line adjustment - at 22.700 km | 500 |
| **E** | 22 kV HV line relocation - at 1.720 km | 300 |
| | 22 kV HV line relocation - at 2.450 km out of "Rusovce" interchange | 600 |
| | 22 kV HV line adjustment - at 8.300 km | 400 |
| | 22 kV HV line relocation - at 8.350 km | 300 |
| | 22 kV HV line relocation - at 8.350 km for TS Lieskové | 300 |
| | 22 kV HV line relocation - at 8.350 km for TS Lieskové | 1500 |
| | 110 kV HV line relocation - at 8.350 km | 1500 |
| | 22 kV HV line relocation - at 9.750 km out of the planned bridge | 300 |
| | 22 kV HV line relocation - at 10.050 km | 300 |
| | 22 kV HV line relocation - at 10.100 km | 300 |
| | 22 kV HV line relocation - at 11.950 km | 300 |

| | | |
|---|---|---|
| E | 22 kV HV line relocation - at 12.800 km out of the new bridge route | 400 |
| | 5 x 22 kV HV line relocation - at 12.950 - 13.100 km | 1500 |
| | 2 x 400 kV HV line relocation - at 10.920 km | |
| | 1 x 400 kV HV line relocation - at 10.960 km | |
| | 1 x 110 kV HV line relocation - at 13.210 km | 600 |
| | 22 kV HV line relocation - at 15.500 km out of the "Most pri Bratislave" interchange | 500 |
| | 22 kV HV line relocation, connection for TS - at 15.500 km out of the "Most pri Bratislave" interchange | 200 |
| | 22 kV HV line adjustment 2 x connection for TS "Prucká sihoť" at 19.700 km | 500 |
| | 22 kV HV line adjustment - at 22.700 km | 500 |

D4 collision with upcoming lines and equipment

**Option C**

- HV 1 x 400 kV line of Podunajské Biskupice - Gabčíkovo at 10.880 km
  - Part of the project "2 x 400 kV Gabčíkovo - Veľký Ďur", according to the planning and technical study
    by Elektrovod, a.s., December 1999
  - parallel with the southernmost existing 2 x 400 kV line
  - collision of D4 with the planned lines, must be dealt with mutual coordination within the entire junction node of "Rovinka" uopn providing a complete map data

**Option E**

- HV 1 x 400 kV line of Podunajské Biskupice - Gabčíkovo at 10.880 km
  - Part of the project "2 x 400 kV Gabčíkovo - Veľký Ďur", according to the planning and technical study
    by Elektrovod, a.s., December 1999
  - parallel with the southernmost existing 2 x 400 kV line
  - collision of D4 with the planned lines, must be dealt with mutual coordination within the entire junction node of "Rovinka" uopn providing a complete map data
- HV 1 x 400 kV line of Podunajské Biskupice - Petržalka III at 8.300 km
  - parallel with existing 1 x 110 kV line at "Rovinka" parking area

- collision of D4 with the planned lines, must be dealt with mutual coordination within the entire junction node of "Rovinka" uopn providing a complete map data

***LV line relocations***

The documentation considers the following range of telephone and remote lines with the fact that their extent and type will be specified in subsequent stages of PD.

| Option | C | E |
|---|---|---|
| Local telecommunication distribution (m) | 655 | 345 |
| Remote telecommunication networks and lines (m) | 13,800 | 13,700 |

***Further conditions for the construction of the proposed options***

In terms of designed options the following adaptations of the Bratislava road system should be considered (related investments that are within the competence of Bratislava city):

- to adapt the existing Svornosti st. by extending to the four-lane road, including adjustments to strategic interchanges with Slovnaftská and Popradská street to elevated junctions,
- build a new four-lane "radial road", which will interconnect Bajkalská st. from the intersection on D1 Prievoz and D4 through the Ketelec intersection (defined in the planning documentation as an extension of Bajkalská st.).

The above adjustments are defined and protected in the form of binding regulations in updated and currently valid zoning plan of Bratislava of 2007, respectively its amendments 01 of 2008.

## 9. Options of the proposed activity

D4 in the section of Jarovce - Ivanka North was based on the comments to the Plan, respectively in terms of the specific requirements set out in Assessment range, technically resolved in the Feasibility and effectiveness study processed in September 2009 by Dopravoprojekt, a.s., while in addition to the basic options "A" purple and "B" red, which have been designed in Plan in accordance with Act No. 24/2006 Coll. (Geoconsult, spol. s.r.o. in December 2007), further options "C" red, "D" blue (tunnel option) and "E" green were solved. Solutions of the new D4 options resulted from the following comments and requests for Option "A" and "B" proposed in the Plan, resp. referred to in the specific requirements of Assessment range issued the Ministry of Environment for further assessment of D4 section of Jarovce - Ivanka North, namely:

1. When passing D4 over the Danube considerable intervention in protected areas. Intervention in nature reserve of Gajc and nature reserve of the Danube islands, which consist of valuable habitats of floodplain forest and steppe habitats, affects the PKA Danube floodplains, the systems of European importance Natura 2000 and part of the sites protected by the Ramsar Convention, intervention also means affected elements of regional and provincial TSES. Therefore there is a request to search for other, new options of crossing over the Danube River, where the intervention in protected areas would be lower. It is required to examine the possibilities of routing D4 via tunnel under Danube.
2. Consider the possibility of extending the D4 six-lane in the section from the intersection with D2 ("Jarovce" elevated interchange) to D1 ("Ivanka - North" EI).
3. In terms of the bridges over the Danube and Little Danube it is advisable to deal with the pedestrian, respectively cycling linking of existing trails.
4. As a solution of R7 expressway, Bratislava prefers Option A, which is consistent with the LUD Bratislava. Option C of R7 is not acceptable for Bratislava due to its outlet into the

congested road I/63 (Biskupická radial). Most of the other affected municipalities and authorities is for Option C of R7.

5. "Ivanka - North" elevated interchange to be designed as a full clover leaf interchange.
6. "Rovinka" EI requirement to supplement the interchange branch of D4 (Petržalka) to the road I/63 (towards Šamorín).
7. Worries for exceeding the permissible noise load in "Zálesie" and "Ivanka" tunnels, worries for flooding the tunnels in the event of dam breakage of Šúrsky channel.
8. Resolve routing of D4 near the Bratislava Airport and airport beacon in cooperation with the Civil Aviation Authority.
9. Examine the possibility of connecting feeder of Zálesie to the D4 highway with a complete entrance and exit from the highway.

In accordance with the Scope of the assessment and recommendations of the Feasibility and effectiveness of the D4 highway study the following options have been designed of the D4 highway in the section of Jarovce - Ivanka north:

- **Option C red**
- **Option E green**

When processing the Assessment Report, technical documents were supplemented by a technical study "D4 highway, Ivanka - north interchange, option", drawn up by our company in April 2010. The technical study was dealing with alternative conduct of the vertical alignment of D4 when crossing D1 at Ivanka north interchange due to unfavourable hydrogeological conditions in this section (in option "C" led under D1 with a recess under the ground, it is necessary to build a sealed bath due to high groundwater level and other flood protection measures). Option for conduct of D4 is based on modification of the D4 vertical routing over D1, while the modification of the vertical levelling of the highway touches option C at km 21.250 - cad. area (22.800 643) in the section of Jarovce - Ivanka north and options 2a resp.7a and 2b, resp.7b at 0.0 to 0.575 km of Ivanka north - Záhorská Bystrica. Adapting the vertical levelling of option "C" in the section of D4 was, given the baseline option "C" and "E", referred as **option "C1"**. This option addresses the problem section of D4 at the Ivanka north interchange, while significantly eliminating the adverse effects of option "C".

The technical solution of designed options is mentioned in the previous section of the report.

**Phasing of construction:**

The construction of the entire D4 highway is proposed to be implemented in the following stages, in sections:

- Section I Jarovce – Ivanka North, resp. Rača interchange*
- Section II Ivanka North, resp. Rača interchange* – Záhorská Bystrica,
- Section III Záhorská Bystrica – Devínska Nová Ves (extension to 4-lane),
- Section IV Devínska Nová Ves - nat. border SK/A

(* According to the Feasibility study, a recommendation to extended section I to the Rača interchange of Section II.)

The assessed section of Jarovce - Ivanka north, respectively Rača crossroad is recommended to be built as first, because after it is put into operation, the greatest positive impacts on other roads in the southern and south-eastern part of Bratislava are expected, as follows:

- partial traffic relief of the D1 highway inside the city (especially in Ružinov, Prievoz, on a busy bridge over the Danube, in Petržalka),
- diversion of transit traffic to the D4 highway ring,

- partial diversion of traffic between outskirts on the outer edge of the City of Bratislava,
- a favourable impact on the 3rd class road network is expected (decreased congestion), for example between Podunajské Biskupice and municipalities of Most pri Bratislave - Zálesie - Ivanka pri Dunaji, which currently replace the missing outer ring road of the city,
- if the construction of a part of the section Ivanka North - Rača crossroad (Section II) began in Section I, this would have a positive impact not only on Rybničná street - through a reduction of traffic load (currently assumes the function of the missing outer ring of the town), but also on internal part of Vajnory, where there would be a significant reduction in congestion of a new urbanization (Čierna voda), as car traffic would have already been caught up on the D4 highway.

In there were problems in preparing Section I., i.e. passing across the Danube, it is recommended to begin the construction of Section I from "Rovinka" interchange and end it on D1 in "Ivanka - North" EI, respectively we recommend to start building at the same time with part II. of the section from "Ivanka - North" EI to "Rača" EI. This would solve a substantial part of the traffic issues in the eastern part of Bratislava, that would also accelerate urban development in Vajnory suburb (CEPIT, a new planned urbanization at the former airport in Vajnory, removing unwanted traffic in the urban area of Vajnory from the direction of Čierna voda).

## *10. Total costs*

Summary of estimated costs for the construction of the D4 highway of Jarovce - Ivanka north by the Feasibility Study is stated in the following table:

| Option | Total length of D4 (km) | Construction costs excl. VAT (€) | Total costs excl. VAT (€) | Construction costs incl. VAT (€) | Total costs incl. VAT (€) |
|---|---|---|---|---|---|
| **C** | 22,800 63 | 624,529,483 | 843,561,884 | 743,190,084 | 987,535,462 |
| **E** | 22,168 94 | 646,615,144 | 887,804,782 | 769,472,021 | 1,036,788,794 |

## *11. Municipalities concerned*

- Capital city of Bratislava
- Bratislava - Jarovce suburb
- Bratislava - Rusovce suburb
- Bratislava - Podunajské Biskupice suburb
- Bratislava - Vajnory suburb
- Most pri Bratislave
- Zálesie
- Ivanka pri Dunaji

## *12. Self-Governing Region Concerned*

- Bratislava region

## *13. Authorities concerned*

- Ministry of Environment of the Slovak Republic

- Ministry of Defence of the Slovak Republic
- Ministry of Interior of the Slovak Republic
- Ministry of Economy of the Slovak Republic
- Regional Office for Road Transport and Roads in Bratislava
- Regional Land Office in Bratislava
- Regional Forest Office
- District Environmental Office in Bratislava
- District Environmental Office in Senec
- District Mining Office
- Regional Public Health Office Bratislava
- District Headquarters of Fire and Rescue Corps in Bratislava
- Railway Regulatory Office in Bratislava
- Air Transport Authority SR

## *14. Authorising authority*

- Capital city of Bratislava
- Most pri Bratislave
- Ivanka pri Dunaji

## *15. Authority*

- Ministry of Transport, Posts and Telecommunications of the SR

## *16. Statement on the expected transboundary impacts of the proposed activity*

Transboundary environmental impacts of the proposed activity change are not expected.

# B. DATA ON DIRECT IMPACTS OF THE PROPOSED WORKS ON THE ENVIRONMENT INCLUDING HEALTH

## I. INPUT REQUIREMENTS

Indicative balance of works taken from the Feasibility Study is shown in the following table:

| | | m.u. | Option C | Option E |
|---|---|---|---|---|
| Earthworks | embankment | $m^3$ | 3,559,232 | 3,149,955 |
| | excavation | $m^3$ | 549,215 | 561,044 |
| roads | | $m^3$ | 376,673 | 349,743 |
| Bridges on D4 | | m | 6,110 | 6,139 |
| | | $m^3$ | 213,493 | 212,638 |
| Bridges over D4 | | m | 830 | 830 |
| | | $m^3$ | 14,000 | 38,131 |
| Noise barriers | length | m | 7,600 | 9,250 |
| D4 draining | road drainage | m | 45,900 | 42,800 |
| | ORL | pc | 19 | 19 |
| Relocations (adjustments, reconstruction) | of water mains | m | 1,690 | 1,630 |
| | of meliorations | m | 16,450 | 13,350 |
| | of sewerage systems | m | 400 | 400 |
| | of gas pipelines | m | 2,355 | 2,350 |
| | of oil pipelines | m | 300 | 300 |
| | VHV | m | 500 | 2000 |
| | HV | m | 7,200 | 11,100 |
| | LV | m | 5,900 | 8,900 |
| Landscaping | | $m^2$ | 589,497 | 623,365 |

### 1. Soil

In terms of soil requirements, its use is clearly defined. Permanent and temporary land use areas were calculated in the technical documentation based on the expected land shape of the proposed options and are listed in the following table.

| *Option* | *Permanent use of ALU and FLU in total ($m^2$)* | *Temporary use of ALU and FLU in total (m2)* |
|---|---|---|
| ***C red*** | 1,430,942 | 317,135 |
| ***E green*** | 1,422,346 | 439,529 |

The forest land use (FLU) will occur in option C between 4.8 and 5.8 km (about 4.01 hectares), in option E between 4.6 and 5.4 km (about 2.90 hectares). Subsequently, the land use will also occur at 16.0 km (about 0.21 ha), 19.1 (about 0.01 ha), 19.3 (about 0.04 ha) and at Ivanka - West interchange (about 3.09 ha). In total for option C, the FLU will represent 7.36 ha and for option E 6.25 ha.

## 2. Water

*Water abstraction*

Demands for water abstraction for building works related to the construction of highway lie mainly in technical water consumption (particularly for the production of concrete), potable water consumption for personnel and hot water for sanitary purposes within construction yards. Due to the expected range of construction works and building technologies it is not expected any substantial influence or change in the current system of water supply for the needs of D4 construction in the affected area.

*Water source*

Supplying construction yards including construction equipment can be addressed by connecting the local water supply and water resources, and it is possible to build their own water sources due to the favourable hydrogeological conditions . In case of connecting the building to non-potable water source only, it can supply workers with drinking water using separate containers.

*Water consumption*

The exact calculation of water amounts (consumption) will be implemented in the technical documentation at the level of implementation projects.

## 3. Raw materials

The maximum use of excavated soil (soil body - embankments) and other raw materials, which need to be provided for other construction will be used for the construction of the highway:

- aggregates and gravel sands (base layers of roads, backfilling, shroudings, concrete production)
- asphalt (construction of roads)
- cement (concrete production)
- steel (steel bridges, concrete reinforcement, crash barriers, fencing, other structures)
- other materials (drainage, relocation and connection of networks, lighting, etc.).

The type and amount of material need to be evaluated at the level of implementation projects. Claims for the provision of these raw materials can be applied by the next contractor for the manufacturers, which are in the affected area.

## 4. Energy Sources

Detailed requirements for power consumption during operation will be specified in further stage of project preparation. Indicatively, the most significant devices requiring energy power were specified in the technical documentation.

**Water pumping stations**

Given the nature and height parameters of the territory, which the route passes through, several pumping stations need to be built within sewerage that need to be provided with power source. HV 22 kV connections shall be drawn from the public network, reduction of voltage for pumping stations is ensured by mast transformer stations, located at each of the pumping stations. Requirements for electricity consumption are as follows:

- PS 1 km 1.400 131.5 kW input power
- PS 2 km 5.700 155.5 kW input power
- PS 3 km 6.800 201.5 kW input power
- PS 4 km 9.900 260.5 kW input power
- PS 5 km 15.200 134.5 kW input power
- PS 6 km 16.200 89.5 kW input power
- PS 7 km 16.900 245.5 kW input power
- PS 8 km 19.650 17.5 kW input power
- PS 9 km 20.250 28.5 kW input power
- PS 10 km 21.250 28.5 kW input power
- PS 11 km 22.800 60.5 kW input power

**„Rovinka“ parking area**

Energy needs of this type of equipment are for such a large parking area about 600 kW left and right, 1,200 kW in total. HV 22 kV connection is designed from the public power system by air conduction with the transition to cabling. Transfer of voltage for parking areas will be provided by kiosk substation placed in the parking area on the right with LV connection for the left parking area.

During the construction, the method of supplying construction yards is to be addressed to the existing low-voltage system. Substantial influence or change in the current system of power supply in the affected area for the needs of the D4 construction D4 is not expected.

## 5. Transport and Other Infrastructure Requirements

In the area, given the enormous increase in traffic, it is necessary to build a highway that would address the partial transfer and relieve congestion on existing roads I/61 and I/63 and divert transit traffic from the capital city. In the construction phase of the highway, increased traffic demands will be put on local roads in the context of the need to material supply for the structure. Access to the construction site as well as to individual buildings during construction will be secured by existing roads and roads that will be adapted after completion of the construction, respectively if necessary even before the start of use. The considered access roads to the site are described

hereinabove. Traffic will be restricted only to points in intersections with existing roads, respectively at the connection points of D4 to the existing network.

### 6. Labour requirements

The period required for construction of the highway is decisive from the aspect of necessary workforce, provided such period depends on the complexity of the structures and selected option of the route. The number of persons employed during construction was not specified in the technical documentation. We assume that the construction of the highway will be an important source of jobs of different professional composition not only in civil engineering but also in other services providing facilities for civil companies. Labour requirements can be actually evaluated only in the actual implementation phase by the contractor.

## II. OUTPUT DATA

### 1. Air

Transport is one of the most significant sources of air pollution. The pollutants getting into the air are carbon monoxide (CO), oxides of nitrogen ($NO_x$) and hydrocarbons ($C_xH_y$). Overall values of specific emissions from car traffic have been determined for Slovakia (estimate for 1995-2005) - according to the methodology for calculating air pollution from car traffic.

In general, car emissions are dependent on the speed, longitudinal slope of the road and traffic flow composition. In this context it is necessary to distinguish air pollution during construction and operation of roads.

During construction the source of air pollution is in particular construction machinery in construction yards and the transport of materials on the access roads within the structure operation and in the site itself. It will be a dusty pollution and emissions from the traffic of heavy vehicles through the site and on the access roads. Currently, it is not possible to further specify the amounts of pollutants, since the composition of the fleet will be announced by major supplier of construction works. Construction works in all options (except for the zero option, i.e. if the activity was not implemented) represent a real risk of increased air pollution. Air pollution may be expected in relation to the population concerned especially in populated urban area of Jarovce and Podunajské Biskupice mainly on the route between the source of the material, respectively the construction yards and the structure. Appropriate organization of work and optimization of access roads to the site can partially eliminate this negative effect.

During operation, the highway as well as other roads will represent a constitute line sources of air pollution and car traffic shall be within the meaning of Act no. 478/2002 Coll. on air protection classified as mobile sources. Emissions produced by traffic moving on the road depend mainly on the traffic intensity and traffic flow, traffic flow composition, technical parameters of vehicles, transport mode, speed and other factors such as road gradient, air temperature, wind, etc.

Following the Dispersion study elaborated within the framework of the Assessment Report (text of the Annex) the maximum concentrations of air pollutants from traffic on the D4 highway have been calculated, including the cumulative effect at the intersection of D4/D1 Ivanka north, as shown in the following table:

| Pollutants | Averaged period | Year | Maximum concentration in the immediate vicinity of the road µg/m$^3$ | | |
|---|---|---|---|---|---|
| | | | D4 highway | | Surroundings of D1/D4 intersection |
| | | | red option C | green option E | |
| $NO_2$ | 1 hour | 2015 | 61.4 | 60.5 | 300.9 |
| | | 2030 | 57.6 | 56.1 | 252.4 |
| $NO_2$ | 1 year | 2015 | 10.5 | 9.7 | 39.0 |
| | | 2030 | 9.9 | 9.2 | 32.0 |
| CO | 8 hour | 2015 | 44.5 | 43.6 | 245.4 |
| | | 2030 | 24.6 | 24.0 | 113.9 |
| PM10 | 24 hour | 2015 | 4.4 | 4.3 | 23.4 |

*The results of calculation of $NO_x$ have been evaluated in relation to the nearest residential area near D4 highway located in the sections:*

- *km 0.400-1.100 - northern edge of Jarovce*
- *km 10.500-11.500 - southern edge of Podunajské Biskupice*
- *km 10.500-11.500 - northern edge of Rovinka*
- *km 15.200-15.600 - western edge of Most pri Bratislave*
- *km 18.300-18.600 - western edge of Zálesie*
- *km 19.500-20.700 - western edge of Ivanka pri Dunaji*

*Evaluation of the calculated one - hour concentrations of $NO_x$ at these locations in relation to the hygienic limit are presented in the following table.*

| Locality | Distance from D4 in m | Year | Maximum concentration in residential area µg/m$^3$ |
|---|---|---|---|
| Jarovce | 380 | 2015 | 20 |
| | | 2030 | 19 |
| Podunajské Biskupice | 660 | 2015 | 92 |
| | | 2030 | 108 |
| Rovinka | 740 | 2015 | 35 |
| | | 2030 | 24 |
| Most pri Bratislave | 530 | 2015 | 30 |
| | | 2030 | 25 |
| Zálesie | 1,100 | 2015 | < 5 |
| | | 2030 | < 5 |
| Ivanka pri Dunaji | 330 | 2015 | 34 |
| | | 2030 | 30 |

## 2. Waste water

During construction it is necessary to consider multiple sources of waste water, e.g.:

- materials used and substances detrimental to water (fuel, oil, lubricants)
- sewage of contaminants from used construction machines
- waste water from construction yards.

Waste water, respectively polluted rain water due to car traffic is produced during operation of roads. The waste water sources are:

- sewage from road surfaces
- waste water from the equipment used in the maintenance of the road
- waste water from the parking area operation.
- leakage of hazardous substances from moving vehicles.

The effects of waste water effluent from the road surface may affect the quality of groundwater. In case of large quantities and concentrations of pollutants with a high proportion of suspended solids (for accidents only) waste water can cause local pollution of groundwater.

The same threat comes from waste water from winter maintenance of the road. Chemical agents have a very negative impact on various environmental components, especially on soil and vegetation in the area of the maintained road, but also on groundwater and surface water and on means of transport and the road itself. This activity is dependent on the volume of de-icing agents, surface, category and road load, weather conditions, deployment of green and its resistance to salt, road position in the field, type of soil and etc.

The amount of waste water during construction can be specified in subsequent stages of project documentation. During operation, the estimated amount of waste water from D4 is as follows:

| Option | C red | E green |
|---|---|---|
| Waste water in l per s | 3,929 | 3,648 |

## 3. Waste

Waste production and the subsequent waste management is an issue concerning all the stages from start of construction of the highway to its operation. It should therefore be prepared the waste disposal project in the next stages of the project preparation, which proposes a method of waste management, respectively waste disposal. The amount of waste produced during construction of the highway is not possible to specify at present.

During project preparation and its implementation, the waste will be produced mainly from excavated soil, which is not suitable for use in embankments, respectively extra soil, stumps and roots, or landfill material uncovered during construction. The waste associated with construction activities (wood waste, demolished pavement, asphalt, concrete, etc.) and the use of vehicles and mechanisms will also be produced. During reconstruction of connecting roads or in demolition of the original roadway the waste from resins will be produced (road cover). During construction and operation of D4 highway, various types and quantities of waste will be produced, Waste types and categories classified according to Decree no. 284/2001 Coll. of MoE establishing the Waste Catalogue, as amended, are presented as follows:

*During highway construction*

| Cat. no. | Name of Waste type | Category | |
|---|---|---|---|
| 15 01 10 | Packaging containing residues of or contaminated by dangerous substances | | N |
| 15 02 02 | Absorbents, filter materials including oil filters not otherwise specified, wiping cloths, protective clothing contaminated by dangerous substances | N | |
| 16 02 13 | Discarded equipment containing hazardous components other than those mentioned in 160209 to 160212 | N | |
| 17 01 01 | Concrete | O | |
| 17 02 01 | Wood | O | |
| 17 02 03 | Plastic | O | |
| 17 03 02 | Bituminous mixtures other than those mentioned in 170301 | O | |
| 17 04 02 | Aluminium | O | |
| 17 04 05 | Iron and steel | O | |
| 17 04 11 | Cables other than those mentioned in 170410 | O | |
| 17 05 03 | Soil and stones containing dangerous substances | N | |
| 17 05 04 | Soil and stones other than those mentioned in 170503 | O | |
| 17 05 05 | Dredging spoil containing dangerous substances | N | |
| 17 05 06 | Dredging spoil other than that specified in 170505 | O | |
| 17 05 07 | Track ballast containing dangerous substances | N | |
| 17 05 08 | Track ballast other than that mentioned in 170507 | O | |
| 17 06 03 | Insulation materials consisting of or containing dangerous substances | | N |
| 17 06 04 | Insulation materials other than those mentioned in 170601and 170601 | | O |
| 17 09 03 | Other construction and demolition wastes including mixed wastes containing dangerous substances | N | |
| 17 09 04 | Mixed construction and demolition wastes other than those mentioned in 170901, 170902 and 170903 | O | |
| 20 02 01 | Biodegradable waste | O | |

*During highway operation*

| Cat. no. | Name of Waste type | Category | |
|---|---|---|---|
| 13 02 06 | Synthetic engine, gear and lubricating oils | N | |
| 15 01 10 | Packaging containing residues of or contaminated by dangerous substances | | N |
| 15 02 02 | Absorbents, filter materials including oil filters not otherwise specified, wiping cloths, protective clothing contaminated by dangerous substances | N | |
| 16 01 04 | Old vehicles | N | |
| 16 02 13 | Discarded equipment containing hazardous components other than those mentioned in 160209 to 160212 | N | |
| 17 02 01 | Wood | O | |
| 17 02 02 | Glass | O | |
| 17 02 03 | Plastic | O | |
| 17 03 02 | Bituminous mixtures other than those mentioned in 170301 | O | |
| 17 04 05 | Iron and steel | O | |
| 17 05 03 | Soil and stones containing dangerous substances | N | |
| 17 05 04 | Soil and stones other than those mentioned in 170503 | O | |
| 17 05 05 | Dredging spoil containing dangerous substances | N | |
| 17 05 06 | Dredging spoil other than that specified in 170505 | O | |
| 20 02 01 | Biodegradable waste | O | |

All activities related to waste management, particularly during construction of the D4 highway, will be ensured by supply on a contractual basis with authorized individuals.

Biodegradable waste - cat. no. 20 02 01 will be produced in the construction and operation of the planned highway. The above type of waste will need to be sort out and recycled by composting in accordance with the Slovak Waste Management Programme. In this regard, the developer and operator of the highway should also consider this option - to create conditions for the recovery of biodegradable waste - by composting.

Waste management during construction and operation will be managed in accordance with the Waste Management concepts and strategies of the SR and under the legislation for waste management. The basic principles of waste management are:

- waste prevention,
- material and energy waste recovery,
- environmentally-friendly waste disposal.

Waste prevention can be achieved by good organization of work, consistent waste separation harvested from exploited natural materials and the prevention of emergency situations, especially during construction. Material recovery of waste is considered for the case of waste concrete, reinforced concrete and asphalt from demolition of buildings, paved areas and roads. Recycling these types of waste is possible directly on site (mobile recycling units). Recycled materials should preferably be used directly in the construction of a new road. Environmentally-friendly waste disposal is in the responsibility of the contractor during construction works and the structure administrator during operation by entering into a contractual relationship with the legal or natural persons authorized to perform the required type of activity.

The operator of the structure shall develop a waste management plan in accordance with the legislation in force after putting the structure into operation. Moreover, he shall develop operational guidelines on the hazardous waste management and emergency plan of hazardous waste management for his employees.

## *4. Noise and vibrations*

*Noise conditions*

Protection of the environment against adverse effects of traffic noise and vibration is determined by Decree no. 549/2007 Coll., establishing details on the permissible values of noise, infrasound and vibrations and on the requirements for the objectification of noise, infrasound and vibrations in the environment and Decree no. 237/2009 Coll. amending and supplementing Decree of the Ministry of Health no. 549/2007 Coll..

In connection with the analysis of the noise situation in the area affected by the proposed construction of D4 highway, it is necessary to distinguish between the highway construction phase and its operation.

Construction works in all options (except for the zero option, i.e. if the activity was not implemented) represent a real risk of increased noise level in residential area. The noise will have disturbing effect especially in populated urban area of Jarovce and Podunajské Biskupice mainly on the route between the source of the material, respectively the construction yards and the structure. The noise attack will be limited by working hours and the total duration of the construction works. Appropriate organization of work, optimizing the access roads to the

construction site, the exclusion of night work and working on bank holidays can partially eliminate this negative effect.

Operation of the road in the proposed parameters with the anticipated traffic flow is an important source of traffic noise. The noise issue is mostly demonstrated in the relationship of traffic to residential environment. The noise from car traffic does not affect only certain objects, but the whole territories and built-up areas. It can be expected the increase in noise values on the D4 highway linked to the predicted increase in traffic, on the other hand, diverting traffic from local roads, mainly in Ivanka pri Dunaji, will decrease the noise.

***Prediction of noise stress was assessed in the Noise study (annex) based on the contact of D4 with surrounding housing estate by each assessed options. Consequently, the following locations have been identified:***

**Option C red**

- cad. area of Jarovce – northern edge of IBV housing, km 0.3 – 2.0,
- cad. area of Rovinka – northern edge of IBV housing, km 10.00 – 11.50,
- cad. area of Most pri Bratislave, wester part of IBV, km 15.25 – 16.00,
- cad. area of Zálesie, Most pri Bratislave – gardening settlement and western part of Zálesie, including the proposed built-in area of IBV, km 18.00 – 19.00,
- cad. area of Vajnory and Ivanka pri Dunaji – western part of IBV and Farná, km 19.5 – 21.5.
- cad. area of Vajnory

**Option E green**

- cad. area of Jarovce – northern edge of IBV housing, km 0.3 – 1.7,
- cad. area of Podunajské Biskupice – Lieskové - northern edge of housing, km 7.8 – 8.5,
- cad. area of Rovinka – northern edge of IBV housing, km 9.75 – 10.5,

***cad. area of Jarovce - red option***

***The area is flat, the route from the beginning mainly in the low embankment with a height of 1 m to 1.5 m, then rises above the railway bridge up to a height of about 11 m. The closest protected objects are formed by a compact area in the northern part of Jarovce. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.***

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***325*** | ***day*** | ***55.0*** | ***57.0*** |
| ***325*** | ***night*** | ***47.8*** | ***49.6*** |
| ***450*** | ***day*** | ***52.0*** | ***54.0*** |
| ***450*** | ***night*** | ***44.8*** | ***46.6*** |

***cad. area of Jarovce - green option***

The area is flat, the route from the beginning mainly in the low embankment with a height of 1 m to 1.5 m, then rises above the railway bridge up to a height of about 11 m. The closest protected objects are formed by a compact area in the northern part of Jarovce. The area is in Category II.

under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***325*** | ***day*** | ***55.1*** | ***57.0*** |
| ***325*** | ***night*** | ***47.9*** | ***49.7*** |
| ***470*** | ***day*** | ***52.9*** | ***54.9*** |
| ***470*** | ***night*** | ***45.7*** | ***47.5*** |

cad. area of Podunajské Biskupice - Lieskové - green option

The route passes flat area in a low embankment, in the hinterland of Slovnaft. There is a separate housing area in Lieskové on the right. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***160*** | ***day*** | ***62.1*** | ***63.0*** |
| ***160*** | ***night*** | ***55.5*** | ***56.0*** |

cad. area of Rovinka - red option

The route passes through an arc around the northern edge of Rovinka. The road is designed on the surface, respectively via a bridge over the road I/63 in a height of 11 m. Then it passes into the embankment. IBV housing area is on the northern outskirts of the village on the right from the highway. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***575*** | ***day*** | ***53.6*** | ***55.8*** |
| ***575*** | ***night*** | ***47.6*** | ***48.8*** |
| ***570*** | ***day*** | ***53.5*** | ***55.8*** |
| ***570*** | ***night*** | ***46.6*** | ***48.5*** |

cad. area of Rovinka - green option

The road is designed on the surface prior to bridging the road I/63 and climbing the embankment and connecting option C at 11.5 km. Housing area of Podunajské Biskupice is on the left side with switching station in the foreground. The northern edge of Rovinka is on the right side. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***310*** | ***day*** | ***57.1*** | ***59.4*** |
| ***310*** | ***night*** | ***50.3*** | ***51.9*** |
| ***740*** | ***day*** | ***49.1*** | ***51.5*** |

| | | | |
|---|---|---|---|
| ***740*** | ***night*** | ***42.3*** | ***44.0*** |

cad. area of Most pri Bratislave - both options

The highway is designed on terrain with minimal deviations. IBV marginal area of the village is located to the right of the road. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***630*** | ***day*** | ***49.6*** | ***52.1*** |
| ***630*** | ***night*** | ***42.3*** | ***44.9*** |
| ***410*** | ***day*** | ***52.8*** | ***55.4*** |
| ***410*** | ***night*** | ***45.6*** | ***48.2*** |

cad. area of Zálesie and Most pri Bratislave - both options

Because of the short distance from the Bratislava Airport and a contact with the airport protection zone, the highway is designed in the notch below the surface to a depth of nearly 7 m at 17.4 to 19.0 km. The closest protected objects are on the right at 18.5 km. It is a recreational area separate from the surrounding forest cover. Housing area of Zálesie is at a sufficient distance. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***410*** | ***day*** | ***37.1*** | ***39.8*** |
| ***410*** | ***night*** | ***29.7*** | ***32.5*** |

cad. area of Ivanka pri Dunaji - downtown - both options

The road passes a low embankment of above 1.5 m above the ground. Housing area of Ivanka is located to the right of the highway. It consists of a compact area on the western edge of the village. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results are summarized in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***350*** | ***day*** | ***55.8*** | ***58.4*** |
| ***350*** | ***night*** | ***48.4*** | ***51.1*** |
| ***365*** | ***day*** | ***53.5*** | ***56.2*** |
| ***365*** | ***night*** | ***46.1*** | ***48.8*** |
| ***430*** | ***day*** | ***53.5*** | ***56.2*** |
| ***430*** | ***night*** | ***46.1*** | ***48.9*** |

cad. area of Vajnory - both options

The road is in a slight incline in the embankment from 3 to 13 m above the ground at 22.250 km. Subsequently, the road decreases and crosses the D1 highway underneath the depression in the ground. After crossing D1 it rises again to the embankment of 7 m above the ground, but this part already extends into the next section of D4 Ivanka north- Záhorská Bystrica at 0.0 to 1.0 km (option 7), while the closest assessed housing area is located to the left at a distance of about 300 m from D4 (option 7). These are mostly the family houses. The area is in Category II. under Decree no. 549/2007 Coll. of the Ministry of Health. The results (for the next section of D4 at 0.0 to 1.0 km) are stated in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***310*** | ***day*** | ***53.9*** | ***56.2*** |
| ***310*** | ***night*** | ***46.2*** | ***48.8*** |

cad. area of Vajnory - modified option C (option C1)

It differs from option C in a way of crossing the D1 highway. The designed highway bridges over D1 in option C1, directional guidance remains the same. After bridging over D1 it passes the embankment of 14 m above the ground with a gradual descent to 7 m, but this part already extends into the next section of D4 Ivanka north- Záhorská Bystrica at 0.0 to 1.0 km (option 7), while the closest assessed housing area is located to the left at a distance of about 300 m from D4 (option 7). These are mostly the family houses. The area is in Category II. under Decree no.

549/2007 Coll. of the Ministry of Health. The results (for the next section of D4 at 0.0 to 1.0 km) are stated in the following table.

| Distance in m | Reference time interval | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|
| ***310*** | ***day*** | ***54.1*** | ***56.3*** |
| ***310*** | ***night*** | ***46.3*** | ***48.9*** |

cad. area of Jarovce - D2 and D4 highway

The noise conditions in the transport node of D2 and D4 in the cadastral area of Jarovce have been assessed at the claimant´s request . They are processed in more details in the noise study.

At zero option, the noise load of the area is protected by noise barriers, respectively with increasing traffic volumes mainly on D1 it will need to address the protection of the territory by building noise barriers in certain sections. Given that new highway will take over a considerable traffic from the south-eastern and eastern direction, we can rightly assume a significant improvement of the noise situation in currently busiest area in the centre of Ivanka pri Dunaji.

*Vibrations*

Protection of the environment against adverse effects of traffic vibrations is determined by Decree no. 549/2007 Coll., establishing details on the permissible values of noise, infrasound and vibrations and on the requirements for the objectification of noise, infrasound and vibrations in the environment and Decree no. 237/2009 Coll. amending and supplementing Decree of the Ministry of Health no. 549/2007 Coll..

In connection with the analysis of vibrations in the area affected by the proposed construction of D4 highway, it is necessary to distinguish between the road construction phase and its operation. Construction works in all options (except for the zero option, i.e. if the activity was not implemented) represent a real risk of increased vibration in a residential area, and these are particularly disturbing in a residential urban city district of Jarovce and Podunajské Biskupice, especially on the route between the source of the material respectively the construction yards and the structure itself. The vibration attack will be limited by working hours and the total duration of the construction works. Appropriate organization of work, optimizing the access roads to the construction site, the exclusion of night work and working on bank holidays can partially eliminate this negative effect.

Operation of the road in the proposed parameters with the anticipated traffic flow is an important source of traffic vibrations. The vibration issue is mostly demonstrated in the relationship of traffic to residential environment. It can be expected the increase in vibration values on the D4 highway linked to the predicted increase in traffic, on the other hand, diverting traffic from local roads, mainly in Ivanka pri Dunaji, will decrease the vibrations. During operation of D4, the negative impact of vibrations on population and objects is not expected due to their distance from the assessed options.

## *5. Radiation and other physical fields*

During construction and operation of highway no production of radiation or other physical fields is expected. Local heat and odour production is likely in construction yards, during asphalt works, etc., but these will be carried out well away from built-up areas.

### 6. Odour and other outputs

During construction and operation of highway, a local heat and odour production is expected and is likely in construction yards, mixing centres, during asphalt works, etc., but these outputs can not be further specified. No other outputs are expected.

### 7. Additional Data

Additional outputs are defined mainly by induced investments required by the assessed activity. The overview is in section A of the report. Landscaping related to intervention in to area has not a significant affect, in addition to specially protected areas, as outlined in the next section of the report.

## C. COMPREHENSIVE CHARACTERISTICS AND ASSESSMENT OF IMPACTS ON ENVIRONMENT INCLUDING HEALTH

## I. DEMARCATION OF THE AFFECTED AREA

The D4 highway in the section of Jarovce - Ivanka north in the proposed options (zero option, red and green option differing mainly in the bridging of the Danube) crosses the territory of the municipalities Bratislava - Jarovce, Bratislava - Rusovce, Bratislava - Podunajské Biskupice, Bratislava - Vajnory, Most pri Bratislave, Ivanka pri Dunaji. Wider assessed territory is located on the map sheets 44-22, 23, 24, 42 - example of basic maps, SR 1:50 000.

# II. CHARACTERISTICS OF THE CURRENT STATUS OF THE ENVIRONMENT IN THE AFFECTED TERRITORY

Examination of the assessed area in terms of the main components of the environment is extraordinary within Slovakia, as it includes the territory of the capital city of Bratislava and suburban zone of municipalities of Most pri Bratislave and Ivanka pri Dunaji. The baseline documents for the assessment of natural elements are implemented geological, pedological, forestry surveys, documents and databases archived in the relevant institutions and professional institutes (Geological Survey of the Slovak Republic, Soil Fertility Research Institute, State Nature Conservancy, Slovak Hydrometeorological Institute, etc.) and above all the Project - "D4 Highway of Jarovce - Ivanka north," according to Act no. 24/2006 Coll., developed by Geoconsult Bratislava. Several environmental studies related to the construction of larger investment projects have been processed in wider area, with information about the country summarized in LUD of Bratislava, Most pri Bratislave, Ivanka pri Dunaji and Bratislava region.

Information about the socio-economic landscape components are concentrated in the bodies of state and local governments and specialized institutions (Slovak Statistical Office, State Health Institute, etc.).

Background materials were supplemented by field survey of the area concerned carried out in March 2010 with a focus on updating underlying materials, biota research etc.

## 1. Geomorphology

Wider area concerned occupies the south-east, east and north-east of Bratislava - city districts of Jarovce, Rusovce, Podunajské Biskupice and Vajnory and municipalities adjacent to Bratislava on its eastern border - Rovinka, Most pri Bratislave, Zálesie, Ivanka pri Bratislave and Chorvátsky Grob.

In terms of geomorphological subdivision (Mazúr, Lukniš 1984) the territory belongs to the Little Danube Basin sub-province, the western edge of the Danubian Lowland, the Danubian Plain as a whole. It is a flat area with a slight slope towards the south-east. In terms of geomorphology, it is a young structural plain forming even today. Ongoing subsidence and accumulation processes of the Danube were the main geomorphological factors acting in its formation. Relief forming is currently very slow and is performed mainly by the activity of fluvial erosion-accumulative processes of the Danube.

Danubian Plain is a flat aggradation plain occupying a wide band along the Danube. The relief is flat with a slight vertical articulation. This monotonous plain is divided only by dead and vivid arms, or hydro-technical structures constructed recently within the Gabčíkovo Water Dam. The height difference is about 3m and is set by the general slope of the surface to the south-east, the relative height differences are not greater than 0.5 to 1.5 m.

In terms of typology of the relief, the bulk of the territory is characterized by fluvial relief.

## 2. Geology

In terms of regional geological division of the Western Carpathians the interest area makes part of a single geotectonic and structural unit - Danubian Lowland. Detailed geological outline of the affected area are presented in the attached geological map.

Danubian Lowland forms a pan filled with sediments of Neogene. The sub-base of Neogene forms crystalline composition of the Small Carpathians, which was exposed to severe denudation during the Mesozoic and early Tertiary era and its surface was significantly aligned. Neogene era, however, is a significant change in the geological development of the Danube Plain. Sedimentation in its periphery starts with the sea transgression in upper Tortonian. The dominant member of upper Tortonian sediments are grey fine sandy marl clays, based on sand, gravel and granite fragments. In this period a tectonic secession of the Small Carpathians mountain occurs associated with the formation of margin subsidence ruptures that bound the Danube Basin on the north-west.

After interruption of sedimentation due to Moldova phase, the new beginning of Sarmatian transgression follows, which is known for synsedimentary basin subsidence along Tortonian faults. Principal presence of green grey marl clays with sands, based on the coarse sand and gravel with Little Carpathian granite boulders.

At the end of Sarmatian phase under influence of Attic phase, the sedimentation was again suspended and transgression of kaspibrackish lake occurs in decline of basin in early Pannonian era. This decline starts major development period the Danube Lowland and sediments of the Pliocene become predominant due to total thickness of Neogene infill. Pannonia is characterized by restless sedimentation and varied facial development.

Central part of the Danube Lowland strongly declined in early Pontus and sedimentation acquired a lake-like character. Pontus sediments are significantly uniform in development represented by a variety of sandy marly clays, occasionally with positions of marly sands often bound.

Sedimentation lasted until the end of Pontus, but eventually it acquires fluvial character, with its top members formed by gravel and sand deposits of late Quaternary. Settling these layers makes end to Neogene evolution of the Danube Lowland, but its central portion declines even in the Quaternary and its decreasing trend continues until today. It is evidenced mainly by power of Danube Quaternary sediments.

Today's relief of the lowland area (Danube Plain) is the result of quaternary erosion and accumulation activities of the Danube. The bulk of the lowland is covered with accumulation of fluvial sediments apparently of Danube origin, proved by the alpine origin of gravel.

Tectonic movements and climatic changes in the Quaternary conditioned the emergence of several terraced levels with application of periglacial processes where huge alluvial cones at the junction of the Little Carpathians and lowland were formed. A major part of the lowland, however, is filled with the youngest gravel accumulation, which is part of fillings of alluvial plain of the Danube.

A greater part of the lowland area was historically the inundation area of the Danube, resulting in accumulation of the youngest gravel covered with sandy-loam alluvial sediments. Relics of the old stream meanders are dead arms filled with sediments and having a high proportion of sapropels.

Geological structure of the wider area, which belongs to the SW part of the Danube plain, is characteristic for this whole area by representation of Neogene and Quaternary sediments.

Neogene sediments are represented by molas formation with sub-formations of Miocene continental-marine and Pliocene Limno-fluvial sediments. These are represented by Pannonian and Pontus rocks, which form the bedrock with quaternary formations. In the Danube plain, these sediments are covered with strata of fluvial deposits of the Danube.

Neogene sediments are represented mostly by the sandy and marly clays and silts, clayey and silty fine-grained micaous sands. The most widely represented soils are fine-grained medium to highly plastic clays, less sandy clays and clay. Soils are mostly grey and brown with shades of green, blue and rust. Their consistency is solid, and less rigid. There often occur also the calcareous concretions. Reinforced positions are rare, sporadically clays and siltstones occur. The strata regularly include micaous position of fine-grained silt and clay sands that are grey and light brown in colour. Sands are often bound to disintegrating sandstone and siltstone. Sands are usually watered with stressed level.

Quaternary sediments are represented in the area concerned as:

- complex fluvial sediments
- complex anthropogenic sediments

The complex *fluvial sediments* can be distinguished by:

- river bed facio
- offshore shoals facio
- aggradation mounds facio
- alluvial sediments facio
- dead arms facio

Facies of riverbed sediments are the most widespread in the territory concerned. Forming medium upper mid-small low-graded sandy gravel, gravel and sand with gravel with a slight admixture of fine-grain fraction. Substitution of layers and lenses of soils of varying granularity, frequent wedging and sometimes diagonal bedding highlight the variable hydrodynamic conditions of sedimentation.

The offshore shoals facio can be assigned to sandy sediments represented by middle- and fine-loamy sands which have been sedimented under smooth hydrodynamic conditions in outlying shoals. Overlying clayey sands belong to aggradation mounds facio that sedimented under torrential conditions.

Fluvial sediments settling cycle is complete by alluvial deposits facio originated in the inundation zone. They are represented by loamy sands, sandy loams, loams and clays.

Occurrence of dead arms facio is limited to a few morphologically obvious relics of the Danube meanders, or are in the form of buried arms. They are represented by sandy and fine-grained soils often blended with organic substances.

The complex of anthropogenic sediments represents mainly fills in landscaping in built-up areas, respectively artificial embankments of roads. Local occurrence of landfills that were stored in the former gravel pits and clay pits.

**Engineering and Geology**

According to engineering-geological zoning the area belongs to the region of Neogene tectonic hollows, area of inner-Carpathian lowlands - Danubian Lowland.

This area includes engineering-geological regions of fluvial deposits and Neogene fine-grained sediments.

Fluvial deposits region

Fluvial deposits region corresponds to the territory, which is built by complex fluvial sediments, which are the most widely represented. It consists of sediments facio, riverbed facio, offshore shoals facio, aggradation mounds facio, alluvial sediments and dead arms. This is a very varied lithologically variable area, with a higher prevalence of gravel riverbed sediments.

The fluvial deposits region forms good (well tolerable riverbed sediments) to conditionally suitable building sites (less tolerable sediments of dead arms, high groundwater level).

According to STN 73 1001 it is the soil of class F3-MS - sand clay, F4-CS - sandy loam, F6-CI - loam with moderate plasticity (alluvial sediments, sediments of dead arms), S2-SP - sand badly graining, S3-S-F - sand blended with fine-grained soil, S4-SM - aluminum sand (off-shore shoals and aggradation moulds facio), G1-GW - gravel well graining, G2-GP - gravel badly graining, G3-G-F - gravel with admixture of fine-grained soil (riverbed facio). According to STN 73 3050 we include soil to 1st to 3rd class of extractability.

Alluvial sediments are represented mainly by fine-grained soils, poorly suitable even unsuitable to form the bedrock for the road. Soils are frosty and even dangerously frosty and inconsistent in contact with water. Classification by suitability for the bedrock, we count with VII.-IX. class of soils. They are relatively suitable or even unsuitable for the use in embankments.

Sediments of dead arms are represented predominantly by fine-grained soils often with the occurrence of organic matter. Soils are dangerously frosty, unstable and highly inconsistent, mostly soft and mushy in consistency. They form the bedrock unsuitable for roads, while it also requires an intensive sanitation of such soil.

Sediments of offshore shoals and aggradation moulds are made up of mostly sandy soil. Soils are not frosty to moderate frosty, by suitability for the bedrock they belong to appropriate to conditionally suitable ones. Classification by suitability for the bedrock, we count with III.-VI. class of soils. They are very suitable or suitable for the use in embankments.

Neogene fine-grained sediment region

The region is predominantly formed with fine-grained sediments with positions of loamy sands and sandy clays.

Neogene fine-grained sediments region forms relatively suitable building sites (less resistant and sensitive fine-grained soil, tense groundwater levels). Excavation work may disturb stability of slopes.

According to STN 73 1001 it is mainly soil of class F4-CS - sandy clay, F6-CL, CI - clay with low and medium plasticity and F8-CH - clay with high plasticity, sandy positions to class S4-SM - aluminum sand and S5-SC - clayey sand. According to STN 73 3050 we include the soils to 1st to 3rd class of extractability.

Neogene sediments are represented mainly by fine-grained soils, poorly suitable even unsuitable to form the bedrock for the road. Soils are frosty and even dangerously frosty and inconsistent in contact with water. Classification by suitability for the bedrock, we count with VI.-IX. class of soils. They are relatively suitable or even unsuitable for the use in embankments.

**Hydrogeological conditions**

In terms of hydrogeological regionalization of Slovakia the territory belongs to the region of Q 052 - Quaternary SW part of the Danube plain.

Hydrogeological region of Q 052 - Quaternary SW part of the Danube plain is the most important in Slovakia in terms of water management. It is a tectonic depression filled mainly with Danube gravel.

Groundwater in the territory is bound to two different geological and structural units with different hydrodynamic conditions of watered horizons. Neogene sediments of the Danube plain form as a whole an impermeable bedrock by gravel fluvial sediments that create the most favourable environment for the accumulation of ground water.

Groundwater in Neogene sediments is tied to sandy positions and at the margin of the Danube plain to permeable sand-clastic Neogene-based rocks in the form of artesian horizons. Filtration coefficient of watered horizons varies between $1x10^{-4}$ to $5x10^{-5}$ m/s. Perhaps the slopes of the Small Carpathians make an infiltration area of Neogene waters.

Groundwater in quaternary sediments is accumulated mainly in fluvial deposits of gravel. Other sediments do not form suitable conditions for the accumulation of groundwater because of small power, low permeability and limited extension.

The most favourable of fluvial sediments for accumulation of ground water is the Danube sand and gravel deposits with suitable conditions of water infiltration by rainfall water and bank storage of surface water flows. Groundwater mode, that can be characterized from hydraulic point of view as uneven unsteady flow, is affected by the surface topography of Neogene sub-base and variable power and permeability of gravel sediments. The inconsistency causes also different filtration coefficient values which is between $7x10^{-3}$ to $8x10^{-4}$ m/s.

**Geodynamic phenomena**

**No geodynamic processes have been registered in the lowland of the area concerned. Under certain conditions, however, we may consider suffosion due to rapid rise, or downturn of surface flows levels.**

According to STN 73 0036, Bratislava is located in the area with possible seismic turbulences of the intensity of 7 ° MCS.

**Mineral deposits**

There are deposits of gravel sands in the area concerned, out of which Podunajské Biskupice - Ketelec and Most pri Bratislave are mined are present or are ready to be mined (Podunajské Biskupice - Ketelec). An overview of these deposits is given in the following table:

| Locality | Deposit user | Commencement of the extraction | Completion of the extraction |
|---|---|---|---|
| Podunajské Biskupice – Ketelec | Holcim, a.s. Bratislava | 2006 | 2014 |
| Podunajské Biskupice – Ketelec | AZ STAV, s.r.o. Bratislava | 2005 | 2010 |
| Podunajské Biskupice – Ketelec | Ančeta, s.r.o. Bratislava | 2006 | 2009 |
| Most pri Bratislave | Štrkopiesky a stavohmoty, a.s. Bratislava | 2008 | 2012 |

Most pri Bratislave gravel deposit is at the same time also used for recreation and fish farming. Other gravel deposits with completed or stopped mining are mainly used for recreation and fish

farming (Košariská lake, partly Rovinka lake, Ivanka lake). There are some local gravel deposits which had been used for the local mining without adequate legislation and are currently unused, or are flooded and used for recreational purposes or fish farming. Many of them are buried (illegal dumps) mostly with shambles or industrial and municipal waste (e.g.Jarovce, Most pri Bratislave, Ivanka pri Dunaji) and reclaimed.

According to mineral resources, the gravel deposits in the Danube inundation were balanced at the stage of searching survey, which are currently a part of the water reservoir Hrušov after construction of Gabčíkovo dam. It is a quality gravel deposits, which have not been exploited so far, or only in small quantities for the purposes of construction of Gabčíkovo dam.

**Pollution of rock surrounding**

Pollution of the rock environment depends mainly on the self-cleaning properties of rocks and their permeability. Given that most of the assessed area is made up of very well-permeable gravel sand sediments, susceptibility to contamination of these rocks is very high. Pollution of the rock environment was not monitored or qualified in the affected area, provided however that in the vicinity of the agglomeration of Bratislava and major industrial sites, the pollution of rocks will be mainly due to fallout of solid air pollutants, transfer by groundwater, as well as the use of chemicals in agricultural production.

## *3. Soil*

The soil cover in the area is very diverse due to long-term impacts of anthropogenic activities in variable erosion-accumulation landscape. As for the soil types, mostly represented are hydromorphic soils, partly semi-terrestrial and on old aggradation moulds where the impact of groundwater on soil formation processes perished terrestrial soil was developed.

Total predominance of fluvisols typical lighter on fluvial sediments, which are in the part between Podunajské Biskupice, Most pri Bratislave and Ivanka pri Dunaji used as fertile agricultural lands. A relatively large share of fluvisols is located along the Danube under the remnants of floodplain forests. Smaller enclaves of black typical carbonate, as well as their sizing forms are in the local districts along the Danube and the Little Danube.

There are sizing subtypes of mentioned soil types and typical glues in the depression positions of the Danube floodplain and under the floodplain forest.

There is muck soil developed on older aggradation moulds without groundwater level effect.

The area is represented by the following soil types:

- muck soil carbonate – v ostatnych prekladoch sa nachadza chernozem – černozem – posielala sa charakteristika pody, ako sa bude prekladat!
- fluvisol carbonate
- fluvisol carbonate "of muck soil"

Muck soil carbonate (ČMm$^{c}$) is the dominant unit in the area of interest. It is so-called two-phase soil only with mollic humus horizon, which passes through a transitional horizon to substrates (A-C soil). Humus horizon is grey-black in colour and 30 to 45 cm thick. It passes loud enough (45-55 cm) in alluvial, loess-like carbonate substrates. Quite early, usually to a depth of 1 m (60-80 cm) it passes to Würm gravels containing carbonate coatings on boulders. These soils are mostly loamy to loamy-sand. These characteristics together with the proximity of the ballast bedrock make them very vulnerable - at risk because they are dried.

Fluvisols carbonate are represented in the wider surroundings of the site by a subtype or "variety", which is not though individually classified in the classification system, but in the past they were referred to as fluvisols carbonate "of muck soil". As they developed on the Würm-Holocene sediments, thus slightly older than recent (Holocene), already without inundation area (except arms), they have dark humus horizon, not very typical for fluvisols. This puts them forward to muck soils in their evolution.

In addition to these naturally occurring soils in the monitored area, there are also types conditioned or created by humans:

- anthrosol - anthropogenic soils around gravel, building sites, plant sites and so on.
- ultisol - a special group of soils (originally muck soil) under orchards that are in the upper horizons transformed by human activity.

Despite the plain character, the present surface is undulating, caused by the presence of older branch system. Old arms were clogged with the new material with uneven granularity. However, only soils with light to medium granularity are predominant. They are represented by the following granular classes of soils:

- loamy-sand
- sandy-loam
- loam

Grain size transitions are sudden, the entire territory has uneven grain size with representation from loamy-sand through sandy-loam to loamy soil. Locally, there are gravel and stony soils from the surface or under the topsoil, with a rounded gravel and stones up to 25% and rarely even 50%. The soils are slightly alkaline, with carbonates content of 2-25%.

The bulk of the territory is covered with soils of the best bonito with BPEJ code 0001001, 0002002, 0002012, 0018003, 0036002. Among other BPEJ there are soils with the code 0014062, 0015005, 0003003, 0036032 and 0036042 (muck soils typical, carbonate, light to moderate, sandy and loamy-sand, drying, deep without skeleton, on the plane in very hot and very dry lowland climate region).

Agricultural land located in the territory are susceptible to the effects of wind erosion, therefore, there are alleys and green belts built especially along field roads and at the interface of large-scale plots of arable land.

## 4. Climate

According to the book of maps, in terms of climate, the monitored area may be classified as warm climate area with an average of 50 or more days of summer a year, with a daily maximum air temperature of ≥ 25°C, to a warm, dry precinct T2 with mild winter and temperature in January of >-3°C.

From the climate and geographical point of view, the monitored territory is characterized by lowland warm climate and soft inversion of temperature, dry to moderate dry. The sum of temperatures is 10°C and more gains values of 3,000 to 3,200, average temperature in January reaches -1 to -4°C, the average temperature in July reaches 20.5 to 19.5°C, the annual amplitude of the monthly average air temperatures is 22 to 24°C, and annual rainfall amount to 530 to 650 mm.

*Air temperature*

The coldest month (on average) in this region is January, with average monthly temperature of -1.8 °C, and the warmest one is July with the average temperature of 20.2°C, thus an annual amplitude of monthly temperatures is 22.0°C. The depth of freezing in the frost index $I_m$ 350 is 94 cm.

According to long-term observations of SHMI the average monthly air temperatures (°C) recorded at Bratislava - airport station are listed in the following table.

| Station | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bratislava - airport | -1.5 | 0.7 | 4.6 | 9.9 | 14.7 | 18.4 | 19.8 | 19.1 | 15.2 | 9.7 | 4.8 | 0.7 | 9.7 |

*Precipitation*

Precipitation of the specific site is identified by prevailing atmospheric processes and local orographic conditions. Bratislava is situated on the northern edge of the Danube Lowland at an altitude of 135 m. The urban area intervenes in the southern part of the Little Carpathians mountains on the north-west of the city with altitudes up to 500 m and continues in Záhorská lowland on the north-western foothills. The Danube, which flows south of the city, formed a depression in the Little Carpathians mountains called the Devin Gate on the south-west of the city. A nozzle effect is applied in the Devin Gate, especially in the north-west airflow, that influences the surface distribution of rainfall in Bratislava region to some extent.

The average monthly rainfall for a year is 579 mm. According to long-term observations of SHMI the average monthly rainfall (mm) recorded at Bratislava - airport station and Bratislava - Trnavská street station are listed in the following table.

| Station | Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Airport | mm | 38 | 37 | 38 | 39 | 53 | 75 | 67 | 61 | 36 | 42 | 53 | 49 | 587 |
| Trnavská st. | mm | 42 | 39 | 42 | 48 | 53 | 73 | 64 | 60 | 38 | 46 | 54 | 49 | 606 |

*Wind conditions*

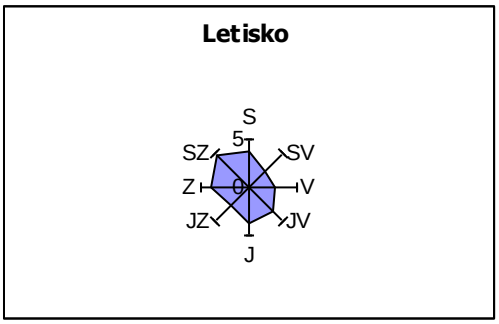
One of the most important orographic factors for Bratislava climate is the Devin Gate, which was formed by antecedent depression of the Danube to the southern edge of the Little Carpathians. It is this space where air masses fall through the city to the Danube plain from the north and north-west, often accompanied by stormy winds and sudden climatic changes. Maximum strong winds during the year are in the months of February-March, respectively April. Minimum strong winds falls on the end of summer and beginning of autumn. Strong winds are north-west, north and south-east in direction. Rarely, strong winds occur ($6^0$B). The territory of Bratislava with the adjacent part of the Danube plain are among the most windy areas of Slovakia.

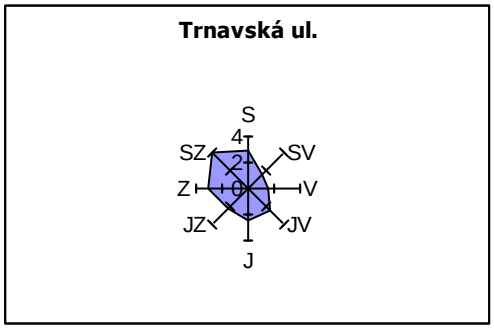
According to long-term observations of SHMI the average relative frequency of wind directions (%) and average wind speed ($ms^{-1}$) recorded at the Bratislava - airport and Bratislava - Trnavská st. station are given in the tables below.

| Station | Calm | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|---|
| Airport | 90 | 11.9 | 14.6 | 8.0 | 9.6 | 6.2 | 4.4 | 10.4 | 25.9 |
| Trnavská st. | 211 | 16.0 | 15.2 | 8.3 | 5.0 | 5.1 | 2.9 | 9.4 | 17.0 |

| Station | Calm | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|---|
| Airport | <1.5 | 3.8 | 2.4 | 2.8 | 3.6 | 3.8 | 2.8 | 4.0 | 4.7 |
| Trnavská st. | <1.5 | 2.9 | 1.6 | 1.6 | 2.3 | 2.4 | 2.1 | 3.0 | 3.9 |

8-point wind roses




## 5. Air

Bratislava south-east is the most industrialized area in the urban area, which is also reflected in the total burden on the environment. The largest impact on the increase in the environmental quality is assigned to petrol, energy, chemical industry and transport. In terms of production of basic pollutants this part of Bratislava is the biggest producer across the SR. There are 31 large air pollution sources and about 220 medium air pollution sources.

The amount of discharged basic pollutants (P) in the agglomeration of Bratislava in 2005 and the share of the five largest (selected) operators of the sources - Slovnaft a.s. Bratislava, Bratislavská teplárenská a.s. , Paroplynový cyklus a.s., Volkswagen Slovakia a.s. and Odvoz a likvidácia odpadu a.s., is presented in the table below:

| Type of P | ToP | SO2 | NOx | CO | TOC |
|---|---|---|---|---|---|
| **Amount t/year** | 379.79 | 9269.49 | 4607.49 | 934.20 | 249.33 |
| **Share 5 NZ t/year** | 334.46 | 9092.16 | 4031.51 | 710.01 | 114.68 |
| **% share 5 NZ** | 8.12 | 98.10 | 87.50 | 76.00 | 50.00 |

A steady increase in car traffic is recorded in the city area. The positive fact is improving the quality of vehicles and obligation for technical tests. Exchanging leaded gasoline for unleaded gasoline caused a rapid decrease in the amount of toxic lead in the environment, however, it was

replaced by an increase in concentrations of carcinogenic benzene. The area the most contaminated by car traffic in Bratislava and in Slovakia is Trnavské mýto interchange.

In 2005, the monitoring stations in the Bratislava region recorded the greatest extent of exceeding the 24-hour limit value of 50 µg.m$^{-3}$ for the pollutant PM$^{10}$ (AMS Trnavské mýto - 103 times, AMS Mamateyova - 73 times, AMS Kamenné Square 45 times).

## 6. Hydrology

**Surface water**

The territory belongs to the main hydrographic basin of the Danube. Slovak section of the Danube belongs to the upper middle flow, but it has signs of an alpine character yet, given by all the right-hand tributaries springing in the Alps. Based on the data, the Danube is type of an alpine river. Minimum water levels in the river occur during autumn and winter in the months: October, November, December, January. Maximum water levels are in March, April, May, June and July, August. Out of the total length of the Danube that is 2,830 km, the Slovak territory involves the section of 1708, 2-1 888.2 rkm (length of the river in Slovakia is 172 km). Bratislava catchment area is 131,388.2 km$^2$ is 131, the long-term average flow is 1,992 m$^3$.s$^{-1}$. In addition to the main flow, however, its tributary of the Little Danube is also significant in terms of hydrology.

The water level in surface flow of the Danube is not dependent on the amount of precipitation fallen in the immediate vicinity, but on the amount of melted snow and ice in the Alps. Over the last period, the hydrological regime under Bratislava has been significantly affected by the construction of Gabčíkovo Water Dam. Average monthly and extreme flows of selected stations in the Danube Basin (m$^3$.s$^{-1}$) for 2005 are as follows:

| **Bratislava - Devín station** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | Year |
| $Q_m$ | 1440 | 1847 | 2583 | 2951 | 2948 | 2064 | 2848 | 2929 | 1866 | 1506 | 1001 | 1140 | 2097 |
| $Q_{max}$ 2005<br>$Q_{max}$ 1990 - 2004 | | | 6740<br>10390 | D/M/<br>H | 13/07/23<br>15/08/24-2002 | | $Q_{min}$ 2005<br>$Q_{min}$ 1990-2004 | | | 907.8<br>754.9 | D/M<br>D/M/Y | 05/12<br>18/12/1991 | |
| **Bratislava station** | | | | | | | | | | | | | |
| Month | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | Year |
| $Q_m$ | 1440 | 1847 | 2583 | 2951 | 2948 | 2064 | 2848 | 2929 | 1866 | 1506 | 1001 | 1140 | 2097 |
| $Q_{max}$ 2005<br>$Q_{max}$ 1901 - 2004 | | | 6741<br>10400 | D/M/<br>H | 13/07/23<br>15/07/11-1954 | | $Q_{min}$ 2005<br>$Q_{min}$ 1901-2004 | | | 907.8<br>580.0 | D/M<br>D/M/Y | 05/12<br>06/01 - 1909 | |

*Source: SHMI, Bratislava, Hydrological yearbook for 2005, Surface water, Bratislava, 2005*

Average monthly and extreme flows of selected station in the Little Danube Basin (m$^3$.s$^{-1}$) for 2005 are as follows:

| **Malé Pálenisko station** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | Year |
| $Q_m$ | 27.63 | 25.66 | 26.45 | 28.38 | 29.31 | 29.10 | 28.31 | 28.67 | 28.83 | 29.30 | 27.77 | 26.97 | 28.04 |
| $Q_{max}$ 2005<br>$Q_{max}$ 1968 - 2004 | | | 37.27<br>96.74 | D/M/<br>H | 18/05/10<br>25/12/11-1983 | | $Q_{min}$ 2005<br>$Q_{min}$ 1968-2004 | | | 23.28<br>0.030 | D/M<br>D/M/<br>Y | 02/02<br>12/11/1975 | |

Source: SHMI, Bratislava, Hydrological yearbook for 2005, Surface water, Bratislava, 2005

The dominant share of water pollution in the area is assigned to pollution from point sources. These are waste water discharges from industrial plants, especially the chemical industry. Other potential sources of surface water pollution are waste water produced by sewage and rainwater drainage. The bulk of the waste water is discharged into the Danube and the Little Danube after

purification in WWTP. The quality of surface water in the Danube above Bratislava is affected by the tributary of the Danube - Morava (IIIrd IVth purity class). Bratislava sampling site (centre) has a group of indicators of oxygen regime and additional chemical indicators in the IInd purity class, a group of basic chemical indicators in the IIIrd purity class and microbiological and biological indicators corresponding to IVth purity class. The content of the heavy metals is low, it corresponds to the Ist purity class. The most significant point sources of pollution discharging waste water into the Danube and the Little Danube in Bratislava region are the WWTP Petrzalka, Vrakuňa, Istrochem and Slovnaft.

The overall quality of surface water in the Danube has long been slightly improved, which is reflected in the decrease of nutrients, $CHSK_{Mn}$, TOC, saprobic index and bacteria. Changes in water quality at observation points in the Danube throughout the year correspond to the water quality fluctuation in Bratislava, which characterizes the quality of water entering the area affected by the construction of the Gabčíkovo Water Dam.

The water quality in indicators of oxygen regime corresponds to criteria for the Ist purity class in the seepage canals of Gabčíkovo WD. The water in seepage canals shows good quality in other groups of indicators, too.

**Groundwater**

The territory is allocated by hydrogeological zone of Q 051 "Quaternary western edge of the Danube plain."

From the local hydrogeological point of view, the environment can be schematically characterized as:

**Hydrogeological insulator** - Neogene strata of rocks represented by clays and sandy clays with minimal circulation and accumulation of groundwater. Represented by high and medium plastic soil types. Their compactness is partially disrupted by closed sand lenses. Clay neogene sands can also be considered less permeable.

Positions of loam and loamy-sandy impermeable or low permeable sediments (flood loam, silty clay, sandy-clayey loams) may occur in the Quaternary fluvial sediments. These sediments form semi-permeable barriers to the flow of the ground water of the quaternary collector.

**Hydro-geological collector** - is composed of the rocks of fluvial sediments of the surface flow of the Danube. The collector is represented by the gravel, sandy gravel and sands, is permanently watered by free surface of groundwater, very high transmissivity. Groundwater is in hydraulic connection with the Danube and its level depends on the surface flow rate.

Gravel sands and gravel sediments, which are dominant in the complex of Quaternary fluvial sediments, have a large variability of the content of sandy fraction to produce a stratified heterogeneity of the environment. Filtration coefficient ranges $k_f = 10^{-3} – 10^{-2}$ $m.s^{-1}$. Large thickness of Quaternary sandy gravel sediments and very good permeability create favourable conditions for the accumulation of rich groundwater reserves in these sediments. The main direction of groundwater flow is south-east.

Groundwater of Quaternary sediments in the area concerned belongs to fluviogene waters. The chemical composition of these waters is under naturally undisturbed conditions formed by mineralization processes in rock environment only to a very limited extent and carries its essential features with already infiltrating groundwater. After infiltration of the Danube water into gravel sandy sediments, mineralization processes start to run on one hand (especially the hydrolytic

degradation of silicates and dissolution of carbonates) and on the other hand, desalting processes (sorption, degradation of organic matter, denitrification of nitrates, etc.).

We can assume the occurrence of groundwater with values of total mineralization ranging from 300 to 600 $mg.l^{-1}$ in this area, at the base, less significant to significant Ca-$HCO_3$ type of water. Even in those waters, however, there are some contents of natural or anthropogenic substances such as sulphates, chlorides, nitrates, ammonia and iron. However, they are not demonstrated by the type and do not significantly affect the basic features of chemical composition. Transient types, especially Ca-Mg-$HCO_3$-$SO_4$, occur extremely rarely and are usually conditional on the occurrence of organic sediments and effects of buried dead arms of the Danube.

Quaternary groundwater in the area is of shallow circulation with a strong secondary anthropogenic impact of industrial production and settlements (industrial and municipal waste water) and partly from agricultural activities on their chemical composition. The affected area is, in terms of risk to groundwater resources threatened by pollutants, classified as area with very high risk of threat.

When assessing the quality of groundwater in the Danube riverside area, the monitoring program of SHMI determined indicators divided into four subgroups, as in the assessment of water quality not only the range of the total pollution, but also the type of contamination is taken into account. Indicator of pollution levels is the degree of contamination, which represents the amount of the limit values exceeding for the indicators defined in the legislation. Unsuitable groundwater properties are within all analyses most often caused by the occurrence of excessive values of total iron and manganese, which shows the persisting unfavourable situation of redox conditions. As for the compounds of nitrogen, the most common actors for the contamination of groundwater are ammonium ions. No exceeding limit values of trace elements has been recorded in the group of trace elements. Impact of human activities on groundwater quality is also reflected in increased concentrations of general and specific organic substances.

In an area not affected by human activity, however, groundwater of Danube sediments chemically meets the requirements for drinking purposes. Bacteriological harmlessness is conditional to the implementation of protection measures.

Water quality in the Neogene horizons is generally suitable for drinking, but increased contents of iron and manganese are usual, which is, however, possible to remove due to the water treatment.

**Water areas**

There are several water areas represented by natural dead arms of the Danube and artificial gravel in the area concerned.

Nowadays, the dead arms are mostly cut off from the mainstream, and their water regime is heavily influenced by the construction and operation of the Gabčíkovo WD. The area includes Jarovecké arm, Rusovecké arm and Biskupické arm.

Among artificial water areas, which are the remains after the extraction of gravel, there are Jarovce lakes, Rusovce lakes, water areas near Jarovecké arm near the main Danube river, Rovinka lake (small and large lake), Nové Košariská lakes. In cadastral area of Most pri Bratislave, there are artificial water areas of Zelená voda, which is a remnant after gravel extraction, respectively part of the current gravel mining lake. In cadastral area of Ivanka pri Dunaji, there is Ivanka Lake and a lake near the Metro shopping centre.

The PLA Danube floodplains involves several water areas, e.g. Topoľové hunts gravel lake, Topoľové hunds - mud pool, Sand pit. Water areas of seepage canal and Hrušovská Dam are an important element in the landscape and are part of Gabčíkovo WD.

**Springs and spring areas**

There are no natural springs and spring areas in the area concerned,

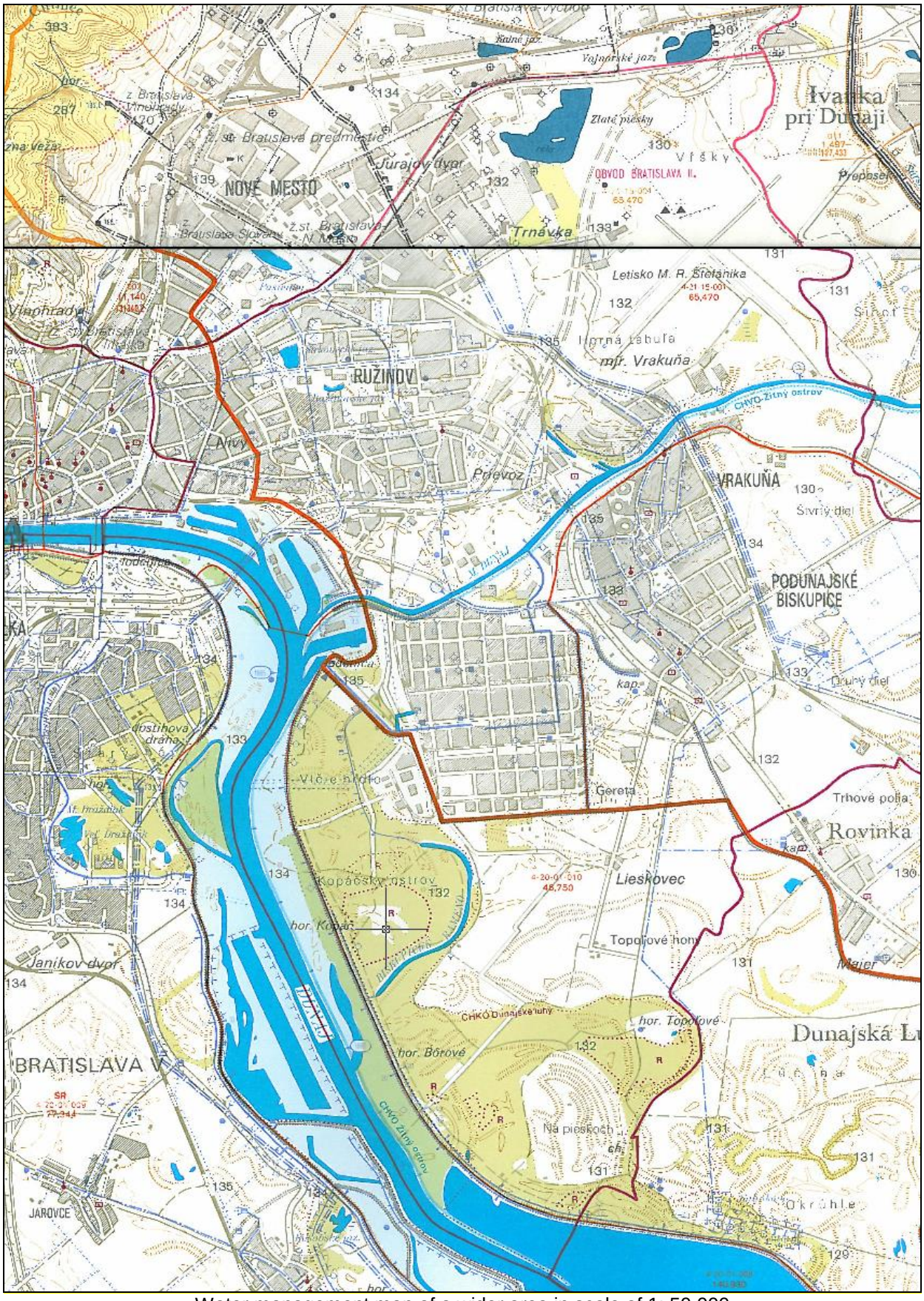
**Thermal and mineral water**

There are mineral and thermal waters in the Danube basin bound to Neogene strata at depths of about 800 to 1,300 m, while there are no natural springs of thermal and mineral waters because of their appearance in considerable depths.

Within the area of "Great Bratislava", the assessment for research of geothermal resources proposed two geothermal wells, one of which was designed in the central depression north of Dunajská Lužná. Geothermal wells have not yet been implemented.

A protection zone of II. degree of natural healing waters in Čilistov is situated in the affected area. Source structure can be classified as semi-open structures with natural infiltration and accumulation area and artificial spring area. Water is exploited through geothermal well FGČ-1 in the depth of 2,500 m, located in Čilistov in cadastral area of Šamorín. According to Palmer-Gazda water classification it is a fundamental significant type of water Na-$HCO_3$, being the natural healing water, highly mineralized, bicarbonate-chloride, sodium, with increased content of fluoride, slightly alkaline, hot, hypotonic. The thermal water from the well FGČ-1 is formed in the Neogene watered sediments of pontus, exploited at a depth of about 1,200-1,550 m at temperature of 62°C, while the temperature at the well-head is 54°C. Steady supply coverage is 15 $ls^{-1}$.

Protection zones of natural healing resources in Čilistov were determined by Decree no. 552/2005 Coll. Currently, the natural healing water is used for medical institution built near the source.




Water management map of a wider area in scale of 1: 50,000

**Disclaimer**

This is an English translation of a document that was originally produced in the Slovak language. While we have exercised utmost care to make this translation accurate, it may contain typing or translation errors. Therefore, always consult the Slovak original before making decisions on the basis of this translation.

The name of this document in Slovak is *Správa o hodnotení navrhovanej činnosti*. The file name has not been changed.

We hereby confirm that the European Bank for Reconstruction and Development shall have no responsibility for the translated content.

Project Implementation Services, spol. s r. o.
Consultant under Consultancy Contract C31934

**Protected areas in terms of water management**

According to Annex 1 to the Regulation of the Ministry of Agriculture of the Slovak Republic No. 211/2005 Coll. setting the list of significant water supply streams, the Danube and the Little Danube river are included in the list of significant water supply streams.

| Number | Name | Number of hydrological catchment area | Water flow significant for water management | |
|---|---|---|---|---|
| | | | in the section (km) | border in the section (km) |
| 69. | Danube | 4-20-01-001 | - | 1708.02-1850.2 and 1872.7-1880.2 |
| 72. | Little Danube | 4-20-01-010 | all the section | - |
| 293. | Šúrsky channel | 4-21-15-005 | all the section | |

The Danube river with its system of branches represents the predominant factor in creation of the supplies and quality of ground water. The Danube gravel alluvia are a significant reservoir of ground water and they represent the biggest accumulation of ground water in Central Europe. The main source of ground water is the infiltrated water of the Danube, while the greatest sources of drinking water are located in the alluvial zone of the river. For the above reason, this territory is protected by law and it entire belongs to the significant water supply area of PWA (protected water area) Žitný ostrov. Protected water management area of Žitný ostrov has an area of nearly 1,400 $km^2$, however, it represents only about 20% of the total area (about 7,000 $km^2$) of all PWMA in Slovakia. The biggest sources of drinking water out of the underground water sources in Europe are situated in this territory (17.3$m^3$, i.e. 17 300 litres per second); this quantity can supply with drinking water (without further processing) 10,100,000 inhabitants at average consumption of 150 l per inhabitant per day.

Well-arranged data on the water supply conditions of the territory can be found in the attached cut-out of water management map of the territory of interest.

## *7. Fauna and Flora - Qualitative and Quantititave Characteristics, Biotope Characteristics, Protected Rare and Endangered Species and Biotopes, Significant Migration Corridors of Animals*

According to the Feasibility and Effectiveness Study for the D4 line, the routes of the assessed variants C and E, lead through three basic types of habitats, which are of decisive importance in creating conditions for the presence of specific species of animals and plants. From the section beginning up to approx. 2.5 km (variant E), or 3 km (variant C), the highway runs through ruderal habitats, mainly intensively cultivated fields. In the following section up to approx. 5.5 km (variant E), or 6 km (variant C), the interested territory consists of a mosaic of water habitats (the Danube and related water surfaces) and forests (alluvial, oak- hornbeam, oak, and oak mixed forests). The remaining part of the highway up to the end of the section runs again mostly through ruderal habitats (intensively cultivated fields mainly), interrupted at 17 km by water habitats (the Small Danube and related water surfaces).

**Fauna**

Based on division of the territory of Slovakia into zoogeographical regions, the interest area is a part of the zoogeographical province of the Inner Carpathian Lowlands, Pannonian area, South Slovakia district and riparian Danube district. In view of the potential presence of protected species of animals, the most notable is the section between 2.5 km (variant E) or 3 km, and 5.5 km (variant E) or 6 km (variant C).

Research of protected species of invertebrates on the right bank of the Danube between Petržalka and Rusovce was carried out for the State Nature Protection SR (ŠOP) by a research team of the Faculty of Natural Sciences of the Comenius University in Bratislava in 2006. Confirmed occurrence:

- 6 species of darning needles
  - *Aeshna isosceles* - green-eyed hawker
  - *Anax imperator* – emperor dragonfly
  - *Anax parthenope* – lesser emperor
  - *Brachytron pratense* – hairy dragonfly
  - *Epitheca bimaculata* – Eurasian baskettail
  - *Somatochlora metallica* – brilliant emerald
- 2 species of beetles
  - *Hydophilus piceus* Linnaeus, 1758 – great silver water beetle
  - *Hydrophilus atterimus* Eschscholtz, 1822 - water beetle
- 3 species of butterflies
  - *Lycaena dispar* (Haworth, 1803) – large copper
  - *Carcharodus alceae* (Esper, 1780) – mallow skipper
  - *Glaucopsyche alexis* (Poda, 1761) – green-underside blue.

In the final report of the research, however, the presence of tens of other protected species of invertebrate is foreseen in the territory, since the inventory/stocktaking was performed only during a part of the growing season (May to August) and in one year (2006).

62 taxons of fish (85% of ichtyofauna of Slovakia) have been determined in the Slovak section of the Danube and the branch system is an important spawning ground. The protected species include:

- *Cottus gobio* – Bullhead
- *Rhodeus sericeus amarus* – Amur Bitterling
- *Zingel streber* – Streber
- *Gobio kessleri* – Kessler's gudgeon
- *Gymnocephalus baloni* – Danube ruffe
- *Gobio albipinatus* – White-finned gudgeon
- *Sabanejewia aurata* – Golden spined loach
- *Rutilus pigus* – Pigo
- *Aspius aspius* – Asp
- *Gymnocephalus schraetser* – Schraetzer
- *Pelecus cultratus* – Sabre Carp
- *Zingel zingel* – Common zingel

During the stocktaking research of the amphibians and reptiles in the selected area of the alluvial forests of Bratislava, performed by State Nature Protection (ŠOP) SR, (RNDr. Ján Kautman, 2005), the following species have been identified:

- *Rana ridibunda* – Marsch Frog
- *Rana kl. esculenta* – Edible Frog
- *Rana dalmatina* – Agile Frog
- *Bombina bombina* – European Fire-bellied Toad

- *Bufo bufo* – Common Toad
- *Bufo viridis* – Europen Green Toad
- *Hyla arborea* – European Tree Frog
- *Salamandra salamandra* – Fire Salamander
- *Triturus dobrogicus* – Danube crested newt
- *Triturus vulgaris* – Smooth newts
- *Lacerta agilis* – Sand lizard
- *Anguis fragilis* – Slow worm
- *Natrix natrix* – Grass snake
- *Natrix tessellata* – Dice snake
- *Elaphe longissima* – Aesculapian snake
- *Coronella austriaca* – Smooth snake

An overview of the bird species found in the part of PWA of Dunajské luhy, through which the proposed highway routes shall pass, is contained in the text annexes. (Mgr. Matúš Kudela, PhD.).

Data on bat occurence (all species of bats are protected) can be found for instance in the research of Bc. Michal Noga, carried out for ŠOP SR in 2005 in three areas of Danubian alluvial forests in the Bratislava region. The final report confirms the presence of 8 species:

- *Myotis daubentoni* – Daubenton's bat
- *Nyctalus noctula* – Common noctule
- *Pipistrellus pipistrellus* – Common pipistrelle
- *Pipistrellus nathusii* – Nathusius' pipistrelle
- *Pipistrellus pygmaeus* – Soprano pipistrelle
- *Eptesicus serotinus* – Serotine bat
- *Myotis mystacinus /Myotis brandtii* – Whiskered bat /Brandt's bat (undistinguished couple)

Along with the protected species of mammals, there is also a notable species of *Castor fiber* - European beaver, whose population increases and gradually takes over all appropriate locations in the territory of its original occurrence.

Ruderal habitats in the route of the highway also represent space for occurrence of protected species. In terms of consequences of the assessed activity, this area is of lesser importance. To present some examples, here are the results of the monitoring of small mammals in the agrocoenoses of the cadaster of the Rusovce municipality, which was carried out for STate Nature Protection (ŠOP) SR by RNDr. Ján Krištofík, CSc. in 2005. There are 4 protected species, out of 12 registered:

- *Sorex araneus* Linnaeus, 1758 – Common shrew
- *Sorex minutus* Linnaeus, 1766 – Eurasian pygmy shrew
- *Crocidura leucodon* (Hermann, 1780) – Bicoloured shrew
- *Cricetus cricetus* (Linnnaeus, 1758) – European hamster

The nature protection documentation of the given territory also states the occurrence of the following species:

- *Putorius eversmanni* – Steppe polecat
- *Mus spicilegus* – Steppe mouse
- *Cricetus cricetus* – European hamster
- *Erinaceus concolor* – Southern white-brested hedgehod

We also enclose the results of the avifauna monitoring of the agrocoenoses of the east edge of Bratislava, performed by Mgr. Matúš Kudela, PhD in 2008. (Text Annexes)

The most significant migration corridor of animals, crossed by the proposed highway route, is a corridor in the area of the Danube river. It ensures migration for all animal species, nevertheless, in particular for fish and birds (spring and autumn migration), for which it constitutes a corridor of international importance. Less significant corridor for migration of animals in the highway route is the area of the Small Danube. Migration of animals at local level takes place naturally in many places of the corridor of planned transport communication. With respect to its location on the interface of urbanised (or intended for urbanisation) territory and mostly agricultural landscape, it can be anticipated that migration of animals, for which the highway might represent a barrier, will not be significant in the future.

In terms of hunting management of the affected territory it can be stated that the highway will be passing mainly through the hunting districts of Jarovce, the Danube, Podunajské Biskupice, the Small Danube and Ivanka pri Dunaji. The main game is roe, rabbit and pheasant or boar and duck.

**Flora**

According to the phytogeographical division of Slovakia, the flora of the assessed territory belongs to the area of Pannonian flora (Pannonicum), Eupannonian xerothermic flora circuit (Eupannonicum), and to the district of the Podunajská nížina Lowland.

From the viewpoint of potential natural vegetation (ÚEBE, CBEV SAV, 1983), the routes of both variants cross, on the right bank of the Danube, mostly willow and poplar alluvial forests; the route of variant E crosses these only on the left bank almost until the Ketelec interchange. Subsequently, approximately until the Rovinka interchange, the route crosses a territory of ash-elm-oak lowland forests. The route of variant C, after crossing the Danube, continues for a short time through willow and poplar alluvial forests, then for a similarly short section through Pontian and Pannonian oak forests (hawthorn bushes), and then, similarly to variant E, through ash-elm-oak lowland forests. From the Rovinka interchange, the highway has a single route approximately until Most pri Bratislave, crossing a territory of Pontian - Pannonian oak forests (Jordan Pannonian forests) and then through ash-elm-oak lowland forests interrupted by willow and poplar alluvial forests alongside the Little Danube.

Real vegetation is significantly modified in the majority of sections of proposed highway routes. Its character is strongly influenced by human activity.

For more information on the vegetation of ruderal habitats in the route of the highways on both banks of the Danube, the results of botanical research of the agrocoenoses of the initial part of the highway, carried out for ŠOP SR in 2005 are stated in the text annexes.

The vegetation of the Danube innundation territory situated in areas crossed by the highway routes, is formed by various succession stages of alluvial forest, given that the territory was significantly impacted by the preparation works for the Gabčíkovo Water Works construction in the 1980s. At that time, the alluvial forests were excluded from the FLU and mostly removed, since the original intentions were to create an area with changing water level in the dam. Over the last 20 years, the territory has been subject to a disorganised and spontaneous development. The alluvial lands' ability to regenerate naturally has been evident, on the other hand the area is heavily impacted by a non-regulated recreational use (housebots and related traffic infrastructure).

Over the left-bank dam on the Danube, both variants of the highway cross the forest lands in the FLU for approximately 1 km. According to forest typology, following forest types are present in the given area:

- 951 Damp elm and ash stand with common hornbeam
- 952 Common nettle and elm stand with common hornbeam
- 953 Garlic and elm stand with common hornbeam
- 954 Dry elm and ash stand with common hornbeam
- 1603 Dogwood oak wood with common hornbeam

Along with the species typical for the given forest types, there are also non-native habitat species in the current wood species structure, such as *Fraxinus americana, Populus x euroamericana, Juglans nigra*), even invasive (*Negundo aceroides*, *Ailantus altissima, Robinia pseudoacacia*).

There is no data available on the occurrence of protected plant species directly in the way of proposed highway routes. A detailed botanical research was not carried out, due to the season (winter, early spring) in which the territory research was performed. It is necessary to verify the data on the occurrence of protected species with a subsequent research in the next stage of project documentation, and in the initial phase of the monitoring (before the construction) within a precisely selected route of the preferred variant.

**Habitats**

The habitat identification in the corridors of the highway variants focused on the habitats of European as well as national importance in view of the regulation of the Ministry of Environment of the Slovak Republic No. 24/2003 Coll. implementing the Act no.543/2002 Coll. on nature and landscape protection, as amended. Provided that an overall habitat mapping in the given territory has not been performed so far, we relied on the actual territory research of the highway corridors, and also on the information from Forest Management Policy (LHP) on forest stands. We have taken inspiration from the methodology of habitat mapping of the Catalogue of Habitats in Slovakia (DAPHNE, 2002), and the mapping methodology of forest habitats (NLC, 2009) in case of forest stands. With regard to the season of the year of the territory research (winter, early spring), only the habitats which could be identified in that time period are described. The mapping would necessitate further research in the growing season. The results of the inventory and research of the habitats are expressed also graphically in the text annexes.

There are habitats of European importance identified in the corridor of the variant C, at 4.8 to 5.6 km. In this area, there are forest stands in a temporary natural condition on the forest land of the dry elm and ash stand with common hornbeam type. According to the Methodology of mapping of forest habitats (NLC, 2009), considering their location in the forest sub-region 02 A - Podunajská rovina and their mostly original representation of domestic poplar trees, they belong to the habitat **91E0 Mixed ash-alder alluvial forest of temporate and Boreal Europe (*Alno-Padion, Alnion incanae, Salicion albae*),** that is a habitat of primary European importance**.** The characteristics and danger to this habitat in general are stated in the text annexes. The forest habitats No. 252, 253, 243a, and 254a in the LHC Rusovce, which are directly traversed by the highway route, have been included into the said habitat. The stand No. 245b in the LHC Rusovce, located in the highway corridor between 5.2 km and 5.6 km, has been classified as the habitat **91F0 Riparian mixed forests of *Quercus robur*, *Ulmus leavis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along great river of the Atlantic and Middle European provinces (*Ulmenion minoris*)**, that is a habitat of European importance.

The habitat of primary European importance **91E0 Mixed ash-alder alluvial forest of temporate and Boreal Europe (*Alno-Padion, Alnion incanae, Salicion albae*)** is situated also on the right bank of the Danube river, around km 4.0., that is in the way of the highway route of the variant C. This habitat is located also in the Nature Reserve of Dunajské ostrovy, in close proximity of the variant C.

The habitat of primary European importance **91E0 Mixed ash-alder alluvial forest of temporate and Boreal Europe (*Alno-Padion, Alnion incanae, Salicion albae*)** in the area of 3.3 km to 4.3 km is located in the way of the highway route of the variant E.

## 8. The Landscape - the Structure of the Landscape, Landscape Image, Scenery, Stability, Protection

The structure of landscape is the result of a long-term historical development. It reflects the exploitation of the natural landscape by people. It originates as a result of human impact on natural ecosystems, by their exploitation, visible in the modification and influence on the properties of the landscape components.

The structure of the landscape of the territory involved results from its functional orientation. The territory of interest is represented by a typical lowland agricultural landscape with the concentrated village settlements of Most pri Bratislave, Zálesie and Ivanka pri Dunaji, positionally related to heavily urbanised municipal landscape represented by the city of Bratislava and its municipal parts of Jarovce, Rusovce, Podunajské Biskupice and Vajnory.

The landscape in the proximity of the Danube River has a totally different character, the dominant position belongs to the course itself, its branches and alluvial forests. The exploitation of the territory is significantly different, where use or recreation prevails.

Within the assessed territory, we may earmarked the following basic elements of landscape structure:

- Inundated forests – the occurrence of forests is concentrated to the proximity of the Danube River and its branches. The forests are concentrated mostly alongside the Danube, the most in its inundation territory. The majority of forest stands is part of the PLA Dunajské luhy.

- Landscape vegetation - has the character of scattered greenery within the agricultural countryside – game refuges, groves, shelter belts, accompanying vegetation alongside communications, etc. Its representation in the intensively agriculturally exploited landscape is very low. The most significant locations of landscape vegetation may be considered to be the following:
    - The vegetation of baulks – it is formed by Black Locust, European Ash, Cherry, Field Maple, Dog Rose, etc.
    - The line vegetation alongside the communications – it is the non-forest tree or bush vegetation, often not connected, creating mostly the accompanying edge of transport communications with the following representation of species: Field Maple, European Ash, Small-leaved Lime, Cherry, White Willow, the understorey is formed by natural regeneration of Black Elder and Dog Rose.
- The permanent grassland (TTP) - are represented by hayfields and pastures, located at the outskirts of branches and in terrain depressions. This vegetation is represented by the alliance of Rorippo sylvestris -Agrostietum Stoloniferate. Also a part of the agricultural land is used as the permanent grassland (TTP), however their representation is very low and therefore the grassland is bound in particular to the area of the PLA Dunajské luhy.
- Water courses and areas - the most important element of the territory is the Danube river with its branches and system of channels built within the Gabčíkovo WD. Other water courses (the Small Danube, Šúrsky channel) and water surfaces form a significant

landscape element in the agricultural country. Some of them are part of protected areas, or recreational areas, allotted gardens and cottage areas

- Arable land – is spatially the vastest element of the landscape structure of the territory of interest. The development of agriculture in the territory depends on very favourable natural conditions - it is an area of very fertile soils with favourable climatic conditions.
- From amongst the permanent cultivations, the biggest representation belongs to gardens and orchards:
    - Orchards – these are large-area, mostly intensively used lands, focused on the production of fruit
    - Gardens and allotted gardens – the gardens have the character of gardens located near houses, the allotted gardens, recreation gardens, etc.
- Built-up areas and other areas - according to their characteristics they may be divided into various groups:
    - Residential areas – the individual residential development and residential houses are the most significant structural unit of the village residential zone
    - Civil facilities areas – they are represented by the facilities for the satisfaction of the settlement needs of population
    - sport-recreational objects, refreshment objects along cycling paths, allotted gardens areas
    - floating recreational houses (hausbots) are of significant presence - situated on the Jarovce branch
    - Large-area industrial areas – they represent large production companies (Slovnaft)
    - Other industrial areas - they have just local representation in the territory within the business activities (Strabag, Ferona, Stachema) and small manufactures
    - water management objects - represented by protective anti-flood dams and regulation objects
    - Power objects – they are represented by the distribution centres of electric network
    - Agricultural areas – they are mainly represented by the individual yards of the agricultural companies
    - equipment and areas of the airport of M.R. Štefánik - take-off and landing runways, radio beacons, etc.
    - objects of MO SR
- existing gravel mining and processing areas
- objects of hunting associations and gamekeeper's lodges
- sacral objects, cemeteries, memorial monuments - M. R. Štefánik Memorial
- Line transport elements – they may be divided to the following elements:
    - Roads - the planned road communication shall be connected to the highways D1 and D2. In the area, there are also primary, secondary and tertiary roads, namely the roads I/2, I/63, I/61, II/572, and III/06359, local roads and a net of field and service roads.

- railway routes - the territory is crossed by the railways No. 132 Bratislava - Rusovce, No. 131 Bratislava - Dunajská Streda, No. 130 Bratislava - Galanta and the railway siding of Slovnaft
- Waterway – leading through the main course of the Danube River
- tourist and cycling routes - the Danube cycling route passing along both sides of the Danube on the anti-flood embankments

- Line elements – electric lines and stations – there are distribution stations in the territory having the connection to the areal line of 400/100kV and 22 kV.
- Line elements – product ducts – the routes of gas pipeline, oil pipeline, water supply system, cable lines are in the territory, in majority of cases buried under ground.

From the point of view of geo-ecological natural landscape types, the entire monitored territory is characterised as intramontane lowland landscape of moderate zone, as a flatland accumulation landscape with pore ground water. The territory represents a fluvial flatland with hydromorphic soils and hydrophilic to water vegetation where aggradation embankments and floodplains and inundated soils with inundated forests dominate, old aggradation dams with mycelar-carbonate chernozems and forest steppe have smaller representation.

From the point of view of the types of contemporary landscape, the vast majority of the territory belongs to the agricultural lowland flatland ploughed landscape with countryside settlements. From the West, industrial and technology-comprising lowland landscape of urban type reaches there. The most valued type of landscape from the point of view of natural values is represented by the landscape around the Danube stream that is characterised as forest unsettled to sporadically settled lowland landscape with primary composition of wood species.

In terms of country scenery in the monitored territory, the urbanised and agriculture land, as well as the Dunajské luhy area can be identified.

Urbanised area - the most important urbanised landscape area is the agglomerate of Bratislava, the capital of Slovakia. The municipalities of Rovinka, Most pri Bratislave, Zálesie, Ivanka pri Dunaji, and Chorvátsky Grob form a regional development pole of Bratislava in relation to the neighbouring city districts of Bratislava, while all the types of settlement structure are present, ranging from residential and multi-functional zones with resident facilities, to large-area and small-area industrial and agricultural sites, etc.

Agricultural landscape – intensively cultivated agricultural countryside with flatland relief and the absence of attractive landscape aesthetic elements composes the concerned territory. The typical landscape consists of large-block fields and permanent crops, interrupted by the water flows of the Danube, the Small Danube, the Šúrsky channel, alluvial forests, water surfaces of gravel pits, line elements and airport areas.

The territory of interest represents the landscape with low perception value since it is a monotonous agricultural landscape with large-block structure of land resources, characterised with large plots of arable land with low spacial ecological stability. The low aesthetic quality of landscape structure is conditioned in particular by little attraction and diversity of the places with monotonous agricultural scenery with central built-up area that has been recently intensively expanded in particular to the North part of the territory where it changes the original use of the territory for agricultural production to the zone for living an making business.

The positive supporting elements of landscape scenery in the concerned territory and its hinterland can be considered to be, above all, the inundate forests in the inundation area of the Danube River, then the grassland along the Small Danube and Šúrsky channel, which are the part of the

large-area and small-area protected territory and TSES elements, the elements of tree lines alongside roads, refuges and little forests in agricultural countryside.

The landscape of Dunajské luhy – is the attractive natural and semi-natural elements of the countryside typical for lowland, represented by the course of the Danube River and its branches, its littoral zones with, wetland and inundated forests.

In terms of stability, the territory of interest represents the landscape with low perception value since it is a monotonous agricultural landscape with large-block structure of land resources, characterised with large plots of arable land with low spacial ecological stability. The low aesthetic quality of landscape structure is conditioned in particular by little attraction and diversity of the places with monotonous agricultural scenery with central built-up area that has been recently intensively expanded in particular to the North part of the territory where it changes the original use of the territory for agricultural production to the zone for living an making business.

In addition to the protected areas under the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection, there are territories with legislative protection of other natural resources in the monitored territory. The protected zones include the function zones determined by law for the purposes of the protection of natural sources - water, forest, soil, etc. The following zones are earmarked in the territory:

- Protected water supply territory (PWA) Žitný ostrov – the area is important from the point of view of the occurrence of ground water used for supplying the inhabitants with drinking water. Therefore all the activities carried out in the territory should be in accord with the protection of this area of natural accumulation of water.

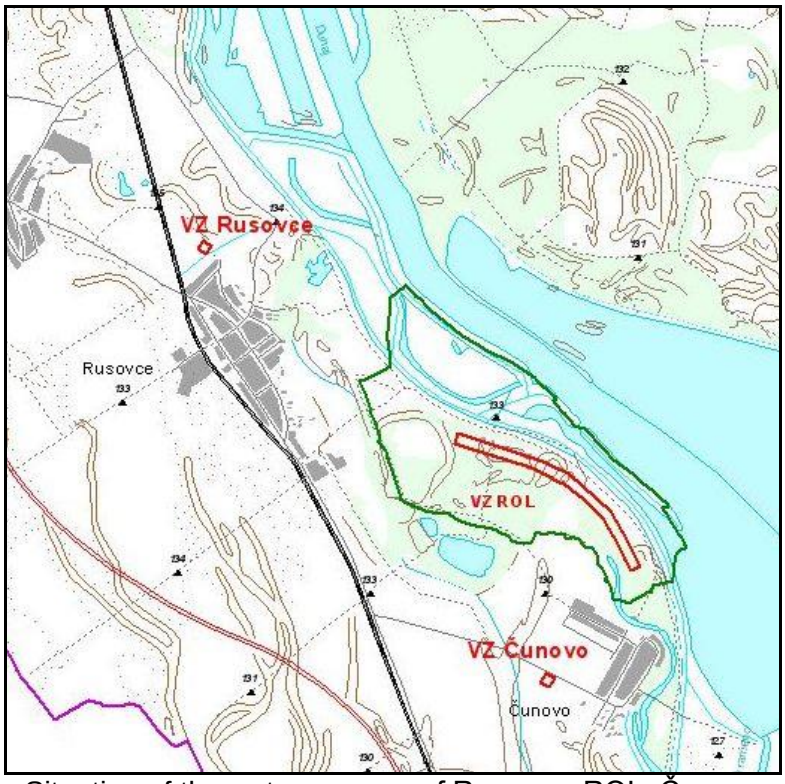
- Special-purpose forests – in the monitored territory they represent mostly the remnants of inundated forests in the proximity of the Danube River that are the part of the PLA Dunajské luhy, many of them form the part of small-area protected territories or are bound to the locations of the proposed protected territories and the locations of the TSES elements. In particular, they are the forests within the Danube inundated forests with high eco-stabilisation and ecological significance, with a notable occurrence of rare and endangered species. For this reason, the majority of forests in the territory of interest has the statute of protective forests. The protective forests require a special regime of management, that dominantly ensure the fulfilment of their protective function. They act as the legislative limits of the social and economical development. Their limiting effect is in particular from spacial aspect - the bank of tree cutting or negative endangerment due to the implementation of social and economical activity stressing the environment with secondary stressing factors.

- zone of hygienic protection of water source of 1st grade Podunajské Biskupice - was constructed in the 60-s under the name "2nd water source". The water source was commissioned in March 1966, however in July 1972 it was completely decommissioned. This was due to pollution of the subsurface waters by the Slovnaft refinery. The area of the water source includes a water reservoir with a capacity of 20 000 $m^3$ and a pumping station with the capacity of 1600 l/s. From the pumping station, water is transported by DN 1200 and DN 800 mm pipelines to the consumption points and to water reservoirs of the 1st pressure zone. The water source limits and restricts the development of activities even when unused, it is a local biocentre at present.

- zone of hygienic protection of water source of 2nd grade Rusovce - is located north of the built-up area of the village, water is transferred through the consumption area into the

tower-like water tank with the volume of 200 $m^3$, to this tap water system urban areas Rusovce and Jarovce are connected.

- zone of hygienic protection of water source of 2nd grade Rusovce-Wetland-Ostrovné Lúčky (VZ ROL) – one of the most significant water sources of Bratislava, from which as much as 1 600l/s is used, in 2007 the zone of hygienic protection was updated by decision of the District Authority of Environment in BA, Department of state water administration No. ZPS 1040/2007-GGL-1 of 9 June 2007 and after its amendment the route of D4 does not interfere in the new borders of the hygienic protection zone 2




Situation of the water sources of Rusovce, ROL, Čunovo

- zone of hygienic protection of water source of the 2nd grade of Ivanka pri Dunaji - is out of reach of D4

- protected zone of the sources of natural healing water of 2nd grade of Čilistov - is out of reach of D4

- The best-quality soils – the territory of interest belongs to the areas with the best-quality soils from the national point of view, which predetermines them for the use for agricultural purposes.

Within the landscape protection, it is necessary to state the protection of the cultural and historical monuments located in the concerned territory. This is the original anti-flood protective dam (built in the period of the Austria-Hungary, under the rule of Maria Theresa) as the part of secondary anti-flood line (Hornožitnoostrovná dam), from Podunajské Biskupice towards Hamuliakovo. After putting the waterworks of Gabčíkovo into operation in 1992, this embankment has become non-functioning and its function was taken over by the left-side embankment of Hrušov pool. The given section of the original embankment was declared by the Ministry of Culture of the Slovak Republic to be the protected cultural and technical monument (the Resolution of the Ministry of Culture – 954-3 of 22 September1994).

Another protection group consists of protected zones of the social and economical elements (the technical objects and lines - communications, railway, product ducts, oil pipelines, electric lines, etc.) Their objective is the protection of the surrounding environment against their unfavourable impacts, as well as the safe protection of objects. In addition to the stated areas, there are also the gravel mining areas that are provided for by law as well.

The protected area of the M. R. Štefánik Airport consisting of a few protected areas, secured by law and respected by the D4 highway routing (see technical solution) may be mentioned separately.

## *9. The Protected Territory pursuant to the Regulations and their Protected Zones*

The substantial portion of the monitored territory is located in the Podunajsko area that is significant from the point of view of forest, gene pool and water resources. There are the remnants of inundated forests of the Central European importance there, to which notable gene pool resources of both flora and fauna are bound. The locations of protected territories are bound to inundated forests located in the vicinity of the Danube river. On the highway D4 route there are multiple protected areas under the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection. The text annexes describe the situation of such relations.

**PLA Dunajské luhy**

The selected sections of the Danube river with adjacent flood plains have assured protection by the declaration of the territory to be the Protected Landscape Area (CHKO) by the Regulation of the Ministry of Environment of the Slovak Republic No. 81/1998 Z.z. on the Protected Landscape Area Dunajské luhy of 3 March 1998 with the effect as of 1 May 1998. The territory of the Protected Landscape Area represents a unique natural environment under the Central-European conditions with its vast system of river branches. From the point of view of nature protection, out of 172 km log Slovak section of the Danube, the most valuable is 80 km long section from Bratislava up to Zlatná na Ostrove with a developed branch system, extensive complexes of inundated forests and alluvial meadows. Biskupické luhy, the independent first part of the PLA, are directly traversed by the highway routes in variants C and E. They are characteristic with stands of hardwood inundated forests and in particular specific communities of xerothermic biotopes of the Danube forest steppe/Danube hawthorn growth *(Asparago- Crataegetum*). This variety of natural conditions is demonstrated in the plentiful representation of plant and animal species, out of which many are rare and endangered. Second grade of protection pursuant to the Act of the National Council of the Slovak Republic N. 543/2002 Coll. on nature and landscape protection is valid in the PLA Dunajské luhy.

**Nature Reserve Dunajské ostrovy**

The reserve was declared by the generally binding regulation of the Bratislava Regional Authority no.7/2002 of 8 November, 2002, and by the regulation of the Bratislava Regional Environment Office in Bratislava no. 4/2007 of 14 November, 2007. The purpose of the Nature Reserve foundation is to secure protection of natural processes and unlimited development of the vegetal and animal communities, habitats of European importance of willow-poplar lowland alluvial forests and oak-elk-ash lowland forests as typical characteristics of the alluvial land The reserve covers an area of 219,71 ha. In the territory applies the 5th level of protection pursuant to the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection. The highway routes do not run across the reserve. The variant C moves closest to the area at 3.1 km at a distance of approx.100 m .

**NR Gajc**

The present-day area of 62,72 ha of the reserve was declared by the regulation of the Bratislava Regional Environment Office in Bratislava no. 4/2005 of 13 September, 2005, effective from 1 October, 2005. The purpose of the declaration of natural reserve is the assurance of the protection of the habitat of the steppe vegetation directly bordering with inundated forest. The 4th grade of protection pursuant to the Act of the National Council of the Slovak Republic N. 543/2002 Coll. on nature and landscape protection is valid in the reserve. The variant C runs directly across the centre of this "small-area" protected territory, which makes us devote more attention to the characteristics of its present condition.

The territory is situated behind the Danube dam and seepage channel, so it is out of reach of the regular inundations, although it is influenced by the changing level of the under-surface water. Dry elm and ash forest stand with common hornbeam with added garlic, elm and ash stand with common hornbeam is the prevailing forest type. There is dogwood oak wood with common hornbeam in higher places. The vegetation is mostly old, mutli-level, interrupted with well-developed layer of shrubs. Among the species typical for the given forest prevail *Quercus robur* (English oak) , *Fraxinus excelsior* (European Ash), *Quercus cerris* (Austrian oak), *Populus alba* (White poplar), intermixed with *Robinia pseudoacacia* (Black locust), *Juglans nigra* (Eastern blanck walnut). On elevated gravel substratum,in between the forest communities, there are grass-herb-shrub enclaves of the community of *Crataegetum danubiale* with the occurrence of bushes of *Crataegus monogyna* (Common hawthorn), *Ligustrum vulgare* (Common privet), *Ulmus minor* (Field elm). A wetland habitat is part of the area. It is a remnant of an oxbow lake in an advanced deposition stage. Protected plant species identified in the area:

- *Orchis coriophora* – Spotted orchis,
- *Orchis militaris* - Soldier orchis

Other noteworthy endangered, vulnerable and rare species include: *Lycopodioides helveticum, Thesium ramosum, Centaurium erytraea* (European centaury), *Orobanche minor* (Common broomrape), *Hippochaete hyemalis* (Scouring rush), *Thalictrum flavum* (Yellow meadow rue), *Quercus pedunculiflora* (English oak).

The territory also represents an important refuge to many species of protected animals. The list of detected taxons is to be found in the text annexes.

**NR Kopáčsky ostrov**

The area was declared a natural reserve by the Inactment of the Ministry of Culture of the Slovak Socialist Republic No.7439/1976-OP from 30 October, 1976, effective from 1 November 1976. The objective of the declaration of natural reserve is to assure protection of the mosaic of specific steppe and forest-steppe communities and instances of forest communities of alluvial forests, as well as to serve science and research, educational and cultural-educational purposes. The reserve covers an area of 82,62 ha. In the territory applies the 5th level of protection pursuant to the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection. The highway route does not run across the reserve. The site will be impacted mostly by the noise of the routing of the highway according to the variant E.

**NR Topoľové hony**

The natural reserve Topoľové hony is also situated out of reach of direct highway routes, although it is impacted by the noise pollution of the variant C. It is a 60.06 ha territory declared by the Decree of the Ministry of Culture of SSR No. 1160/1988-32 of 30 June, 1988 (effective from 1 September 1988) for the protection of xerothermic Pannonian oak stands and plant communities

with European Bladdernut (Staphylea pinnata). The second grade of protection pursuant to the Act of the National Council of the Slovak Republic N. 543/2002 Coll. on nature and landscape protection is applied in the area.

**Ramsar site Dunajské luhy**

The reason for the registration of Dunajské luhy amongst the internationally important wetlands was the existence of the system of river branches and oxbow lakes in the Slovak-Hungarian section of the Danube that belongs to the greatest inland deltas in Central Europe and is the representative and rare example of natural and nature-close type of wetland in the Pannonian area. It was recorded in the list of wetlands with international importance on 26 May, 1993 and its total area between Bratislava and Zlatná na Ostrove is 14,488 ha. The variants C and E directly cross the said ramsar location.

In territorial protection in the NATURA 2000 system, the following territories of European importance (SKÚEV) and protected bird territories (SKCHVÚ) are located in the route of the D4 highway.

**The territory of the European importance SKUEV0295 Biskupické luhy**

The territory belonging to the system due to habitat protection of European importance of the xerophilic Pannonian Oak forests (91H0), the Carpathian and Pannonian Aok and Hornbeam forests (91G0), Inundated Oak-Elm and Ash forests (91F0) and the species of the European importance: Great Capricorn Beetle (Cerambyx cerdo), Stag Beetle (Lucanus cervus), Dioszeghyana schmidtii, White-finned Gudgeon (Cottus gobio), Danube Ruffe (Gymnocephalus baloni), Kessler's Gudgeon (Gobio kessleri), European Fire-bellied Toad (Bombina bombina) and Eurasian Beaver (Castor fiber). Area of the location is 869,03 ha. Both variants of the highway cross the territory of European importance SKUEV0295 Biskupické luhy.

**The territory of the European importance SKUEV0269 Ostrovné lúčky**

The territory listed in the system with the purpose of protection of habitats European importance of Alluvial oak-elm-ash forests along lowland rivers (91F0), Alluvial willow-poplar and alder forests (91F0), Xerophilous grass and herb bushy stands on lime subsoil (6210), Natural eutrophic and mesotrophic dead waters with vegetation of floating and/or immersed vascular plants of Magnopotamion or Hydrocharition (3150) and species of European importance Great Capricorn Beetle *(Cerambyx cerdo)*, Cucujus cinnaberinus (*Cucujus cinnaberinus*), Stag Beetle *(Lucanus cervus)*, Large white-face darter (*Leucorrhinia pectoralis*), White-finned Gudgeon *(Cottus gobio)*, Streber *(Zingel streber*), Danube Ruffe *(Gymnocephalus baloni)*, Tubenose goby (*Proterorhinus marmoratus*), European bitterling (*Rhodeus sericeus amarus*), Kessler's Gudgeon *(Gobio kessleri)*, White-finned gudgeon (*Gobio albipinnatus),* European Fire-bellied Toad *(Bombina bombina),* Danube newt *(Triturus dobrogicus),* European beaver *(Castor fiber),* and Greater mouse-eared bat *(Myotis myotis)*. The area of the location covers 613,56 ha. The proposed highway route does not run across the territory of European important of SKUEV0269 Ostrovné lúčky. However, the area is situated within the variant C corridor.

**The protected avian territory SKCHVU029 Sysľovské polia**

Sysľovské polia is one of the three most significant territories in Slovakia for nesting of species Great bustard *(Otis tarda)* and Red-footed falcon *(Falco vespertinus).* More than 1% of Central European populations of geese (*Anser sp*.) regularly spend winter in the territory. The area of the location is 1 773 ha. The highway does not run across the area, yet it is in contact with the beginning part of the assessed segment.

**The protected avian territory SKCHVU007 Dunajské luhy**

Dunajské luhy is one of the three most significant territories in Slovakia for nesting of the following species*:* White-tailed Eagle *(Haliaeetus albicilla),* Little Egret *(Egretta* garzetta), Black Kite (*Milvus migrans*), Little Bittern (*Ixobrychus minutus*), Mediterranean Gull (*Larus melanocephalus*), Common Tern (*Sterna hirundo*), Kingfisher (*Alcedo atthis*) and one of five territories for testing of the following species: Garganey (*Anas querquedula*), Common Redshank (*Tringa totanus*), Red-crested Pochard (*Netta rufina*) and Gadwall (*Anas strepera*). More than 1% of the European migratory population of the species: Smew (*Mergus albellus*), Tufted Duck (*Aythya fuligula*), Common Pochard (*Aythya ferina*) and Common Goldeneye (*Bucephala clangula*) regularly winters in the territory or migrate. The territory supports during migration more than 20,000 and during wintering more than 70,000 individuals of several water bird species. Furthermore, more than 1% of the national population of the species: Tawny Pipit *(Anthus campestris),* Black Stork *(Ciconia nigra),* Marsh Harriers *(Circus aeruginosus)* and Sand Martin *(Riparia riparia) regularly nests in the territory.* Area of the location is 16511,58 ha. Both of proposed variants cross the PLA Dunajské luhy.

In addition to the protected areas under the Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection, there are territories with legislative protection of other natural resources in the monitored territory. Their overview is given in part A of the Report.

## *10. Territorial system of ecological stability*

Within the corridors of the assessed variants of the highway D4, there are several elements of territorial system of ecological stability (TSES), of regional and supra-regional importance, and the route pass directly through some of the elements. The text annexes describe the situation of such relations. The identification and characterisation of the TSES elements was performed in view of the Regional TSES of the Bratislava city (SAŽP, 1994), and Update of Bratislava Regional TSES elements (SAŽP, 1994), and Regional TSES of the district of Bratislava-countryside district (SK, 1993).

A bio-centre is an ecosystem or ecosystem group that creates permanent conditions for reproduction, hiding and feeding of live organisms and for the preservation and natural development of their communities. From the point of view of hierarchy and importance, there are the bio-centres of supra-regional, regional and local importance in the monitored territory.

**Supraregional bio-centre (NRBc) Bratislavské luhy**

It represents a complex of preserved inundated forests on both banks of the Danube. The area of this biocentre was permanently reduced by ca 5,000 ha of forest stands due to the construction of waterworks Gabčíkovo. The contemporary area of the bio-centre and high level of its impairment do not provide the conditions for permanent survival of several species that occurred there in past (e.g. Deer, Beaver, Otter, Badger, White-tailed Eagle, etc.). In order to ensure the function of the supra-regional bio-centre, its revitalisation and extension by the missing area to the detriment of arable land shall be necessary. Both assessed variants cross the given bio-centre as well as the territories on both banks of the Danube which were proposed to extend this particular element of TSES.

The bio-corridors may be characterised as spatially interconnected set of ecosystems that connects the biocentres and allows the migration and exchange of genetic information of live organisms and their communities, spatially followed by interaction elements. From the point of view of hierarchy and importance, there are the bio-corridors of provincial, supra-regional, regional and

local importance in the monitored territory. The most significant migration corridor in the territory of interest is the Danube River that together with its branches and surrounding riparian forests belongs to the system of intercontinental bio-corridors through which in particular birds migrate from their wintering places in Africa and on the shores of the Mediterranean Sea. It is also an international corridor for fish migration, that however is of not so great importance as in past for the reason of the deterioration of quality of water in the river and the construction of waterworks. It plays its role also in the migration of other animal species, either aquatic or terrestrial. These facts sort the territories alongside the Danube River course in the category of provincial bi-corridors with international importance.

**Provincial bio-corridor Danube**

The corridor is interrupted two times in the area of Bratislava, in the area of the Hrušov embankment and in the area of the city itself. It is necessary to restore its functionality by extending the supraregional biocenter of Bratislava's floodplains and creating a new "bypass" around Bratislava from the SW side (a new provincial biocorridor). The proposed highway crosses the bio-corridor in the premises of a supraregional bio-centre Bratislavské luhy.

**Supraregional biocorridor Small Danube.**

At present its functionality is severely disrupted by the watercourse control in the territory of the city, and by felling of the riparian vegetation and systematic pollution. Revitalisation of the entire damaged section is inevitable. It is also necessary to solve a functional connection of the Little Danube and the Danube bio-corridors in the Vlčie hrdlo area. The route of the highway crosses the bio-corridor approximately in km 16.8.

**Regional bio-corridor Bratislavské luhy - Bažantnica**

The main purpose of the proposal of creation of a bio-corridor is to link the southern vegetation from the Jarovské arm to the bio-centre Bažantnica, subsequently eliminating its isolation. It is expected that the creation of the route of the bio-corridor will be made by planting bushes and verdures in the route of the depression of an original meander of an old arm, connecting to the existing residual verdure. The creation of the proposed biocorridor will be important especially to order to increase the stability of biodiversity as well as the functionality of exchange of genetic information in the regional bio-centre Bažantnica. The highway route collides with the originally proposed direction of the given bio-corridor, therefore a new routing was proposed within the Update of the RTSES elements of the Bratislava municipality (SAŽP, 2005).

During the territorial research of the highway route, to the above mentioned TSES elements of provincial, supra-regional and regional importance were added important land elements functioning as TSES elements on the local level (mainly interaction elements). These are forests covering the section from 19.1 to 19.3 km and the area of the Ivanka - West interchange (text annexes).

**Gene pool locations (GL)**

The locations important as gene pools are represented by the countryside areas with nowadays recorded species important from the gene pool standpoint (the protected species and species entered into red books). Flora and fauna is the riches on these locations in the monitored territory, that was still preserved in the environment with very heavy anthropic pressure. The most significant gene pool locations are located alongside the Danube river stream. These areas create the suitable preconditions not only for an abundant occurrence of flora and fauna species, but also

for the migration of biota to the entire surrounding area. As a matter of fact, they are identical with the other preserved locations.

## *11. Population*

**Demographic Data**

The proposed activity directly involves Bratislava, the capital of Slovakia, and its districts of Jarovce, Rusovce, Podunajské Biskupice, Vajnory, as well as the municipalities of Most pri Bratislave, Zálesie, and Ivanka pri Dunaji.

Bratislava is an autonomous administrative centre covering an area of almost 370 $km^{2.}$ Bratislava is backed by the Bratislava Self-Governing Region counting further 170 thousand inhabitants. The population of Bratislava currently represents approximately 425,000 resident citizens of the Slovak Republic. Since the 2001 national census, the number of inhabitants has decreased by 0,8 % (approximately 3,500 inhabitants) over the last three years. The reproduction tendency to decrease has been confirmed by the development of the population growth rate. The transformation of demographic behaviour under new social and economic circumstances has been continuing. The previous patterns of nuptiality, natality and fertility of women have been gradually abandoned, and the reproduction characteristics have reached the average level of the Western European countries. Considering the inhabitants daily present in town, Bratislava is an important target of commute for work, school, etc. It is an administrative, organisational, economic and transit city of the Slovak Republic. It is an important centre of both domestic and foreign tourism.

In terms of territorial administration of Slovakia, the towns of Most pri Bratislave, Zálesie and Ivanka pri Dunaji are situated in the district of Senec, which belongs to the Bratislava Self-Governing Region. The population development of both cities is characterised by various developmental waves, both progressive and regressive. It has been influenced by the administrative, political and social situation, by investment activities in residential construction and financial policies of the state as well as the city of Bratislava in relation to the municipality. The dynamic development of the suburban area of Bratislava has recently increased the requirements concerning the territorial development of towns in proximity of the urban agglomerate as well as the housing and business demands, which has impacted the demography of the municipalities involved. The following table includes basic data related to permanent residents according to municipalities:

| Municipality | Permanent residents | | | Permanent residents - female (in %) |
|---|---|---|---|---|
| | total | male | female | |
| Bratislava | 428672 | 200541 | 228131 | 53.4 |
| Jarovce | 1199 | 575 | 624 | 52.0 |
| Rusovce | 1922 | 958 | 964 | 50.2 |
| Podunajské Biskupice | 19749 | 9,403 | 10,346 | 52.4 |
| Vajnory | 3,828 | 1899 | 1929 | 50.4 |
| Most pri Bratislave | 1,555 | 770 | 785 | 50.5 |
| Zálesie | 750 | 365 | 385 | 51.3 |
| Ivanka pri Dunaji | 4,989 | 2,414 | 2,575 | 51.6 |

Source: Slovak National Census 2001, SŠÚ, 2001

The next table shows the basic data on present and economically active population listed according to municipalities:

| District/Municipality | Present population | Economically active population |
|---|---|---|

| | total | per 1000 permanent residents | total | male | female |
|---|---|---|---|---|---|
| Bratislava | 423,085 | 4,936 | 221,383 | 109,303 | 112,078 |
| Jarovce | 1,209 | 1,008 | 595 | 311 | 284 |
| Rusovce | 1,879 | 978 | 961 | 534 | 427 |
| Podunajské Biskupice | 19,392 | 982 | 11,130 | 5,603 | 5,527 |
| Vajnory | 4,131 | 1,079 | 2,005 | 1,066 | 939 |
| Most pri Bratislave | 1,476 | 949 | 824 | 433 | 391 |
| Zálesie | 797 | 1,063 | 385 | 205 | 180 |
| Ivanka pri Dunaji | 4,971 | 996 | 2,460 | 1,310 | 1,150 |

Source: Slovak National Census 2001, SŠÚ, 2001

Since the second half of the 1990s, major changes have occurred in the demographic development of Bratislava and surroundings, which reflect the current socio-economic situation. A major decrease of nuptiality and fertility, continuous slight increase in the number of divorces, unsatisfactory level of mortality in spite of the improvement of healthcare, changes occurring in development of the abortion rate, as well as migration all contribute to the decrease of natural increment of population, thus to its aging.

The latest available information on number of inhabitants of individual municipalities:

- Bratislava total 425 155 inhabitants (2004)
- Municipal District Jarovce 1 227 inhabitants (2005)
- Municial District Rusovce 1 922 inhabitants (2005)
- Municipal District Podunajské Biskupice 19 749 inhabitants (2005)
- Municial District Vajnory 4 200 inhabitants (2005)
- Most pri Bratislave 1 540 inhabitants (2006)
- Zálesie 1 120 inhabitants (2007)
- Ivanka pri Dunaji 5 500 inhabitants (2006)

Basic data on permanent residents according to age group and municipality, based on the National Census 2001 are as follows:

| | Municipality | Bratislava | Jarovce | Rusovce | Podunajské Biskupice | Vajnory |
|---|---|---|---|---|---|---|
| age | **Total** | 428672 | 1,199 | 1,922 | 19749 | 3,828 |
| | **0 – 14** | 59866 | 172 | 291 | 2693 | 583 |
| | **Male 15 – 59** | 134261 | 354 | 639 | 6679 | 1,242 |
| | **Female 15 – 54** | 135375 | 348 | 557 | 6496 | 1,115 |
| | **Male 60 +** | 28055 | 81 | 135 | 1017 | 269 |
| | **Female 55 +** | 55325 | 150 | 242 | 2111 | 473 |
| | **Unknown** | 16230 | 94 | 58 | 763 | 146 |

Source: Slovak National Census 2001, SŠÚ, 2001

| | Municipality | Most pri Bratislave | Zálesie | Ivanka pri Dunaji |
|---|---|---|---|---|
| age | **Total** | 1,555 | 750 | 4,989 |
| | **0 – 14** | 257 | 121 | 782 |
| | **Male 15 – 59** | 519 | 259 | 1,592 |

| | | | | |
|---|---|---|---|---|
| | **Female 15 – 54** | 452 | 226 | 1,433 |
| | **Male 60 +** | 103 | 48 | 394 |
| | **Female 55 +** | 182 | 98 | 739 |
| | **Unknown** | 42 | 1 | 49 |

Source: Slovak National Census 2001, SŠÚ, 2001

The available statistical data show that the health condition of the Bratislava population is not worse than the Slovak average. On the contrary, it appears to be better based on the data observed, despite the air pollution of the Bratislava area, which is the heaviest in comparison with the considerably less polluted rest of the country. There are certain positive factors operating, such as higher education level resulting in a more rational life style (in terms of diet, physical activity, stress management, etc.). The city life is attractive to marginal groups, such as persons with various types of addiction problems, prostitution of both genders, homeless people, etc., which causes various problems in the city. The said group appear in the statistics concerning selected infectious diseases, e.g. HIV positive and affected by AIDS. The mortality in Bratislava per 100 thousand inhabitants according to death cause and district in 2003 is described in the following table:

| **Name of disease** | **Bratislava 1** | **Bratislava 2** | **Bratislava 3** | **Bratislava 4** | **Bratislava 5** | **Bratislava together** |
|---|---|---|---|---|---|---|
| infectious and parasitic diseases | 4.58 | 5.56 | 9.74 | 4.29 | 5.83 | 5.86 |
| tumours | 368.75 | 305.69 | 308.38 | 206.11 | 141.65 | 244.61 |
| diseases of blood and blood generating organs | 2.29 | 0.93 | 1.62 | 1.07 | 0 | 0.94 |
| gland, metabolic and nutrition diseases | 27.48 | 13.89 | 11.36 | 11.81 | 11.67 | 13.84 |
| mental illnesses | 0 | 0 | 0 | 0 | 0 | 0 |
| diseases of the nervous system | 11.45 | 19.45 | 17.85 | 10.74 | 10.0 | 13.84 |
| circulation diseases | 817.66 | 550.24 | 634.61 | 378.95 | 248.30 | 467.41 |
| respiratory diseases | 66.42 | 57.43 | 69.79 | 42.94 | 25.83 | 48.08 |
| digestive diseases | 48.10 | 56.51 | 60.05 | 46.16 | 32.50 | 47.14 |
| pregnancy, labour and puerperal complications | 0 | 0 | 0 | 0 | 0 | 0 |
| muscle and bone diseases | 2.29 | 0.93 | 3.25 | 3.22 | 0.83 | 1.88 |
| diseases of the skin and subcutaneous tissue | 0 | 0 | 0 | 0 | 0 | 0 |
| perinatal diseases | 0 | 5.56 | 1.62 | 1.07 | 0.83 | 2.11 |
| urinary and venereal diseases | 27.48 | 21.31 | 29.21 | 16.10 | 8.33 | 18.29 |
| congenital disorders | 2.29 | 0 | 1.62 | 3.22 | 0.83 | 1.41 |
| injuries and poisonings | 52.58 | 53.73 | 53.56 | 54.75 | 48.33 | 52.30 |
| intentional self-harm | 11.45 | 17.60 | 16.23 | 19.32 | 9.17 | 14.78 |

Source: Institute of Heath Information and Statistics in Bratislava

### Municipalities involved

### Bratislava, the capital of the Slovak Republic

The historical image and urban layout of the city of Bratislava have evolved since the prehistoric times. Geographical and natural factors have shaped the human settlement of the territory of Bratislava. The Danube channel of and the morphology of the surrounding territory formed the historical core and local infrastructure, giving rise to the settlement. The positional stabilization of the city's territory was

determined by the ford across the river and passes through the Carpathians: north - south direction. The Danube delimited the second general traffic direction: west - east. Both directions were part of transcontinental routes.

The current urban concept of spatial arrangement and image of Bratislava has been impacted by important construction initiatives in the history of its development. Wine making has been documented by archaeological findings from as early as the end of the ancient times. Archaeological monuments of important buildings of the Roman fortification system of Limes Romanus in the city district of Rusovce - military camp Gerulata and Villa Rustica in the city district of Dúbravka have been preserved from the Roman period. The most important monuments of the Great Moravian Empire are archaeological sites situated in the Slavic settlements area on the Castle Hill and the cliff of Devín.

Written proof of the Bratislava foundation dates back to the year 1291. The most important era in the development of the medieval town is a 250-year period of Bratislava's prominence as a coronation city of the Austro-Hungarian Empire. The late 17$^{th}$ and early 18$^{th}$ centuries saw the medieval core merge with the suburbs, forming a single unit surrounded by palisades (the internal walls were demolished in 1774). The demolition of the internal city walls created conditions for the emergence of a new settlement over the external fortification (palisades), and the town began to develop a radial-orbital operational and compositional arrangement. Until the first half of the 18$^{th}$ century Bratislava has been developing as one of the most beautiful cities of the monarchy. All major roads come from the Old Town which is the historical core of the settlement arrangement. The most characteristic construction granting the city its typical image and panorama has already been built in this time period: Bratislava Castle with the extramural settlement, the representative sacral as well as civil monuments, the promenade together with the construction of a theatre in Petržalka, and entertainment facilities for citizens on the islands of the unregulated Danube. The former suburbs gradually transform into new characteristic urban districts, following the circle of aristocratic summer palaces and gardens, originally built behind the city walls. The industry development in the second half of the 19$^{th}$ century left its mark of sprawl of industrial objects on the perimeter of the city. The railroad from Bratislava to Trnava was built, creating an important traffic flow (Dostojevského rad street - V. Karadžič street). In this period, the development differentiation in the settlement structure according to the social stratification of the population begins to be consistently applied. The Old Town is shaped into a centre of shopping and the first rental houses are built. New residential areas arise. New worker colonies emerge in the suburbs in connection with new industrial areas and objects. After the bridge construction (in today's Old Bridge location), Štúrova street with representational urban areas is built.

After the war, in 1946, the territory of the city was extended by eight adjacent municipalities of Petržalka, Vajnory, Prievoz, Devín, Karlova Ves, Dúbravka and Lamač. The area of the city in 1945 was 68, 58 km$^2$ and after the affiliation of the municipalities it reached 187, 88 km$^2$. That allowed careful evaluation of the compact city area as well as introduced a principle of territorial development in terms of key developmental directions. The periods of the 1950s and 1960s were marked by considerable demolition interventions in the historic city centre and in the adjacent areas, aimed at improvement of the operation of the city. In this time the housing fund was renewed and first apartment houses of the residential areas were built in Račianska street, Hostinského and Miletičova street, in the Ružová dolina area the Ružinov neighbourhood, including the districts of Štrkovec, Trávniky, Ostredky and Pošeň. The existing industrial areas are modernized, as well as new factories, campuses (STU, UK) and dormitories, primary and secondary schools, the Kramáre hospital, science and research institutes, representational facilities of administration, state and municipal administration, cultural facilities including PKO and reconstruction of the Bratislava Castle.

After the 1968, other municipalities were affiliated to the city territory, namely Podunajské Biskupice, Vrakuňa, Záhorská Bystrica, Jarovce, Rusovce, Čunovo, which brought the current city area to 367,49 km$^2$. The development of the various radial growth directions increases, including the completion of parallel spaces interconnecting the radial roads especially within the compact/ city. In the 1970s, new blocks of flats were built and completed, such as Karlova Ves, Záluhy, Rača, Petržalka, often including only the housing facilities. The realization of new housing areas and the radical solutions of traffic problems including the construction of the Novy bridge requested major demolition of the original housing fund, failing to consider the protection of cultural and social values mainly in the city centre.

Bratislava became the capital of Slovakia for the first time after the foundation of the Czechoslovak republic in the year 1918. The territory development but also the economic basis after the Second. The position of Bratislava strengthens due to new relations of ČSFR in 1970. The city became a full-fledged and internationally recognized capital of a sovereign state in 1993, after the foundation of the Slovak Republic. Bratislava, the capital of the Slovak Republic, is the seat of the President of the Slovak Republic, the Parliament of the Slovak Republic, as well as the central and local state administration bodies. The city is the cultural, social, educational, scientific and research as well as economic capital of Slovakia. Also, it is the most important Slovak urban centre of international tourism. The social infrastructure facilities in the territory of Bratislava provide highly specialised services to the citizens of the entire Slovakia.

The capital with its surroundings currently represents one of the two main residential centres of the macro-settlement system of Slovakia bearing international importance. A special feature of the settlement structure of the Western Slovakia region is the fact that despite the attraction power of Bratislava, in the 46-60 km marginal zone strong settlement centres with a developed economic and cultural - social base have evolved (such as the towns of Trnava, Hlohovec, Galanta, Dunajská Streda, in wider relations Nitra, Senica). Most of them are connected to Bratislava through an efficient communication system in direction of the core urbanization axes, including the railway connection. These settlements along with the tertiary nuclei in the region of Bratislava create a potential, in case of coordinated development, in terms of guidance to possible migration pressure within the territory of the EU border. Bratislava, as a part of the settlement system of the Western Slovakia having close relations with the territory of Vienna, Brno - Břeclav, Györ and Budapest, and as one of the settlement points situated along the river Danube, possesses the potential to promote the participation not only of the capital with its background, but also of the entire Slovakia in the European flow of capital and goods, as well as in the science, research and socio-cultural international cooperation. There is a space for representation and benefitting from the existing values and the development potential of the entire Slovakia and its regions.

The prerequisite for making the most of the strategic nationwide potential of Bratislava and its hinterland is, above all, to meet the requirement of the environment quality improvement. In spite of the positive developments, the environment within the Bratislava territory is one of the most heavily impacted and burdened areas in Slovakia.

According to the conclusions of the Austrian part of the analyses within the common trilateral strategy JORDES+, the Austrian municipalities situated north of the Danube will be impacted by the region integration process in a different manner than the municipalities located on the south side of the Danube. The Danube and Morava rivers form a strong spatial barrier. The centres which the development may focus on are located out of the interested territory JORDES+ (Břeclav, Brno). In the territories north of Vienna and Bratislava, it is necessary to envisage a linear growth along the traffic axes. On the contrary, the southern areas are expected to extend horizontally over the settlement areas. The municipalities of Berg, Wolfsthal and Kittsee, located near Bratislava, will feel the influence of such developments the most. It is difficult to predict the speed of this process. The estimates are that the municipalities will form a territorial unit with Bratislava in the future. The

future functionality of the Austrian municipalities near Bratislava is currently being worked on from the traffic, economic, residential-political and urbanistic points of view. The current valid planning documentation of the settlements involved consider their functions in terms of the Austrian border space. The open border attribute has not been included yet among the instruments of the territorial planning of the Austrian municipalities.

The conclusions of the analyses state that the Slovak side has already been offering and satiating the specific demands of the population within its international background. Mainly regarding the commerce, services, capitalizing on the socio-cultural attributes of the city, values of tourism, existing traffic infrastructure and satisfying the Austrian border territory demands through specific facilities of technical infrastructure. The potential of a developing territory in direct relation to international background, as well as capitalizing on the natural potential of the city will promote the improvement in the quality of relations and create an offer of highly attractive job opportunities, also for the inhabitants of the Austrian and Hungarian border territory.

Within specific international relations, it is possible to consider the system of tertiary centres of the Bratislava region also in connection with the neighbouring states, specifically in existing as well as potentially functional and operating relations of Bratislava with the cities of Mosonmagyárovár in Hungary, Bruck/L, Hainburg, Marchegg, partially Gänserndorf in Austria. These settlements have already had the tertiary centre importance, or their development in this sense has been planned.

**Municipal District of Jarovce**

Jarovce is situated on the right bank of the river Danube at 9 km distance south - east from Bratislava. Considering the location of the municipality, it is probable that the territory was inhabited mainly in the Roman era, when the adjacent Rusovce, the ancient Gerulata, was an important point of the fortification complex in the border area of the northern Roman provinces. Jarovce and Rusovce did not belong to the Bratislava County by their geographical location, but into the Transdanubia, where they had an important role in the state defence after the formation of the Hungarian monarchy. The oldest written mention of the municipality dates back to 1208. In the document, there is also a mention of the village of Ban, located in the area of today's Jarovce, which also recent archaeological findings from the local cemetery support. It appears that the municipality of Ban ceased to exist due to the major plague epidemic in western Transdanubia between 1409 and 1410 and also as a consequence of exhausting fights between Matthias Corvinus and the German Emperor Frederick III occuring in this region. Today's Jarovce originated in the first half of the16$^{th}$ century. The municipality was found by Croats who called it Chorvátska Ves (Croatian Town) - Horváth falu. The German name "Kroatisch Jahrendorf" became widely popular, given that the municipality was part of the Kopčianske panstvo (estate) - Austria from its origin. After the First World War, the Trianon conference determined the borders of the Czechoslovak Republic so that Jarovce became part of the Hungarian territory. It was annexed to Czechoslovakia only after October, 15 of 1947. From 1947 to 1950 Jarovce belonged to the local administration commission in Rusovce. On the 9$^{th}$ of August 1950, the local national committee in Jarovce was established. It belonged to the Bratislava-countryside district. Jarovce became part of Bratislava on January the 1$^{st}$ 1972. Considering that there is mostly agricultural production in Jarovce to this day, the recovery of the historical symbol is appropriate for the municipality. The recovered coat of arms of Jarovce consists of a green shield with a silver plough blade positioned between two golden spikes.

**Municipal District of Rusovce**

This district of the capital of the Slovak Republic was proclaimed cultural monument zone, following a proposal of the City Administration of Monument Management and Conservation and Protection of Environment in Bratislava on October the 1st, 1990. Enclosed by the Balkánska street in the north and west, by the Maďarská street from the south and by the Rusovský channel from the east, the territory is an important archaeological location documenting the settlement from the prehistoric times to the present. The ruins of the castle from the Roman period, which is unique in Slovakia, are covered by folk architecture and complemented by a large historical park, yielding gradually near the castle to the alluvial forests along the Danube.

The position of the municipality within the communication relations of the region played an important role in its development: besides the road from Hainburg to Győr crossing the area, it was, above all, its location at the crossroads of the Danubian trade route and the Amber route (north-to-south), which had two main fords at the Danube, precisely at the so called Bergel in Rusovce (in addition to the ford at Vodná veža (Water Tower) in Bratislava). The first written record of the Rusovce settlement dates back to 1208. It appears in a document by which Andrew II confirms the foundation of the Benedictine Abbey in Lebény. During the first centuries of the Hungary kingdom existence, Rusovce was an important border fortress, acquiring a trade centre importance with a right to market in the late 14th century. The population was originally Slavic, devoted to agriculture. In the course of the 15th century, a Jewish community settled in the area, becoming a major leader in the development of trade. The Croats arrived to Rusovce in the 16th century. In 1646, Count Stephen Zichy gained most part of the land. From the 18th century until 1947, Rusovce belonged to Hungary, passing to Czechoslovakia in 1947 together with Jarovce and Čunovo, following the results of the Paris Peace Conference. The population lived off agriculture, cultivation of fruit and carrying trade.

The area of today's Irkutská, Maďarská and Gerulátska streets with the St. Marry of Magdala Church on the hill, heading towards the Danube ford is considered to be the foundation of the original urban structure of the municipality. The development of the municipality was influenced to a great extent by the closing of the Danube arm in the 1880s (approximately from 1775 to 1777). As a result of the ford abandonment and the construction of the Danube dam, the road lost its original purpose. The focal point of the municipality development moved west, where the existing urban structure began to expand. The basis of the new urban unit was formed by the elliptical square consisting of today's Balkánska street, crossed by a trade route between Hungary and Austria, which gradually connected to a younger street network. Historical and urban development of the municipality was determined by two basic facts. The first was the existence of a longitudinal type of street pattern enlarging in a spindle-like manner in the middle. The second fact forming the footprint of the municipality are rows of adjacent parcels on both sides of the street axis. The housing development of the municipality was determined by a longitudinal medieval parcel, which is filled by a residential part until about a half of the deep axis. The part is perpendicular to the street with adjoining farm buildings and a yard which was originally closed by an independent barn. A relatively independent part of the municipality is the castle with accessory buildings and a large historical park.

The traces of the oldest people living in the area of the present Rusovce date back to the Early Bronze Age (approximately 2200 – 1600 B.C.). There was a time when the so called Wieselburg culture representatives (whom we name this way due to their unknown ethnic origin) appeared in the region. This culture is one of the oldest of the Bronze Age in Slovakia. After the early Bronze

Age, there was an almost thousand year long period which is not documented by any remnants of settlement in Rusovce. Other findings come from the 7th century B.C. In the same elevated space where a burying place of the Bronze Age had been located, there were found graves from the Early Iron Age (Hallstatt period), the territory was inhabited also in the later Iron Age (La Tene culture). After the arrival of the Romans, the most famous period in the oldest history of Rusovce began. Between 12 and 9 B.C., the territory located south from the Danube down to the Adriatic Sea became part of the Roman province Illyricum. The Danube became the border separating two worlds: the antique and the barbarian. There has been preserved a multitude of military objects (iron spear tips, parts of shields protecting the bodies of soldiers, short sword - gladius, etc.). The graves of women contained various jewellery, such as bracelets, necklaces, decorative hair pins, but also objects used in cosmetics and, of course, coins. The Slavs come to Rusovce in the 9th century.

Rusovce is a popular place for walking and hiking. Among the most admired monuments are the castle, Ancient Gerulata, churches of the Evangelical Church, St. Venceslaus,Marry of Magdala and the attractive Rusovce Park. The city district of Rusovce has children folk choir Gerulata and offers a wide range of cultural events every year, including the most well-known historical fire fighting equipment competition and Zadunajský majáles (Transdanubian party) and performances of SĽUK(Slovak Folk Artists Association).

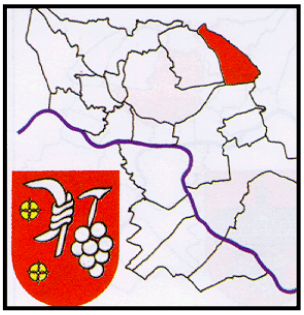
**Bratislava, Municipal District of Podunajské Biskupice**

The municipal district of Podunajské Biskupice is a part of the agglomeration of Bratislava. The current image and urban arrangement of the historical town of Bratislava is a result of a long-term process dating back to the ancient times. Bratislava is among those few European cities whose history is very rich in historical events. Its geographical position at the foot of the Little Carpathians and in direct vicinity of the Danube created a suitable environment for permanent settlement. It is possible to say that it used to be a traffic crossroads of two important routes in Central Europe, e.g. the Amber route in direction North - South and the Danube - Rhine route in the direction East - West. The history of Bratislava is very rich in events of great importance. At present, it fulfils the function of the capital of the Slovak Republic. Due to its location near the border with Hungary and Austria, Bratislava has established relations with the Vienna and Győr regions. Such location factors, as well as its human potential, create conditions for future development of the city and its background as a settlement and place of European importance showing potential for further territorial and demographic development.

**Until 1909, Podunajské Biskupice were called Biskupice-Püspöki. In 1912 they were given the attribute of Bratislava - Bratislavské Biskupice, Pozsonypüspöki in Hungarian. From 1928, they were called Biskupice pri Dunaji and since 1944 the municipality has been named Podunajské Biskupice. The municipality territory was probably first inhabited in the Roman Empire times, which is testified by a Roman milestone found in Biskupice, worked stones with Latin writings built in the gable wall of the parish church of St. Nicolaus, and bricks and roof tiles with a seal of a Roman military camp. The first written mention of the church of St. Nicolaus dates back to 1221. Previously, an older church had been built at the same place. On the site of today's Biskupice, there had been Kirchbach, a centre of the Avar province Vetvár, hosting the seat of Avar bishops. The name "Biskupice" is likely to come from that time period. After the foundation of the Archbishopric of Esztergom, the territory passed into its estate, where it belonged until 1912. The Kuruc-Labanc fighting was followed by the arrival of a strong colony of Saxon Germans in Biskupice. In the period after 1918, also a Slovak colony of people coming from Kysuce, Orava and other Slovak regions was formed, including emigrants from Yugoslavia and Romania. After the construction of**

**blocks of flats, Podunajské Biskupice were attached to Bratislava as of January the 1st, 1972. Since 1990, they have become one of the seventeen municipal districts of Bratislava. In the municipal district, there is also a George Albert mansion from the 18th century, and a plague column of the St. Trinity from 1730.**

### Municipal District of Vajnory

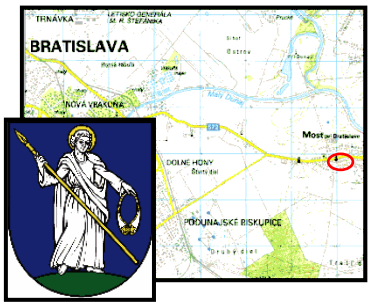


The municipal district of Vajnory is situated at the foot of the Little Carpathians, at the altitude of 130-133m above sea level. With an area of 13.5 km$^2$ and approximately 4000 residents, it is one of smaller districts of the capital of the Slovak Republic.

First mentions of a settlement in the Vajnory territory date back to the Late Iron age - La Tene, i.e. approximately 2300 years ago. During a motorway construction, there was also found a Slavonic-Avar cemetery, including ten skeleton tombs and six Slavonic urns of ancient shape. The site was not preserved. The original municipality originated as a subject settlement of the Bratislava Castle. Its inhabitants served the city, providing the royal court with their quality wine. The oldest written mention dates back only to 1237, when the place had become a developed village (villa). It bore the original Slav name of Prača, or Pračany. From 1307, when the municipality was owned by an Austrian monastery in Heiligenkreuz, the German name of Weinern had came into usage, referring to the prevailing activity of the residents - viticulture and wine-making. The name has been used to this day in the adapted Slovak form of Vajnory. In the 16th century, the village was purchased by the city, so that Vajnory could return to the original owner and founder. The abolition of serfdom represented a change, allowing the municipality to become independent in 1851. Vajnory became a municipal district of Bratislava again, but no sooner than in 1946 after the World War II.

Vajnory possessed their own municipal coat-of-arms seal equipped with a circular writing SIG: DES. RICHTER. V. WEINER. There is a winemaker motive in the middle of its Renaissance coat of arms - a bunch of grapes, a winemaker's knife with two roses on its sides. A bigger coat-of-arms seal has been known since 1628. With a circular writing SIGILLVM: PRACHENSE 1.6.2.8 contains a motive of a figure of St. Ladislaus, whom the Vajnory church was dedicated to in the 14th century. Considering the late Gothic form of the coat-of-arms, the seal must have had a preceding model.

### Most pri Bratislave




The municipality of Most pri Bratislave lies south-east from Bratislava, the capital of Slovakia. It is situated 4km from the outskirts of Bratislava. It is crossed by the second most important road traffic route to Dunajská Streda and Komárno. It occupies a plain area of 1901 ha. At present, the population consists of 1540 residents. The location of the suburban district enables the residents to commute to work, school, cultural events, or shopping to Bratislava in a very short amount of time, while living out of the city offers a quiet natural countryside.

The oldest settlement is represented by Old Slavic dwellings equipped with remnants of vessels, bones of animals and an amorphous green object from the 8th to 9th century in location "Pod Pšenom" (Under the Millet) (folk name - Srňacie). The municipality, in its present day form, originated in 1947, when Most, called na Ostrove (on the Island) at that time, was attached to the municipal district of Tomášov under the Hungarian name of Hideghét. The name was changed to Most pri Bratislave in 1947.

The municipality is documented as of 1283 (Pruck), later called Hidas. The municipality represented an ancient privileged settlement, which received the rights already in the 13th century and was the king's property. It belonged in part to the Eberhardt manor and in part to several yeomen families. In 1715 there were two mills and a meat processing facility in the municipality, as well as 30 tax payers, while in 1828, there were 110 houses and 790 residents. There were also 4 wooden bridges.

The municipality experienced waves of further settlers after the invasion of the Turks. In the first half of the 18th century it was a colony from Carinthia. A strong wave arrived after the 1945, when the residents of German and Hungarian nationality were exiled. 200 families from northern and central Slovakia arrived to the town. Between 1953 and 1954, 26 families from Romania, Hungary, Bulgaria and Yugoslavia moved to Most pri Bratislave. The residents almost exclusively lived off agriculture until very recently.

The municipality of Hideghét is documented in 1283 as Vtiheth, later Heet. It belonged to yeomen families. During feudalism, it was a yeoman village. In 1828, the municipality counted 26 houses and 189 residents. In 1971 the name was changed (slovakised) to Studené. The settlement originally developed as a false spindel-like village. Nowadays, it can be described as a group road village with a net-shaped pattern. The houses from the 19th century are brick built, three-room, with brick gables and hard covering, daubed and whitewashed. Accessory farm buildings are built behind the residential houses, in closed and/or open yards.

**Zálesie**

The land area of today's Zálesie was a property of the Malinovo estate, which originally belonged to the counts of Svätý Jur and Pezinok from the Hunt-Poznan line. The family had built a water castle in Malinovo. The family later split into a Svätý Jur and Malinovo lines, while the castle became property of the latter. In 1543 the family of counts from Svätý Jur and Pezinok faces the absence of any male descendant, and so the huge property passes to the State. King Ferdinand donated the Malinovo estate to the Méreys. The estate underwent various changes of ownership. In 1810 it was purchased by Anna Zichyová, the wife of Juraj Apponyi. They were the grandparents of the Count Albert Apponyi. The territory between Malinovo (Eberhard) and Ivanka pri Dunaji was called Tökes (Klatov - today's Zálesie). It was divided in three parts: the upper, the middle and the lower. The Apponyi family built several farms and solitary buildings on their large estate. One of the farms was called Jurajov dvor (George's yard), where there were three structures standing next to each other (a tenants house, peasants' flats, a stable, and stock houses). They have been preserved to this day, obviously including certain changes. They have been partially renovated and serve different purposes.

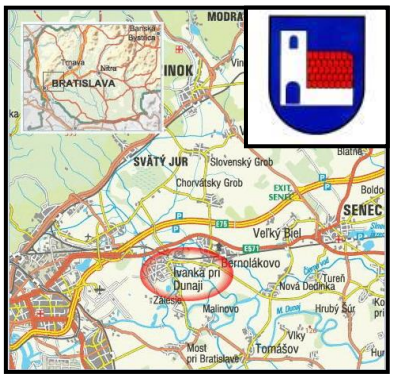
After the foundation of the first Czechoslovak Republic, the situation changes dramatically. One of the laws passed by the parliament was the law on seizure of the estates and their partial allotment. The permit of allotment concerned 1603 ha of the estate and the sale was planned for the 1921. It is here where Ignác Gessay enters the scene, with the intent of helping the Slovaks returning from abroad. With the support of the Slovenská Bank, he acquires the land that had been divided and sold with inadequate profit. The Slovaks, mainly those from the northern parts of Slovakia, were offered 604 ha of land for sale. Such news had to sound amazing to many, given the times after the war, when there was no fertile land or industry, no jobs for the inhabitants, and subsequently

migration peaked in the area. It was possible to buy good quality land, farm independently and earn one's own living.

In 1923 first Slovaks from the northern Slovakia moved in. They came from Terchová, Nová Bystrica, Stará Bystrica, and Čadca. From Zliechov, Horné Zelenice, Siladice, and Sasinkov. To help local people, Ignác Gessay, established Stavebné a bytové družstvo (Construction and housing cooperative) which, using the local materials, built houses for those who decided to settle permanently in the area. Loans were granted and debts settled. In short time, 30 farmsteads were built for the immigrants to be bought and paid in instalments beginning in 1927. Moreover, Roľnícka banka (Farm bank) was offering convenient loans to buy agriculture machinery, animals, seeds, etc. The municipality office and the Parish seat was in Tomášov, the municipal school in Malinovo. Life was difficult. People lived on agriculture and farm animals breeding. The dense forest lands receded. Wood was used for construction as well as in households. In times of workforce shortage, many leave to find jobs in America.

**Ivanka pri Dunaji**

The municipality is located in the flat area of the danubian valley, south of the Bratislava - Senec road, at 128 - 132 m above sea level. It covers 1 425.7 ha.




The origins of the settlement date back to the 4th century B.C., when the area was inhabited by Early Iron Age people of the Neolithic culture. The first written mention of the existence of the municipality is from 1209. It is a deed of donation by which King Andrew II was giving Svätý Jur, Čeklis, Iwand, Eberhart and the town of Kastelan to Tomáš from Hont – Svätojurský for his service in fighting against the Bulgarians at the Morava river in 1205. The settlement of Farná has been part of Ivanka from the beginning - it was an ancient property of the ordines and provost office in Bratislava. Their servants and assistants had lived there already in 1290. That is the reason why they were called "popné“, "poppnepe“ i.e. priest's people (a Pop - is an Old Slavic priest. At present the name denotes a Russian priest.). Due to the Hungarian influence, the name underwent various changes: Popfolna-Papfalva-Pafár-Farná.

Farná and Ivanka have formed a political unit since 1932. In preserved church documents, in the part describing the collection of the papal tenth in 1324, the municipality is named Terra Iwan, i.e. Land of Ján. These documents also mention the church and the parish. At the beginning of the 15th century, in the period of a considerable German influence, Iwand becomes a German settlement named Aichen. In the 16th century, it passes to Hungarians who call it Aicha. In 1526, after the defeat of the Hungarians at Mohács, when the Turks appropriated a major part of Hungary, King Ferdinand II issued an order to list and describe all courtyards - ports for the purpose of tax collection in 1553. The list includes the municipality of Iwáni with its lords G. Šerédy, and later Leonard Amade. In the 18th century, the Ivanka estate was bought by Anton I. Grassalkovich, a land administrator and an actual secret counsellor of the sovereign Maria Theresa. On January the 1th, 1943 the Jesuites moved into the Ivanka castle. In the castle, they established a dormitory for the youth studying at their gymnasium in Bratislava. In 1948 the property was communised, passing to the Agriculture Commission which occasionally used is for various purposes, such as trainings, etc. World War II significantly impacted the life in the area, given the geographical location in proximity of Bratislava. After the 2nd of April 1945, the liberation of the town, the local life took a new direction. In 1950, a Collective Farm was founded. The collective joined the State property in 1962, creating the National Poultry Enterprise, which, along with the Research Institute

of Poultry Keeping and Breeding, determined the direction of the municipality development and offered jobs to a major part of the population. In 1961, the Secondary Agricultural Technical School with a focus on poultry-keeping with a nationwide scope was established. Later, also an agriculture machinery repair shop. Various public-service buildings, such as a primary school, a shopping centre, a healthcare centre were built. Collective as well as individual construction developed. In a majority of the town, the gas and water supplies were introduced and the local infrastructure was built. Several scientific institutes of different fields and levels, including the academic, were founded. Their importance crossed not only the village, but also the country boundaries.

Within the urban concept of Bratislava, the developing construction in the individual parts and districts of Most pri Bratislave, Zálesie, and Ivanka pri Dunaji maintain their peculiar characteristics of solitaires with individual central nodal parts.

Production activities

The production structure is represented by sectors of industrial production, building production, production services and agricultural production. It is an activity concerning obtaining material objects from nature and their subsequent processing. The production sectors influence the state economy to a great extent, provided that they considerably contribute to the GNP formation. Also, these sectors have undergone huge capacity, structure and transformation changes. This process has been evident also in the Bratislava area - many businesses have closed, new have been established and the transformation has been very visible as well. Bratislava production companies represent the most important structure in Slovakia, as they account for over 35% of the national creation of VAT and they also achieve the highest work productivity.

In terms of economic performance of Slovakia, only the Bratislava region has a performance comparable to the EU average (in 2001, 101% of the EU average). Other regions move about 40-46% of the EU average and are classified as less developed. The mentioned disproportion in the GDP formation in the regions are mostly linked to their fixed assets per capita. In the Bratislava region this indicator exceeds SKK 1. 9 million per capita, while in other regions it varies between SKK 252 and 361 thousand per capita.

Residential and recreation functions have currently become predominant in the municipalities of Most pri Bratislave, Zálesie and Ivanka pri Dunaji. A smaller part of the cadastral area of the municipalities has been dedicated to production in their zoning plans.

Industry

In terms of processing industries in Bratislava, a leading position is held by the manufacture of transport equipment, refined petroleum products, chemical products, and publishing and printing industry. Food industry is also significant. In recent years, the construction industry has seen a massive soar.

Industrial production in Bratislava continues to significantly exceed the national average in all indicators. The Bratislava share in the national industrial production is 42,3 %. The process of industry restructuring in Bratislava has recently been very intense, yet often lacking control. There are still several former industrial park areas which remain unused or have been transformed into warehouse sites, small and medium enterprise areas, or civic amenities.

In Bratislava, there are more than 22 thousand economically active legal entities, and 43 thousand natural persons. The biggest employers are Slovnaft, Volkswagen Slovakia, Slovenský plynárenský priemysel, Slovenské elektrárne, T– com, Henkel Slovensko, Kraft Foods Slovakia, IBM Slovensko.

The most important company in a larger sense is Slovnaft, situated in the municipal district of Podunajské Biskupice. Among smaller companies, Slovasfat, Ferona, Stachema a ZIPP are located in the area. Considering the prevailing agricultural character of the land, there are no large industrial companies. There are only small local enterprises. Alas Slovakia performs gravel mining at the Rovinka lake.

Agriculture

At present, the agrifood complex in the Bratislava region is a demanding sector in terms of its production, as well as territorial distribution, and is closely related to material, social and cultural development of rural areas. Therefore, its further development should rely on maintaining the sustainability of suburban settlements through the development of employment and infrastructure. Production capability of the agricultural lands in this area is very good, although their agronomic value is negatively influenced by the lack of moisture in the growing season.

There are 8 suburban agricultural collective farms in the territory, namely: PD Prievoz, Villa Vino Rača, a.s., PD Vajnory, PD Vinohrady, PD Dunaj Rusovce, DP Devín, PD Podunajské Biskupice, RD Zeleninárstvo Bratislava. These agriculture farms cultivate 9,942 ha of farm land (data from 2004). The majority of the land is cultivated by four of the agricultural farms, namely: Rusovce (42,3%), P. Biskupice (19,1%), Devín (18,3%), and Vajnory (12,9%).

The structure of the agricultural production has undergone gradual transformation in relation to the current needs of the market demand of agricultural commodities and foods. Changes in crop production are mostly characterized by a modest growth of the cereals and oilseeds areas. The production aims at supplying the city of Bratislava. Considering the city demands, the decrease in vegetable land area represents a major problem. High performance is achieved in the cultivation of cereals (wheat), the most widespread crop in these suburban areas. The vineyards have witnessed a decrease in acreage.

Forestry and water management, fishing and hunting

The forest of Bratislava covers 8,280 ha of forest land (it is a part of the BLP - Bratislava Forest Park), which means an approximately 23%-forestation of the Bratislava territory. The forest spreads over two different geomorphological subsystems: Lesser Carpathians (approximately 75%) and Danube Floodplains (approximately 25%). Since July 11, 1994 Mestské lesy (City Forests) in Bratislava (MLB) have been in charge of the forests of the Bratislava city covering a land area of 3,059 ha (2,873 ha of which are forests).

According to the classification of the forests in terms of prevailing functions, the forests are divided into forests with special purposes, and protected forests. The process of management of the forests involved is concerned mainly with public functions as well as significant production functions (production forests). Contrary to production forests, the protected forests and special purpose forests, undergo preferably a softer, purposeful, or selective cultivation modality in production.

Aiming at preserving the united ecosystem of the Bratislava City Forests, which have survived to this day thanks to high professionalism of generations of foresters, the principle of sustainable development has been promoted. The sustainability has been no longer limited to products and use. It has progressed to the principle of the ecological sustainability of forests.

Forest management in city territory is performed by MLB, Mestské lesy Svätý Jur, Lesy SR, š.p. Banská Bystrica, Lesné spoločenstvá Lamač, Záhorská Bystrica and other smaller subjects, in accordance with LHP (Forest management policy).

Fishing is also widespread in the area. Former gravel deposit areas are used for fish cultivation. Near the motorway route, there are fisheries managed by local organisations of the Slovak Fishing Association, namely fishing carp waters Rusovecká sústava ramien (Rusovce river distributaries system), Zelená voda 1 a Zelená voda 2.

Hunting is also practised in the territory at issue, and it is managed by local organizations of the Slovak Hunting Association.

The area is extremely important in terms of water management. The Gabčíkovo Waterworks System, currently represented by the Hrušov reservoir and other water management objects, is among the most important water works not only in Slovakia, but also internationally, due to the influence of the Danube river. The water works serve not only for flood-protection, but also for the energy production and river traffic.

In addition, the territory is a source of drinking groundwater, covered by CHVO Žitný ostrov (protected landscape area), of Central-European importance.

Trade and services

In Bratislava, the capital of Slovakia, there are facilities of international, national, regional, urban as well as local importance. Besides the administrative, cultural and educational functions of the city, also health care, banking, insurance sector, and retail trade are a significant presence.

In Most pri Bratislave, Zálesie, and Ivanka pri Dunaji, the services and trade are proportionate to the needs of local communities. As the population increases, further development of these sectors is going to be necessary.

Tourism and recreation

Recreation - staying outside and breathing fresh air is essential for maintaining the population in good health and prevent illnesses. It is a type of outdoor relaxation or activity performed in free time, which contributes to physical and mental regeneration. Recreation areas are defined mainly as territories of unspecified character serving the recreation function, including a predominant natural element as well as sport, hiking and/or water facilities. The city of Bratislava shows considerable recreational potential of natural background, also in view of its wider regional relations, mostly in connection with recreation zones in natural mountain regions of the Lesser Carpathians, Danube floodplains, the Morava river, areas in proximity of water surfaces, as well as recreational areas at the Danube water works. The city and its background provide suitable conditions for enjoyment of water, mountains - forests, winter sports, cycling, and tourism.

The area along the Danube river is important in terms of recreation, also considering its planned use for recreation and sports around the Hrušov reservoir. The Danube banks are used by active local people for walking, cycling as well as roller-skating. For swimming and bathing in summer, there are Zelená voda, Ivanka lake, Vajnory lake and the Danube meanders (housebots). According to the urban study ARST Jarovské rameno, the Jarovce distributary area has been designated to become a recreation, sport and hiking area.

Tourism is the most promissing direction of the Slovak service sector. It is generally considered the sector of the future, in terms of the multiplication effects following its development. Average annual growth of tourism is predicted on a global scale at a rate of 2.5-2.8%, while in Europe the greatest growth is expected in the middle-east and south-east countries of the continent.

Tourism represents an industry of the service sector, which has a cross-cutting character. Several other industries contribute to it.

The capital of the Slovak Republic, Bratislava, has already become the most important urban centre of international as well as national tourism in terms of sight-seeing tourism. Conference tourism has begun to develop in line with the strategy aimed at shaping the city into a place of creativity and exchange of top information.

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Catering facilities, often part of tourist accommodation facilities, serve the needs of the visitors as well as the local people.

Road traffic

The basic road system of Bratislava is a separate group of roads from a selected road network, which executes a decisive share of road transport in the city and whose quality is decisive for the operability of the whole urban transport system. For the given reasons, ZAKOS received the preferential attention from the point of view of transport and engineering (the monitoring of the development in the intensity of transport (see annex), traffic accident rate and traffic modelling), complex maintenance and in particular construction development). ZAKOS consists of traffic circles (inner and central), traffic semicircle, radial roads and connecting sections. At the moment, ZAKOS consists of the following roads:

- *inner traffic circle* - Staromestská, Štefánikova, Šancová, Legionárska, Karadžičova, Dostojevského rad, Vajanského and Rázusovo nábrežie
- *central traffic circle* - Einsteinova, Prístavný most, Bajkalská, Jarošova, Račianska, Šancová, Pražská, Brnianska, Mlynská dolina, Lafranconi bridge, V1 and V2 highway branches
- *external transport semicircuit* – the D4 highway

*Radial roads*

- Lamač radial road: on roads of Hodonínska, Lamačská road, Brnianska, Pražská, with the ending in the internal traffic circle at the intersection of SSA.
- Rača radial road: on the roads of Púchovská, Račianska st. with the ending in the internal traffic circle of Račianske mýto
- Senec radial road: on the roads of Senecká, Rožňavská, Trnavská, Krížna, with the ending on the internal traffic circle
- Biskupice radial road: in the roads of Svornosti, Gagarinova, Prievozská, Mlynské nivy up to the internal traffic circle
- Rusovce radial: from the boundary with Hungary on the following communications: Balkánska cesta, Panónska cesta, Nový most bridge up to the internal transport circuit Rusovce radial road branch starts in Petržalka when crossing Dolnozemská and consists of Dolnozemská st. with the end on the Biskupice radial road

- Pečenská radial: from the boundary with Austria (at Berg) on Viedenská road with termination on Rusovce radial.

*Connecting sections*

- the riverbank of L. Svoboda, Starý most (the Old Bridge) , Šancová street (in the section from Račianske mýto up to Trnavské mýty).

The analysis of the contemporary condition of the automotive transport implies that the greatest increase in traffic load and also the most critical situation is evident in the central traffic circuit or in contact with it on the entering radials. The request applied in all hitherto processed concept materials is proved in full and still insistently - to complete the highway sections, to complete the selected communication network by the missing sections, to extend the selected communication network by further traffic lanes, as well as the demand of re-construction of the critical intersections from level one interchanges to partially or completely grade separated.

Draft road network has been developed so that it mostly addresses:

- long-term shortcomings and disproportions of the current state,
- the requirements resulting from the main original documents, mainly the interconnection of the communication network with the European transport network,
- relief to urban road network from transit and heavy traffic,
- relief to the city centre from the interim (diagonal) transport,
- the transport interconnection with Austria and Hungary,
- traffic connection of newly urbanized areas.

The design of the communication network consists in the network of highways and the communication network the part of which is the roads of class I, II and III, as well as the local communications of class I and II. Pursuant to STN, these are expressway (A1, A2), collector (B1, B2) an servicing communications C1 and communications with mass transport. The proposal does not include the development of III. and IV. class local roads, i.e. service and access roads inside the zones which will be the subject to solution of zoning documentation. The traffic condition, as well as the results of traffic surveys, shows that the traffic situation in Bratislava and its surroundings is poor. The above mentioned road network is in many cases either solely planned or the existing technical conditions and width arrangement of these roads do not correspond to the actual daily traffic volume.

In terms of traffic engineering assessment, it would be appropriate to consider in the next five years, with the strongest intent to solve international, supra-regional and regional relations, and implement the following transport structures, beginning the construction of:

- Highway D1 Bratislava - Trnava, extending into a 6-lane road (currently being built)
- Expressway R7 Bratislava - Dunajská Lužná
- Highway D4 in the section of the interconnection of D2 from Jarovce up to D1, or to the Rača interchange
- Highway D4 - the continuation as far as D2 (Stupava - South)
- Extending road I/61 to a four-lane road with unlimited access
- The road of regional importance - the interconnection of highway D1 with road II/502 (connection to the bypass of Pezinok and Sv. Jur)
- Highway D4 - Devínska Nová Ves - state boundary with Austria

Simultaneously with these solutions, the following constructions shall continue within the city and region:

- Pezinok and Svätý Jur Bypass
- Solution of the capacity and reliability of the public transport system and general transport system

Concurrently with the historical development of the city, also its communication network has developed. Since the 1960s, the development was guided with the aim to create the radial-circular system complemented with the network of servicing streets. The system enables the optimum distribution of transport by means of circuits and also the bypass of transit transport outside the centre of the city or outside the residential zones. Bratislava is the intersection of significant European routes for the international car transport. There are three main European roads E65, E75 and E58 as well as two additional roads E571 and E575. The communication network is formed by the communications of national and supra-urban importance and local communications with the overall length of 808.8 km.

The following operated roads belong to the group of communications of nationwide and supra-urban
importance:

- highways (D1, D2) with the length of 50 km that are part of the international multi-modal corridors No. IV and Va,
- roads of class I (I/2, I/61, I/63) with the length of 53 km,
- roads of class II (I/502, I/505, I/572) with the length of 31 km,
- roads of class III (III/06359, III/00246, III/0611, III/00243) with the length of 20 km.

The group of local communications includes:

- the local communications of class I and II with the overall length of 261 km, these are a part of the so called reserved communication network used also by city public transport,
- the local communications of class III and IV with the overall length of 402 km.

The impact of social and economical changes after 1989 significantly affected also the development of the traffic situation in Bratislava. The crucial factors that significantly affected and changed the traffic situation in Bratislava and the nearby proximity are as follows:

- a sudden increase in the automotive rate and greater use of passenger cars in private and business sphere,
- the stagnation of the development of the system of mass transport that contributed to the reduction in the number of transported passengers by the mass city transport,
- the long-term lagging behind of the construction of transport structures caused by the problems of their funding (the construction of the carrier system of the mass transport, the basic communication network).

Highway D4, section Jarovce - Ivanka North shall have an important function in improving the traffic relations in the catchment area and existing road system. From the transport point of view, it will connect the following roads:

*Superior road and highway network:*

- Highway D1, end of the section, flyover interchange (FOI) Ivanka North, interconnection of selected directions,

- Highway D2, beginning of the section, FOI Jarovce, interconnections of all directions,
- Highway D4, state border Slovak Republic/Austria, beginning of the section, FOI Jarovce, interconnection of all directions.

*Remaining road network:*

- road I/2, FOI Rusovce,
- road I/61, FOI Ivanka West,
- future interconnection of the proposed road "prolongation of Bajkalská st." at FOI Ketelec
- road I/63, FOI Rovinka (connection with R7) - Podunajské Biskupice feeder,
- road II/572, FOI Most pri Bratislave (connection to expressway - future),
- road III/0614 Zálesie, connection to the highway D4 by a feeder with the option of complete entrance and exit from the highway - future.

Railway transport

The railway node of Bratislava forms an important complex of the facilities in the network of Slovak railways. Currently, 7 track directions lead to the node - Kúty, Trnava, Galanta, Dunajská Streda, Rajka (Hungary), Marchegg (Austria), and Kittsee - Parndorf (Austria). The city hosts 13 railway stations, 2 deviations, and 2 stops. A total of 89.450 km of railways exist in the territory of the city; 52.515 km of that are double-track. 66% of the entire length have been electrified. In 1998, the completion of the track Bratislava Central Cargo Station - Bratislava Petržalka Station was completed, including a rebuilding of the Petržalka Station and construction of a new track to Austria (Bratislava - Parndorf - Vienna). In the given section, the highway D4 crosses the railway No. 132 Bratislava Petržalka – Rusovce, No. 131 Bratislava Nové Mesto - Dunajská Streda and the railway No. 130 Bratislava hlavná stanica - Galanta.

River transport

The Danube river, Europe's second biggest river, flows through Bratislava from its 1850 km to 1880 km. The width of the riverbed reaches 350 to 400 m in Bratislava, the width of the shipway with international navigation varies from 100 to 180 m. After the opening of the Rhine-Main-Danube Canal, Bratislava has moved to the geographic centre of the trans-European waterway between the Black Sea and the North Sea. The predominant carrier and water transport operator is Slovenská plavba a prístavy, a.s. Bratislava. It provides both individual and load transportation.

Air transport

There are 2 airports at the east end of Bratislava, namely Letisko M.R. Štefánika and Letisko Bratislava - Vajnory, situated north of the former. The airspace of the airports is defined vertically and horizontally by protective zones. The M.R. Štefánik airport is one of the strategic public international airports. The runway system is formed by two perpendicular runways RWY 04/22 (length of 2.900 m, width 60 m) and RWY 13/31 (length of 3.190 m, width 45 m). The airport has been operating since 1951. The development of the performance of the M.R. Štefánik airport until 1989 was characterised by a growth up to almost 500 000 passengers per year in 1989. However, after 1990, the number of passengers dropped rapidly to as low as 130 000 per year; air transportation has been reviving gradually since 1994. In 2003, the M.R. Štefánik airport served 480 000 passengers; the last statistics for 2005 state 1 326 500 passengers per year. The share of national passenger transport dropped since 1990 from 47.2% to the current 6.7%. In air transportation of goods, a very significant decrease of performance occurred after 1990 (from 5 700 tons/year to 2 013 tons/year), yet in 2003, this indicator grew to 10 746 tons/year. The

dispatching building for travellers provides the capacity of 654 passengers per hour (the contemporary peak load is 265 persons per hour). The runway system has a capacity of 205,000 airplane movements per year. Its use in 2003 was to 10.3% (21,214 movements), in 2004 it was increased to 13.2% (27,133 movements) and thus it has a sufficient reserve for further development of transport. The capacity of the dispatching area is 26 airplane stands. The technical and operation equipment of the airport are built at various qualitative levels. The highway D4 collides with the take-off and landing runways, therefore it has been proposed to run the highway under the ground level in the collision section.

The Airport of Bratislava -Vajnory belongs to small airports of regional importance. The track system is formed by two perpendicular tracks RWY 04/22 (length of 1,000 m) and RWY 13/31 (length of 650 m). The capacity of tracks is 32,000 movements of airplanes per years (in 1998 there was ca 7,700 movements). The airport serves for general aviation. The services for passengers are provided directly on the clearance area near hangars. The airport lacks facilities for a potential development of aerotaxi services.

Bicycle transport and hiking trails

Bicycle transport accounts for 1% of the transportation distribution. In Bratislava, it is mostly a seasonal way of transport, intensifying during the summer season. Nowadays, there are ca 33 km of main and ca 20 km of side cycling routes that are the part of future complete system, interconnecting the individual parts of the city and following the suburb and international cycling routes. From amongst the existing cycling routes, the most significant one is the so called International Danube Route - from the border crossing of Berg on the Danube embankment up to the border crossing of Rajka, running under the proposed D4 route. Other transit and regional routes in the surroundings:

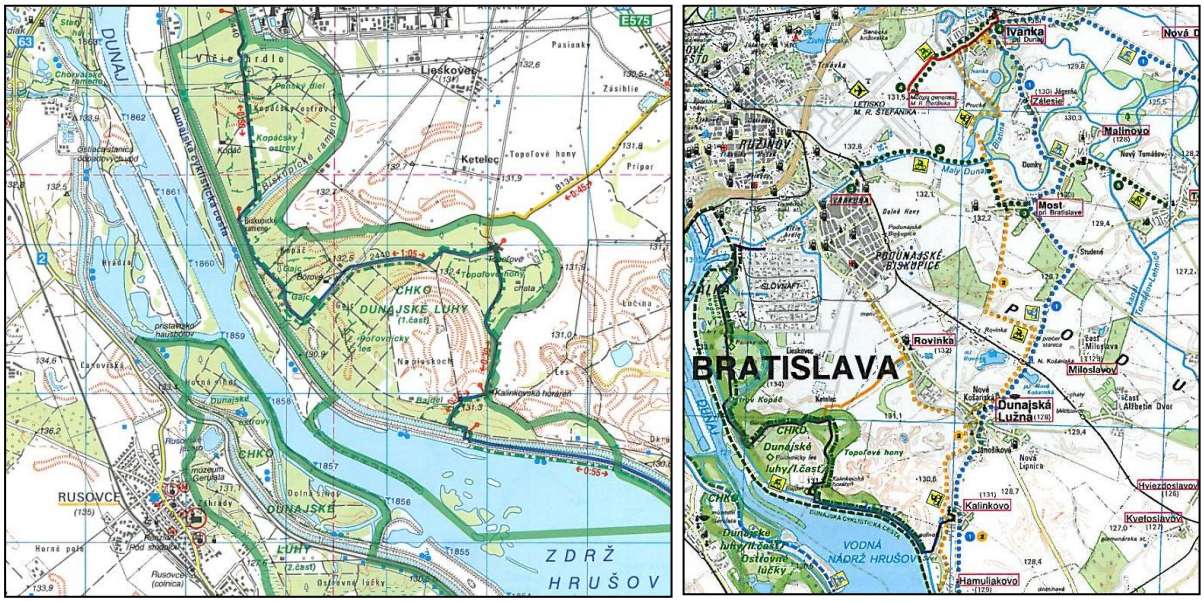
- *Carpathian cycling route* - connecting the international Danube Cycling Path with the Little Carpathians. It runs across the Lafranconi bridge and Mlynská dolina up to the modest traffic area of Železná studnička.
- *Moravian cycling route* - starts on the left-bank of the Danube under the Nový bridge and runs on the bank (against the stream) along Karloveská zátoka and Devínska cesta to Devín, from where it continues alongside the river Morava to Devínska Nová Ves and further in direction of Záhorie region.
- *Vajnory cycling route* - starts on the bank of the Danube under the Starý (Old) bridge, connecting the centre with the north-east end of the city along the inner traffic circle.
- *Záhorie cycling route* - this regional route starts under the Devín castle, runs on north to Malacky, Holíč, ending in Senica.

Main city routes:

- *Dúbravka cycling radial road* - runs from the Lafranconi bridge through Líščie údolie in Karlova Ves to Dúbravka and Devínska Nová Ves.
- *Lamač cycling radial road* - runs from Karpatská cycling road (Červený most) through Lamač to Záhorská Bystrica.
- *Round route Slovnaft* - cross-connecting the cycling paths from Račianska st. to the Small Danube.
- *Along Chorvátske rameno (branch Chorvátske rameno + branch Starohájska)* - runs from Starý brigde along Chorvátske rameno (river distributary) with a branch on Starohájska and connection to the Danube Cycling Path.

- *Along the Small Danube* - runs from the Danube cycling path (Pálenisko) on the embankment of the Small Danube.
- *Račianska radial road* - runs from the Vajnorská cycling route in direction Krasňany and Rača district.
- *Ružinov radial road* - runs from Páričkova, Trenčianska, Ružinovská up to the edge of the Vrakuňa district.

We cross the blue tourist route passing along the right bank of the Danube. The route shall be crossed using a bridge structure.




Cycling and tourist routes in the territory involved (Tourist Atlas of Slovakia)

**Disclaimer**

This is an English translation of a document that was originally produced in the Slovak language. While we have exercised utmost care to make this translation accurate, it may contain typing or translation errors. Therefore, always consult the Slovak original before making decisions on the basis of this translation.

The name of this document in Slovak is *Správa o hodnotení navrhovanej činnosti*. The file name has not been changed.

We hereby confirm that the European Bank for Reconstruction and Development shall have no responsibility for the translated content.

Project Implementation Services, spol. s r. o.
Consultant under Consultancy Contract C31934

**Most pri Bratislave**

Most pri Bratislave is crossed by the road II/572 and II/510 and currently represent a major transport- operational and compositional axis of the municipality. Road II/572 is part of the regional IInd class road. The road enters into the area from the direction of Dunajská Streda and under the basic arrangement of road system of the municipality, it creates south-east radial road. The roads II/572 and II/510 are followed by three basic transportation entrances to the village from the direction of Bratislava, Dunajská Streda and Tomášov. At the end of boundaries of the village the road II/572 is connected with the road III/06359 to Podunajské Biskupice.

**Zálesie**

The municipality is accessible only via the road III/0614, which interconnects Ivanka pri Dunaji and Malinovo. The road is a link between subregional/regional major roads I/61 and II/510. The road III/0614 passes through residential areas and in view of the increasing intensity, it will be necessary to address its capacity using e.g. turning lane.

**Ivanka pri Dunaji**

Ivanka pri Dunaji has been engaged by the best transport road and railway systems:

- multimodal corridor TINA no. Va Bratislava - Žilina - Košice - Záhor state border SK/Ukraine, which includes D1 highway, road I/61 in the territory of Slovakia in the affected area. The D1 highway is under the agreement on the most important European roads AGR designated as E50 and E75 and the road I/61 as E571,
- a supplementary network TINA. It is a rail track of the multimodal corridor no. IV interconnecting Slovak railway branch with the Hungarian branch of the same corridor. The Slovak branch of the corridor is situated on the route of Bratislava - Galanta - Nové Zámky - Štúrovo - Budapest,
- Bratislava Airport.

Regional transport links are directly integrated into the territory and create a basic road network in the area. In this context, two regional road directions are identified for car traffic. The road III/0614 comes out of the road I/61, road III/06166, which connects the territory to Bernolákovo comes out of the road III/0614. Transverse transport relations of the territory are ensured by the road III/0614 in the direction to Zálesie, Most pri Bratislave and Tomášov. IIIrd class roads remain as superior internal road system. The road III/0614 forms north-south interconnection of the whole settlement and regional importance. In the broader transport connections it provides transport relations to Zálesie, Most na Ostrove and Bratislava, which follows the one from the eastern entrances to the town (Vrakuňa, Podunajské Biskupice).

<u>Pipelines and product lines</u>

There are pipelines, oil and gas pipelines, conducted to Slovnaft, built in the affected area. There is also a remote water supply from sources in Kalinkovo. In addition to underground lines there are also air and HV and LV power lines. In the event of a collision of identified lines with D4, some technical measures are to be set up. Currently, an alternative of the Družba pipeline is being processed on the route Bratislava - Petržalka - Schwechat (Austria).

<u>Waste and Waste Management</u>

Bratislava is a major source of waste in Slovakia. 8.4% of Slovakia's population lives here and the share of the city in the total waste production is around 3.7% and the production of municipal waste 10.6%. In 2002, Bratislava produced 508,663 tons of waste, of which 43,520 tons of hazardous waste and 465,143 tons of other waste.

Out of the total amount of waste, 201,683 tonnes (39.6%) were recycled and 261,495 tons (51.4%) disposed. The basic method of disposing of household waste at present is incineration.

Municipal waste incineration plant in Vlčie hrdlo - in operation since 1977, has a capacity of 135,000 tons, it burns about 108,000 tons of household waste and waste from manufactures on average per year, which produces about 35,000 t of slag and fly ash (25,000 tonnes of slag and 10 000 tons of ash) which are stored in a landfill outside the city, at present it is the landfill in Pezinok. The incineration plant has a line of magnetic separation, annually captures about 1,600 to 1,700 tons of metal scrap. Between 2000 to 2002, it was reconstructed mainly due to complying with the new emission limits. The incineration of waste generates heat, which is used to generate electricity for their own needs as well as to public supply, heat supply for Florea greenhouses, if necessary for Slovnaft a.s. Reconstruction of incineration plant can extend its operation by 15-20 years. The municipal incineration plant includes sorting - mechanical line on Ivanská road, where the final sorting of glass, metals and paper and PET bottles is carried out. Looking ahead, it is considered to supplement technological process of final sorting line of imported waste and solidification line to capture residues from flue gas cleaning, or incineration residues.

In 1997, an incineration plant for medical waste was put into operation in the new polyclinic in Petržalka, with a planned capacity of 900 tons / year. Due to lack of space, however, its performance is about half, while from the city perspective, the desired capacity of this type of facility is 1,200 to 1,500 tons.

Slovnaft, a.s. operates three incineration plants serving for their own needs, due to the introduction of new emission limits they will be replaced by new hazardous waste incineration plants with a capacity of 12,000 tons.

In the complex of Istrochem, a.s., there is a hazardous waste incineration plant of Hoval GG 14 with an output of 100 kg per hour, used for research purposes.

There are three landfills in the city, which are in accordance with the legislation:

- landfill for inert waste in the Devínska Nová Ves. It was put into operation in 1997, its total capacity is about 650,000 tons. The remaining capacity is now 150,000 tonnes. There is a space being cultivated after mining brick earth near the landfill, allowing the storage of inert waste until 2011.
- landfill for inert waste in cadastral area of Podunajské Biskupice under Slovnaft, put into operation in 2003 with a capacity of 250,000m$^3$.
- landfill for waste that is not dangerous, is in the area of WWTP in Vrakuňa with a capacity of 45,000 m$^3$, is used solely for the use by the water company (waste from sewage cleaning and grits).

Other landfills are situated outside Bratislava - landfills in accordance with the legislation are in Zohor, Stupava, Senec, Pezinok, Budmerice, Dubová.

The largest waste producer in Podunajské Biskupice is the company Slovnaft, a.s. Bratislava. In 2000, Slovnaft produced 52,976 tons of waste, of which hazardous waste 51%, special waste 7% and other waste 42%. Although the total production of waste in 2000 decreased by almost 15%, in the case of hazardous waste, there is an increase. This was caused by the creation of waste catalyst on new production units of EFPA. Of the waste produced, approximately 24.5% are

incinerated at corporate waste and sludge incineration plants. Bratislava municipal waste is disposed of through the OLO a.s., Incineration plant centre - Vlčie hrdlo, Florea centre - Vlčie hrdlo.

**Most pri Bratislave**

Two landfills have been stablished in the cadastral area of the municipality - Studené, RDP Most pri Bratislave and Prucké operator, operator of HSM Bratislava. Both landfills in Prucké and Studené were operated under specific conditions until 31 July 2000. After this date, they have been closed and will be progressively restored respectively rehabilitated. A separate collection is being organized in Most pri Bratislave - transportation provided by the company Petmas-Onyx Pezinok.

**Zálesie**

Zálesie uses for recovery and disposal of wastes a regional landfill - SOBA s.r.o. (cad. area of Senec - Červený majer with a capacity of 70 thousand $m^3$).

**Ivanka pri Dunaji**

Ivanka pri Dunaji uses for recovery and disposal of wastes a regional landfill - SOBA s.r.o. (cad. area of Senec - Červený majer with a capacity of 70 thousand $m^3$).

## *12. Cultural and historical monuments and sights*

Among cultural and historical monuments located directly in the affected area we should mention the original flood protection dike (implemented during the Austro-Hungarian Empire under the reign of Maria Theresa) as part of a secondary inundation line (Upper Rye Island dike), from Podunajské Biskupice towards Hamuliakovo. After putting the Gabčíkovo WD into operation in 1992, the dike became inoperable and it took over the function of the left-side dam of Hrušov reservoir. The section of the original dam was declared protected cultural and technical monument by the Ministry of Culture (Decision no. MK - 954-3 from 22 September1994).

Cultural and historical sights of Bratislava are further described in the section of Settlements concerned.

In the cadastral area of Most pri Bratislave, we can find the following cultural monuments registered in the Central List of cultural sites:

- Church of the Sacred Heart - formerly Church of St. Thomas the Apostle (cat.), originally Gothic from the 1st quarter of the 14th century, modified in the second half of the 16th century and the mid 19th century, expanded in 1910 in neo-Romanesque style.


- God's torment - built at the turn of the 18th and 19th century in the classical style to commemorate re-baptism of original German population from Lutheran to Catholic religion.
- M.R. Štefánik Memorial - is located in the north-western part of the village. The author of the memorial is D.S. Jurkovič, who in 1921 designed the memorial at the site of Stefanik´s accident. in 1923 they built a memorial with a rampart and the Slovak lime trees around the perimeter. A simple stone stele with an inscription is built at the foot of

the memorial. In 1988 and1992 the monument was restored. Tribute to M.R. Štefánik is being held every year. The memorial was visited by many political and cultural persons from all over Slovakia and abroad.

Other cultural and historical monuments in Most pri Bratislave:

- The manor house in Studené was probably built in the 17th century by Hideghétyi family as a ground floor Renaissance building (or originally as a monastery). The building was owned by many owners who restored it several times, due to which it has lost its original shape.
- There is a wooden cross with painted sheet metal corpus built in 1933 in the church garden. Memorial to victims of the First World War was erected on 25 August 1929 by the municipality of Bruk.

In the cadastral area of Zálesie there are no historically protected objects registered in ÚZPF SR. Cultural-historical monuments in the village are:

- Roman Catholic Chapel of St.Trinity
- The original wooden cross in the central part of the local Catholic cemetery
- The original wooden cross in the central part of the local Lutheran cemetery

In the cadastral area of Ivanka pri Dunaji there are the following historically protected objects registered in ÚZPF SR.

- Monument to the victims of the World War II, dating from 1952, located on the Square of the fallen heroes.
- The manor house built in the new Gothic architecture in the second half of the 19th century, the original building from the 2nd half of the 18th century, located at the Square of the fallen heroes.

- Roman Catholic Church of St. John the Baptist built in the architecture of classicism between 1770 to 1772, single-nave, located at the Square of the fallen heroes.
- Statues of St. Florian, St. Donatus and St. John Nepomucky from the fourth quarter of the 18th century in the classic style, located in front of the church of St. John the Baptist at the Square of the fallen heroes.

Other cultural and historical monuments in Ivanka pri Dunaji:

- St. Rosalie Chapel - there is a rotunda with neo-classicist facade, dome-shaped roof and a small tower with the bell inside at the St. Rosalie Square. The chapel was built in 1832 to commemorate the end of the plague epidemic that spread in the village since September 1831. Believers of Ivanka prayed St. Rosalie for help. The epidemic stopped just at the Feast of St. Rosalia - on 4 September. In the past, this feast was worshiped by pilgrims from the surrounding villages.
- Bell tower of the 18th century and a stone cross with a sculpture of the Pieta from 1818.

## 13. Archaeological sites

**Ivanka pri Dunaji**

The northern location Ivanka region reveales a housing location with ceramics of Lengyel culture (3500 - 3200 BC), in the immediate vicinity there is a settlement with ceramics of Baden culture (Boleráz group) dated back to 2800 BC in position of Šakoň. For the period 2000 - 1700 BC. we know four locations of the village. It is the burial place at "Pískový vŕšok", vessels from the grave, culture of Slavonia (Group Kosihy - Čaka), which replaced Baden culture at the south-west . Furthermore, stone axes from Obora (current dredging spoil) probably from a housing building. Together with the graveyard with people of corded culture in Zemanovo in Grasalkovičova street, they can be from one time period i.e. about 1850 - 1750 BC, which forms the beginning of the Bronze Age. Corded culture of Chlopice - Veselé typ belongs to the people of Indo-European race and their impact on local groupes of corded culture of Nitra type and others forms the basis of Central European culture in the Bronze Age. On the north-west edge of the Ivanka area, there are debris of pots from housings of the conclusion of the Central Danubian barrow culture before 1200 BC. There is a lot of housing objects from the Iron Age to the Roman period to the north of this area until Vajnory cadastre. It is the period since 700 BC to the 2nd century. Among the examined objects of those sites, there are remarkable findings of wells with water filtration, recessed residential areas and weights of looms. A cinerary urn burial place from 3rd to 4th century is known from the village (at Štiglica´s). According to the shape of the urns and offerings stored it is classified to the early Roman period. Some pot-shaped containers according to their shape and processing are typical Germanic products of the period from 2nd to 4th century. A bronze statue of Mercury is a striking finding, which was stored in a container made on the potter's wheel. At that time a Germanic Quadi tribe lived here. We can observe the stay and evolution of human society for nearly four millennia since prehistoric times until the 5th century on archaeological sites in the territory of the village.

## 14. Paleontological sites

No important paleontological sites or significant natural forms have been discovered in the area.

## 15. The characteristics of the existing sources of environmental pollution and its environmental impact

Bratislava south-east is the most industrialized area in the urban area, which is also reflected in the total burden on the environment. The largest impact on the increase in the environmental quality is assigned to petrol, energy, chemical industry and transport. In terms of production of basic pollutants it is the biggest producer across the SR. The territory is included in the loaded areas, i.e., it is an area that requires special air protection. There are 31 large air pollution sources and about 220 medium air pollution sources.

The area is part of the Rye Island, whose groundwaters are the largest reservoir of good drinking water in Europe. For the sake of protection, the area is declared by Government Directive Nr. 46/1978 Coll. a protected area of natural accumulation of water on the Rye Island. Due to this fact, Bratislava has created favourable conditions for the supply of drinking water. Nowadays, a part of the city is supplied from Kalinkovo and Šamorín water resources, which are outside the capital city of Bratislava, as II. water source in Podunajské Biskupice was shut down after an accident in 1971. For this reason, the area around Slovnaft developed a system of hydraulic groundwater protection - 33 pumping wells with continuous pumping of groundwater and about 500 observation wells were built.

The affected part of Bratislava, Most pri Bratislave and Ivanka pri Dunaji built public sewers, while the areas in the southern part of Podunajské Biskupice, Prievoz, Malé and Veľké Pálenisko and Vrakuňa do not have a sewage system. Water from the drains is treated at the Central waste water treatment plant in Vrakuňa, which has been in operation since 1987. In addition to the public network, there is also a network of areal sewerage systems from individual companies. It is notably sewers of Slovnaft a.s., which diverts contaminated water from its operations to its own waste water treatment plant, which has been in operation since 1985. The water quality in the Little Danube corresponds initially to the quality of Danube water that is gradually affected by the entry site sources of pollution. According to different groups of indicators, it is mainly classified into IInd - IVth purity class.

The most important problems related to hygiene in wider area of Bratislava is definitely air pollution due to emissions, high dust and load of the environment by odour. Noise condition is a very unfavourable situation, open issue of waste disposal, and related illegal landfills. Also current condition of surface and groundwater pollution is unfavourable. The attention must be paid to detailed analysis of soil pollution and also health condition of forests and vegetation, that are reflecting the impact of unfavourable hygiene on the environment.

Surface water pollution sources

The dominant share of water pollution in the area is assigned to pollution from point sources. These are waste water discharges from industrial plants, especially the chemical industry. Other potential sources of surface water pollution are waste water produced by sewage and rainwater drainage. The bulk of the waste water is discharged into the Danube after purification in WWTP. Despite the fact, water in the Danube is quite dirty. The quality of surface water in the Danube above Bratislava is affected by the tributary of the Danube - Morava (IIIrd IVth purity class). Bratislava sampling site (centre) has a group of indicators of oxygen regime and additional chemical indicators in the IInd purity class, a group of basic chemical indicators in the IIIrd purity class and microbiological and biological indicators corresponding to IVth purity class. The content of the heavy metals is low, it corresponds to the Ist purity class. The most significant point sources of pollution discharging waste water into the Danube in Bratislava region are the WWTP Petrzalka, Vrakuňa, Istrochem and Slovnaft.

Groundwater pollution sources

Groundwater pollution affects the environment it flows through. In the area of Bratislava they are the sand-gravel sediments of the Danube, which are partly replenished by groundwater flowing down from the Little Carpathians. Major groundwater polluters are industrial enterprises (Istrochem, Slovnaft, Matador), transport (infiltration of contaminated water from roads), landfills, old environmental burdens, sewerage (leaks, accidents), polluted rainwater. Groundwater quality is also closely related to the quality of surface water in the Danube that infiltrates into the gravel sand sediments. Persisting contamination with sulfates, specific inorganic material and chlorinated hydrocarbons. However, the groundwater contamination in the relevant is related to intensive agricultural production.

Air pollution sources

In terms of air quality, the area of Bratislava belongs to the medium to severely polluted areas. It is caused due to strong industrialization and high concentration of pollution sources concentrated in a small area.

At present, the crucial local sources of dust air pollution in the affected area are:

- car exhaust gases and industrial activity
- suspension and re-suspension of solid particulates due to insufficient cleanliness of roads
- mineral dust from construction sites (demolition, excavation and construction activity)

Based on the results of statistical analysis it can be assumed that the contribution of local sources to $PM_{10}$ pollution at AMS in the agglomeration does not exceed 20%. Local measures should aim to reduce the number of exceeding of the limit values for $PM_{10}$ especially by changing the organization of transport, expanding pedestrian zones and vegetation restoration, bolstering surfaces, preventing excessive green felling, checking the technical condition of vehicles, checking local resources and activities which may cause air pollution (construction sites, landfills of bulk materials, waste landfills).

The main share in the pollution of loaded area of Bratislava has the chemical industry, energy and car traffic. $NO_x$ and a significant proportion of particulate matter emissions are among the pollutants monitored that contribute to air pollution at a high level. The secondary dust is also important. In order to reduce the proportion of air pollutants on the quality of the environment, some emission allowances have been assigned for sulfur dioxide to each operator in the capital city of Bratislava.

The amount of discharged basic pollutants (P) in the agglomeration of Bratislava in 2007 and the share of the five largest (selected) operators of the sources - Slovnaft a.s. Bratislava, Bratislavská teplárenská a.s. , Paroplynový cyklus a.s., Volkswagen Slovakia a.s. and Odvoz a likvidácia odpadu a.s., is presented in the table below:

| Type of P | ToP | SO2 | NOx | CO | TOC |
|---|---|---|---|---|---|
| Amount t/year | 379.79 | 9269.49 | 4607.49 | 934.20 | 249.33 |
| Share 5 NZ t/year | 334.46 | 9092.16 | 4031.51 | 710.01 | 114.68 |
| % share 5 NZ | 8.12 | 98.10 | 87.50 | 76.00 | 50.00 |

Source: NEIS

The most significant stationary sources of air pollution in Bratislava loaded area and their emissions of major pollutants are:

| OPERATOR | POLLUTANT in t per $year^{-1}$ | | | |
|---|---|---|---|---|
| | TOP | $SO_2$ | $NO_X$ | CO |
| Slovnaft, a.s., Bratislava | 205.4 | 13,3012.3 | 3,429.5 | 550.2 |
| OLO, a.s., Bratislava (incineration plant) | 68.7 | 47.8 | 71.9 | 0.1 |
| Slovasfalt, s.r.o., Bratislava | 0.2 | 118.2 | 1.7 | 26.6 |
| BT, a.s., Juh heating plant | 21.5 | 2.6 | 530.7 | 44.9 |

Source: SHMI

A steady increase in car traffic is recorded in the city area. Given the lack of capacity of the existing road network (issue of all major cities in Europe) and still unformed classic "bypass ring road", a deterioration of air contamination in the city centre occurs.

The positive fact is improving the quality of vehicles and obligation for technical tests. Exchanging leaded gasoline for unleaded gasoline caused a rapid decrease in the amount of toxic lead in the environment, however, it was replaced by an increase in concentrations of carcinogenic benzene. The area the most contaminated by traffic in Bratislava and in Slovakia is Trnavské mýto interchange.

In 2005, the monitoring stations in the Bratislava region recorded the greatest extent of exceeding the 24-hour limit value of 50 $\mu g.m^{-3}$ for the pollutant $PM_{10}$ (AMS Trnavské mýto - 103 times, AMS

Mamateyova - 73 times, AMS Kamenné Square 45 times).

Sources of noise and vibrations

Noise is unwanted and harmful phenomenon which has an unfavourable effect on the health of the population and the natural environment. Noise stress is manifested mainly in industrial centres, along transport lines, along the areas of air landing cones, in the extraction of raw materials and so on. Evaluation criterion of traffic noise level is an equivalent noise level, the maximum noise level will be applied for air transport. Noise is one of the major risk factors affecting the quality of the environment. It adversely affects the health of the population, particularly in the field of sensory and nervous system. The situation in terms of noise load in the area is unfavourable. Bratislava is the most burdened town in Slovakia in terms of noise. Noise condition is affected by three transport modes:

- car traffic,
- air transport,
- railway transport.

*Traffic noise*

It is observed only on a selected road network of Bratislava (362 sections with the length of about 330 km) during the day time. Exceeding the permissible value is assessed on the facade of the nearest objects in a given section. Number of sections exceeding the permissible values is as follows:

- exceeding by 0 – 5 dB – 124 sections,
- exceeding by 5 – 10 dB – 92 sections,
- exceeding by 10 – 15 dB – 10 sections.

The allowable value is exceeded in 226 sections out of the total monitored sections. The loudest sections include Harbor Bridge, D1 and D2 highway, Bajkalská street, Lamačská road in the area of Patrónka and Einstein street. The sections with the highest exceeding the noise limits are: Bajkalská, Šancová, Pražská, Lamačská, Staromestská, Trnavská, a part of Vajnorská, Prievozská, Gagarinova streets.

Tram transport is also a major source of noise.

*Air transport noise*

The noise situation around the Bratislava Airport is continuously monitored at two locations in the airport area. Over-limit noise affects the northern and western part of Vajnory, south-east of Rača (with residential function), east of the Now Town, and large parts of Ružinov, Vrakuňa and Podunajské Biskupice (without housing function) and individual municipalities of Most pri Bratislave, Zálesie and Ivanka pri Dunaji.

*Railway transport noise*

Of the total length of track keeping Bratislava railway junction (87.7 km) the exceeded allowable noise limit during the day time is in the length of 19.2 km, representing 21.8% of the total length of tracks. Prevailing of excess up to 5 dB, except for short sections around the main station and Krasňany where the exceeded value is from 5 to 10 dB.

The loudest sections in Bratislava in terms of rail transport are: Main station - to Kúty, Main station - to Trnava, Main station - to Senec and sections leading into the station of Bratislava - Nové Mesto.

Also vibrations are an accompanying phenomenon of noise (mechanical oscillations), which represents the movement of the mechanical system or its part for which the quantity describing its movement or position is variably larger and smaller than a certain equilibrium or benchmark of this quantity. Vibration affects not only a person close to the source, but can also threaten the stability of some of the older buildings. The source of vibration, same as with noise, is transport.

Soil pollution sources

Long-term colonization of Bratislava resulted in changes in pedological conditions in the urban area. It was found that many areas are intoxicated and devastated. At some locations, the original cover is completely removed and replaced by Anthrosol cover.

Contaminated soil was found in the following areas: Slovnaft, a.s., OLO, a.s. Spot soil pollution caused by increased concentration of oil products and heavy metals such as Cr, Hg, Pb, As, Se, Ni, Cd, Sn, Pb, and Ag.

According to current measurements of the content of hazardous substances in soil the affected area is in category A, $A_1$. Soil in the affected area are soils slightly threatened by water erosion (0-4 $t.ha^{-1}.year^{-1}$). Wind erosion is not a serious problem as it affects in the territory of the Slovak Republic only 6.5% of the area of agricultural land.

The major part of the area concerned is agriculturally used and has high-quality soils. These, however, are potentially contaminated with a high level of application of chemistry in agricultural production and chemicals used as means of plant protection and nutrition. At present, the volume of chemicals is reducing and contaminants are stabilizing in the limit values.

Waste and landfills

One of the main forms of waste disposal is landfilling. In 1995, there were 38 landfills permitted in the Bratislava region, including 3 regional landfills of the IIIrd building class (Senec, Zohor, Stupava), one unsecured waste landfill (chemical waste landfill of a.s. Istrochem in Budmerice) and 34 landfills with designated special conditions including landfill of the IIIrd building class in Pezinok. In the current state, the landfill is operated as a landfill of the IIIrd building class, which fulfils the technical conditions without setting of special conditions. Authorized landfills have a capacity for about 15 years. NO landfill in Budmerice has a capacity up to 2050.

There are about 150 illegal landfills in the Bratislava region, out of which 79 wild landfills have been discovered (in 1991, 120 landfills) in Bratislava area by updating landfill sites (Capital city Magistrate of the SR, 1996). In 1993 - 1996, 20 wild potentially riskiest landfills have been reclaimed, respectively rehabilitated in Bratislava area. Permanent rehabilitation of uncontrolled landfills is a serious problem of waste management.

## *16. Comprehensive assessment of the current environmental issues*

The most important issues are the high air pollution due to emissions, high dust (mainly secondary) and odour (particularly from chemical plants). A particularly unfavourable is noise situation, the unresolved issue of waste (landfills, old environmental burdens), loss of eco-stabilizing elements, surface and groundwater pollution. The attention must be paid to hygiene condition of soil, forest

condition and vegetation as such. An important role is also played by the resistance of soils against contamination by harmful substances. The affected area is classified as unsafe and vulnerable region of Slovakia. Environment in Bratislava, despite the implemented measures, does not meet the requirements of the appropriate quality of the environment, which is negatively reflected in the quality of health and life of humans.

Rock environment and relief

Contamination of the ground as a result of anthropogenic activities can be expecte in the area intensively used by industry and agriculture.

Air

Air condition in Bratislava is monitored by automatic monitoring stations, which are located at: Trnavské mýto, Turbínová st., Mamateyová st. and Kamenné Square. The most involved in air pollution are the monitored pollutants: nitrogen oxides, sulfur dioxide, airborne dust, carbon monoxide, ozone, lead, cadmium. In general, the highest values are achieved by the indices calculated for daily values $IZO_d$ under which Bratislava is ranked among areas with high level of air pollution. The values of air pollution in Bratislava in 2006, 2007 and 2008 are presented in the following table.

| **POLLUTANTS** | **Amount of pollutants in t/year** | | |
|---|---|---|---|
| | **2006** | **2007** | **2008** |
| Solid pollutants | 344 | 266 | 253 |
| Sulphur oxides | 11,747 | 8,636 | 8,289 |
| Nitrogen oxides such as $NO_2$ | 4,384. | 3,940 | 3,978 |
| Carbon monoxide | 899 | 713 | 667 |
| Organic matters, TOC | 236 | 241 | 325 |

Source: NEIS

Based on average data of measured values and exceeding the limit values for pollutants, SHMI designed to delimit the field of air quality management for the whole agglomeration of Bratislava for pollutants $PM_{10}$ and $NO_2$, while Bratislava was classified into:

Group 1 - by the level of air pollution by $NO_x$ and $PM_{10}$, which is higher than the limit value; the limit value is increased by the margin of tolerance,

Group 2 - under the ozone concentration, which is higher than the long-term objective for ozone, but below or equal to a target value for ozone,

Group 3 - based on levels of air pollution by $SO_2$, Pb, CO and benzene (classification based on a preliminary assessment of air quality), which is below the limit values, or the limit value is increased by the margin of tolerance.

Municipalities as Most pri Bratislave, Zálesie and Ivanka pri Dunaji are located in the contact area with Bratislava endangered area. The closest monitored largest sources of pollution are Slovnaft a.s. and CGC Termotech Senec. The local air pollution sources may include local heating sources of individual housing units. As these quantities are not measured, their share can not be determined objectively. The significant secondary air pollution source of the municipality is the secondary dustiness, the level of which depends on the meteorological factors, earthworks and agricultural activities and especially on application of chemistry in agricultural production. The high level of air pollution in municipalities involves notably the nitrogen oxide with concentrations near roads with heavy traffic of long-term exceeding the emission limits.

Noise and vibrations

Bratislava is the most burdened town in Slovakia in terms of noise. The noise situation is particularly affected by the transport. Evaluation criterion of traffic noise level is an equivalent noise level, the maximum noise level will be applied for air transport.

The highest noise exposure is represented by the road transport. The noise situation is observed on a selected road network represented by 362 sections with the length of about 330 km during the day time. Noise-sensitive functions such as housing, education, health, are located along the 320 sections. Exceeding the permissible value is assessed on the facade of the nearest objects in a given section. Out of the total monitored sections the allowable value is exceeded in 226 sections (approximately 62% of all sections and 71% of sections along which residential and other noise sensitive functions are located). The total length of the monitored sections is 330.3 km.

Soil

The major part of the area concerned is agriculturally used and has high-quality soils. These, however, are potentially contaminated with a high level of application of chemistry in agricultural production and chemicals used as means of plant protection and nutrition. At present, the volume of chemicals is reducing and contaminants are stabilizing in the limit values.

Surface water and groundwater

Surface water quality in Bratislava is monitored as part of monitoring of surface water quality in Slovakia carried out by the Slovak Hydrometeorological Institute in Bratislava. The analysis has been conducted to determine physical and chemical, biological and microbiological indicators. Results of the analysis are evaluated according to STN 75 7221 "Classification of Surface Water Quality". The measured values of individual indicators are according to the standard included in the relevant groups of indicators (A-oxygen mode, B-basic physical and chemical indicators, C-nutrients, D-biological indicators, E-microbiological indicators, F-micropollutants, H-radioactivity) to five quality classes as follows:

- Class I - very clean water
- Class II - clean water
- Class III - polluted water
- Class IV - heavily polluted water
- Class V - very heavily polluted water

Among other flows in Bratislava, in particular water quality of the Danube and the Little Danube is being monitored. The data are presented in the table below.

| Watercourse Profile observed | Year | Groups and classes of water pollution | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | H |
| Danube Bratislava - Karlova Ves | 2002 | II | III | III | III | IV | III | II |
| | 2003 | II | II | II | III | IV | E | I |
| Danube Bratislava - right bank | 2002 | II | III | II | III | IV | III | II |
| | 2003 | II | II | II | III | IV | E | II |
| Danube Bratislava - left bank | 2002 | II | III | III | III | IV | II | II |
| | 2003 | II | II | III | III | IV | E | II |
| Little Danube Bratislava | 2002 | I | II | III | IV | IV | IV | - |
| | 2003 | II | II | III | IV | IV | III | - |

Source: MP of the Slovak Cap. City of Bratislava
A - oxygen mode
B - basic physical and chemical indicators
C - nutrients
D - biological indicators
E - microbiological indicators
F - micropollutants
H - radioactivity

In Bratislava area, there is a persisting problem of groundwater contamination by iron and manganese, nitrates, nitrites, sulphates and chlorides. Among heavy metals, the limit values are exceeded for arsenic, nickel and also cadmium and mercury. There is also a persistent problem with NEL-UV pollution. Specific organic compounds with exceeded limit values measured according to STN 75 71111 are 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,1-dichloroethane and 1,1,2,2-tetrachloroethene. This condition is related to the concentration of chemical and petrochemical industry in the region as well as dense population. Major groundwater polluters are industrial enterprises, transport, waste dumps and old environmental burdens, sewerage (leaks, accidents).

Flora

Strong air pollution has an impact on the health of vegetation. Necrosis is found on more species of plants, there is a reduced number of epiphytic lichens, or complete lack. Forest ecosystems are characterized by chronic damage of many species by toxic substances and acidic fallout. Serious factor damaging forest ecosystems is represented by water management modifications in the territory. In some areas, the groundwater level dropped and caused a total death of trees.

Fauna

The Danube with its arms and adjacent floodplain forests is most important of all the habitats in this area. This habitat is threatened constantly by the action of secondary stress factors associated with the development of industrialization, urbanization and agriculture. This is related to the noise and destruction of the local habitats by the presence of a man who uses these sites for recreation and sport. Maintenance of these sites is completely lacking and the impact of air pollution and overall environmental pollution threatens animal food base as well as the possibility of shelter, nesting and migration.

Territorial system of ecological stability

In terms of TSES formation, it is important that its different ecological stabilizing elements are bound to the legislative protection that ensures their functionality and positive influence on the landscape. This function is fulfilled by Act no. 543/2002 Coll. on nature and landscape protection, which determines 5 degrees of territorial protection.

Building TSES elements supposes not only conceptual declaration of these ideas, but also the subsequent creation of legislative, territorial, financial and other prerequisites for their implementation. In the territory of Bratislava, it was found that the establishment of functional and proportional elements corresponding to the level of R-TSES encounters and will encounter function-related issues especially in urban areas. The urban area will need ecological stabilizing functionality to be derived mainly from the global functionality of all biotic elements, the rural locations have better conditions for the implementation of TSES elements at different hierarchical levels, not only in Bratislava, but also in affected municipalities of Most pri Bratislave and Ivanka pri Dunaji.

It is expected that Slovakia's accession to the European Union will change views on land use, reinforce the trends of ecological stabilizing of the entire area (including fragile agro-ecosystems).

The system of nature protection also includes areas in NATURA 2000 - Areas of Community importance (ACIs) and Protected Bird Areas (PBAs), Ramsar sites and others. It is realistic to expect that at Community level, some tools for the operationalization of the proposed TSES elements will be gradually developed, to be finalized in successive stages of TSES.

Flood protection

Artificial regulating the flows of the Danube and construction of Gabčíkovo Water Dam reliably provides flood protection. Flood protection is currently implemented using the retention capacity of the Gabčíkovo WD. In the past, it was implemented by a dam line construction beginning under Bratislava and ending in Hamuliakovo. This whole area used to serve as a flood area.

During the long period various flood protection measures were implemented and protection dikes were built, so today the entire territory of the Upper Rye Island is protected by the Danube, Little Danube and Chotárny channel. A network of drainage channels is built inside the territory, which are mouthed into the main recipients by means of pumping stations allowing harmless drainage of internal waters during high flood flows. The drainage systems were separated until 1960, their interconnection took place after the flood in 1965.

The Upper Rye Island channel system, which originally provided only drainage, today fulfils also other functions: to supply irrigation water, acts as a stabilizing factor in groundwater levels, provides drainage for municipal and industrial wastewater treatment, improves and complements the environment.

Higher located riverbed of the Danube supplies the groundwater flowing towards the Little Danube, Mosoni Danube and drainage channels. This fact is also important during floods. Rupturing the Danube embankments and dykes has serious consequences, because the surrounding terrain has no natural ridges or terraces to retain flood water passing at breaking dykes as being common under the normal alluvial conditions of rivers. As a result, the watered layer is thick and highly permeable, there will be other forms of flooding - flooding of low-lying areas near the river by subsoil irrigation.

The current stress factors

Stress factors adversely affecting the overall ecological stability of the area can be summarized as follows:

- areas of concentrated industrial and agricultural production
- Bratislava urban area with a high concentration of population and its activities
- area of municipalities of Mosti pri Bratislave, Zálesie and Ivanka pri Dunaji with the development of housing related to the Bratislava conurbation
- air pollution, groundwater and surface water pollution
- noise pollution
- forests affected by emissions
- landfills.

Adverse environmental condition is generally characterized particularly by the fact that Bratislava and its surroundings are among the areas with the most polluted air in Slovakia. The permissible noise levels are exceeded in many places and these adverse factors are reflected in deteriorated health of the population. Children suffer mainly from chronic respiratory diseases and weakened immune system. Bratislava region is included in the areas of strong to extreme environmental damage, caused by strong industrial and urban development in the communist era. In terms of landscape structure and spatial stability, the area belongs to the least stable Slovak regions due to

strong anthropogenic transformation of the natural environment. TSES elements, protected areas and other ecologically valuable sites are in addition to the surface extension of the expanding construction threatened by a change in their living conditions (contaminated air, water, noise). The environmental problems of the affected area with concentrated industrial production of conurbation and agricultural landscape with suburban locations can be summarized as follows:

*Threat to natural resources*

- transfer of emissions and subsequent damage to forest vegetation, consequential reduction in stability of forests due to poor health
- threat to surface and groundwater quality
- aggressive urbanization and industrialization and threat to the gene pool sites

*Threat to a man and his environment*

- noise pollution especially from traffic
- air pollution by emissions from large industrial parks and transport
- pollution of drinking water sources due to the concentration of the chemical industry

## 17. Global Environmental Quality

According to the strategy, policies and priorities of the State Environmental Policy of the Slovak Republic, Bratislava region is one of unsafe and vulnerable areas in Slovakia. The environment in Bratislava, despite the implemented measures, does not meet the requirements of the appropriate quality.

The issue of environmental vulnerability of the natural environment is one of the relatively young issues of environmental research and may be considered the strictly purposeful landscape feature, expressing the rate of potential carrying capacity of the landscape system by anthropogenic activities without disturbing its structure and reproductive capacity of its resources. Determination of ecological vulnerability helps to determine the quality and quantity of possible carrying capacity of the landscape within the preserving its natural structure of biotic diversity, genetic resources and reproductive capacity resources. Natural vulnerability is understood as the capacity of the natural ecosystem to bear a level of use to avoid adverse ecological changes.

The vulnerability of the natural environment is represented by contamination, pollution, accidents, risks of regional or local character. Due to the geological environment with a substantial share of gravel, the most important measures must be focused on the elimination of the threat and then groundwater protection. The affected area is part PWMA Rye Island, which is a very important reservoir of drinking water in the Slovak Republic. They are localized sources of drinking water with indoor and outdoor water source zones. For this reason, it needs a sensitive approach within the individual investment plan. The proposed plan should not represent a deterioration of the environmental quality. The accidents and the subsequent threat to the quality of ground and surface waters may occur during the construction of the projected highway and its operation - leakage of harmful substances to water e.g. oil products, chemicals etc.

*Geological environment vulnerability*

When assessing the vulnerability of rock environment in terms of activities in the natural environment, it foresees the following vulnerability factors:

- change in the ground water level or hydrogeological regime
- change in humidity and temperature of rocks

- changes in morphology of the terrain surface - relief
- seismic or other quakes
- mechanical and chemical degradation of rocks
- transfer of loosened rocks by means of hydro, wind or another power
- sedimentation of rocks in water, or dry conditions
- dumping of wastes and other anthropogenic materials
- exposing geological environment.

Action and intensity of the above factors on the geological environment is set by the geological - tectonic structure of the area, engineering snf geological, hydrogeological, geomorphological and climatic conditions of the area, where they can be summarized under a common name - Geodynamic processes.

The geological environment as a relatively stable landscape ecosystem element of the area is particularly vulnerable to the action of water erosion, extreme climatic fluctuations and anthropogenic activities.

The territory shall apply in particular:

- erosion - due to the impact of floods on the Danube, the erosion of surface soil cover used to occur in past, at present, this phenomenon is significantly limited due to adjustment of the Danube by Gabčíkovo WD
- climate extremes - increase the intensity of erosion, particularly in excessive rainfall activities in summer and snow-freeze destruction of rocks
- anthropogenic activity - polluted rain and air, polluted surface water and groundwater, landfills, vibrations from traffic.

The overall level of vulnerability of the geological environment is, however, low to very low with local differences in the area concerned. The vulnerability of rock environment due to possible contamination depends primarily on the hydrogeological properties of rocks. Given that most of the assessed area is made up of very well-permeable gravel sand sediments, susceptibility to contamination of these rocks, as well as groundwater, is very high. Groundwater contamination, however, is partially eliminated by the top layer of clay that is less permeable.

*Relief vulnerability*

The vulnerability of rock environment directly affects the vulnerability of relief. Engineering geological properties of rocks along with endogenous processes are the basis for the main features of the terrain relief. Relief vulnerability is compared on the basis of morphodynamic typing of relief, current manifestations of geodynamic processes, as well as conditions for their formation and evolution. Relief vulnerability can be classified on the basis of:

- Geodynamic stability of area- Active gully erosion - Slope of relief.

Due to lowland character of the relief, the area is not sensitive to geodynamic processes and the relief can be globally considered a little vulnerable.

*Surface and groundwater vulnerability*

The vulnerability of surface water is influenced by many factors, the most significant one is pollution. The main sources of pollution in the affected area are the waste water from sewerage system and waste water treatment plants discharged into water bodies. Waste water is mainly

composed of industrial waste water, domestic sewage, but a significant proportion of waste water comes from agricultural and industrial areas.

Given the close interaction of surface water with groundwater in a given hydrogeological environment the main surface and groundwater pollution carrier is mainly the surface flow of the Danube.

It is obvious that the risk of water pollution in the Danube brings a risk of groundwater pollution especially in the shipwreck accidents, at accidents of waste water treatment plants and sewerage networks or possibly industrial accidents near the Danube. Groundwater is the most vulnerable in this case for large flows when the transport of contamination by groundwater flowing is very significant.

*Soil vulnerability*

Vulnerability of soils is assessed on the basis of two potential parameters:

- vulnerability of physical and mechanical properties of soil
- vulnerability of chemical properties of soil.

Vulnerability of soils in terms of physical and mechanical degradation - this parameter defines the relative vulnerability of the soil cover based on substantial physical and mechanical properties of soils - depth, grain size, content of skeleton. The soils belong to the category of medium and shallow, with light granularity, which are particularly vulnerable to drought. They are very dry and the risk soils to wind erosion particularly in periods without vegetation cover. Susceptibility to mechanical degradation due to soil compaction is low for these soils.

Vulnerability of soils in terms of chemical degradation - this parameter expresses the potential vulnerability of soils in terms of anthropogenic-based acidification based on the so-called buffering (self-cleaning) ability of soils. Soils are little prone to intoxication.

*Air vulnerability*

In general we can say that the vulnerability of the atmosphere is related mainly to the tendency of accumulation of undesirable substances in the air (especially in the lower part of the atmosphere) and a deterioration of conditions for their spread. These conditions are directly dependent on the circulation of air masses (ventilation capability, respectively frequency of air masses exchange), which is locally under topoclimatic conditions.

The monitored territory is located in an area which is ranked among the most loaded areas in Slovakia, mainly due to high levels of air pollution. Construction will take place in the rural area that is well ventilated.

*Biota vulnerability*

Biota vulnerability results from the nature of the area, which is quite intensively used for agricultural purposes, while there is the presence of rare species of plants and animals. The most serious negative element is unfavourable anthropogenic activity. In the territory there are areas with different levels of protection, but these have their own regime under the current legislation. However, they are most vulnerable due to unsuitable human activity in the territory concerned.

*Vulnerability of human well-being and quality of life factors*

Basic factors of well-being and quality of life are in particular the quality of living and quality of basic elements of the environment - notably air, water and environmental hygiene (noise and vibration) and other subjective factors of perception of the environment. Hardly it is possible to further characterize the vulnerability of these factors - we are not aware of all the criteria according to which it would be possible on the basis of these factors to allocate sites with varying degrees of vulnerability of factors of well-being and quality of human life. The most significant negative impact on the quality of human life in the territory concerned, among others, has mainly the road transport producing air pollution, noise and vibration. All in all, the quality of the environment in the territory concerned may be evaluated particularly in terms of noise and air pollution as a heavily loaded environment.

## *18. Anticipated area development assessment if the proposed activity is not implemented*

Development of the transport

Zero state is a state specified by the road system in the affected area, while the planned investment would not be implemented and the existing road would have to cope with the increasing demands of transport. The main transport function is represented by the section of D1 and D2 passing through built-up area of Bratislava. After putting into operation, the section of D4 would cause a decline in traffic and reduction in load of D1 highway sections and selected sections of D2 passing through the capital city of Slovakia.

But the decline will not be very significant because the percentage of transit transport is around 13-18% of the total traffic load and the bulk of traffic congestion of the mentioned sections, especially of D1, is a source, destination and inner-city transport. The section of D4 would achieve the redistribution of traffic before entering Bratislava. Another bridge across the Danube and fast and safe transport connections of the area south of Bratislava (near the road I/63) to the D1 highway is also very important.

Traffic forecast for zero state is based on the underlying case used for the preparation of regional growth rates of transport. This is essentially the development of the area based on the expected development of motorization, traffic performance and the demographic potential of the area.

In this alternative, a road network in the affected area has been considered since 2009. This forecast should be the basis for the specification of the traffic problems in the area focused on capacity requirements and the resulting modernization of the existing road system. A method combining the expected development of the affected area, the impact of greater transport relations and regional traffic growth rates published in guidelines of MP 01/2006, issued by Ministry of Transport, was used for the needs of prospective transport situation.

Sections of the selected road network of D1, D2 highway and affected roads of I., II. and III. class have been reviewed for zero state in terms of capacity.

The results of this revision show that some sections of the D1 conducted in an urban area of Bratislava, which are particularly burdened by public transport, will not meet requirements of transport load by 2015. Furthermore, the sections of Ist class roads - I/61 and I/63 are not suitable, and already have exceeded acceptable traffic levels and directly affect traffic on selected sections within the zero option.

By 2020, 2030 and 2040 , due to the increase in traffic, other sections of D1 become inappropriate, and the rural area of D1 Vajnory - Senec assessed as a 6-lane road in width arrangement of D 33.5 including collectors. Increase in the capacity of certain sections of D1 by increasing the number of lanes is very difficult and unrealistic particularly in built-up areas. It is therefore desirable to consider a solution alternative route through mass comfortable road.

The capacity assessment - zero option in accordance with STN 73 6101 is explained in the table below:

| Section | Year | Light vehicles | Heavy vehicles | Profile in total | Peak intensity act. v/h direction | Velocity km/h | Allowable intensity act. v/h direction | Reserve | Functional* level |
|---|---|---|---|---|---|---|---|---|---|
| D2 Kapitulské pole – Jarovce D 26,5 | 2015 | 3,654 | 7,359 | 11,013 | **441** | 90 | **1,020** | 579 | **A** |
| | 2020 | 3,682 | 8,090 | 11,772 | **471** | | | 549 | **A** |
| | 2030 | 4,375 | 9,586 | 13,961 | **558** | | | 462 | **A** |
| | 2040 | 4,722 | 10,750 | 15,472 | **619** | | | 401 | **A** |
| D1 Incheba – Ovsisšte D 26,5 | 2015 | 46,095 | 8,024 | 54,119 | **2,165** | 90 | **2,775** | 610 | **C** |
| | 2020 | 52,995 | 8,819 | 61,814 | **2,473** | | | 302 | **C** |
| | 2030 | 61,452 | 9,424 | 70,876 | **2,835** | | **3,330** | 495 | **D** |
| | 2040 | 70,252 | 12,424 | 82,676 | **3,307** | | | 23 | **D** |
| D1 Prístavný most (Ovsište – Prievoz) D 26,5 | 2015 | 116,393 | 15,027 | 131,420 | **5,257** | 90 | **3,800** | - 1,457 | **F** |
| | 2020 | 132,340 | 16,655 | 148,995 | **5,960** | | | - 2,160 | **F** |
| | 2030 | 145,147 | 17,918 | 163,065 | **6,523** | | | - 2,723 | **F** |
| | 2040 | 161,137 | 19,283 | 180,420 | **7,217** | | | - 3,417 | **F** |
| D1 Prievoz – Ružinov D 26,5 | 2015 | 98,341 | 11,738 | 110,079 | **4,403** | 90 | **3,800** | - 603 | **F** |
| | 2020 | 109,019 | 12,522 | 121,541 | **4,862** | | | - 1,062 | **F** |
| | 2030 | 119,569 | 13,474 | 133,043 | **5,322** | | | - 1,522 | **F** |
| | 2040 | 128,376 | 15,079 | 143,455 | **5,738** | | | - 1,938 | **F** |
| D1 Ružinov – Trnávka D 26,5 | 2015 | 83,929 | 11,839 | 95,768 | **3,831** | 90 | **3,760** | - 71 | **F** |
| | 2020 | 92,879 | 12,729 | 105,608 | **4,225** | | | - 465 | **F** |
| | 2030 | 101,986 | 13,695 | 115,681 | **4,628** | | | - 868 | **F** |
| | 2040 | 112,645 | 14,965 | 127,610 | **5,104** | | | - 1,344 | **F** |
| D1 Trnávka – Airport D 26,5 | 2015 | 71,605 | 11,819 | 83,424 | **3,337** | 90 | **3,720** | 383 | **E** |
| | 2020 | 79,620 | 12,868 | 92,488 | **3,700** | | | 20 | **E** |
| | 2030 | 87,325 | 13,845 | 101,170 | **4,047** | | | - 327 | **F** |
| | 2040 | 96,271 | 14,678 | 110,949 | **4,438** | | | - 718 | **F** |
| D1 Airport – Zlaté Piesky D 26,5 | 2015 | 76,035 | 10,697 | 86,732 | **3,470** | 90 | **3760** | 290 | **E** |
| | 2020 | 85,535 | 11,840 | 97,375 | **3,895** | | **3760** | - 135 | **F** |
| | 2030 | 93,813 | 12,738 | 106,551 | **4,262** | | | - 502 | **F** |
| | 2040 | 102,148 | 13,820 | 115,968 | **4,639** | | | - 879 | **F** |
| D1 Zlaté Piesky - Vajnory D 26,5 | 2015 | 61,965 | 9,121 | 71,086 | **2,843** | 90 | **3,366** | 523 | **D** |
| | 2020 | 69,190 | 10,022 | 79,212 | **3,169** | | | 197 | **D** |
| | 2030 | 75,886 | 10,783 | 86,669 | **3,467** | | **3,760** | 293 | **E** |
| | 2040 | 84,376 | 11,223 | 97,599 | **3,904** | | **3760** | - 144 | **F** |
| D1 Vajnory – Senec D 33,5 | 2015 | 65,718 | 11,927 | 77,645 | **3,106** | 130 | **3,937** | 831 | **C** |
| | 2020 | 71,499 | 13,504 | 85,003 | **3,401** | | **3,915** | 514 | **C** |
| | 2030 | 84,957 | 16,000 | 100,957 | **4,039** | | **4,698** | 659 | **D** |
| | 2040 | 93,692 | 17,640 | 111,332 | **4,453** | | | 245 | **D** |
| D4 border of Kittsee | 2015 | 6,299 | 412 | 6,711 | **269** | 90 | **1,164** | 895 | **A** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Jarovce (D2) D 26,5 | 2020 | 7,171 | 457 | 7,628 | **305** | | | 859 | **A** |
| | 2030 | 8,520 | 542 | 9,062 | **363** | | | 801 | **A** |
| | 2040 | 11,195 | 2,607 | 13,802 | **552** | | **1,092** | 540 | **A** |

* Degree A to E - functional level of transport quality that characterize the quality of the traffic flow on the road. Degree F characterizes the unsatisfactory functional level. Highways, expressways and first class roads must meet the functional level of degree C.

Environmental condition of the citizens concerned

One of the important factors affecting the need for the implementation of the construction is a justification in terms of the needs of the population, with respect to the position of the highway, the proposed highway will significantly improve traffic situation in Bratislava and the affected municipalities. This is to eliminate the negative effects of transport on the population - especially noise, vibration and accidents.

*Traffic noise and vibrations*

Anticipated noise and vibration exposure of population in the event of non-implementation of the designed road will definitely multiply due to the impact of the increased traffic on existing roads, while noise and vibration protection measures are virtually insoluble problem given the complexity of investments and land use conditions.

To eliminate noise from the current traffic, noise reducing measures by building noise barriers must be introduced, which impinge on the space-related issue. The second option is to perform a secondary noise reducing measures in the form of reinforcing the envelope of objects by fitting acoustic windows with façade using ventilation sound-absorbing grid.

*Road safety, accident rate*

With the growing intensity of traffic on the road network it is also expected the rise of accidents not only on the roads themselves but also within the municipalities concerned where there is intense movement of pedestrians and transport services related to existing plants.

## *19. Compliance of the proposed with with applicable land-use planning documentation*

The route of D4 highway is defined in the valid land-use planning documentation of Most pri Bratislave, Ivanka pri Dunaji, Bratislava and HTU Bratislava region as follows:

Master Plan of HTU Bratislava region

The valid documentation defines the corridor of D4 in option C red (formerly the prime circuit of Bratislava).

Master Plan of the Slovak Cap. City of Bratislava

The valid documentation defines the corridor of D4 in option C red (formerly the prime circuit of Bratislava).

Master Plan of Most pri Bratislave

The valid documentation defines the corridor of D4 in option A purple (based on the plan).

Master Plan of Ivanka pri Dunaji

The valid documentation defines the corridor of D4 in option C red (formerly the prime circuit of Bratislava).

# *II. ASSESSMENT OF THE PROPOSED ACTIVITY EXPECTED IMPACTS ON THE ENVIRONMENT, INCLUDING HEALTH AND THEIR ESTIMATED RELEVANCE*

When processing the Assessment Report, existing technical documentation, effective land-use planning documentation, opinions on the plan, as well as source documents completed with expert studies were taken into account. At the same time, documents from the actual field survey, discussions and opinions received during processing the report have been delivered.

The core document for the report was an elaborated plan and Feasibility and effectiveness study of the D4 highway. Technical documents, specifications, surveys were developed within the technical documentation and completed within the Assessment Report. Sources of information on the individual components of the environment are given in the relevant chapters, in the bibliography and LUD of Bratislava and affected municipalities.

Overall, the submitted Assessment Report has been prepared from the most recent documents, with adequate own researches and with sufficient details meeting the requirements of the Act no. 24/2006 Coll. on Assessment of impacts on the environment and on amendments to certain laws.

## *1. Impacts on Population*

Population affected

It is hard to quantify the number of affected citizens in the case of highway that is of international significance, while being the backbone of the superior road network in Slovakia, as the assessed activity broadly affects the population outside the affected area. Estimated number of immediately affected citizens in the affected municipalities is evident from the demographic data referred to earlier in the report.

Residents of Most pri Bratislave, Zálesie and Ivanka pri Dunaji will be immediately directly positively affected by reallocating existing traffic on the concerned road network, the travel speed and safety on existing roads will be increased, especially in the residential areas. Positive effects will be felt by reducing negative effects on the environment and reducing time of public bus travellers.

Residents of Podunajské Biskupice will be indirectly positively influenced by interconnection of D4 and Bajkalská Street through the intersection of D4 Ketelec in both options. Unless the connection to Bajkalska street is constructed, unfavourable current status remains, which will be deteriorating with increasing traffic volumes on Svornosti street and adjacent roads.

Residents of Jarovce, Rusovce and Vajnory will be indirectly positively influenced in particular by improving transport accessibility due to capacitive road.

The rest of the population of the region concerned, including residents of the neighbouring countries, will be positively influenced indirectly by improving their access to Bratislava through so-called "outer circuit" from all directions.

The number of directly, resp. indirectly negatively affected residents by assessed options can not be defined as the negative effects will be eliminated by introducing technical measures. Negative impacts may be qualified only during construction, but these will be temporary and minimum, because future construction site, construction yards and access roads are led mostly outside the urban area of the affected municipalities.

Health risks

The current health of the population in the affected municipalities is affected by demographic change (ageing population) and current stress factors in the territory of the agglomeration of Bratislava and surrounding municipalities. Representation of the older population that is physically and mentally more vulnerable than the younger generation, can statistically adversely affect the health of permanent residents.

Health risks are directly related primarily to the hygiene of the environment, which is characterized in case of a construction by increased noise, vibration and emissions production, and also indirectly to road safety.

**Noise levels** were evaluated in the noise study (text annexed), while valid legislation sets out the permissible values determining the noise values in external conditions on the basis of area category, respectively the reference time interval, as follows:

| Category of outer area | Localization of premises in outer area | Permitted outer noise from traffic[a] $L_{Aeq,.p}$[dB] | | | After applying a correction* Permitted outer noise from traffic[a] $L_{Aeq,.p}$[dB] | | |
|---|---|---|---|---|---|---|---|
| | | day | evening | night | day | evening | night |
| I. | Territory with special protection against noise, e.g. spa resorts, spa and wellness facilities | 45 | 45 | 40 | 45 | 45 | 40 |
| II. | Space in front of the windows of residential buildings and houses, the area in front of windows of protected rooms of school buildings, health care facilities and other protected premises, outer space in residential and recreation area | 50 | 50 | 45 | 55 | 55 | 50 |
| III. | Territory as in category II. near highways, Ist and IInd class roads, local roads with public transport, railways and airports, city centres | 60 | 60 | 50 | 70 | 70 | 60 |
| IV. | Territory without the residential function and without protected outside premises, production zones, industrial parks, factory area | 70 | 70 | 70 | 80 | 80 | 80 |

* Chapter 1.6 of Decree no. 549/2007 - If it is proved that the existing noise from the road and railway transport, exceeding the permissible values according to Table 1 for territory category II and III, caused by the gradual increase of traffic cannot be restricted by the available technical and organizational measures without significant disruption to transport performance, the assessed value for the category II may exceed the permissible noise levels from road traffic shown in Table 1 by no more than 5 dB and for category III and IV by no more than 10 dB.

[a] permissible values apply to the dry road surface and terrain free of snow. In case of seasonal facilities, the noise is assessed in conditions that may be anticipated from the operation.

The affected area is under the current legislation included in category II of outer area with the limits specified in the table above. Results of noise conditions assessed according to options and their comparison with the aforementioned allowed hygiene limits (in the PH tables) are as follows:

***cad. area of Jarovce - red option***

| Distance in m | Reference time interval | PH (dB) | ***$L_{Aeq}$ from D4 transport for 2015 in dB*** | ***$L_{Aeq}$ from D4 transport for 2040 in dB*** |
|---|---|---|---|---|
| ***325*** | ***day*** | ***50*** | ***55.0*** | ***57.0*** |
| ***325*** | ***night*** | ***45*** | ***47.8*** | ***49.6*** |
| ***450*** | ***day*** | ***50*** | ***52.0*** | ***54.0*** |
| ***450*** | ***night*** | ***45*** | ***44.8*** | ***46.6*** |

***cad. area of Jarovce - green option***

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***325*** | ***day*** | ***50*** | ***55.1*** | ***57.0*** |
| ***325*** | ***night*** | ***45*** | ***47.9*** | ***49.7*** |
| ***470*** | ***day*** | ***50*** | ***52.9*** | ***54.9*** |
| ***470*** | ***night*** | ***45*** | ***45.7*** | ***47.5*** |

cad. area of Podunajské Biskupice - Lieskové - green option

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***160*** | ***day*** | ***50*** | ***62.1*** | ***63.0*** |
| ***160*** | ***night*** | ***45*** | ***55.5*** | ***56.0*** |

cad. area of Rovinka - red option

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***575*** | ***day*** | ***50*** | ***53.6*** | ***55.8*** |
| ***575*** | ***night*** | ***45*** | ***47.6*** | ***48.8*** |
| ***570*** | ***day*** | ***50*** | ***53.5*** | ***55.8*** |
| ***570*** | ***night*** | ***45*** | ***46.6*** | ***48.5*** |

cad. area of Rovinka - green option

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***310*** | ***day*** | ***50*** | ***57.1*** | ***59.4*** |
| ***310*** | ***night*** | ***45*** | ***50.3*** | ***51.9*** |
| ***740*** | ***day*** | ***50*** | ***49.1*** | ***51.5*** |
| ***740*** | ***night*** | ***45*** | ***42.3*** | ***44.0*** |

cad. area of Most pri Bratislave - both options

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***630*** | ***day*** | ***50*** | ***49.6*** | ***52.1*** |
| ***630*** | ***night*** | ***45*** | ***42.3*** | ***44.9*** |
| ***410*** | ***day*** | ***50*** | ***52.8*** | ***55.4*** |
| ***410*** | ***night*** | ***45*** | ***45.6*** | ***48.2*** |

cad. area of Zálesie and Most pri Bratislave - both options

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***410*** | ***day*** | ***50*** | ***37.1*** | ***39.8*** |
| ***410*** | ***night*** | ***45*** | ***29.7*** | ***32.5*** |

cad. area of Ivanka pri Dunaji - downtown - both options

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***350*** | ***day*** | ***50*** | ***55.8*** | ***58.4*** |
| ***350*** | ***night*** | ***45*** | ***48.4*** | ***51.1*** |
| ***365*** | ***day*** | ***50*** | ***53.5*** | ***56.2*** |
| ***365*** | ***night*** | ***45*** | ***46.1*** | ***48.8*** |
| ***430*** | ***day*** | ***50*** | ***53.5*** | ***56.2*** |
| ***430*** | ***night*** | ***45*** | ***46.1*** | ***48.9*** |

cad. area of Vajnory - both options

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***310*** | ***day*** | ***50*** | ***53.9*** | ***56.2*** |
| ***310*** | ***night*** | ***45*** | ***46.2*** | ***48.8*** |

cad. area of Vajnory - modified option C (option C1)

| Distance in m | Reference time interval | PH (dB) | $L_{Aeq}$ *from D4 transport for 2015 in dB* | $L_{Aeq}$ *from D4 transport for 2040 in dB* |
|---|---|---|---|---|
| ***310*** | ***day*** | ***50*** | ***54.1*** | ***56.3*** |
| ***310*** | ***night*** | ***45*** | ***46.3*** | ***48.9*** |

In terms of these results, exceeding hygienic limits of noise from traffic will occur in some sections of the assessed options. For that reason the technical measures were proposed to ensure the population against the effects of noise in the form of noise barriers (screens). Proposal of noise barriers (PC) within the meaning of the noise study is presented in the following table:

| **Designation** | **Stationing in km** | **Location** | **Length in m** | **Height in m** | **surface in $m^2$** |
|---|---|---|---|---|---|
| **Option C** | | | | | |
| **PC1 (cad. area of Jarovce)** | 0.00 – 2.00 | on the right | 2000 | 3 | 6000 |
| **PC2 (cad. area of P.Biskupice)** | 9.80 – 11.40 | on the right | 1600 | 3 | 4800 |
| **PC3 (cad. area of Most)** | 15.30 – 15.90 | on the right | 600 | 3 | 1800 |

| | | | | | |
|---|---|---|---|---|---|
| **PC4 (cad. area of Ivanka)** | 19.50 – 21.50 | on the right | 2000 | 3 | 6000 |
| **Total** | | | **6200** | | **18600** |
| **Option E** | | | | | |
| **PC1 (cad. area of Jarovce)** | 0.00 – 1.75 | on the right | 1750 | 3 | 5250 |
| **PC2 (cad. area of P.Biskupice)** | 7.70 – 8.75 | on the right | 1050 | 4 | 4200 |
| **PC3 (cad. area of P.Biskupice)** | 10.00 – 10.50 | on the left | 500 | 3 | 1500 |
| **PC4 (cad. area of Most)** | 15.30 – 15.90* | on the right | 600 | 3 | 1800 |
| **PC5 (cad. area of Ivanka)** | 19.50 – 21.50* | on the right | 2000 | 3 | 6000 |
| **Total** | | | **5900** | | **18750** |

* Red option stationing

Given the needed length of noise control measures in terms of the impact of noise on the population, **option E green** is more favourable.

Based on the traffic intensity forecast on the D2 highway, respectively D1 (regardless of the construction of D4), roads in cad. area of Jarovce and Vajnory will be considerably loaded in the near future due to the increase in traffic and it is therefore necessary to address the relevant transport junction area of Jarovce, respectively Ivanka north together with the D4 highway to forecast traffic intensity for each branch of said interchanges including sections of D2 and D1 highway.

**Air pollution** due to traffic on the assessed highway was evaluated in the dispersion study (text annexed).

Pursuant to Act no. 478/2002 Coll. on air protection and Decree no.705/2002 Coll. of Ministry of Environment on air quality, as amended by Decree no. 351/2007 Coll., air quality criteria are expressed by limit values for pollutants that are shown in the following table:

| ZZL | Purpose | Averaged period | Limit value |
|---|---|---|---|
| **Nitrogen oxides $NO_2$, $NO_x$** | **hourly limit value for health protection** | **1 hour** | **200 µg/m$^3$ $NO_2$ not to be exceeded more than 18 times a calendar year** |
| | **annual limit value for health protection** | **calendar year** | **40 µg/m$^3$ $NO_2$** |
| | **annual limit value for vegetation protection** | **calendar year** | **30 µg/m$^3$ $NO_2$** |
| **Carbon monoxide CO** | **limit value for health protection** | **Maximum daily 8-hour average** | **10 mg/m$^3$** |
| **PM Solid particles$_{10}$** | **24-hour limit value for health protection** | **24 hours** | **50 µg/m$^3$ $PM_{10}$ not to be exceeded more than 35 times a calendar year** |
| | **annual limit value for health protection** | **calendar year** | **40 µg/m$^3$ $PM_{10}$** |

Results from the dispersion study compared with the limit values under current legislation are stated in the following table:

| Pollutants | Averaged period | Year | Maximum concentration in the immediate vicinity of the road µg/m$^3$ | | | Limit value for health protection µg/m$^3$ |
|---|---|---|---|---|---|---|
| | | | D4 highway | | Surroundings of D1/D4 intersection | |
| | | | red option C | green option E | | |
| $NO_2$ | 1 hour | 2015 | 61.4 | 60.5 | 300.9 | 200 |
| | | 2030 | 57.6 | 56.1 | 252.4 | |
| $NO_2$ | 1 year | 2015 | 10.5 | 9.7 | 39.0 | 40 |
| | | 2030 | 9.9 | 9.2 | 32.0 | |
| CO | 8 hour | 2015 | 44.5 | 43.6 | 245.4 | 10,000 |
| | | 2030 | 24.6 | 24.0 | 113.9 | |
| PM10 | 24 hour | 2015 | 4.4 | 4.3 | 23.4 | 50 |

*A detailed evaluation of the calculated 1 - hour concentrations of $NO_x$ in relation to the hygienic limit in the affected areas are presented in the following table.*

| Locality | Distance from D4 in m | Year | Maximum concentration in residential area µg/m$^3$ | Limit value for health protection µg/m$^3$ | Percentage of limit |
|---|---|---|---|---|---|
| 1 Jarovce | 380 | 2015 | 20 | 200 | 10 |
| | | 2030 | 19 | 200 | 9.5 |
| 2 Podunajské Biskupice | 660 | 2015 | 92 | 200 | 46 |
| | | 2030 | 108 | 200 | 54 |
| 3 Rovinka | 740 | 2015 | 35 | 200 | 17.5 |
| | | 2030 | 24 | 200 | 12 |
| 4 Most pri Bratislave | 530 | 2015 | 30 | 200 | 15 |
| | | 2030 | 25 | 200 | 12.5 |
| 5 Zálesie | 1 100 | 2015 | < 5 | 200 | 2.5 |
| | | 2030 | < 5 | 200 | 2.5 |
| 6 Ivanka pri Dunaji | 330 | 2015 | 34 | 200 | 17 |
| | | 2030 | 30 | 200 | 15 |

*1 - km 0.400-1.100 - northern edge of Jarovce*
*2 - km 10.500-11.500 - southern edge of Podunajské Biskupice*
*3 - km 10.500-11.500 - northern edge of Rovinka*
*4 - km 15.200-15.600 - western edge of Most pri Bratislave*
*5 - km 18.300-18.600 - western edge of Zálesie*
*6 - km 19.500-20.700 - western edge of Ivanka pri Dunaji*

**With regard to the above results, the residents nearby the D4 highway route will not be influenced by excessive air pollution from traffic, allowable concentrations of pollutants in the air in a residential area are not exceeded even under the most unfavourable dispersion conditions and any measures do not need to be introduced.**

The most unfavourable situation is in Podunajské Biskupice, which is not due to the D4 highway, which runs at a sufficient distance from this municipality, but due to the road I/63, which passes directly the municipality with forecast transport intensity of 32,687 vehicles per day in 2015 and 42,514 in 2030.

The most unfavourable place in terms of immission load is in the area of the intersection of D1 and D4 and D4 with the road I/61, where there is a significant accumulation of effects. Maximum 1-hour $NO_2$ concentrations in the immediate vicinity of the intersection will reach 300.9 mg/m$^3$ in 2015, which is about 50% exceeding the permitted limit. The concentrations of pollutants are decreasing proportionally with distance from the roads. On the edge of Ivanka pri Dunaji the value of $NO_x$ declines to about 34 mg/m$^3$, which is well below the threshold of 200 µg/m$^3$.

In terms of immission load there are no substantial differences between two options assessed, in terms of the impact on air quality they may be considered equivalent.

Health risks to the immediately affected population, however, will be present mainly during construction, these risks will be temporary and minimized thanks to appropriate organization of construction, location of the construction yards and access roads.

Impacts on the quality of life and well-being

The disruption of well-being and quality of life means primarily the negative effects on the fundamental factors in the environment for residents of municipalities (quality of housing, the quality of essential elements of the environment - notably air, water and environmental hygiene, subjective factors of perception of the environment). It is understood that during direct construction work of highways, the previously established way of life and the quality of the environment will change, and these changes are mostly negative, however, are temporary.

Factors influencing the well-being and quality of life can be regarded as direct and indirect effects of construction activities associated with the construction of highway and implementation of related investments e.g .:

- increased intensity of freight transport with subsequent increase in noise, dust and general traffic especially in the area of construction yards and larger construction objects
- disruption of the long-term perception of landscape (new technical elements in the landscape).

After putting the structure into operation, however, the benefits of the activity will be immediately apparent for the inhabitants of affected municipalities by redistribution and subsequent reduction in transport intensity on the road network, which will occur as a result of the use of the new section of the highway. Reducing traffic load will improve the quality of life and well-being especially for residents near the roads leading through the urban areas by reducing noise, vibration and emissions, by increasing traffic safety and accident risk. As a result of that positive change, there will be the decrease in fuel consumption and operating costs of users of the highway section.

**Social and economic impacts**

Social and economic effects of the structure are reflected in the traffic parameters by redistributing traffic after using the new structure, but also in the initial part of the relevant road network, and this is by reaching a higher driving speed, travel speed and safety of users and by reducing the negative impacts on the affected population, as a consequence of higher quality of the new structure compared to the deteriorating status quo.

The economic effects will be felt mainly for the final customers of the section of road network by decrease in the costs related to transport of goods and people, respectively to the operation of their vehicles. The social effects will be demonstrated for road users by increasing their road safety and reducing the negative effects on the environment. They will also be seen in a decline in travel time for passenger cars and buses.

## 2. Impacts on rock environment and relief

The direct and indirect impacts of the proposed activity on the rock environment and relief can be included:

- intervention in the rock environment and relief with natural body of the highway as a direct impact
- possible contamination of the ground as an indirect impact

Interventions in the rock environment and relief represented especially by digging slit (sealing bath at 17.5 to 18.8 km) and sections of high embankments can be characterized as a permanent, irreversible and long-term impact on geological environment and relief. Impacts are identical for both options.

The presence of well-permeable soils indirectly determines the possible pollution of the rock environment during the highway construction and also during its operation in a collision of vehicles carrying dangerous substances, which can be characterized as a state of emergency. If they are activated, it would cause permanent, irreversible condition producing additional costs for necessary remediation.

The adverse impacts arising from the construction and operation of the road can be mentioned optimizing the road conduct in terms of intervention in the rocks and relief and preventing progressive evolution of current geodynamic processes by appropriate technical measures.

## 3. Impacts on Climate

Implementation of construction will not cause changes in local climate elements, respectively their change due to implementation will not be proved. More significant microclimate changes (due to landscaping, etc.) will more likely affect the structure itself, respectively activities related to its operation.

## 4. Impacts on Air

Air condition in Bratislava is monitored by automatic monitoring stations, which are located at: Trnavské mýto, Turbínová st., Mamateyová st. and Kamenné Square. The most involved in air pollution are the monitored pollutants: nitrogen oxides, sulfur dioxide, airborne dust, carbon monoxide, ozone, lead, cadmium. In general, the highest values are achieved by the indices calculated for daily values $IZO_d$ under which Bratislava is ranked among areas with high level of air pollution. Based on average figures of measured values and numbers of exceeded limit values of pollutants, the SHMI in accordance with § 9 paragraph 2 and 3 of the Air Protection Act no. 478/2002 Coll. proposed for defining the areas of air quality management the whole agglomeration of Bratislava for pollutants of $PM_{10}$ and $NO_2$. Bratislava agglomeration is included in:

Group 1 - by the level of air pollution by $NO_x$ and $PM_{10}$, which is higher than the limit value; the limit value is increased by the margin of tolerance,

Group 2 - under the ozone concentration, which is higher than the long-term objective for ozone, but below or equal to a target value for ozone,

Group 3 - based on levels of air pollution by $SO_2$, Pb, CO and benzene (classification based on a preliminary assessment of air quality), which is below the limit values, or the limit value is increased by the margin of tolerance.

The activity assessed by the dispersion study will not significantly affect the current air quality in the affected area, on the contrary, diversion and redistribution of transport outside the central part of Bratislava to the open landscape will reduce the concentration of air pollutants in urban areas.

The final assessment of the proposed activity in air pollution is part of the dispersion study set out in the text annexes to the report.

## *5. Impacts on Water*

Contamination of water flowing down from the road surface is caused by the contents of a number of pollutants, while waste water may have a negative impact on the quality of surface and groundwater. The intensity of impact is dependent on the concentration of pollutants, climatic, hydrological and hydrogeological conditions.

Surface water

Impacts on surface water represent a threat to surface water quality during construction and operation of highway, which is essentially equivalent for both options.

During the construction we can expect a threat to water quality in establishing the pillars of the bridges crossing surface streams and water areas in both options, respectively during necessary adaptation of Biskupické arm in option E.

D4 highway bridges the Danube and adjacent system of arms and channels at 3.0 to 4.8 km of option C, respectively at 2.7 to 4.6 km of option E, while the proposed bridge pillars will be directly installed in Jarovské arm. D4 highway then bridges the Little Danube and water area of gravel pit called Zelená voda at 16.8 to 17.5 km. The direct threat to the quality of surface water can be caused by leakage of pollutants directly into water from construction machinery, respectively during accidents.

During operation, the quality and mode of surface water is threatened in the affected flows due to the entry site of the waste water drained from the highway to the respective recipients (Danube, Little Danube, Šúrsky channel); according to the technical solution, however, it is considered before the outlet to purify the water in ORL, or hold them in the retention basins.

Groundwater

Given that the whole section of the assessed options crosses the area of highly permeable rocks (gravel sand sediments) and substantial underground water reserves, a part of the affected area is also one of the major sources of drinking groundwater (PWMA Rye Island) and close to the highway there are very important groundwater sources (WR Rusovce - Mokraď - Ostrovné lúčky, WR Rusovce), it is necessary to the pay attention to protection of groundwater during construction and operation. Expected impacts are identical for both options.

In the construction phase there may be a threat to the quality of the groundwater especially in the earthwork, which will reach the groundwater level, in installing sealing baths and bridges that will intervene in the groundwater collector - sand-gravel layers. Groundwater contamination may occur through leakage of dangerous substances directly into an open groundwater level in the trenches and digging of foundations (piles, ground walls), respectively indirectly through leakage to sand-

gravel horizons which are highly permeable and groundwater contamination may be caused by leakage of pollutants to watered horizons.

During operation, based on hydrogeological and protection limits within the technical solution, a road drainage has been designed for both assessed options, which in normal operation of the highway provides protection of ground water against negative influences. However, it is being considered a partial inlet of waste water from the road, respectively from the operation of the parking area into the rock environment by infiltrating, waste water will be purified in ORL according to the technical solution before the inlet, which will ensure the groundwater quality.

To assess the potential impacts of the proposed sealing bath at 17.5 to 18.8 km (excavated tunnels of Zálesie and Ivanka were excluded from the original technical solution) on the mode and groundwater flow in the affected area, a hydrogeological assessment has been processed in the report, which is indicated in the text annexes. The result of the assessment is a possible influence of the mode and the groundwater flow in the area of the proposed sealing bath due to the barrier effect of the designed structure, which can cause a swelling of groundwater level against this barrier and decrease in groundwater levels behind this barrier, thus it is necessary to propose effective measures to minimize the impact.

The sealing bath at the end of the relevant section when crossing the D4 and D1 was, following the review of vertical alignment (modification of option C - option C1), excluded in view of the possible effect on the groundwater flow and mode same as the sealing bath at 17.5 to 18.8 km.

Natural healing water

There are no natural healing water in direct contact with the structure. There is IInd degree PZ of Čilistov in the wider area. The impact of the structure is not expected given the hydrogeological collector of the water.

## *6. Impacts on Soil*

Among indirect impacts of the proposed options, in addition to the permanent and temporary land use, there is also the impact on the quality of soils.

Permanent and temporary land use

Permanent and temporary land use areas were calculated in the technical documentation based on the expected land shape of the proposed options and are listed in the following table.

| *Option* | *Permanent use of ALU and FLU in total ($m^2$)* | *Temporary use of ALU and FLU in total (m2)* |
|---|---|---|
| ***C red*** | 1,430,942 | 317,135 |
| ***E green*** | 1,422,346 | 439,529 |

The forest land use (FLU) will occur in option C between 4.8 and 5.8 km (about 4.01 hectares), in option E between 4.6 and 5.4 km (about 2.9 hectares). Subsequently, the land use will also occur at 16.0 km (about 0.21 ha), 19.1 (about 0.01 ha), 19.3 (about 0.04 ha) and at Ivanka - West interchange (about 3.09 ha). In total for option C, the FLU will represent **7.36** ha and for option E **6.25** ha.

Impacts on quality of soil

During construction, given the use of heavy machinery we can count with degradation, compaction of the soil profile and potential soil intoxication near the construction, handling belts and the construction yards. Given construction impacts during construction of the road, it can be expected a change in the quality of soil in the immediate vicinity of the highway and in areas reclaimed after temporary land use. The changes in quality are reflected depending on the restoration and reclamation.

Another change in the quality of soil is a possible contamination of soil during construction and operation of the road. During construction, the most vulnerable sites to accumulation of works are around the larger structures, construction yards, parking areas of machinery and equipment. Soil contamination during operation of the road depends on several factors:

- the mere production of substances contaminating the soil (exhaust gases, winter maintenance equipment);
- distance from the kerbside,
- buffering capacity of the soil (soil resistance to anthropogenic-based acidification).

Following the current researches and measurements the impact of road and highway traffic on the environment can be characterized as follows:

- about 70 to 90% of the emitted amount of metals from transport are depositing close to the road at a distance of 3 to 30 m.
- pollution is mainly bound to the surface layer of about 25 cm.

Based on observations of the impact of exhaust gases on vegetation, it is possible to consider the zone of the possible negative effect on soil within about 30 m from the road. Possible soil contamination depends on the permeability and damping (buffering) ability of soils. The buffering capacity of the soil in assessed area is good given the physical and chemical properties, the decisive factor for possible contamination is the permeability of soil and substrate. A special case of potential soil contamination are car accidents associated with leakage of fuel or transported chemicals. This produces a local soil pollution, which will require timely clean-up work to avoid contamination to penetrate into groundwater.

## *7. Impacts on Flora, Fauna and their Habitats*

Line structures represent a substantial risk for biodiversity conservation. It can be threatened directly (extinction of species at destroyed or degraded habitats) and indirectly (e.g. loss of food sources for certain species, their isolation and inability to overcome the distance between natural habitats). If the habitats and populations living in are fragmented into small groups and the link between them is disturbed, their long-term existence may be disrupted. Small and isolated populations are vulnerable to extinction due to inbreeding. This, however, relates mainly to line elements such as highways and expressways that form a hardly surmountable obstacle in the area. In recent years, a significant impact on the game is represented also by the noise that must also be defined as negative.

When assessing the impact of the proposed activity, direct, indirect, secondary, cumulative, synergistic, short-term, temporary, long-term and permanent projected impacts must be taken into account and effects caused during construction and operation of the proposed activity.

In general, the impacts of the proposed options on the fauna, flora and their habitats can be divided as follows:

- primary (disappearance of habitat due to construction of roads),
- secondary (killing of animals, fragmentation of habitats, pollution by salting materials, exhaust fumes, noise, light, changes in the hydrological regime, climate etc.),
- tertiary (penetration of new, often invasive species into the environment, the construction of the highway will also bring the development of human settlements, technical infrastructure, industry, recreation etc.)

In assessed sections of the highway, it will in particular be the following impacts that may be seen during the preparatory work, the construction itself and then also during operation:

- direct damage and destruction of habitats,
- tree felling,
- killing of animals,
- creating a barrier in migration corridors,
- fragmentation of habitats,
- noise, light load of animals,
- air pollution.

In view of these impacts, both options will be identical, the difference is, however, in affecting the habitats.

For **option C**, a habitat of Community importance **Ls1.1 Willow-poplar lowland floodplain forests (91E0 floodplain willow-poplar and alder forests)** will be directly destroyed in the following approximate range and social value in terms of MoE Decree No.24/2003 Coll. implementing the Act no.543/2002 Coll. on nature and landscape protection, as amended:

26,430 $m^2$ x 17.92 €/$m^2$ x 2 = **947,252 €**

For **option E**, a habitat of Community importance **Ls1.1 Willow-poplar lowland floodplain forests (91E0 floodplain willow-poplar and alder forests)** will be directly destroyed in the following approximate range and social value in terms of MoE Decree No.24/2003 Coll. implementing the Act no.543/2002 Coll. on nature and landscape protection, as amended:

20,010 $m^2$ x 17.92 €/$m^2$ x 2 = **717,158 €**

The area includes all sites with habitats of Community importance in the routes of individual options, while for option E, the said habitat is located outside the ÚEV Biskupické floodplains and for option C, about 2/3 of the size of the destroyed habitat are situated in ÚEV Biskupické floodplains and 1/3 is beyond the territory.

In option C, there will be a stronger (compared to option E) impact on the habitats of species of Community importance for which the ÚEV Biskupické floodplains is declared. This is particularly related to the habitats of species such as great capricorn beetle *(Cerambyx cerdo)*, and stag beetle *(Lucanus cervus)*.

Other habitats in the vicinity of the highway will be indirectly negatively affected by noise and air pollution. The scope of the effect can be defined from the results set out in the noise and dispersion study.

In both options, there will be a disposal of other forest habitats in the area of the Danube, they are not protected, but they have a strong potential in the appropriate manner of management and care to achieve the criteria for inclusion to the habitats of Community importance. Even in present state they provide within protected areas a space for the existence of protected animal species and this area will be reduced due to highway construction. Reducing the area of ruderal habitats crossed by the highway will represent, with respect to the total surface area in a given space, a less significant impact on the biota of the affected area.

The tree felling will occur during the construction of the highway, either in the route of option C or E. More precise specification of the range will be possible in the next stage of structure preparation. The tree felling will be concentrated, as well as activities in forest habitats, in the Danube area and the places of crossing the highway route with line and areal elements of non-forest tree and shrub vegetation in the agricultural landscape. Sites with extensive tree felling are highlighted in the text annexes.

The killing of animals will be an ongoing activity during operation of the highway. Some animals are attracted by hot bitumen road (e.g. reptiles), others will be attracted by the available food (e.g. already-killed animals). Killing of particularly less mobile species will occur already during construction.

Highway barrier effect with respect to animal migration in migration corridors will start acting during construction and will continue throughout operation. In the sections of the highway passing through bridges the barrier effect seems more significant during construction, after construction it will be reduced to a minimum.

Habitat fragmentation is considered one of the main causes of today's extinction. Roads and railways crash animal populations into smaller, often isolated units. Smaller populations are becoming less stable, exposed to greater predation pressure, reducing the availability of shelter and food, and may be threatened by inbreeding and genetic disorders. Consequences of fragmentation can be partly mitigated by establishing crossings through migration barriers. This, however, solves only the problem of insulation but not loss of interior habitats.

Noise and light load around the highway will be particularly disturbing to wildlife. Hearing of many species is more sensitive than hearing of people. The reactions of each species present in the corridor of the highway on the mentioned stress factors are highly individual. Some species are unable to get adapted to these changes, but most of them prefer to avoid noisy areas. In general, we can say that the noise makes their mutual communication, mating and hunting difficult. In relation to wildlife, no exact values of noise are set up that would not have disturbing effect on them. Loading the vicinity of the highway with noise acting on wildlife is documented in a separate noise study.

Based on the results referred to in the dispersion study we can conclude that the annual limit value for the protection of vegetation ($30\mu g.m^{-3}$ $NO_x$) will be not be exceeded when passing the proposed options of the highway through attacked habitats.

## *8. Impacts on the landscape - the structure and land use, landscape image*

The landscape scenery of the assessed area is determined by the deployment of a positive perception of landscape elements in the heavily urbanized and agricultural land. The technical and urban features, such as mass housing, industrial sites, engineering works (roads, power lines, etc.) are largely negatively perceived elements in the landscape. In this regard, we must consider the

status of new technical element in landscape scenery, which would be a new highway. This will be strongly apply mainly in relief-exposed areas and protected areas of nature and landscape.

The range of influencing the landscape scenery by implementing the assessed options depends primarily on the nature of the technical intervention in the landscape. Both options will be significantly disturbing in the landscape scenery due to their considerable barrier effect, but only in protected areas of nature and landscape. The major part of the route of the assessed options, however, consists of agricultural land near the Bratislava agglomeration, where the negative effect of the new line of highway in the are will not be manifested. The use of the narrow corridor from agricultural production to transport infrastructure will be changed in the highway corridor. However, given the strong pressure of urbanization around Bratislava, which requires another especially agricultural land use, the proposed highway is acceptable in the landscape and its negative impact will be manifested only in a short section of highway crossing through the territory of the Danube floodplains. The design of the highway in this section on the bridge will partially mitigate the negative impact on that territory, while option C is slightly less favourable in terms of length of passage through the protected area.

The landmark in the landscape scenery will be the bridge over the Danube, this can be architecturally incorporated into the landscape so that it will not affect the overall landscape image of the Danube floodplains. In this regard, we consider the bridge designed in option E green as better.

## *9. Impacts on Protected Areas and Protection Zones*

**Impacts on protected nature and landscape areas of Natura 2000**

The highway route in terms of Act no. 543/2002 Coll. on nature and landscape protection, as amended, passes through the first to fifth level of protection.

In terms of impacts of the proposed highway on nature protected areas and NATURA 2000 areas, the following can be expected:

- direct land use of parts of protected areas,
- impact on migration,
- stress factors (noise and dazzling with spotlights) putting load on the affected parts of protected areas,
- air pollution in protected areas.

The identified effects of the assessed options are specified in the following table:

| Protected area / degree of protection under the Act 543/2002 Coll. (total area) | Direct land use | | Territory affected by the noise up to 50 dB | | Territory affected by the noise over 50 dB | | Proposed options |
|---|---|---|---|---|---|---|---|
| | ha | % of the total area | ha | % of the total area | ha | % of the total area | |
| PLA Dunajské luhy / 2nd degree (12,284 | 3.89 | 0.03 | 267.13 | 2.17 | 178.52 | 1.45 | E |
| | 4.81 | 0.04 | 363.35 | 2.96 | 248.34 | 2.02 | C |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ha) | | | | | | | |
| NR Dunajské ostrovy / 5th degree (219.71 ha) | 0.00 | 0.00 | 0.53 | 0.24 | 0.00 | 0.00 | E |
| | 0.00 | 0.00 | 41.5 | 18.89 | 0.00 | 0.00 | C |
| NR Gajc / 4th degree (62.72 ha) | 0.00 | 0.00 | 47.03 | 74.98 | 29.32 | 46.75 | E |
| | 1.64 | 2.61 | 62.72 | 100.00 | 60.21 | 96.00 | C |
| NR Kopáčsky ostrov / 5th degree (82.62 ha) | 0.00 | 0.00 | 46.66 | 56.48 | 24.1 | 29.17 | E |
| | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | C |
| NR Topoľové hony / 5th degree (60.06 ha) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | E |
| | 0.00 | 0.00 | 10.48 | 17.45 | 0.00 | 0.00 | C |
| ÚEV Biskupické luhy (869.03 ha) | 3.5 | 0.40 | 218.41 | 25.13 | 158.09 | 18.19 | E |
| | 3.96 | 0.46 | 265.68 | 30.57 | 163.31 | 18.79 | C |
| ÚEV Ostrovné lúčky (613.56 ha) | 0.00 | 0.00 | 0.66 | 0.11 | 0.00 | 0.00 | E |
| | 0.00 | 0.00 | 42.47 | 6.92 | 25.52 | 4.16 | C |
| PWMA Dunajské luhy (16,511.58 ha) | 12.44 | 0.08 | 566.31 | 3.43 | 412.95 | 2.50 | E |
| | 12.77 | 0.08 | 617.82 | 3.74 | 444.94 | 2.69 | C |
| Ramsar site Dunajské luhy (14,488 ha) | 6.42 | 0.04 | 386.32 | 2.67 | 262.54 | 1.81 | E |
| | 7.58 | 0.05 | 496.45 | 3.43 | 345.15 | 2.38 | C |
| Total | **26.25** | option **E** (green) | | | | | |
| | **30.76** | option **C** (red) | | | | | |

The table below shows that the **option C is less favourable** given the greater land use of protected areas.

The overview of impact of the assessed options on protected areas is presented as follows:

*Impact on the protected landscape area of Danube floodplains*

*Option C red (4.7-5.2 km), E green (4.5-5.3 km)* - the highway in both options is mostly conducted by the bridge, **direct land use** of the protected area, **direct impact** of noise and lighting. The direct impact of noise and lighting is significant for option C (Jarovské arm).

*Impact on Nature Reserve of Danube islands*

*Option C red* - the highway is conducted by the bridge, **out of** the protected area, **direct impact** of noise and lighting (route runs close to the borders of NR - Jarovské arm).

*Option E green* - the highway is conducted by the bridge, **out of** the protected area, **out of** the impact of noise and lighting.

*Impact on Nature Reserve of Gajc*

*Option C red (4.8-5.1 km)* - the highway is conducted by the bridge, **direct land use** of the protected area, **direct impact** of noise and lighting.

*Option E green* - the highway is conducted by the bridge, **out of** the protected area, **direct impact** of noise and lighting (route runs close to the borders of NR).

*Impact on Nature Reserve of Kopáčsky island*

*Option C red* - the highway is conducted by the bridge, **out of** the protected area, **out of** the impact of noise and lighting.

*Option E green* - the highway is conducted by the bridge, **out of** the protected area, **direct impact** of noise and lighting.

*Impact on Nature Reserve of Topoľovské hony*

*Option C red* - the highway is conducted by the bridge, **out of** the protected area, **direct impact** of noise and lighting.

*Option E green* - the highway is conducted by the bridge, **out of** the protected area, **out of** the impact of noise and lighting.

*Impact on site of Community importance of Biskupické luhy*

*Option C red (4.8-5.1 km), E green* - the highway in both options is mostly conducted by the bridge, **direct land use** of the protected area, **direct impact** of noise and lighting.

*Impact on site of Community importance of Ostrovné lúčky*

*Option C red* - the highway is conducted by the bridge, **out of** the protected area, **direct impact** of noise and lighting (route runs close to the borders of NR).

*Option E green* - the highway is conducted by the bridge, **out of** the protected area, **out of** the impact of noise and lighting.

*Impact on the protected bird area of Danube floodplains*

*Option C red (3.0-5.4 km), E green (2.7-5.3 km)* - the highway in both options is mostly conducted by the bridge, **direct land use** of the protected area, **direct impact** of noise and lighting.

*Impact on Ramsar site of Danube floodplains*

*Option C red (3.0-3.2 km and 4.1-5.7), E green (3.9-5.3 km)* - the highway in both options is mostly conducted by the bridge, **direct land use** of the protected area, **direct impact** of noise and lighting. The direct land use and impact of noise and lighting is significant for option C (Jarovské arm).

Impact of migration can be defined as the total effect on the movement of animals in the affected area of conservation. For terrestrial, semi-terrestrial, aquatic and semi-aquatic animals their migration will be restricted at minimum after putting into operation, given the technical solution of the highway (through the affected area the route is mainly conducted through bridges). Migration of avifauna will be affected mainly by the construction of the Danube Bridge as a partial barrier. Appropriate solution to minimize the impact on migration and overflow of birds in the area seems to be the bridge designed in option E green, due to its lower structure with clearly identifiable structural elements for migratory birds more favourable than hanging rope bridge with high pilons designed in option C red.

To minimize stress factors (noise, dazzling) the recommendations indicate proposed noise barriers, which may also form screens against dazzling while ensuring their multi-functionality. The overview is identified in the table below:

| Designation | Stationing in km | Location | Length in m | Height in m | surface in $m^2$ |
|---|---|---|---|---|---|
| **Option C** | | | | | |
| **PC1** | 2.90 – 7.50 | on the right | 4600 | 2 | 9200 |
| **PC2** | 2.90 – 5.80 | on the left | 2900 | 2 | 5800 |
| **Total** | | | **7500** | | **15000** |
| **Option E** | | | | | |
| **PC1** | 2.60 – 5.50 | bilateral | 2900 | 2 | 11600 |
| **Total** | | | **5,800** | | **11600** |

A review of the required length of noise barriers clearly shows that the option C is less favourable in terms of stress effects on protected areas.

The impacts are further evaluated in details in a separate study in text annexes.

**The impact on protected water management area of Rye Island and water resources**

The two proposed options are located in **PWMA Rye Island** practically in the same length in the section at about 4.0 to 16.9 km, their effect is the same and pose a risk of contamination of ground water reserves in the PWMA. Identified impacts can be classified as in the previous part of the report - the groundwater.

Option C is conducted near protection zones of PHO 2 outdoor **VZ Rusovce.** The direct impact on VZ is not expected, groundwater quality may be indirectly threatened near VZ of similar extent as in the previous part of the report - the groundwater.

## *10. Impacts on Territorial System of Ecological Stability*

The impacts of the highway on the national bio-centre NRBc of Bratislava floodplains will be similar as the impacts on the protected areas that are part of bio-centres, respectively they involve the bio-centre. In option C a direct use of the bio-centre will happen. The impacts of option E will be similar with the exception that the route of option E is conducted in relatively less valuable (working) part of the bio-centre.

Highway barrier action for migration and exchange of genetic information of living organisms and their communities through bio-corridors (PBk Danube and NRBk Little Danube) in both options will be mitigated by the fact that highway will cross corridors at the elevated level. The nature-less section of bio-corridor under bridges with a width of about 45 m will not pose an insurmountable barrier for most organisms, however, the functioning of terrestrial parts of bio-corridors will be limited in these parts.

The highway impact on regional bio-corridor RBk Bratislava floodplains - the Bažantnica, designed in concurrence with the highway route, will depend on the particular circumstances following the completion of these two objectives. Since the bio-corridor is now broken, it can not exactly specify the effects on this TSES element.

The engagement of local TSES elements comes at 19.1, 19.3 km and at the Ivanka - West interchange. The engagement is the same for both options.

Among the identified impacts on TSES the following can be stated for the evaluated options in terms of subregional and regional aspect, while the effect of negative factors will be similar as for the protected areas in the phase of construction and operation of highway.

*NRBc Bratislava floodplains*

*Option C red (2.9-7.2 km), E green (2.4-6.7 km)* - the highway in both options is mostly conducted by the bridge, **direct land use** of the NRBc area, **direct impact** of noise and lighting.

PBk Danube, NRBk Little Danube

*Option C red, E green -* passages through the corridors can be considered in both options for the same (width of the corridors can not be precisely defined), highway barrier action for migration, however, will be mitigated by the fact that the highway crosses the corridors at elevated level. The most significant effects will be felt during the construction and early operation. Migration of animals after a certain time will adapt to new conditions and bio-corridors will continue working.

## *11. Impacts on Urban Complex and Land Use*

Construction of the D4 highway will fundamentally change land use in the affected part of the territory. The largest part of the area of proposed options today is taken up by agricultural land. The intensity of land use will be influenced by the road only temporarily during construction, during operation, no important effects on the intensity of land use are expected due to the fact that all the technical measures to eliminate adverse effects will be implemented.

Impact on the urbanization of the territory

Both options are under current LUD located outside the existing built-up area of Bratislava and affected municipalities and the construction does not require the demolition of permanent structures. Regarding temporary buildings, it will need to remove the restaurant facility placed on the dam at 3.0 km in red option, respectively to relocate floating cottages (houseboats) on Jarovské arm in the route of bridges. It will also be necessary to remove the garden house at 5.9 km in green option.

At 7.7 to 8.5 km the highway route in green option bypasses the local part of Lieskové in the north where there are several houses, besides the production plants. The highway route does not extend into the built-up area, but negative impacts can be expected during construction. During operation the site is protected by noise control measures against the effects of noise.

Both options, however, collide with surfaces of prospective urbanization of the affected area, that is the cadastral area of Jarovce - areas of prospective civil amenities - green option at 1.600 to 2.500 km and red option at 1.500 to 2.860 km. Prospective areas of sports and recreation (ARST Jarovské arm) will be crossed by green option at 2.7 to 3.9 km, by red option at 3.0 to 4.1 km. At 17.0 to 17.9 km (red option stationing) both options intervene in a prospective recreation area of Zelená voda in the cadastral area of Most pri Bratislave.

Conflict of the airport interests has been solved in the Feasibility study, at 21.1 km (red option stationing) the highway route is in contact with the radio-beacon, it will need to address the security of the object (building of replacement, shifting the highway route).

The impacts of the highway route on the objects of the Ministry of Defence were discussed with the authorities concerned, while the highway will be in contact with an underground unit of the Ministry of Defence at about 1.5 km (red option stationing).

Impacts on land use

The area of proposed options of D4 are predominant by agricultural land use, i.e. the most significant impact on agricultural production. The highway route passes from 8.250 to 8.600 km in red option through the gravel mining area of ANČETA company. Mining is to be completed this year and the mining pit will be backfilled with soil and landscaped in original condition. From 17.230 to 17.400 km (red option stationing) the highway is led through the current space of gravel mining in the cadastral area of Most pri Bratislave. Mining is to be completed in 2012, it is required to consider a bridge on D4, given that after the completion of mining in this area, there will remain a lake.

## *12. Impacts on cultural and historical monuments*

Option C red at 10.350 km and option E green at 9.710 km crosses the **protected cultural and technical monument** - the original flood protection dike (implemented during the Austro-Hungarian Empire under the reign of Maria Theresa) as part of a secondary flood line (Upper Rye Island dike).

## *13. Impacts on archaeological sites*

Some archaeological findings may be expected in cadastral area of Jarovce and Rusovce that will require an archaeological survey.

## *14. Impacts on palaeontological sites and important geological sites*

No important paleontological sites or geological sites have been discovered in the area.

## *15. Impacts on Intangible Cultural Values*

The proposed options or their possible construction will not affect the intangible cultural values.

## *16. Other Impacts*

**Impacts on Agriculture**

The area of proposed options of D4 is dominated by agricultural land use. The impact of the project on agricultural production will be negative in terms of agricultural land use, while the size of the permanent agricultural land use in the area concerned depends on the proposed option. When dividing the agricultural areas by the highway, their accessibility for maintenance shall be ensured.

At 18.5 to 19.0 km (red option stationing) the highway route runs close to the area of a farm. The impact on this farm will be felt only during construction, access to the premises must be permanently secured.

**Impacts on Forests**

Impact of construction and operation of the proposed action on forestry will be mainly in the separation of forest vegetation by the highway route. During construction and operation the access to the forestry activities shall be ensured.

**Impact on hunting and fishing**

Impact on the activities of hunters and fishermen in the affected area will be particularly important in the construction period, when the activity will be significantly restricted (establishment of a bridge directly in the waters of Jarovské arm, construction of the highway right in hunting areas). After completion of construction and during operation, mainly hunting activity will be partly reduced with respect to the occupation of hunting areas by the highway and due to excessive noise the game will probably move to quieter areas of the Danube floodplains, which will cause the changes to the frontier of the hunting grounds.

**Impact on water management**

In terms of the impact of construction and operation of the highway on water management it can be considered significant impacts such as direct impacts related to crossing existing hydro-meliorations and indirect effects related to the existence of water management important areas and protection zones of water resources in the wider area through the possible contamination of groundwater. The impact on the affected hydro-meliorations is solved in the technical design of the D4 highway, impacts on PWMAs and water resources have been described in previous sections hereof.

According to Decree no. 211/2005 Coll. of the MoE, the important water management watercourses are the Danube under Bratislava at 1,708.2 to 1,850.2 rkm and above Bratislava at 1,872.7 to 1,880.2 rkm, the Little Danube and Šúrsky channel throughout the entire section. Within Gabčíkovo Water Dam, there is a seepage canal of Janíkov dvor - Jarovce - Rusovce - Čunovo. The water facilities are respected within the technical design of the D4 highway.

Šúrsky channel according to the administrator´s data SVP, OZ Danube Basin, Management of internal waters of Šamorín was built to drain all the watercourses flowing down from the Little Carpathians. But the mouthed streams were not protected against alluviation, so the channel became sludgy over time. Mouth of Vajnorský waste then required the deepening of the channel. The flow is now regularly maintained, there is a sporadic tree stand on the banks, river bed is overgrown with aquatic plants. D4 highway route is situated near the channel by digging groove (sealing bathtub). The flow administrator requires for ensuring the maintenance and protection of the channel to keep min. 10 m, and in exceptional cases 5 m wide operating strip from the foot of the dam until D4 highway.

**Impact on flood protection of the area**

The route crosses the flood protection dikes of the Danube and that is the right bank at 3.0 km (red option) and at 2.650 km (green option), left bank at 4.8 km (red option) and at 4.6 km (green option). The flow administrator requires for ensuring the maintenance and protection of dikes to

keep min. 10 m wide operating strip from the foot of the dike. In installing pillars of bridges the technical solution of dams shall be also respected (prolonged sealing asphalt layer).

**Impacts on industrial production and technical sites**

The proposed road does not directly affect (possible demolition) any of the industrial, production and other technical sites. It can favourably affect some production and entrepreneurial activities within the region.

D4 route extends into the mining area of gravel in Ketelec what was mentioned in the previous sections of the report. According to the data obtained, these deposits are to be mined and reclaimed at the time of highway construction, so that they will not be affected. Impact on gravel extraction in the cadastral area of Most pri Bratislave was mentioned in the previous section of the report

At 3.1 km of the red option, the highway route passes nearby Bratislava water company and at 11.900 to 12.300 km (red option stationing) passes near the Slovasfalt´s packaging plant, but it is led out of their areas, the impact on listed buildings will only be during construction, however, their accessibility shall be ensured.

**Impacts on non-production activities**

The proposed options will not affect non-production activities in the affected area.

**Impacts on services, recreation and tourism**

Construction of highway will have a negative impact on the current service providers in the area related to restaurants, that are located at 3.0 km of red option. These facilities, however, are seasonal and serve for cyclists, skaters and walkers who use the nearby area for their sports activities. The facilities are directly in the route of the future construction site of red option and will probably have to be shifted. Other services will be positively affected, mainly catering services during construction. The further development of services in the affected area may be subject to possible construction of production plants, which will benefit from the accessibility of the area using the new transport infrastructure after completion of the high-capacity road. The assessed road is located in a suburban area of Bratislava. Construction of the highway will indirectly have a positive impact on the development of all activities related to the provision of services to meet the increased traffic of the area due to the convenient transport access through planned interchanges.

The proposed highway in the section of the Danube floodplains will have a negative impact on the current use of that area for recreation and sports activities especially during construction. The international Danube bike and hiking marked trails in the relevant territory will be negatively affected during construction . The most significant negative impact is the intervention of the proposed options in the territory of the projected area of recreation, sports and tourism of ARST Jarovské arm, which the D4 highway in green option passes through the proposed area right at 2.7 to 3.9 km, in red option at the border of 3.0 to 4.1 km.

Positive impacts on the bike and hiking trails during operation will be ensured by linking both banks of the Danube in both options by a bridge, which will have a path for pedestrians and cyclists allowing access to the recreational area in between the dikes. Access for pedestrians and cyclists to the bridge over the Danube from the existing bike trails and paths is designed with a pair of ramps in three places.

A partial positive impact on recreation, sports and tourism in the territory concerned may be regarded as improving accessibility of the area through the proposed intersections.

At 5.9-6.1 km of the green option there is a garden settlement near the highway to which the access during construction shall be ensured, given that the field road, which now ensures the availability of the area, will be interrupted by the highway. During operation the technical solution designed a bridge over the highway on the field road. With regard to this, one garden in this section is located separately outside the village and right in the highway route, this will likely be destroyed.

In Most pri Bratislave at 17.0 to 17.9 km, the highway route extends into the area of the village recreation facilities with suburban area of Zelená voda, where the mined gravel pits are used for recreational purposes associated with swimming etc. However, there are no service facilities built in this area, recreational use is still just natural swimming. At present, gravel mining has been restored in the area, therefore the use of the site will be quite limited until the end of mining. With regard to the highway route through the said area, the use of Zelená voda for recreation will be limited by negative impacts, particularly noise.

In Ivanka - Farná, a dog training area of KŠK Rottweiler Ivanka is situated neat the proposed highway route at 19.9 to 20.2 km of the red option, which will be indirectly affected, particularly during highway construction.

**Impacts on infrastructure**

In terms of impacts on infrastructure it is needed to include collisions with existing roads, railways and collisions with existing utilities as significant impacts of the highway construction. These are designed as forced investments and their range is given in the technical solution of proposed activity in the previous sections of the report.

**Impacts on territorial development**

The proposed activity will have an impact on territorial development of Bratislava, affected municipalities and higher territorial units. According to the valid land use documentation of Bratislava region, Bratislava City, Most pri Bratislave, Zálesie and Ivanka pri Dunaji, the impact on their territorial development can be assessed as follows:

*Option C red*

- acceptable for the city of Bratislava and HTU
- acceptable for Most pri Bratislave
- acceptable for Zálesie
- acceptable for Ivanka pri Dunaji

*Option E green*

- to be discussed for the city of Bratislava and HTU, because it is not in compliance with current LUD
- acceptable for Most pri Bratislave
- acceptable for Zálesie
- acceptable for Ivanka pri Dunaji

**Impact on the transport system and transport infrastructure**

The basic road system of Bratislava is a separate group of roads from a selected road network, which executes a decisive share of road transport in the city and whose quality is decisive for the

operability of the whole urban transport system. For these reasons, ZAKOS was given a priority attention in terms of traffic engineering aspect (monitoring the development of the traffic volume, traffic accidents and traffic modelling), comprehensive maintenance and particularly construction development. ZAKOS consists of traffic circles (inner and central), traffic semicircle, radial roads and connecting section. At the moment, ZAKOS consists of the following roads:

- *inner traffic circle* - Staromestská, Štefánikova, Šancová, Legionárska, Karadžičova, Dostojevského rad, Vajanského and Rázusovo nábrežie
- *central traffic circle* - Einsteinova, Prístavný most, Bajkalská, Jarošova, Račianska, Šancová, Pražská, Brnianska, Mlynská dolina, Lafranconi, V1 and V2 highway branches
- *outer traffic semi-circle* – Galvaniho st., Bojnická st.

Radial roads

- Lamač radial road: on roads of Hodonínska, Lamačská road, Brnianska, Prague, with the ending in the internal traffic circle at the intersection of SSA.
- Rača radial road: on the roads of Púchovská, Račianska st. with the ending in the internal traffic circle of Račianske mýto
- Senec radial road: on roads of Senecká road, Rožňavská, Trnavská, Krížna, with the ending on the internal traffic circle
- Biskupice radial road: on the roads of Svornosti, Gagarinova, Prievozská, Mlynské nivy until the inner traffic circle
- Rusovce radial road: from the border with Hungary on the roads of Balkan road, Panónska road, Nový Most until the inner traffic circle. Rusovce radial road branch starts in Petržalka when crossing Dolnozemská and consists of Dolnozemská st. with the end on the Biskupice radial road
- Pečeňská radial road: from the border with Austria (at Berg) on the Vienna road, with the end on Rusovce radial road

Connecting sections

- L. Svoboda riverbank, Old Bridge, Šancová st. (in the section from Račianske mýto to Trnavské mýto).

An analysis of the current state of car traffic shows that the largest increase in traffic and at the same time most critical situation is reflected in the central traffic circle, or in contact with it on entering radial roads. Fully and more urgently, the requirement, applied for all processed conceptual materials so far, for completing the highway sections, completion of the selected road network with the missing sections, the extension of the selected road network with additional traffic lanes and rebuilding the crucial intersections from level to partially or completely elevated junctions is being confirmed.

Draft road network has been developed so it mostly addresses to:

- long-term shortcomings and disproportions of the current state,
- requirements resulting from major source documents, in particular connection of the superior road network to the European transport network,
- relief to urban road network from transit and heavy traffic,
- relief to the city centre from the interim (diagonal) transport,
- traffic connection of newly urbanized areas.

The draft road network consists of highway network and selected road network, which includes I., II. and III. class roads, as well as I and II. class local roads. According to STN, these are

expressways (A1, A2), collecting roads (B1, B2, B3) and service roads C1 and public transport roads. The proposal does not include the development of III. and IV. class local roads, i.e. service and access roads inside the zones which will be the subject to solution of zoning documentation. The traffic condition, as well as the results of traffic surveys, shows that the traffic situation in Bratislava and its surroundings is poor. The above road network is in many cases either solely planned, resp. existing technical condition and width arrangement of these roads does not correspond to the real daily traffic volume.

In terms of traffic engineering assessment, it would be appropriate to consider, with a view to solve international, supra-regional and regional relations, the implementation of the following transport structures with the start of construction in the next five years:

- R7 expressway Bratislava - Dunajská Lužná
- D4 Highway Jarovce (D2) - Ivanka North (D1)
- D4 Highway Ivanka North (D1) – Stupava - South (D2)
- Extending road I/61 to the four-lane road with unlimited access
- The road of regional significance - D1 highway link with road II/502 (connection to bypass of Pezinok and Sv. Jur)
- D4 highway Devínska Nová Ves - nat. border SK/A

Simultaneously with these solutions and within the city and region, it should continue with construction of:

- Pezinok and Svätý Jur Bypass
- Solution of the capacity-reliable public transport system and transport system

The proposed activity covers the first highway section of D4 Jarovce - Ivanka north.

Construction and operation of the D4 highway will unburden and redistribute traffic on the roads in Bratislava. For a certain period of time, the capacity of the busiest roads and highways will increase, including sections leading through the built-up area of the city.

D4 highway service will have a positive impact on:

- improving transport operation service of the affected area,
- increasing traffic flow and safety,
- relief to the road system of Bratislava,
- improving the quality of life of the residents,
- reducing negative impacts on the environment,
- the overall increase in the value and development potential of the area,
- improving the delivery of functional levels of individual sections of the road system,
- increase in economic efficiency of the transit and partly source - target traffic to Bratislava

A more detailed assessment and evaluation of both options can state that in terms of transport relations and the positive impact on the existing road and highway network, both considered options have the same benefits. Option C (red) and Option E (green) bring the same undisputed improvement of transport and transport infrastructure in the affected area.

Negative impacts will operate only during construction by limiting traffic on the concerned road and rail network. Impact on airport operations and the waterways during construction and operation is not expected. Impact on cycle trails has been assessed in earlier parts of the report.

## *17. Spatial synthesis of the impacts of activities in the area*

In terms of the previous section of the report, assessing the expected impacts in terms of their importance and the time course of action is based on the identification of inputs and outputs of the proposed plan, while the basic classification lies in the significance in the modification of the current state of the environment, whether in a negative but in a positive direction and also the timing of their action.

The expected impacts in terms of significance can be classified as follows:

- Degree 1 - very significant impacts
- Degree 2 - significant impacts
- Degree 3 - less significant impacts
- Degree 4 - impacts without significance

The expected impacts in terms of timing can be classified as follows:

- a - impacts during construction
- b - impacts during operation
- c - impacts during construction and operation

When evaluating the different impacts in terms of their significance, the fact needs to be taken into account that the area is heavily anthropogenically modified agricultural land close to the agglomeration of Bratislava, Most pri Bratislave and Ivanka pri Dunaji. The evaluation does not consider the emergency situations.

Degrees of unexpected **negative effects** in terms of significance and the time of action are presented in the following table:

| **Environmental element** | **Expected negative impact in terms of significance and the time of action** | |
|---|---|---|
| | **Option C red** | **Option E green** |
| Rock environment and relief | 4a | 4a |
| Surface water | 2c | 2c |
| Groundwater | 2c | 2c |
| Soil | 1a | 1a |
| Air | 3a, 4b | 3a, 4b |
| Biota and habitats | 1a, 3b | 1a, 3b |
| Protected areas, Natura 2000, TSES | 1a, 3b | 1a, 3b |
| Landscape Scenery | 3c | 3c |
| Quality of life of the population concerned | 2a, 3b | 2a, 3b |
| Territorial development | 3b | 2b |
| Infrastructura and transport | 2a | 2a |
| Health risks of population | 2c | 2c |

*The geological environment and relief* in a given location can be characterized as well bearable, without significant geodynamic phenomena with favourable engineering geological characteristics of the ground. Impacts of the proposed activity are assessed as insignificant and only during construction.

*Surface water* in the area is represented by the rivers of Danube, Little Danube and Šúrsky channel, Biskupické arm, waterways of channels built within the Gabčíkovo WD and gravel pit lake of Zelená voda. Surface water is very vulnerable (possible direct pollution), particularly during construction. Both options concerned are led directly over the river Danube and the Little Danube and Zelená voda gravel pit lake, therefore, the impact on surface water is considered very significant during construction and operation.

*The ground water* in the affected area is very vulnerable due to the high throughput of the environment. Impact of the options concerned considering their position in the PWMA Rye Island is very important during construction and operation.

*The soils* are mainly affected by land use, so it is a very important impact especially during construction.

*Air* pollution is affected by the overall air quality in the area. Given that the current transport is practically only redistributed and will be proportionately increasing even if the D4 was not implemented, only accumulation of air pollution in poor dispersion conditions will be changed, but in open landscape outside the local municipalities, with significantly better ventilation capability. The impact is considered insignificant during operation. During construction, there may be an accumulation of air pollution at construction yards and on access roads to the construction site at introduction of construction machinery and transport capacities in earthworks. The impact can be considered insignificant, but it will be only temporary.

*Biota, habitats, protected areas, Natura 2000 and TSES* - territory in terms of flora and fauna directly affected, particularly by interference with the habitats and ecologically important segments of the landscape, that will also cause local deforestation. The impact during construction is very important in both options, when the direct habitats disposal is to happen. During operation, the impact of both options can be regarded as significant in terms of the production of stress factors (noise, vibration).

*Impacts on landscape scenery* can be considered in both options insignificant during construction and operation, given the nature of the current landscape. However, the bridge over the Danube in a protected area will act in different manner, where it is necessary to ensure its architectural design incorporated in the territory of the Danube floodplains, taking into account the requirements to minimize the impacts on migration and bird overflows.

*The quality of life of the population concerned* will be perceived differently during construction and during operation. It will be strongly influenced by the accumulation of negative factors such as noise, vibration, local increase in air pollution by air pollutants from transport, limited traffic on existing roads, and thus creation of collapses in traffic during construction. This impact is significant during construction and less important during operation.

The proposed activity for *territorial development* in terms of negative impacts can impose constraints and limits for future land use in the corridor of the highway due to its protection zone and also, in particular, by dividing the area with the line structure of the barrier action. Negative impact will be manifested in the area around Jarovské arm, with planned urbanization for purposes of recreation, sports and tourism. The are is more significantly influenced by option E green.

*Infrastructure and transport* during construction will be significantly affected because of the necessary relocation of networks and roads, traffic restrictions etc.

*The health risks* are associated mainly with the operation, especially due to excessive noise. During construction, the noise and air pollution from traffic at the construction site will locally affect communities in the vicinity of construction yards, equipment, access roads.

**Positive impacts** during construction are expected in increasing building production, which will bring increased demand of the other production activities mainly in the production of building materials and products. During construction, the demand for services related to the construction of the structure will increase. During operation, a significant positive impact will be diverting the traffic outside the urban area of affected municipalities and relief of the zero option, which will have an overall impact on improving the accessibility of the area, improving transport links across the region and improving the existing adverse impacts particularly on the population (reduction of noise, air pollution, health risks and overall well-being and the quality of the affected population).

## *18. Comprehensive assessment of the expected impacts in terms of their significance and their comparison with the valid legislation*

Car traffic poses a direct threat to human health not only due to traffic accidents but also by producing pollutants and combustion and diesel engines, noise and vibrations caused by motor vehicles.

**Air pollution**

One of the most observed indicators of environmental quality in the Bratislava region is the air pollution, which is enshrined in legislation by Decree no. 705/2002 Coll. on air quality, as amended by Decree no. 351/2007 Coll.

In connection with accession to the EU, the set emission limits are for $NO_2$, $PM_{10}$, $PM_{2.5}$ CO, benzene and other pollutants. $PM_{10}$ particles are inhalable particles of diameter <10μg.m-3 and are a subset of airborne dust: The emission limit for $PM_{10}$ particles set out in the EU is 50 μg.m-3 for 24 hours and 40 μg.$m^3$ for annual concentrations.

Emission limits are established with such a safety factor that, if followed, it is scientifically justified that the pollutants will not have a negative (non-stochastic is understood, threshold effect) impact on human health. Taking into account the sensitive individuals, long-term, it is understood lifetime incidence of pollutants in the air. Short-term estimated concentrations (1 hour) highlight the impact of the source on air quality under adverse conditions that may occur, but in terms of API (Air Pollution Index) their frequency is insignificant.

Description of the main air pollutants from road transport:

- Nitrogen oxides ($NO_x$) are a mixture of nitrogen dioxide ($NO_2$ and nitric oxide NO). They develop at high temperatures of combustion, where the atomic oxygen is bound to the nitrogen to NO and it oxidises rapidly in exhaust pipes to $NO_2$, respectively creates further nitrogen oxides. Nitrogen dioxide is a gas with a suffocating odour smelled form concentration of 0.2-0.4 mg/$m^3$ and causes irritation of the airways and increase in their resistance after 10-15 minutes of exposure. People with chronic bronchitis respond sooner and asthma patients are most vulnerable, their condition starts to deteriorate already at concentrations of 0.6 mg/$m^3$. When exposed for six weeks at concentration of 0.6 mg/$m^3$, some changes in lung structure and metabolism of the lung occur. In the summer months $NO_x$ contributes to the formation of photochemical smog, consisting of ground-level ozone. The smog is strong irritant to eyes, respiratory system, especially in children and allergy sufferers. It decreases resistance to viral infections, bronchitis. The total share of about 30% of $NO_x$ emissions in Slovakia are just mobile sources.

- Carbon monoxide (CO) is formed in a relatively large amount during combustion of rich mixtures in spark ignition - engines. In combustion of poor mixtures, typical of diesel engines with injection of readily vaporizable fuel, CO is present in the flue gas only in a

small extent. Generally said, the presence of large amounts of CO in the exhaust gas of gasoline engines can be influenced by the dosing devices that is by regulating, for example of carburetor, or the injection pump etc.. CO is a strong toxic gas, which is bound to the blood pigment of haemoglobin, blocking tissue oxygenation while forming carboxyhemoglobin. It has a three hundred times greater affinity than Oxygenium. It is lighter than air, rises relatively quickly from the breathing zone and gets diluted. It is dangerous in enclosed spaces (garages) and in places with poor ventilation (tunnels, intersections of narrow streets with tall houses, etc.). Causing a slowdown of reflexes and increases the incidence of headaches.

- Sulphur oxides ($SO_x$) especially sulphur dioxide are another part of the emissions from combustion engines. Creating during combustion of the fuel and partly of lubricating oils to improve their properties. Irritating the respiratory system and may contribute to the development of chronic respiratory diseases (chronic bronchitis, pulmonary emphysema, bronchial asthma). The result of irritation is the trachea and bronchial constriction with subsequent respiratory phlegm. In winter they are originally formed by coal combustion in furnaces.

- Particulate matter of $PM_{10}$ (airborne threshold) cause local irritation to eyes and respiratory tract. While larger particles are removed from the respiratory tract by sneezing, coughing, ciliary movement and secretion of mucus, particles below 5 μm are brought into the lower respiratory tract and to the lungs, where they irritate or even intoxicate, when adsorbed by toxic substances (heavy metals, organic compounds, PAHs). The solid particles are also bound by microorganisms and thus form a path of transmission of various infectious diseases.

According to Act no. 401/1998 Coll. on Fees for air pollution, as amended by Act no. 161/2001 Coll. of Act no. 553/2001 Coll., Act no. 478/2002 Coll., Act no. 525/2003 Coll., Act no. 587/2004 Coll., Act no. 571/2005 Coll., Act no. 203/2007 Coll., Act no. 529/2007 Coll., Act no. 515/2008 Coll. and Act no. 286/2009 Coll. the source of pollution is represented by moving devices with combustion or other driving engines, which pollute the air. Emission limits and emission controls for motor vehicles in operation are already being implemented by current Decree no. 90/2003 Coll. of Ministry of Transport, Posts and Telecommunications. The use of the three-way catalytic converters is mandatory for all new and older imported passenger vehicles, use of unleaded petrol. The annual inventory of produced emissions from road transport is essentially based on the conversion of fuel consumed in operation of various categories of road vehicles on roads of urban, road and highway network on mass emission amounts of gaseous and particulate pollutants, applying the appropriate emission factors for individual vehicle categories and operation modes.

To determine the amount of pollutants emitted by a transport on a proposed highway, the dispersion study has been processed (text annexes). Basic input data for the calculation of emissions were projected traffic volume and composition of traffic flow on the D4 highway, limit values for human health are not exceeded in either of the monitored periods, the highway route is conducted well away from residential areas.

At present, the most loaded roads in terms of traffic and emissions in the monitored area are the road I/63, I/61 and the D1 highway. With regard to construction of a new high-capacity road, the section of road I/63 is to be significantly unburdened, under the condition od construction of the relevant section of the R7 expressway, thereby reducing the production of air pollution from transport, mainly in Rovinka, Dunajská Lužná and even Ivanka pri Dunaji. Air pollution problems in Podunajské Biskupice need to be addressed at the level of Bratislava city, which requires to build "extension of Bajkalská" road in connection with the D4 highway D4. On the other hand, accumulation of emissions production in the traffic junction of D1 and D4 Ivanka north interchange will significantly increase air pollution (see the Dispersion study), the interchange, however, is well

away from residential buildings (Vajnory), the impact on the health of the population is not expected.

Air pollution during construction should be minimized by placing the building yards and access roads to the construction site. An important measure will be consistent organization of construction and compliance with environmental construction plan.

**Noise and vibrations**

Noise and vibrations can be defined as an unwanted sound, causing the disturbing or unpleasant sensation, which generally has an adverse effect. In urban area the harmful effects of noise and vibration are acting, in fact, without a time limit on all parts of the population, regardless of age, gender or health status. Sources of noise and vibrations from traffic yet are not point but linear, affecting inhabitants of vast areas along transport routes. Effects of the seemingly bearable levels of noise and vibration will be felt only after prolonged exposure, which already causes permanent disruption of the body.

High levels of noise and vibration will be felt immediately and the essential consequences are:

- acute or chronic damage to the hearing organ followed by irreversible damage to hearing sense
- functional damage to hearing with hearing threshold shift
- increased susceptibility to disorders of the sleep cycle
- expressions of subjective feeling of harassment, annoyance, difficulty with concentrating, decreased work productivity, and many others.

For illustration we present some activities and their noise, expressed in decibels:

| | | | |
|---|---|---|---|
| noise of leaves in the woods | 10 dB (threshold of audibility) | truck | 95 -105 dB |
| human whisper | 20 dB | jackhammer | 100 dB |
| quiet conversation | 50 db | big-beat music | up to 110 dB |
| singing, shouting | 60 -80 dB | aircraft | 120 dB |
| vacuum cleaner | 70 dB | pneumatic hammer (pain threshold) | 130 dB |
| passenger car | up to 85 dB | turbojet | 140 dB |

The population will be exposed during construction of the negative effects that accompany any major construction activity. This is the adverse effect of noise and vibrations from the construction site transport, especially on the route between sources of fill material and construction, if passing through the urban areas. These effects, however, are short-term limited to the period of construction activities and should not affect the overall health status of the population living in the immediate vicinity. The structure concerned is situated outside the built-up area and is easily accessible from main roads. Motion of construction transport is implied mostly on the route of the highway and the access roads, which are designed with regard to contemporary urban area of affected municipalities.

Direct positive effect on the population during operation of activity is reflected in a decrease in traffic on the existing main roads and reducing the number of accidents, especially involving pedestrians. When it is a direct impact, it is mainly reducing air pollution by exhaust gases, dust

and noise from transport. By reducing the traffic volume it is expected to reduce the noise level and vibration in the most exposed areas of Ivanka pri Dunaji, Zálesie, Rovinka and Dunajská Lužná, in this context it is necessary simultaneously to complete the section of the R7 expressway Bratislava - D.Lužná. Noise-related problems in Podunajské Biskupice need to be addressed at the level of Bratislava city, which requires to build "extension of Bajkalská" road in connection with the D4 highway D4.

To assess noise ratios of the individual options of the highwaym the noise study has been processed (text attachments). The noise study reveals that the portion of transport, that will be taken over to the new high-capacity road, produces such a noise exposure that it requires in both options to build noise barriers so as to meet the permissible noise limits from traffic set by Decree no. 549/2007 Coll., of the Ministry of Health, establishing details on the permissible values of noise, infrasound and vibration and on the requirements for the objectification of noise, infrasound and vibration in the environment, as amended by Decree no. 237/2009 Coll. amending and supplementing previous decree.

Vibration study has not been processed separately, we expect that due to sufficient distance of the highway, there will be no impact on the affected population. On the other hand, the current state is to be significantly improved, as explained above.

The proposed highway is also a direct threat to surface and groundwater in the PWMA Rye Island by producing polluted waste water from the road surface and from operation of parking areas as well as a direct threat to protected areas, including the habitats of Community importance. There are also good soils in the area, which will be occupied by the construction of highway.

**Water pollution**

In terms of threats to the quality of groundwater and surface water during construction of the highway, the following sources of contamination are considered:

- leakage from storage and equipment during road construction,
- leakage of sewage from the building facilities,
- accidental leakage of dangerous substances from construction machinery during construction.

In terms of threats to the quality of groundwater and surface water during operation of the highway, the following sources of contamination are considered:

- waste water from the road,
- waste water from the parking area operation,
- emergency situation.

For the proposed technical solutions, water drainage from surface run-off (rain water) by sewer system is being considered. Water from the road and paved areas of parking areas will be through pumping stations drained to surface flows, respectively into the rock environment through infiltration. Waste water from the road and paved areas of parking areas can be contaminated mainly by means of winter maintenance and oil spill. Given the high vulnerability mainly of groundwater of the assessed area it is necessary to treat the drained rainwater before running into surface water flows and infiltration systems. When operating parking areas, it is considered to capture waste eater into sealed sumps and their shipment to the nearest waste water treatment plant.

In accordance with Section 31 of Act no. 364/2004 Coll. on water, the area concerned is part of the protected water management area of (PWMA) Rye Island by Regulation no. 46/1978 Coll., with the principles of water protection in PWMA are embedded in. It is prohibited under current legislation to build and expand in the PWMA:

a) new industrial sources or existing industrial sources, which include dangerous substances being produced or used for production,
b) new industrial sources or existing industrial sources that produce industrial waste water containing harmful substances,
c) veterinary and sanitary facilities and sanitary slaughterhouses,
d) oil products warehouses with a total capacity exceeding 200 m3 and capacity of individual tanks greater than 50 m3,
e) oil pipelines and other linear pipelines for the transport of dangerous substances,
f) public recreation buildings or individual holiday facilities without ensuring waste water treatment,
g) conduct aerial spraying of fertilizers and chemicals to protect plants or killing pests or weeds close to groundwater or uncovered groundwater, which may cause water pollution or endanger the water quality and health safety,
h) perform drainage of forest lands to an extent which will significantly damage water conditions in the protected area of natural water accumulation,
i) draining agricultural lands with an area greater than 50 ha of contiguous area,
j) exploit peat in the amount greater than 500,000 m3 in one place,
k) superficial exploitation of minerals, or performing other earthworks, which reveal a continuous groundwater level, with the exception of mining with a possibility of water management space utilization,
l) store radioactive waste,
m) build landfills for hazardous waste.

The prohibition referred to in points d) - f) shall not apply to activities which on the basis of hydrogeological survey proves that it will not affect the available quantity of the groundwater in the catchment area.

Waste water limits are legally guaranteed in Government Ordinance no. 296/2005 Coll. laying down quality requirements and qualitative targets for surface water and limit values for waste water and special water indicators. Based on the limits specified in the relevant legislation it is necessary to propose technical solution requirements for waste water treatment from the highway and within the meaning of the relevant legislative to propose disposal of waste water (sewage and paved areas) from the operation of parking areas.

**Habitats of Community importance**

Act no.543/2002 Coll. on nature and landscape protection in Section 6 Protection of habitats defines that whoever intervenes in the habitat of Community importance or habitat of national importance, shall take appropriate alternative restoration measures resulting mainly from the documentation of nature and landscape protection; this obligation does not apply in the case of routine management of agricultural crops or forest plantations. If the restoration measures cannot be performed, the person shall pay financial compensation to the amount of social value of the affected habitat (§ 95). The financial compensation is the income of the state budget. Nature protection authority shall identify details of the restoration measures or financial compensation, the nature protection authority shall order the use of appropriate restoration measures and determine their scope and details or order to pay financial compensation to those who intervened in the habitat of Community importance or habitat of national importance without authorisation.

Act no. 117/2010 Coll., amending and supplementing the nature and landscape protection act, as amended, and on amending and supplementing Act no. 24/2006 Coll. on assessment of impacts on the environment and on amendments to certain laws, as amended, which will be in force from 1 May 2010 amended the wording of Section 6 Protection of habitats. Nature protection authority provides statement to activities and competences are transferred to the district environment offices.

**Land use**

During construction of the highway, ALU and FLU will be necessary, which has an area mentioned in the preceding sections of the report. After withdrawing land for non-agricultural purposes, it is necessary to follow relevant provisions of Act no. 220/2004 Coll. on the protection and use of agricultural land and use of forest land to comply with the provisions of Act no. 326/2005 Coll. on forests.

## *19. Operational risks and their possible impact on the area*

Risks associated with the implementation of the proposed activity may result from:

- failure of technical and other measures,
- failure of human factor,
- external factors effects (natural forces, weather, etc.).

The formation and effect of risks could adversely affect:

- geological environment, surface and groundwater quality,
- air quality in view of the increase or excess of air pollution limits,
- health and property of passengers in the event of an accident (possible collision with the crossing game)
- health and fortune of residents in the wider area in the event of accident of vehicles carrying dangerous substances and their disposal.

The causes of such conditions may include:

- leakage of harmful substances from construction machinery, machinery and equipment, heavy goods and passenger vehicles during construction and operation,
- traffic collapse due to extreme weather,
- other emergency situations.

The above potential risks that might threaten the quality of the individual components of the environment in that area are not significant and do not pose larger risks. Their limitations, resp. minimization will be ensured by technical and organizational measures, control of the observance of laws and regulations, etc. .. Risks of human origin are taken into account in particular solution of the management, control and monitoring. Other possible risks associated with the implementation of the proposed action, in addition to the above, are not expected.

# III. MEASURES DESIGNED TO PREVENT, ELIMINATE, MINIMIZE AND OFFSET THE IMPACTS OF A PROPOSED ACTIVITY ON THE ENVIRONMENT AND HEALTH

The present documentation contains a comprehensive assessment of the expected impacts of the proposed activity on the environment. In this part of the documentation we submit the draft measures to minimize, respectively eliminate the presumed impacts of assessed options.

## 1. Planning Measures

Planning measures consist in harmonizing valid land use documentation of municipalities Most pri Bratislave, Ivanka pri Dunaji, the capital city of Bratislava and Bratislava region with the option that is in the process of EIA recommended for implementation. In principle, the corridor of the D4 highway of red option is embeded in the LUD of Bratislava, Most pri Bratislave, Ivanka pri Dunaji and Bratislava region with minor variations, while its route is in the corridor of the original "zero" circuit of the city. Some amendments for the Master plan of Bratislava and HTU will need to be prepared in green option of D4 highway. At 18,797 km of D4 the territory should be reserved for any prospective construction of feeder "Zálesie" and "Zálesie" EI and prospective connection to the planned expressway in the cadastral area of Most pri Bratislave.

## 2. Technical Measures

Based on the evaluation of expected impacts on the environment, the documentation recommends to supplement technical measures to minimize, respectively eliminate the negative effects of the proposed activity on the environment for both options in the following.

Measures for **adaptation of conduct** and the technical solution of the highway in the affected area:

- By modifying the vertical alignment of D4 at the end of the relevant section (21.5 km) at the junction of D1 Ivanka north (in terms of TS - variant intersection of D4 and D1 - option C1) the negative impact of the highway on the rock environment, groundwater, flood protection area will be excluded and will minimize the impact on D1 operation during construction of D4.
- It is necessary to consider the R7 expressway Bratislava - Dunajská Lužná in Option C green for further preparation of D4, which requires an adjustment to the Ketelec intersection.
- To complete technically the connection of the planned expressway to the D4 highway.

Measures to protect the **population** from adverse effects of construction and operation of highway:

- Adverse effects of noise, vibration and air pollution in the construction phase will be partly eliminated by placing the access roads to the construction site and construction yards outside the residential areas of municipalities. Given that access to the site will only be possible on the existing road network, which locally leads through urban areas, adverse impacts will be minimized by construction organization.
- Adverse effects of noise during operation applied to the residential zones will be eliminated by noise barriers, but it is necessary to implement sound insulation of the territory in a

comprehensive way at Jarovce and Ivanka north intersections, including intersection branches of adjacent sections of D1 and D2 by means of detailed noise study in the next stage of PD.

- In option E green, it is advised to assess noise situation at 5.9 to 6.1 km pf the gardening settlement (four gardens) and a cottage of hunting association in the next stage of PD. Indicatively, it is advisable to extend the noise (multifunctional) barrier to the left at 2.6 - 5.5 km to 6.1 km.
- At 17.0 to 17.9 km (red option stationing), it is recommended to assess noise situation in the next stage of PD with regard to the use of the site of Zelená voda for recreational purposes, but it is necessary to discuss the planned developing activities in the area concerned with the affected municipality of Most pri Bratislave given the fact that currently the gravel mining has been restored in the area and recreational function of the area is largely limited by this activity.
- During construction and operation, it is necessary to ensure the implementation of monitoring.

Measures to protect the **rock environment and relief** from adverse effects of construction and operation of highway:

- Potential activation of geodynamic processes (suffosion and instability) during construction, especially in installing structures of the D4 highway, will be compensated in a timely engineering geological and hydrogeological survey and detailed design of sanitation and stabilization measures in the next stage of PD, including monitoring, with emphasis on challenging bridges and excavated notch at 17.5 to 18.8 km.
- Protection of rock environment from pollution during construction and operation is necessary to be ensured by discipline in construction, appropriate documentation to deal with accidents and operational documentation.
- Actions against erosion of slopes of embankments need to be secured against wind and water erosion by suitable landscaping.
- Necessary remedial measures for the installation of the highway need to be designed in accordance with the recommendations of engineering and geological survey.
- During operation it is necessary to ensure the continuation of monitoring in selected localities.

Measures to protect the **surface and groundwater** from adverse effects of construction and operation of highway:

- Through the entire route of D4, a road drainage using oil separators is designed, the road drainage will be divided, the water will be drained from road to road sewer and run through cleaning equipment into the recipient, respectively by infiltrating into the rock environment. The proposed method of water treatment must conform to water protection in PWMA Rye Island which the proposed options of D4 pass through.
- An assessment of highway impact on groundwater for VZ Rusovce and in the highway section in PWMA Rye Island should be carried out.
- The optimal design of sewage water drainage by infiltration requires to carry out hydrogeological survey at the site of the proposed infiltration objects.
- In the section of the notch (sealing bath) at 17.5 to 18.8 km with respect to the anticipated impact on the groundwater regime and flow, it is necessary to provide a hydrogeological

survey, including mathematical modelling, while we estimate the need to build drainage "windows" underneath the tub.

- Protection of surface and groundwater from pollution during construction and operation is necessary to be ensured by discipline in construction, appropriate documentation to deal with accidents and operational documentation.
- During construction and operation, it is necessary to ensure the implementation of monitoring of surface and ground water, including waste water from building yards and effluents from road drains and sewers in parking areas.

Measures to protect the **soil** from adverse effects of construction and operation of highway:

- Summary and handling with topsoil and subsoil will be part of the next step in the PD in accordance with the decision of the competent authority for ALU protection.
- Handling with leaf litter and removing stumps and roots will be part of the next step in the PD in accordance with the decision of the competent authority for FLU protection.
- Protection of soil from pollution during construction and operation is necessary to be ensured by discipline in construction, appropriate documentation to deal with accidents and operational documentation.
- Reverse reclamation of temporary ALU and FLU, demolishing roads and so on needs to be addressed in terms of the decision of the competent authority and reclamation project in the next stage of PD.
- Temporary deposition of materials (e.g. soil from excavation) requires to use low-quality non-agricultural areas, for example areas after gravel mining and so on.

Measures for the protection of **nature** (flora, fauna, habitats, protected areas and TSES) against adverse effects of construction and operation of highway:

Option C

- Extension of the proposed bridge over the Danube until about 6.0 km.
  By shifting the highway embankment outside forests and protected areas, the land use of these areas will be reduced. It also extends the space under the bridge, which allows migration and exchange of genetic information to a wider range of living organisms and their communities as a highway fencing on the embankment.
- Building a passage for animals at 10.35 km.
  Passage (subway) is located at the intersection of the old Danube embankment, being a cultural technical monument. It is proposed to build a multifunctional bridge, one of whose tasks will be to mitigate the barrier effect of a linear structure. The bridge needs to be supplemented by corridor with vegetation cover.
- Addition of both-sided noise and light (multifunctional) barriers according to the design in terms of noise study at 2.9 to 7.5 km on the right and 2.9 to 5.8 km on the left.
  The barriers are designed in a section passing through protected areas on the Danube in order to reduce the area of space affected by the noise and light pollution, as well as reducing the risk of collision of birds with cars.

Option E

- Extension of the bridge over the Danube until about 5.5 km.

By shifting the highway embankment outside forests and protected areas, the land use of these areas will be reduced. It also extends the space under the bridge, which allows migration and exchange of genetic information to a wider range of living organisms and their communities as a highway fencing on the embankment.

- Building a passage for animals at 9.7 km.
  Passage (subway) is located at the intersection of the old Danube embankment, being a cultural technical monument. It is proposed to build a multifunctional bridge, one of whose tasks will be to mitigate the barrier effect of a linear structure. The bridge needs to be supplemented by corridor with vegetation cover.
- Addition of both-sided noise and light (multifunctional) barriers according to the design in terms of noise study.
  The barriers are designed in a section passing through protected areas on the Danube in order to reduce the area of space affected by the noise and light pollution, as well as reducing the risk of collision of birds with cars.

Common measures for both options

- Increasing functionality of interconnection of the bio-corridor of the Little Danube at the intersection with the highway for terrestrial organisms (game species, but also protected animals)
  In this regard, it is proposed e.g. extension of a bridge on the Little Danube in extending water flow cross section in this area.
- Building a passage for animals at 14.2 km.
  Passage (subway) is designed at the point where the highway is led above the surrounding terrain and where are relatively extensive areas suitable for animals on both sides of the highway. Its role will be to mitigate the barrier effect of a linear structure. The bridge needs to be supplemented by corridor with vegetation cover.
- Crossing the highway with significant landscape feature at 19.1 km to be implemented at elevated level (bridge).
  This is a linear depression of the old Danube arm with tree species vegetation which acts as a TSES interactive element at the local level. Elevated crossing is to ensure connectivity of the line element and also the possibility of animal migration.
- Necessary tree felling in the route of the highway and also all work associated with the construction of the highway at 3.0 to 6.0 km (option C), respectively 2.5 to 5.5 km (option E) to be implemented in the non-breeding season (August - February) and during the shortest construction period.
  The quantity of animals killed during the construction of the highway can be reduced by an appropriate timetable of work. The greatest losses would occur if the interventions to the most valuable habitats are carried out at the time of breeding and letting out young animals. Shortening the construction period to ensure a reduction of time for which animals are exposed to stress factors related to construction of the highway. It will be based on the current state of nesting species (information provided by the Slovak State Nature Conservation), particularly vulnerable steps should be taken if the nest of the white-tailed eagle, the black kite or black stork are occupied near the structure.
- Implementation of substantial emergency transfers of protected species of organisms from the highway route before the real start of construction.

For this purpose it is necessary within the framework of the preparatory work just before the planned start of construction to ensure the current exploration of the area and identification of the sites and species whose transfer is possible and effective.

- Access roads to the construction site and the construction yards to be situated as far as possible outside protected areas and TSES elements (as proposed in the map attached).
  The aim of this measure is not to burden sensitive areas with noise and emissions respectively direct occupation of spaces for these activities.
- All temporary areas without vegetation during highway construction in protected areas to be put after its completion to its original state using appropriate landscaping.
  The measure particularly important in view of preventing the spread of non-native or invasive plant species into the natural environment. When landscaping water areas along the highway to use mainly habitat-native plants, and in no case invasive species.
- For bridges to use as low and clearly visible structure as possible.
  The aim is to reduce collisions of birds in PWMA with the bridges (e.g. cables) under the poor visibility.

Measures to protect the **landscape image and scenery** from adverse effects of construction and operation of highway:

- When passing the landscape-based valuable territory, especially in the section of the Danube and the Danube floodplains, it requires superstandard architectural integration of the bridge into the scenery using suitable solution of the bridge while meeting requirements of conservation measures, landscaping to be designed with the largest portion of greenery.
- In other sections the route passes through mostly agricultural land around the settlements, the integration of the highway needs the design of appropriate landscaping of higher embankments, intersection branches and parking areas, respecting revitalization programs of the affected municipalities.
- The barrier effect of highway is designed by bridges of sufficient brightness and span, the recommended measures to extend bridges, respectively add bridges (passages for migration) referred to in the preceding part to be respected to minimize the effect of splitting.

Measures to protect the **urban complex and land use** from adverse effects of construction and operation of highway:

- It is to respect the current urbanization of the affected area in the highway route, in the corridor of the proposed options, however, the urban complex in the form of built-up areas is not present, however, impacts on the nearest buildings need to be taken into account (addressed in previous measures).
- Identified impacts on the proposed areas of urban complex embedded in the land use documentation (areas of public facilities and areas for recreation and sports in the cadastral area of Jarovce and Most pri Bratislave) should be addressed within the framework of land-use measures, as mentioned above.
- The highway route near the Bratislava Airport has been addressed in the Feasibility Study.
- The highway route at 21.1 km (red option stationing) collides with guiding airport facility (radio beacon), after accurate focus of the area, its shift, respectively construction of a replacement building, or shifting the highway route needs to be technically resolved in conjunction with the operation of the airport.

- After the precise focus of the area it is also necessary to verify the eventual collision of the highway route with the bridge at 1.5 km (red option stationing).
- It is needed for processing the next degree of PD to check the current status of the affected gravel extraction sites in the highway route of option C red, respectively fulfilment of conditions of Bureau of Mines (requirements for the treatment and reclamation of gravel pit after mining is completed within the meaning of POPD deposit) of the companies extracting gravel in Ketelec at about 8.2-8.6 km and in Zelená voda at about 17.2- 17.4 km, which may influence the technical design of the highway in these sections (founding the highway, bridges).

Measures to protect the **cultural and historical monuments** from adverse effects of construction and operation of highway:

- At 10.35 km the D4 route in red option, respectively at 9.71 km in the green option, passes without bridging protective barrier, which is a cultural and technical monument and also local bike trail; collision recommended to be implemented by bridge (the measure is also mentioned in nature conservation). The technical solution is necessary to align with bridging the pipeline in green option.

Measures to protect the **archeological sites** from adverse effects of construction and operation of highway:

- In the next stage of PD it is necessary to carry out archaeological research and propose the necessary measures.

Measures to protect the **agricultural and forestry production** from adverse effects of construction and operation of highway:

- During construction and operation, it is necessary to provide technology and services of the area for agricultural and forestry activities and the proposed bridges to be designed in sufficient headroom brightness and width. The technical proposal needs to be conform to the relevant agricultural and forestry companies.
- Due to changes in hunts of the field roads relocation and bridges must reflect the new land consolidation projects.

Measures to protect the **hunting and fishing associations** from adverse effects of construction and operation of highway:

- During construction and operation, it is necessary to respect the requirements of affected hunting and fishing associations to route the highway through hunting and fishing grounds and incorporate them into the next stage of PD.

Measures to protect the **water management and flood protection of the area** from adverse effects of construction and operation of highway:

- Collision with hydromeliorations is designed with the Feasibility study, in the next step of PD after focusing the area it is necessary to clarify the technical solution with a view to the highway route. During construction, it is necessary to ensure their functionality.
- Measures for the protection of water management important water courses of the Danube and the Little Danube and water facilities of Gabčíkovo WD are designed by bridging under the technical documentation. In the next stage of PD it is necessary to prepare a detailed

technical design and the conditions for their protection during construction to be solved based on the requirements of the administrator of the flows and water facilities.

- To protect the Danube dikes it is necessary to respect the requirements of the flow´s administrator by leaving the handling strip of min. 10 m wide from the foot of the dam, pillars of the proposed bridging cannot interfere with that protection zone. The technical solution for founding pillars near the dikes should be discussed with the flow´s administrator (possible collision with prolonged sealing asphalt cover of dikes).
- Measures to protect the operation of Šúrsky channel are addressed in the technical documentation (retention tanks). To maintain the channel, it is necessary to meet the flow administrator´s requirement by leaving a handling strip between the highway and the foot of the channel dikes of at least 10 m wide, in special cases 5 m. Draft foundation of the sealing bath in concurrence with Šúrsky channel at 17.4 to 18.8 km according to the option C stationing should be discussed with the flow administrator.

Measures of the industrial and technical sites against adverse impacts of construction and operation of highway:

- After the precise focus of the area it is needed in red option at 3.1 km to technically resolve technical design of the highway route in contact with the facility, BVS, a.s., respectively at 11.9 to 12.3 km in red option stationing with surrounding area of packaging company Slovasfalt, and, for example by a support wall, or shifting the route so that the highway does not intervene in the area of mentioned sites.

Measures of the affected **facilities of services, recreation and sports** from adverse effects of construction and operation of highway:

- The highway route in red option at 3.0 km passes through the food serving facilities for sports activities on the Danube embankments (international Danube cycle trail, hiking, skating, etc.), but which are only operated seasonally and they are not permanent objects. The said objects will need to be moved beyond the highway route.
- Sports activities mainly on the dams on both sides of the Danube will be limited during construction at the intersection with the structure, but it is only local and temporary restriction. During operation of the highway the use of the dikes for sports activities will again be working, dikes will be bridged.
- To ensure the functioning of the international Danube cycle trail, the technical design for bridging the Danube includes the construction of cycle and pedestrian interconnection of the both banks and an island between the Jarovské arm and the main stream.
- The current use of the Jarovské arm for so-called recreation on the water (houseboats) will be partially limited during construction by the installation of bridges in both options in the water area of the arm, after precise focus of the area it is to solve the collision of houseboats especially in the route of red option by moving them before the construction starts. During construction, it is necessary to ensure permanent access to that territory. The technical solution need to respect existing access road.
- Bridging the rowing track is designed in both options by one bridge field, which will not restrict its use.
- At 5.9-6.1 km of the green option, the highway route passes directly through a separate garden with garden house, garden area is likely occupied by a terrestrial body of the highway and garden house will have to be removed. After the precise focus of the area it is necessary to specify the highway collision and measures addressed in terms of compensation. It is also necessary during construction to provide access on the existing

field road to the garden area and hunting lodge near this option at 5.9 km. The technical solution proposes bridging of the highway, which will secure access during operation.

- The measures for recreational use of Zelená voda in the cadastral area of Most pri Bratislave at 17.0 to 17.9 km in red option stationing were stated within the measures for the population. To address location, it is to be respected local bike trails runnung along the Šúrsky channel

Measures of the affected **infrastructure** from adverse effects of construction and operation of highway:

- Due to the highway route collision with existing remote, transit, local pipelines (oil, gas, water), electricity distribution, sewerage etc., their protection needs to be addressed. The technical design includes a collision with the highway route in both options specified as forced investments (relocations, bridges, conduits, etc.).
- In the next stage of PD, crossing conditions of the infrastructure should be discussed with the relevant administrators.
- Limitations to the operation of the infrastructure must be designed in collaboration with the administrators by appropriate organization of construction.
- Planned investments for the expansion of remote electricity transmission and routing of the planned interconnection of the transit Družba pipeline to Austria (Schwechat) in the corridor of the proposed options should be aligned with the organizations concerned.

Measures to the **transport system and transport infrastructure**:

- Highway collision with the affected road and railway network is addressed in the technical documentation by elevated junction in compliance with the requirements of individual administrators and the terms of prospective plans.
- The collision of the proposed option C red with D1 highway is recommended to be resolved by modified option C1, while the original solution by underpass would require intensive measures in the transport restrictions of traffic at D1 (operation by halves), which is quite complicated in forecast traffic intensity. Construction of bridging D1 (option C1) will be much easier.
- In terms of transport planning and traffic intensity forecasts we suggest to deal with the D4 highway in the first stage to the Rača intersection with the road II/502.

## *3. Compensatory measures*

The measures are proposed as compensation for damage to the property and compensation for losses caused by the activity being assessed.

Generally, the compensation of the D4 highway impacts on the environment can be solved by using landscaping, which shall perform the function of erosion protection of slopes in terrestrial body and reducing the negative impacts of transport on the natural and living environment (capturing emissions and partly noise). On road terrestrial slopes, in areas of the interchange branches, as well as road relocation slopes near highway, a concentrated bush planting and group planting of various species of trees will be designed to create a continuous green compact mass with the varied colour and heigh structure. The impact of D4 on nature is reflected mainly by dividing the area with a fenced road, with the possibility of crossing only at sites of designed bridges, changing species composition of plants in the immediate vicinity of the road. The road

will affect the migration routes of animals, create a barrier for the surrounding fauna, which will also be affected by the production of noise and air pollutants. By optimizing spatial routings, by bridging, as well as proper fencing along the road, the negative impact on flora and fauna will be considerably mitigated. the range of negative effects will be mitigated by a significant increase in the scale of landscaping on roads at the point of distortion. In the protected area of Danube floodplains and NR Gajc, it is necessary to minimize the scope of the intervention, while before the construction in this area, it is to carry out a detailed survey of biotic component and propose any limits for the movement of machinery, or carry out an emergency transfer of rare plant and animal species to another location.

To compensate the negative impacts of the proposed activity on the protected areas it is recommended to carry out some of the following measures:

- Expansion of forest area in the vicinity of the planned highway on the left bank of the Danube in the area Biskupické floodplain forests.
  Forest habitats destroyed and mutilated during construction and operation of the highway are to be reforested in areas intended for this purpose in the Master plan of Bratislava and in the documentation for nature conservation (TSES project). When reforesting, to use only native tree species.
- Creating meadows by grassing arable land in PWMA Danube floodplains or areas within 1 km of its border.
  The measure aims to create substitute food and nesting habitats for the selected species.
- Creating (restoring) wetlands by watering (water system recovery) depressions of the former Danube arms.
  The measure aims to create substitute food and nesting habitats for the selected species. In the right-bank Danube inundation it is recommended to implement the measures in the depressions backfilled by construction waste (NR Starý háj, surrounding of Ovsištské arm). Following the disposal of this waste the water areas have been restored which would partly replace the localities affected by the construction. In the left-bank part of the PWMA Danube floodplains it is recommended to implement rehabilitation of former arms in Biskupické floodplains.
- Completion of the complex system of gates and barriers disabling illegal entry to protected areas affected by the activities performed.
  The aim is to reduce the excessive disturbance of sensitive species.

The above compensatory measures need to be implemented at the latest together with the commencement of field works within the proposed activity and finish them before completion (the operation) of the proposed activity.

Among other compensations we can mention:

- Compensation for destroyed habitats to be clarified after processing documentation for their inventory and social assessment under the relevant legislation in the next stage of PD.
- Destroyed tree and bushy green growing out of the forest will be replaced by new planting. The scope needs to be clarified in the next stage of PD.
- Compensation for material damage of land use, necessary demolition and compensation for loss of agricultural production on temporarily used agricultural and forest lands.

## 4. Organizational and Operational Measures

The main objective of organizational and operational measures is to prevent unforeseen circumstances, especially accidents, work and operational disorders, or other damages, excessive waste and to reconcile work and technological procedures with applicable legislation and relevant technical standards. It is the development of master plan for construction organization (POV), emergency plans, handling and processing orders, the waste management plans, organizational directives on health and safety or others. The plan includes also material and technical equipment for their implementation.

During construction, the mitigation of the above negative effects on the environment to be achieved primarily through compliance with required technological discipline at various construction works and for maintenance of machines, by keeping borders of the structure, implementing temporary fencing in selected sections of the site, timely and meaningful transfer of materials and matters (without unnecessary transfer stations), transport organization minimizing crossings of affected municipalities, paved areas under parking lots of cars and construction machinery, with preventing pollution of subsoil and adjacent flows, cleaning mechanisms before the leaving the site to nearby roads, continuous maintenance of the used roads (cleaning, or spraying in order to reduce dust), and ensuring perfect diversion of rainfall and groundwater from the site.

Construction of the highway due to lack of embankment soil from its own excavations will require the establishment of borrow pits. Conditions for site selection should be adequately adapted to the general requirements for the protection of all environmental elements.

Phasing of construction in cross-section (building 1/2 profile) or in the longitudinal direction with respect to the large traffic flow and the nature of the affected area as well as the expected organization of the construction is not recommended. In terms of prospective traffic volumes it is recommended to solve the D4 in width arrangement of 33.5, while in the first phase a four-lane to be built with the two outer lanes and the wider central strip with the fact that when reaching capacity of lanes the internal lanes to be built on the full profile of the highway.

## 5. Other measures

It is recommended to align the time of construction of D4 highway Jarovce - Ivanka north with the construction of the R7 expressway (section Bratislava - Dunajská Lužná).

In the next phase of construction preparation we recommend to develop, in addition to the above proposed measures, the following documentation respectively surveys and other measures during construction and operation:

<u>Other measures in the preparatory phase of the selected option</u>

- ⇨ Engineering geological survey and based on its results to clarify environmental and technical design of the structure.
- ⇨ Hydrogeological survey to determine the conditions of infiltration of waste water from road sewage and groundwater protection in PWMA, examination of the impact on the groundwater regime in the sealing tub
- ⇨ Biological research in protected areas concerned.
- ⇨ Inventory of habitats and their social evaluation.
- ⇨ Archaeological survey.
- ⇨ Pedological survey.
- ⇨ Dendrological survey.
- ⇨ Anti-corrosive and geoelectric survey.
- ⇨ Architectural study.

- ⇨ Specify the measures proposed in the protected areas, spatial solution of proposed eco-ducts and multifunction barriers in cooperation with the staff of SNC SR.
- ⇨ Specify the source of filling material.

- ⇨ Suggest anti-emission and anti-erosion protection of the immediate vicinity of road by tree and bush planting on the slopes of the road.
- ⇨ Suggest reclamation and landscaping in places of distortion and intervention in the bio-corridors with a view of a rapid return of vegetation to its original condition using appropriate plants into the environment i.e. to use primarily geographically and traditional indigenous tree species (to exclude planting of invasive species).
- ⇨ Increased attention to be paid to land use elaborate with evaluation of the quality, balance and the use of overburden material.
- ⇨ Develop a waste management project.
- ⇨ For the operational phase of the road, the administrator is obliged to prepare a waste management plan.
- ⇨ A special attention to be paid to setting the conditions for the technical work influencing groundwater and surface water regime.
- ⇨ Deal with the conflicts of interest of the road construction with the existing infrastructure and to clarify the proposed solution caused by technical measures.
- ⇨ Propose measures to minimize the land use in protected areas in the technical solution.
- ⇨ Suggest a mix of the road, in particular embankments with maximum use of excavated soil from its own construction.
- ⇨ Develop project monitoring the individual environmental components (input data for post-project analysis) at the points provided in the Final Opinion
- ⇨ Develop a plan for the organization of construction
- ⇨ Propose policies for environmental supervision of construction.
- ⇨ Ensure in advance solving the property rights settlement with the affected estates in the route of the proposed road in accordance with applicable legislation.

<u>Other measures during construction</u>

- ⇨ Implement measures to prevent leakage of harmful substances into the soil and bedrock.
- ⇨ In cooperation with the competent authorities to exclude construction interventions, or protect them by fencing, in significant locations (outside the permanent and temporary road use).
- ⇨ Within POV, take actions against noise, emissions and dust in nearby buildings.
- ⇨ Solve the capture and purification of waste water from building yards and the water in lowering the groundwater level from the pits before they are discharged into watercourses.
- ⇨ Carry out biological reclamation and return to its original purpose on temporary used lands after completion of the construction.
- ⇨ In terms of water quality, it is essential to follow the technological discipline, to prevent direct leakage of contaminants, mainly fuels and lubricants into surface and groundwater.
- ⇨ Take precautions to prevent secondary dust during transportation of bulk materials
- ⇨ Dispose of waste in accordance with applicable laws in waste management
- ⇨ Before construction remove only necessary plants, which are located in the road route and carry out felling in non-vegetation and non-breeding season.
- ⇨ Road topsoil and subsoil to be removed, to pass the topsoil for agricultural activities and store subsoil during construction and after completion of the construction to be used for vegetation and landscaping.
- ⇨ Forest soil to be used for reclamation of forest land of temporary occupation after completion of construction.
- ⇨ After completion of the work associated with the construction to immediately proceed to the reclamation works and revitalizing.

- ⇨ Remove and restore all areas of landfills and various commercial areas in the perimeter of the structure with its use as areas with suitable vegetation species composition.

- ⇨ Due to the increased burden of local roads to develop project of alternative transport services in the territory of specific adjustments.
- ⇨ Ensure monitoring of selected elements of the environment according to the approved project documentation.
- ⇨ In the case of archaeological and paleontological findings during construction to inform the relevant professional institute (Archaeological Institute in Nitra).
- ⇨ Construction contractor cooperation with the affected municipalities in determining the routes, the arrangement of machinery traffic, the way of maintenance of roads, traffic signs and traffic control during construction.

Other measures during operation

- ⇨ Implement measures and technical solutions stated in the previous sections of the report.
- ⇨ Perform post-project analysis of monitoring adopting the measures if the assessed components of the environment will be more burdened as expected.
- ⇨ Dispose of waste in accordance with applicable laws.
- ⇨ Ensure continued monitoring of selected elements of the environment according to the recommendations of the post-project monitoring analysis.
- ⇨ In the case of demonstrating adverse effects by monitoring to quickly solve their elimination by appropriate technical and organizational measures.

## *6. Opinion on technical and economic feasibility of the measures*

The proposed measures are technically feasible. Economic evaluation can be assessed only after completion of project documentation. The construction is financed from public funds and therefore one of the decisive economic criteria is to be economic efficiency of the structure assessed by state expertise.

# *IV. COMPARISON OF OPTIONS OF THE PROPOSED WORKS AND PROPOSAL OF THE OPTIMAL OPTION*

Indicative balance of works taken from the Feasibility Study is shown in the following table:

| | | m.u. | Option C | Option E |
|---|---|---|---|---|
| Earthworks | embankment | $m^3$ | 3,559,232 | 3,149,955 |
| | excavation | $m^3$ | 549,215 | 561,044 |
| roads | | $m^3$ | 376,673 | 349,743 |
| Bridges on D4 | | m | 6,110 | 6,139 |
| | | $m^3$ | 213,493 | 212,638 |
| Bridges over D4 | | m | 830 | 830 |
| | | $m^3$ | 14,000 | 38,131 |
| Noise barriers* | length | m | 13,700 | 12,300 |
| D4 draining | road drainage | m | 45,900 | 42,800 |
| | ORL | pc | 19 | 19 |
| Relocations (adjustments, reconstruction) | of water mains | m | 1,690 | 1,630 |
| | of meliorations | m | 16,450 | 13,350 |
| | of sewerage systems | m | 400 | 400 |
| | of gas pipelines | m | 2,355 | 2,350 |
| | of oil pipelines | m | 300 | 300 |
| | VHV | m | 500 | 2000 |
| | HV | m | 7,200 | 11,100 |
| | LV | m | 5,900 | 8,900 |
| Landscaping | | $m^2$ | 589,497 | 623,365 |

* The length of the walls is adjusted by the noise study including recommended extension of the wall in option E green on the left by 600 m

## *1. Creating a set of criteria and determining their relevance for the selection of the optimal alternative*

For comparison of options with regard to the scope and content of the identified impacts, we chose the method of qualitative comparison. Both proposed options were subject to the comparison:

- **Option C red**
- **Option E green**

The options were compared in terms of the criteria that have been set into four groups.

- technical and economic criteria
- landscape and ecological criteria

- medical criteria
- urban planning criteria

The following evaluation is a qualitative comparison of options assessed in each group. When choosing criteria a quality and quantity availability of values for each criterion was taken into account. Evaluation of each criterion contains a description, which is then valid for all methods of evaluation. Also database is compatible. If necessary, the evaluation guidelines is described. At the end of each group, there is an overall assessment with the appropriateness ranking of the options within that group. The criteria within the group have naturally different degrees of significance.

In the overall assessment of the group, the relevant experts of the processor assigned the individual criteria with these degrees of significance:

- 5 - decisive significance
- 4 - high significance
- 3 - medium significance
- 2 - slight significance
- 1 - low significance (additional and informative in nature)
- 0 - without significance (no impact, resp. does not exceed limits and is not evaluated)

**Technical and economic criteria**

Construction costs (1)

The criterion includes construction costs without VAT.

| Option | Option C | Option E |
|---|---|---|
| Costs in EUR | 624,529,483 | 646,615,144 |
| % of more favourable option | 100 | 103 |
| Sequence of variants | 1 | 2 |

Technical complexity of construction (2)

The criterion is evaluated based on the following sub-criteria:

- Total length of route
- length of bridges
- amount of earthwork - embankment + excavation

| Option | Option C | Option E |
|---|---|---|
| Total length in km | 22.800 | 22.169 |
| % of more favourable option | 103 | 100 |
| Sequence of variants | 2 | 1 |
| Length of bridges in m | 6,940 | 6,969 |
| % of more favourable option | 100 | 101 |
| Sequence of variants | 1 | 2 |

| | | |
|---|---|---|
| amount of earthwork in $m^3$ | 4,108, 447 | 3,710, 999 |
| % of more favourable option | 110 | 100 |
| Sequence of options | 2 | 1 |
| Total | 5 | 4 |
| % of more favourable option in total | 313 | 301 |
| Final sequence of options | 2 | 1 |

Investment efficiency (3)

Investment efficiency was assessed by the degree of return (higher value is more favourable). Rated indicators:

- Revenues in thousands of EUR
- level of return IRR in %

| Option | Option C | Option E |
|---|---|---|
| Revenues | 21,300 | 42,940 |
| IRR in % | 5.7 | 5.9 |
| % of more favourable option | 103 | 100 |
| Sequence of variants | 2 | 1 |

Overall evaluation of the technical and economic criteria

Assessment of technical and economic aspect is in road options based on a comparison of options in terms of three criteria.

| | Criterion | Sequence of options | |
|---|---|---|---|
| | | Option C | Option E |
| 1 | Construction costs | 1 | 2 |
| 2 | Technical complexity of the construction | 2 | 1 |
| 3 | Investment efficiency | 2 | 1 |

In simplified weight comparison based on multiplying ranking with the degree of significance we obtain values that indicate the relative differences between the individual options. The highest degree of significance was assigned to the criteria of investment efficiency, which has the highest degree of significance for each investment.

| Criterion | | Degree of significance | Options value | |
|---|---|---|---|---|
| | | | Option C | Option E |
| 1 | Construction costs | 4 | 4 | 8 |

| | | | | |
|---|---|---|---|---|
| 2 | Technical complexity of the construction | 3 | 6 | 3 |
| 3 | Investment efficiency | 5 | 10 | 5 |
| Total | | | 20 | 16 |
| Average option value | | | 6.6 | 5.3 |
| % compared to more favourable option | | | 125 | 100 |
| Sequence of options | | | 2 | 1 |

Comparing options of D4 of **technical and economic** point of view shows the following sequence of options:

**1. - option E – green**

**2. - option C – red**

***Landscape and ecological criteria***

Impacts on groundwater (4)

Risk affecting the quality of groundwater is determined by the length of the linear construction route in an environment susceptible to pollution of groundwater. Practically the entire length of the proposed options is in an environment with good permeability. The criterion is the length of the route of options considered in the area of PWMA Rye Island.

| Option | Option C | Option E |
|---|---|---|
| Length of the section in PWMA in km | 12.4 | 12.0 |
| % of more favourable option | 103 | 100 |
| Sequence of variants | 2 | 1 |

Impacts on water sources (5)

Risk affecting water resources is set by the length of the linear construction route near the protection zones of water sources, in case of D4 it is Rusovce water source. The criterion is the length of the route of options considered in the area of water sources (PHO).

| Option | Option C | Option E |
|---|---|---|
| Length of the section near PHO in m | 300 | 0 |
| % of more favourable option | 300 | 100 |
| Sequence of options | 2 | 1 |

Land use (6)

The criterion is permanent land use by the construction of highway and related objects.

| Option | Option C | Option E |
|---|---|---|
| Permanent land use in ha | 143.1 | 142.2 |
| % of more favourable option | 101 | 100 |
| Sequence of options | 2 | 1 |

Impacts on biota (7)

Impacts on biota were further divided into other sub-criteria as follows:

- Impacts on fauna
- Impacts on flora
- Impacts on habitats
- Impacts on protected areas and Natura 2000 areas
- Impacts on Territorial System of Ecological Stability

Impacts on fauna were evaluated according to the acting of stress factors during construction and operation by comparing the length of the proposed multi-functional barriers in terms of noise study and recommended measures (extension of barrier in option E at 5.5 to 6.1 km to the left).

Impacts on flora were evaluated by the permanent forest land use and tree and shrub vegetation growing outside the forest.

Impacts on habitats were evaluated by the area of direct use of habitats of Community importance.

Impacts on protected areas and Natura 2000 areas were evaluated by a total area of direct occupation of individual protected areas.

Impacts on TSES were evaluate according to the routing the highway in the NRBc Bratislava floodplains.

| Option | Option C | Option E |
|---|---|---|
| Length multifunction screens in m | 7,500 | 6,400 |
| % of more favourable option | 117 | 100 |
| Sequence of options | 2 | 1 |
| Permanent forest land use in ha | 7.6 | 6.25 |
| % of more favourable option | 120 | 100 |
| Sequence of options | 2 | 1 |
| Habitat disposal in $m^2$ | 26,430 | 20,010 |
| % of more favourable option | 132 | 100 |
| Sequence of options | 2 | 1 |
| Surface use of PA in ha | 30.76 | 26.25 |
| % of more favourable option | 117 | 100 |
| Sequence of options | 2 | 1 |
| Route length in the bio-corridor in m | 4,300 | 4,250 |
| % of more favourable option | 101 | 100 |
| Sequence of options | 2 | 1 |

| | | |
|---|---|---|
| Total | 10 | 5 |
| % of more favourable option in total | 587 | 500 |
| Final sequence of options | 2 | 1 |

Overall evaluation of the landscape and ecological criteria

Evaluation of options of the landscape and ecological aspect was based on a comparison of options in terms of four criteria. The order of options after individual evaluation of criteria was as follows:

| Criterion | | Sequence of options | |
|---|---|---|---|
| | | Option C | Option E |
| 4 | Groundwater | 2 | 1 |
| 5 | water sources | 2 | 1 |
| 6 | Land use | 2 | 1 |
| 7 | biota | 2 | 1 |

A higher degree of significance was assigned to criterion of land use, groundwater and biota that are considered the most serious.

| Criterion | | Degree of significance | Options values | |
|---|---|---|---|---|
| | | | Option C | Option E |
| 4 | Groundwater | 4 | 8 | 4 |
| 5 | water sources | 2 | 4 | 2 |
| 6 | Land use | 3 | 6 | 3 |
| 7 | biota | 5 | 10 | 5 |
| Total | | | 28 | 14 |
| Average option value | | | 7 | 3.5 |
| % compared to more favourable option | | | 200 | 100 |
| Sequence of options | | | 2 | 1 |

The order of options in terms of impacts on the **landscape and ecological** environment is as follows:

**1. - option E – green**

**2. - option C – red**

***Medical criteria***

Noise levels (8)

Noise levels is exceeding the limit values in some sections. The criterion is the length of noise barriers (noise study).

| Option | Option C | Option E |
|---|---|---|
| Length noise barriers in m | 6,200 | 5,900 |
| % of more favourable option | 105 | 100 |
| Sequence of options | 2 | 1 |

Overall evaluation of the medical criteria

Evaluation of options in terms of medical criteria:

| | Criterion | Sequence of options | |
|---|---|---|---|
| | | Option C | Option E |
| 8 | noise pollution | 2 | 1 |

In assessing the importance of the criteria, different degrees of significance have been assigned to criteria, the following table represents also the evaluation of the suitability of options.

| Criterion | | Degree of significance | Options values | |
|---|---|---|---|---|
| | | | Option C | Option E |
| 8 | noise pollution | 5 | 10 | 5 |
| Total | | | 10 | 5 |
| Average option value | | | 10 | 5 |
| % compared to more favourable option | | | 105 | 100 |
| Sequence of options | | | 2 | 1 |

The order of options in terms of **medical criteria** is as follows:

**1. - option E – green**

**2. - option C – red**

***Urban planning criteria***

Impacts on community development (9)

Impact on community development is proven by placing a linear structure in space, which limits or prevents urbanization. The criterion is the length of the highway, which passes through the proposed extension of the urban area of municipalities, respectively is in conflict with LUD.

| Option | Option C | Option E |
|---|---|---|
| Length in m | 2,750 | 2,670 |
| % of more favourable option | 103 | 100 |

| | | |
|---|---|---|
| Sequence of options | 2 | 1 |

Impacts on technical infrastructure (10)

Interference with the technical infrastructure and relocations in this comparison are understood primarily as the value potential that exists in the territory and to which substantial resources were put in the past.

Data on the length of relocations including protectors

| Option | Option C | Option E |
|---|---|---|
| roads | 23,786 | 24,270 |
| water mains | 1,690 | 1,630 |
| of sewerage systems | 400 | 400 |
| Gas Pipelines | 2,355 | 2,350 |
| oil pipelines | 300 | 300 |
| Pipelines | 200 | 200 |
| high voltage | 8,400 | 10,300 |
| low voltage | 14,455 | 14,045 |
| Meliorations | 16,450 | 13,350 |
| Total | 68,036 | 66,845 |

Impact on technical infrastructure is evaluated based on the needs caused by relocations in total length.

| Option | Option C | Option E |
|---|---|---|
| induced relocations in n | 68,036 | 66,845 |
| % of more favourable option | 102 | 100 |
| Sequence of options | 2 | 1 |

Overall evaluation of the urban planning criteria

Evaluation of options according to the impacts on urban planning was based on a comparison of options in terms of two criteria. The order of options after individual evaluation of criteria was as follows:

| Criterion | | Sequence of options | |
|---|---|---|---|
| | | Option C | Option E |
| 9 | Impact on community development | 2 | 1 |
| 10 | impact on technical infrastructure | 2 | 1 |

In assessing the importance of the criteria, different degrees of significance have been assigned to criteria, the following table represents also the evaluation of the suitability of options.

| Criterion | | Degree of significance | Options values | |
|---|---|---|---|---|
| | | | Option C | Option E |
| 9 | Impact on community development | 2 | 4 | 2 |

| | | | | |
|---|---|---|---|---|
| 10 | impact on technical infrastructure | 3 | 6 | 3 |
| Total | | | 10 | 5 |
| Average option value | | | 5 | 2,5 |
| % compared to more favourable option | | | 200 | 100 |
| Sequence of options | | | 2 | 1 |

The order of options in terms of **urban planning criteria** is as follows:

**1. - option E – green**

**2. - option C – red**

**Summary evaluation of options according to individual criteria**

The following table summarizes the order of options in terms of the individual criteria.

| Criterion | | Sequence of options | |
|---|---|---|---|
| | | Option C | Option E |
| 1 | Construction costs | 1 | 2 |
| 2 | Technical complexity of the construction | 2 | 1 |
| 3 | Investment efficiency | 2 | 1 |
| 4 | Groundwater | 2 | 1 |
| 5 | water sources | 2 | 1 |
| 6 | Land use | 2 | 1 |
| 7 | biota | 2 | 1 |
| 8 | noise pollution | 2 | 1 |
| 9 | Impact on community development | 2 | 1 |
| 10 | impact on technical infrastructure | 2 | 1 |
| Total | | 19 | 11 |
| Sequence of options | | 2 | 1 |

***Comparison of options C and C1 of Ivanka north interchange***

Within the evaluation of the proposed options C and E, the overall assessment may be added by benchmarking of option to the intersection of D4 and D1 Ivanka north, i.e. of the basic **option C and option C1** (change in vertical alignment of the D4 highway).

Approximate balance of construction work of assessed options C and C1 received from TS of 'D4 highway, Ivanka north interchange with the D1, option" is in the following table:

| **Parameter** | **Measurm. unit** | **Option C** (the "Feasibility and effectiveness study" of September 2009) | **Option C 1** (alternative solution) |
|---|---|---|---|
| D4 highway length | km | 2.1262 | 2.1262 |
| Crossing D4 with D1 | | by subway (notch in the sealing bath) under D1 | by bridging over D1 |
| Construction costs excl. VAT | Eur | 112,736,000 | 96,251,000 |
| Financial saving | Eur | - | 16,485,000 |
| Length of bridges on D4 | m | 1,672 | 1,462 |
| Length of bridges over D4 | m | 324 | 108 |
| embankment | m3 | no change | increasing by 1,254,000 m3 |
| excavation | m3 | 88,000 | 0 |
| permanent land use | m2 | no change | no change |
| temporary land use | m2 | no change | no change |

Option C and option C1 have been assessed according to the following criteria:

- technical and economic criteria
- landscape and ecological criteria

**Technical and economic criteria**

Construction costs (1)

The criterion includes construction costs without VAT.

| Option | Option C | Option C1 |
|---|---|---|
| Costs in EUR | 112,736,000 | 96,251,000 |
| Sequence of options | 2 | 1 |

Technical complexity of construction (2)

The criterion is evaluated based on the following sub-criteria:

- Total length of route
- length of bridges
- amount of earthwork - embankment + excavation

| Option | Option C | Option E |
|---|---|---|
| Total length in km | 2.1262 | 2.1262 |
| Sequence of options | 1 | 1 |
| Length of bridges in m | 1,996 | 1,570 |
| Sequence of options | 2 | 1 |
| amount of earthwork in $m^3$ | 88,000* | 1,254,000** |

| | | |
|---|---|---|
| Sequence of options | 1 | 2 |
| Total | 4 | 4 |
| Final sequence of options | 1 | 1 |

* No cubic capacity of embankments, ** Increase in embankments

Overall evaluation of the technical and economic criteria

Assessment of technical and economic aspect is in road options based on a comparison of options in terms of two criteria.

| | Criterion | Sequence of options | |
|---|---|---|---|
| | | Option C | Option C1 |
| 1 | Construction costs | 2 | 1 |
| 2 | Technical complexity of the construction | 1 | 1 |

In simplified weight comparison based on multiplying ranking with the degree of significance we obtain values that indicate the relative differences between the individual options.

| Criterion | | Degree of significance | Options value | |
|---|---|---|---|---|
| | | | Option C | Option C1 |
| 1 | Construction costs | 4 | 8 | 4 |
| 2 | Technical complexity of the construction | 3 | 3 | 3 |
| Total | | | 11 | 7 |
| Average option value | | | 5.5 | 3.5 |
| % compared to more favourable option | | | 157 | 100 |
| Sequence of options | | | 2 | 1 |

Comparing options of D4 of **technical and economic** point of view shows the following sequence of options:

**1. - option C1**

**2. - option C**

***Landscape and ecological criteria***

Impacts on groundwater (3)

Risk affecting the quality of groundwater is determined by the length of the linear construction route in an environment susceptible to pollution of groundwater. The criterion is the length of the route of the assessed options that extends into the watered environment (including construction).

| Option | Option C | Option C1 |
|---|---|---|
| Length of section in m | 350 | 0 |

| | | |
|---|---|---|
| Sequence of options | 2 | 1 |

Land use (4)

The criterion is permanent agricultural land use by the construction of highway and related objects.

| Option | Option C | Option C1 |
|---|---|---|
| Permanent land use in ha (increase) | 0 | 0 |
| Sequence of options | 1 | 1 |

Overall evaluation of the landscape and ecological criteria

Evaluation of options of the landscape and ecological aspect was based on a comparison of options in terms of two criteria. The order of options after individual evaluation of criteria was as follows:

| Criterion | | Sequence of options | |
|---|---|---|---|
| | | Option C | Option C1 |
| 3 | Groundwater | 2 | 1 |
| 4 | Land use | 1 | 1 |

A higher degree of significance was assigned to criterion of land use, groundwater that are considered the most serious.

| Criterion | | Degree of significance | Options values | |
|---|---|---|---|---|
| | | | Option C | Option C1 |
| 3 | Groundwater | 4 | 8 | 4 |
| 4 | Land use | 3 | 3 | 3 |
| Total | | | 11 | 7 |
| Average option value | | | 5.5 | 3.5 |
| % compared to more favourable option | | | 157 | 100 |
| Sequence of options | | | 2 | 1 |

The order of options in terms of impacts on the **landscape and ecological** environment is as follows:

**1. - option C1**

**2. - option C**

**Summary evaluation of options according to individual criteria**

The following table summarizes the order of options in terms of the individual criteria.

| Criterion | | Sequence of options | |
|---|---|---|---|
| | | Option C | Option C1 |
| 1 | Construction costs | 2 | 1 |
| 2 | Technical complexity of the construction | 1 | 1 |
| 3 | Groundwater | 2 | 1 |
| 4 | Land use | 1 | 1 |
| Total | | 6 | 4 |
| Sequence of options | | 2 | 1 |

## 2. *Selection of the optimal options or ranking the appropriateness for considered options*

The following table summarizes the proposed options C red and E green of the **D4 highway** in their total value and ultimate suitability.

| Criterion | | Degree of significance | Options value | |
|---|---|---|---|---|
| | | | Option C | Option E |
| 1 | Construction costs | 4 | 4 | 8 |
| 2 | Technical complexity of the construction | 3 | 6 | 3 |
| 3 | Investment efficiency | 5 | 10 | 5 |
| 4 | Groundwater | 4 | 8 | 4 |
| 5 | water sources | 2 | 4 | 2 |
| 6 | Land use | 3 | 6 | 3 |
| 7 | biota | 5 | 10 | 5 |
| 8 | noise pollution | 5 | 10 | 5 |
| 9 | Impact on community development | 2 | 4 | 2 |
| 10 | impact on technical infrastructure | 3 | 6 | 3 |
| Total | | | 68 | 40 |
| Average option value | | | 6.8 | 4.0 |
| % compared to more favourable option | | | 170 | 100 |
| Sequence of options | | | 2 | 1 |

**Evaluating options of the D4 highway based on value analysis shows more favourable option E green compared to option C red**.

**Option E green** compared to option C red is more favourable in all assessed criteria, except for slightly higher construction costs, but the rate of return IRR of option E is more money saving. Costs of the proposed measures to be implemented for the option C red, are likely to increase the total costs of option C and for this reason, to mitigate and eliminate the adverse effects the option C requires more action than option E.

The following table summarizes the proposed options C and C1 of the **Ivanka north interchange** in their total value and ultimate suitability.

| Criterion | | Degree of significance | Options value | |
|---|---|---|---|---|
| | | | Option C | Option C1 |
| 1 | Construction costs | 4 | 8 | 4 |
| 2 | Technical complexity of the construction | 3 | 3 | 3 |
| 3 | Groundwater | 4 | 8 | 4 |
| 4 | Land use | 3 | 3 | 3 |
| Total | | | 22 | 14 |
| Average option value | | | 5.5 | 3.5 |
| % compared to more favourable option | | | 157 | 100 |
| Sequence of variants | | | 2 | 1 |

**Evaluating options of the Ivanka north interchange based on value analysis shows more favourable option C1 compared to option C**.

**Option C1** is compared to option C more favourable in the criteria related to construction costs, reducing the overall budget of the D4 highway in the section of Jarovce - Ivanka north and is more favourable in impacts on groundwater.

***Comparison of proposed options with the zero option***

The extent of the highway network and expressway network in Slovakia was approved by the Decree of the Government of the Slovak Republic No. 162 "New Project of Construction of Highways and Expressways" in 2001, which defined the highway network consisting of highways D1, D2, D3 and D4 and a network of expressways R1, R2, R3, R4, R5 and R6 with possible other expressway routes in the distant future outlook and Resolution of the Government of the Slovak Republic No. 523 "Updated New Project of Construction of Highways and Expressways" in June 2003, which extended the network of expressways by expressway route R7. Government Resolution No. 882/2008 dated 3 December 2008 regulates highway route D4, expressway route R1, specifies in more detail and supplements the expressways by another expressway route R8.

The highway network is under UV no. 882/2008 defined by the following sections:

- D1 – Bratislava (Petržalka – interchange with D2) – Trnava – Trenčín – Žilina – Prešov – Košice – national border SK / Ukraine,
- D2 – national border CZ / SK Kúty- Malacky – Bratislava - national border SR / HU,
- D3 – Žilina – Kysucké Nové Mesto – Čadca – Skalité national border SK/PL,
- D4 – national border Austria /SK - Bratislava - D2 interchange Jarovce - interchange Rovinka - interchange with D1 Ivanka pri Dunaji North - interchange with road II/502 - interchange with road I/2 - interchange with D2 Stupava South - national border SK/Austria.

D4 highway is a road link of existing D1 and D2 in the southern, eastern and northern part of Bratislava, while the affected area is also in terms of transport relations and linkages within the region of the "Great Bratislava" very complicated due to the rapid development of the subregion and constantly changing activities and functions in this extremely attractive area where the fixing of transport requirements and links to existing road system is very crucial. In addition to the D2 and D1 highway linking D4 will be a major international interconnection between Slovakia and Austria with transport links to Hungary and the Czech Republic.

Traffic load in zero option, especially D1 highway, tends to rise significantly, and today is the busiest section is the Harbour Bridge. Without transport solutions in the nearest period of time by further bridging the Danube by the proposed D4 highway, it can cause a traffic breakdown in this section. It is therefore essential to continue with further preparation of this section of D4, because the capacity of the zero option in the section of D1 Harbour Bridge (Ovsište) - Prievoz, Ružinov - Ružinov, Trnávka is to be already in 2015.

The disadvantage of the proposed options compared to the zero option is that there is a new divisive element in the landscape, the quality agricultural land use and intervention into protected areas.

Based on the above facts it can be concluded as follows:

- under realistic assessment of all criteria, increase in flow and driving comfort compared to existing road network, with significant traffic restrictions, D4 is unequivocally beneficial in this regard,
- it will increase the road safety in urban areas compared to the zero option,
- existing limitations and significant negative impacts of the zero option on the environment prefer to carry out the proposed activities,
- prognosis of traffic on the zero option and the demands on transport infrastructure in terms of planned housing construction in the affected satellite areas of Bratislava agglomeration, other municipalities in the region (population growth) will be required to solve the redistribution of transport of south-east and east entrance to Bratislava by an external circuit in the short-term perspective.

## *3. Reasoning the proposal of optimal option*

From the above comparison of options, it can be stated that more favourable option of the D4 highway is option E green with a solution of option C1 for Ivanka north interchange rather than option C red. The zero option is in terms of significant negative impacts on the environment and transport criteria significantly less favourable compared to proposed options.

Based on a comparison of assessed options of the D4 in the section of Jarovce - Ivanka North, it is recommended to use **option E green in combination with Option C1 of Ivanka north interchange** for the following reasons:

- In terms of transport and transport relations it is virtually identical to Option C.
- The recommended option E is shorter and more preferred in terms of investment efficiency (revenues).
- Technical solution of the interchange in option C1 will not substantially restrict the operation of D1 during construction.

- In terms of health impacts on the population (noise), groundwater and community development it is slightly more favourable than the option C.
- Direct disposal of habitats of the recommended option has lower acreage, in shorter section intervenes in protected areas and avoids NR Gajc. It also has a shorter distance to the stressful factors for animals during operation.
- The proposed solution bridging the Danube better reflects the migration space in PBk Danube corridor, crossing the river Danube is upright and in a straight route, which simplifies the construction of viaducts (allows e.g. use of technology of bridge ejection).
- The recommended option allows connection of cycle trails and pedestrians trails from both Danube banks with peninsulas of Jarovské arm and thus its greater use for the sports and recreation.
- When shifting the Ketelec interchange closer to Slovnaft, it will reduce the length of planned urban collection road (extension of Bajkalská)
- The recommended option allows expansion of gravel mining in Ketelec.

# *V. PROPOSED MONITORING AND POST-PROJECT ANALYSIS*

## *1. Proposed monitoring from the start of construction, during construction, during operation and after the operation of the proposed activity*

The aim of monitoring is to provide objective information about the real state and development of individual components of the environment in the territory affected by the construction and operation of roads. The purpose of the monitoring system is self-monitoring using a nationwide information system related to monitoring the environment to obtain data on the environmental impacts of the activity concerned (selected option) and to process the observed data in a comprehensive analytical report. In terms of time, it is necessary to divide to monitoring of the impacts before starting construction, during the implementation of construction and during operation**.**

Based on the processed evaluation of the impacts of the activity on the environment it is mainly the monitoring of:

- the impact on the population concerned, especially noise during construction and operation in selected areas in view of the position of the selected route to the built-up areas and recreational zones (subject to current status).
- the impact on surface water during construction, during operation, in particular with regard to the waste water drainage.
- the impact on groundwater during construction and operation (infiltration of waste water) especially in relation to PWMA Rye Island and to the extent of the recommendations of engineering geological and hydrogeological survey (construction of monitoring wells along the route).
- waste water monitoring during operation in view of the vulnerability of groundwater and surface water.

A specific problem is monitoring of the impacts of the highway on fauna, flora, habitats, protected areas and TSES aimed at monitoring the impact of construction and operation of the highway on:

- identification of locations with the occurrence of protected organisms on the route of selected option of the highway before construction begins.
- Monitoring the effectiveness of multifunctional (sound / light) barriers
- The assessment of efficiency of passages for animals.
- Monitoring the development of the newly wooded areas near highway in the area of Biskupice floodplain forests.

The specific objective of the biota monitoring after implementation of the proposed activities will be to identify the impact of new road on the individual components of biota. It is necessary to determine the impact in two ways: direct impact by occupation of the area and change of its use and indirect impact arising in the surrounding areas (migration barriers, disturbance, loss of feeding sites). For detecting the impact of the proposed activity on the composition and structure of biota it is necessary to follow the same method as used for the monitoring before construction, or in certain circumstances it is possible to modify it in some way.

The monitoring program should be drawn up in the form of project monitoring of environmental components in terms of the final opinion and by TP 6/2008 "Guidelines for monitoring the impact of roads on the environment" valid from 15 August 2008 for the final option in the next stage of the project documentation (DZP).

## *2. Proposed monitoring of compliance with specified conditions*

The main aim of monitoring is to pursue a particular phenomenon or a parameter in a precisely defined temporal and spatial conditions. It serves the objective knowledge of the characteristics of the environment and assess the changes in the monitored spatial area.

The basis for monitoring activities is the observation and subsequent environmental assessment. Using information system and information technology will enable further forecasting, draft measures to improve the environment, improving their own monitoring activities and in the next term traceability of denouncing skills of forecasts. Based on these definitions, the monitoring is focused on those elements of the environment in which the implementation of the technical work will cause a quantifiable change in characteristics.

The project monitoring components of the environment must take into account all the conditions set out in the final opinion, and the project is part of the documentation of the structure, which will be subject to the authorization process of the national and municipal institutions, thereby guaranteeing control of specified conditions. Also, the actual results of monitoring shall be submitted to the Building Authorities and, on request, to the competent state organizations working within the Ministry of Environment.

# *VI.METHODS USED IN THE IMPACT ASSESSMENT PROCESS OF THE PROPOSED WORKS ON THE ENVIRONMENT AND METHODS AND SOURCES OF OBTAINING DATA ON THE PRESENT STATUS OF THE ENVIRONMENT IN THE TERRITORY WHERE THE PROPOSED WORKS IS TO BE CONSTRUCTED*

In the process standard methods were used for the assessment of the impacts of linear structures (highways, expressways and roads) , while using findings from previous documentation (technical documentation, plan), which has already taken place in this area.

Data on the current state of the environment in the affected area are available in land-use documentation of Bratislava region, respectively Bratislava City and municipalities of Most pri Bratislave, Zálesie and Ivanka pri Dunaji. Also in the available literature and archival documents that are listed in the next section of the report.

From other sources used in the assessment process, there were the following studies performed in the context of the Assessment Report:

- Noise study
- Dispersion study
- Study of comprehensive solution for car traffic in the affected area
- Impact assessment study of the D4 highway Jarovce - Ivanka north on the favourable status of the areas of the European system of protected areas Natura 2000 in terms of their protection
- Impact of the D4 highway Jarovce - Ivanka north on groundwater flow in the area of the Bratislava Airport

# *VII. SHORTCOMINGS AND UNCERTAINTIES IN KNOWLEDGE ENCOUNTERED IN THE PROCESSING OF THE ASSESSMENT REPORT*

Shortcomings and uncertainties in knowledge over of the assessment report processing can be expected only in some details, but which are not serious and can be resolved in subsequent stages of project preparation.

# *VIII. ANNEXES TO THE ASSESSMENT REPORT*

As part of the assessment report, the following mapping, textual and visual documentation has been drawn up:

Map documentation:

1. General overview of the assessed options including zero option
2. The current state of the environment - the population and the urban environment - orthophotomap
3. The current state of the environment - the natural environment and biota - orthophotomap

4. The situation of expected impacts on the environment and proposal of measures - orthophotomap

Texts and visual documentation:

- The comprehensive solution study of car transport
- Noise study
- Dispersion study
- Table of bridges
- Study of the impact of the proposed activity on the territories of nature protection and Natura 2000 areas
- Impact of the D4 highway on groundwater flow in the area of the Bratislava Airport
- Visualization
- Photo documents
- Documents

## *IX.GENERAL FINAL SUMMARY*

**Name:**

D4 Highway, Jarovce - Ivanka North

**Purpose:**

The purpose of the construction is to ensure the traffic flow and safety of on the concerned road network and reduce the negative impact of road transport on the environment in the affected municipalities in the set projection period. At the same time, the section of D4 will greatly contribute to developing the potential of catchment area with functional utilization of its surface, resulting in a favourable impact on economic growth and standard of living of the population in the area. Construction of the D4 highways shall have the following main objectives:

- improving conditions for international and domestic transit traffic and for the overall Bratislava agglomeration transport (source, destination, urban)
- increase in the traffic flow, speed and safety of all passengers of the road network concerned
- reducing the negative impact of road transport on the environment of the affected municipalities

**Location of the D4 highway in the section of Jarovce - Ivanka north in the area:**

The D4 in the section passes the cadastral area of Bratislava – district of Jarovce, Rusovce, Podunajské Biskupice and Vajnory, Most pri Bratislave, Ivanka pri Dunaji - Farná, Ivanka pri Dunaji,

**Reason for placing the structure at the relevant location:**

The road network in the Bratislava territory and its surroundings is currently characterized by high growth of car traffic congestion, not only urban but also transit one. The importance of the need to address transport - road infrastructure, and constant verification of the road effectiveness in terms

of the Slovak road network development, is described by characteristics of Bratislava and its surroundings. These are:

- Bratislava is the capital and largest city in Slovakia,
- it is located in an eccentric position relative to the entire national territory that is the south-western part near nat. borders with Austria and Hungary,
- Bratislava is a strong source and objective for car traffic, high traffic load at the entrance to the city is due to strong dependence of the population in surrounding municipalities to the capital city, where an important part of their jobs, training and other activities is carried out,
- this trend is further reinforced by the relocation of the urban population to rural settlements for higher quality of housing, particularly in the south-east and east of Bratislava, but also in other parts of the Bratislava region,
- despite the fact that the most part of its territory is flat, SW part of the Small Carpathians extends to the central part of the city, which divides the city into two parts,
- another major barrier is the Central European river of Danube.

Bratislava road network and the entire Bratislava region is heavily burdened, while many sections of the basic Bratislava communication system is already highly congested in capacity. One of the negative consequences of this situation is the high number of accidents. The newly opened sections of D1 (Port bridge - Senecká street) are section with the highest car crash rate within the national average.

In the territory affected by D4, the traffic trends have a negative impact on the existing road network, which is to meet the required standards. Its inadequacy to existing transport requirements is demonstrated by capacity problems on the road I/63 entering Bratislava from Šamorín, on the road II/572 in direction from Most pri Bratislave, on the road I/61 in the direction from Senec, on D1 in the direction from Trnava . Mentioned 1st and 2nd class roads are overloaded in rush hours on a daily basis, and the duration of the rush hours is extending during the day. The most significant problems can be seen on the road I/61 and I/63, which is even on the territory of the Dunajská Lužná and Rovinka led on through roads of the municipalities.

For the lack of capacity of Bratislava communication network the highway network is used by the source and target traffic moving from the eastern edge of Bratislava to the west and vice versa. This causes extra traffic load especially in the area before the Pont Bridge, after the bridge and joined roads via Petržalka. After completion of D1 Vienna Route - Port Bridge through Petržalka and the joined section of D2 via Sitina tunnel the attractiveness of this route has even increased.

Construction of D4 greatly helps out the above traffic problems. Its contribution will be mainly to divert transit traffic to Austria and Hungary as well as in diffusion of transport to the city radial roads. Although the highway is to serve primarily transit traffic, in this specific area it will greatly facilitate the operation of the affected area. If D4 is not implemented, it can be expected in a short time the need for solution of transit transport conduct directly throughout the territory of Bratislava - however, this task in the existing communication system offers only the route through the Port bridge via Petržalka, already congested by source - target traffic from the city area and its immediate surroundings.

Regardless of D4 it will be necessary to launch the capacity solution of the road I/61 from Senec to the entrance to the city as soon as possible (SSC IVSC Bratislava prepares extending of the road I/61 for category C 22.5 / 80). In a very short time, it can also be expected the collapse of the through road I/63 through Rovinka and Dunajská Lužná down to Šamorín, corresponding to the issue of the need to build the R7 expressway. It is thus clear that all upcoming investments - road relocation I/61, R7 expressway, D4 highway, are justified. It can be stated that the zero state in the route D2 interchange Jarovce - interchange D1 / D2 (Pečňa) - D1 Vienna Road - Port Bridge and

D1 Mierová - Senecká road is already on the edge of capacity load, and projected traffic plan expects further increasing traffic load in the following period.

Construction of a new section of D4 highway which will take over the entire transit connections through Austria - Košice, Hungary - Košice and Brno - Košice, is the only conceptual solution to this problem, while D4 will have a significant impact on solving traffic problems in the affected part of the Bratislava region and in the city of Bratislava as such.

**Start date and completion date:**

Commencement of construction: 2012

Completion of construction and putting into operation: 2015

**Brief description of the technical design:**

D4 highway Jarovce - Ivanka North is designed in two options:

- **C - red**
- **E - green**

**Option C red**

The section begins at "Jarovce" EI where the D4 highway joins D2. The route continues north of the city district Bratislava - Jarovce, it crosses the railway track Bratislava - Rusovce through the bridge, road I/2 and right bank of the Danube, passes the southern edge of Jarovské arm and planned rowing course, vertically to the bridge over the Danube and its left-hand barrier. On the right bank of the Danube it passes by the nature reserve (NR) Danube islands and the NATURA 2000 protected area (Ostrovné lúčky). On the left bank of the Danube it passes the viaduct through NR Gajc (but at its narrowest point) and protected landscape area (PLA) Danube floodplains, which are part of NATURA 2000 protected sites (Biskupické Luhy). Negative impacts of D4 passage through this territory will be eliminated by the D4 routed on viaduct up to 5.545 km.

On the left bank of the Danube D4 passes south of the gravel mining site Ketelec where the elevated junction will be placed with the planned urban collecting road from Prístavná street, led west from Slovnaft, a.s. There is designed a large double-sided parking area "Rovinka" at 9.250 km of D4.

The highway route at 10.884 km of D4 crosses the road I/63 as elevated junction. The proposed "Rovinka" EI with the R7 expressway and the highway feeder to the road I/63 is designed at 11.750 km of D4. D4 highway continues through railway track Bratislava - Dunajská Streda north of Most pri Bratislave, which in the future should cross the new, prospective expressway of Bratislava - Vlčkovce (in terms of NDS objectives) and road II/572 as elevated junction. Linking the two roads with D4 will be made through the collector strips in one elevated interchange of Most pri Bratislave.

D4 route continues before landing-takeoff runway RWY 13-31 of Bratislava Airport and crosses the Little Danube with a bridge. In this section D4 is led in the recess so as to respect the protection zones of extended airport runway 13-31. D4 highway then passes the bridge over future water are of Zelená Voda (the western edge of the mining area). Currently, D4 would not intervene in the mining area of approx 70 m and if over the next two to three years the mining was carried out in its intended scope, then D4 highway would cross the newly created lake in the length of about 140 m (over the bridge).

Then the D4 route goes east from the former agricultural farm in the area of Prucká sihoť (away from airport). At the intersection with the planned runway 13L-31R the D4 highway is conducted in the recess of about 6.8 to 7.2 m below ground level, so that (in the construction of runway 13L-31R) the completion of a highway through the "Zálesie " tunnel is possible.

D4 route continues in a low embankment on the right bank, along Šúrsky channel, while respecting its protection zones, crosses the road I/61 as elevated junction, prospective communication between local part of Tanieriky and Sakoň, then it crosses the railway track Bratislava - Galanta as elevated junciton and ends at the connection to the D1 highway in the "Ivanka - north" EI. **Total length of Option "C" is 22,800.63 km.**

Vertical design of D4, in addition to the relief of existing flat terrain, is designed with natural and artificial obstacles. At the beginning of the route, the vertical design is intended by existing position of "Jarovce" EI.

After bridging the railway track Bratislava (Petržalka) - Rusovce - Hungary and road I/2, the route logically bridges Jarovské arm and the Danube, in the range of which the height of the route is determined by both-sided barrage (consider leaving a minimum free height of 2.50 m above the right-sided barrage, 4.20 m above the left-sided barrage and required shipping space on the main river).

Seemingly long routing of D4 behind bridging the Danube above the existing ground level is to allow (after the construction of bridges) animal migration across the new highway. Quite a high amount of bridges is designed to mitigate the adverse effect of dividing the road in fauna that occurs within the protected site.

Terms of level passage of the D4 highway route over railways and roads, set by the relevant standards, are respected throughout the region.

At the intersection of D4 highway with the prospective expressway and road II/572 ("Most pri Bratislave" EI) the D4 highway is conducted at ground level, prospective R and road II/572 is conducted by bridges over D4.

Particularly difficult situation, significantly affecting the vertical design of the D4 route is in the Bratislava Airport section, in local planning extending of the existing runway 13-31 and at the intersection with a forward-looking parallel runway 13L-31R. The need to respect the protection zones of the landing and take-off space of the runways has affected the height design of D4, particularly at runway 13L-31R, where the D4 highway is conducted in the groove. In the future, the D4 highway in the section crossing the runway will be covered in the form of the tunnel within the construction of runway 13L-31R.

According to the representatives Bratislava Airport it is necessary to respect the following:

- The airport plans to extend the runway 13-31 to a total length of 3,600 m and is also considering the relocation of the Little Danube to the new position. When designing the D4 highway, which is conducted at the current ground level, it is necessary to respect existing protection zones of RWY 13-31.

- In the future it is planned to build a parallel runway 13L - 31R, which requires to reserve a territory. Protection zones of the airport runway will be the same as with runway 13-31. During the construction of runway 13L - 31R the former agricultural farm will be cancelled in the area of Prucká sihoť. At the intersection of D4 highway with PZ of transition airport areas it is not required to build "Zálesie" highway tunnel, D4 must be led within the recess so as to respect protection zones of runway 13L - 31 R.

- Runway 04-22 is not projected for expansion in the future, this runway is to be used out (as it passes the populated territory of Ivanka pri Dunaji). It is recommended to request an exception from protection zones of RWY 04-22.

The D4 route is in the area of the intersection with runway 04-22 of the above reasons, vertically conducted in the low embankment above the current ground level (it counts with an exemption from PZ of RWY 04-22). The regulation of the Ministry of Transport of 10 June 2009 the construction of "road I/61 Bratislava - Senec" will be led in its current vertical conduct and D4 it will be led by a bridge over the road I/61.

End of the section based on the request of the claimant NDS, a.s. was technically resolved so that the proposed D4 highway routing in this option underneath D1 was vertically reviewed and designed over D1 regarding the problems with high water table in the original proposal (difficult objects - sealed bathtub). Description of the technical solution is in the next part.

**Option E green**

The beginning of the section from "Jarovce" EI to 1.0 km is designed the same way as in Option "C", the route of the D4 highway is crossed by the railway track of Bratislava - Rusovce via elevated junction (bridge), from "Rusovce" EI it continues in a straight line over Jarovské arm and the main flow of the Danube River on a bridge 2.722 km long. From 4.851 km the route passes north of the planned gravel mining site Ketelec where the elevated junction will be placed with the planned urban collecting road from Prístavná street, led west from Slovnaft, a.s. There is designed a large double-sided parking area "Rovinka" east from Lieskové at 8.700 km of D4. The route continues under option C to "Ivanka - North"EI from the road I/63 bridging at 10.245 km of D4. **Total length of Option "E" is 22,168.94 km.**

The route of option "E" passing the territory of the Danube does not interfere with NR Danube islands and protected area of European importance Natura 2000 on the right bank of the Danube, does not interfere with NR Gajc and NR Kopáčsky ostrov on the left bank of the Danube, in the narrowest point with minimum intervention in the protected area of Danube floodplains and the protected area of European importance NATURA 2000. Negative impacts of the D4 highway passing this territory will be eliminated by conducting the D4 highway on viaduct until 5.110 km, with a bridge for animals at 5.225 km, which will enable wildlife migration via elevated road above D4 and ensure interconnection of biking trails and routes for pedestrians on both banks of the Danube with the peninsula of Jarovské arm and thus its greater use for the sports and recreation. Compared to option C, the bridge on D4 over the Danube is placed further from the existing houseboats on Jarovecké arm and allows expanding gravel mining in "Ketelec" area in south-easterly direction.

*Vertical design*

Vertical conduct is similar to Option "C", where the vertical design of the route in the section of the Danube bridging is determined by both-sided barrages and desired shipping space on the main flow of the Danube.

According to valid STN 73 6101 it is sufficient for the projection period in this section of D4 to apply width arrangement - a four-lane where the recommended range of traffic volumes in the territory not for building-up is from 18,000 to 60,000 vehicles / 24 h. According to the assessment of individual traffic sections, D4 highway capacity will meet the traffic demands of the projection period in the four-lane width arrangement. Given the potential for the development of Bratislava

and its surroundings, as well as the position of the highway ring on the outer edge of the city, we recommend:

- from "Rusovce" EI to "Ivanka - West" EI to build the D4 highway in category D 33.5/120 (100), with four-lane width arrangement in the 1st stage, i.e., with the broader central line so as to allow the prospective expansion of the six-lane highway towards the axis (it is questionable to leave a margin for 6-lane already from "Jarovce" EI, i.e. from the D2 highway).
- in the section between "Ivanka - West" EI, "Ivanka - North" EI, where it is necessary to build collector strips because of the small distance between these interchanges, we propose to build the D4 highway in category D 26.5/120 (100), i.e. in the four-lane width arrangement.
- to purchase lands for broader use (future six-lane) already in the first stage and critical civil structures (bridges, bathtubs, ...) to be implemented for the final layout, that would significantly save costs in the financial outlook for the widening the D4 highway to 6-lane.

Better economic indicators can be achieved in the construction of D4 in the section of four-lane width arrangement, on the other hand, if it was necessary to additionally expand D4 to six-lane, it would mean higher additional costs (construction costs and the cost of the land e.g. in 30 years they will certainly not be lower than they are now) and for certain construction projects, for example on a bridge over the Danube, or in sealing bathtubs unless it is counted in advance, then the extension will not be able to be technically feasible.

Overview of basic indicators of D4 highway in the section of Jarovce - Ivanka, north for options C and E according to documents of the Feasibility and effectiveness study are shown in the following table:

| **Indicator** | **m.u.** | **Option** | |
|---|---|---|---|
| | | **"C" red** | **"E" green** |
| Total length of route | km | 22,800 63 | 22,168 94 |
| Bridges on D4 | km | 6.110 | 6.139 |
| Cubic capacity of embankments | $m^3$ | 3,559,232 | 3,149,955 |
| Cubic capacity of excavations | $m^3$ | 549,215 | 561,044 |
| Road relocations | | | |
| 1st class | km | 0.786 | 0.438 |
| 2nd class | km | 0.618 | 0.708 |
| Field, purposeful, bypasses etc. | km | 22.382 | 23.124 |
| Elevated interchanges | pc | 6 | 6 |
| Bridges on D4 | m | 6,110 | 6,139 |
| Bridges over D4 | m | 830 | 830 |
| Bridges on roads outside D4 | m | 865 | 879 |
| Tunnels | m | 0 | 0 |
| Sealed bathtubs | m | 1,330 | 1,330 |
| Noise barriers | m | 7,600 | 9,250 |
| Parking areas | pc | 1 | 1 |
| Fencing | m | 32,600 | 30,872 |
| IRR | % | 6 | 6 |
| Costs construction part excl. VAT | € | 624,529,483 | 646,615,144 |

| | | | |
|---|---|---|---|
| Total costs excl. VAT | € | 843,561,884 | 887,804,782 |

***Alternative solution of the D4 and D1 highway junction of Ivanka North***

D4 highway crossing the D1 highway according to the Feasibility and effectiveness study is designed under the existing D1 embankment body with partially embedded D4 highway below the ground level due to observance of standard head clearance - Option C. In this way, it is necessary to build D4 in the sealed bathtub in the length of about 600 m because of the high water table.

NDS, a.s., the claimant, regarding unfavourable hydrogeological conditions in that section of highway (the need to build a sealed bathtub due to high ground water level and other anti-flood measures), developed in the course of the Assessment Report processing an optional technical design for routing D4 in the affected region (Ivanka north interchange). The optional design of D4 routing is based on modifying vertical conduct of the D4 highway over the D1 highway - option C1, while the necessary adjustment to the level line also affects the following section of D4 Ivanka north - Záhorská Bystrica.

The option was prepared in the technical study "D4 highway, Ivanka north interchange with the D1 highway, optional solution", drawn up by our company in April 2010. Modification of option "C" of D4 in the section has been temporarily marked as **option "C1"**, while the vertical routing modification of the highway touches option "C" at km 21.250 - cad. area (22.800 643) in the section of Jarovce - Ivanka north and options 2a resp.7a and 2b, resp.7b at 0.0 to 0.575 km of Ivanka north - Záhorská Bystrica.

The modification of vertical levelling of D4 in the section concerned (D4 crossing Ivanka north with D1) will have a positive impact on the overall technical and environmental solutions of D4 Jarovce - Ivanka north in option "C1". In principle, the sealing tub is excluded underneath the D1 highway, thereby eliminating the need to use groundwater during construction and overall impact on the system, the quality and flow and also consuming construction technologies to be excluded (diaphragm walls), in expecting a significant conflict with D1 and its limited operation. The proposed modification will added a bridge over the D1 highway (without affecting the natural body of D1 and limits to its operation), partly however it increases the land use due to the need to build higher embankments and increase the claim for filling material, the difference, however, in view of the general land use and material balance for the entire section of D4 is negligible.

Overview of basic indicators of options C and C1 received from TS of 'D4 highway, Ivanka north interchange with the D1, option" is in the following table:

| **Parameter** | **Measurm. unit** | **Option C** (the "Feasibility and effectiveness study" of September 2009) | **Option C 1** (alternative solution) |
|---|---|---|---|
| D4 highway length | km | 2.1262 | 2.1262 |
| Crossing D4 with D1 | | by subway (notch in the sealing bath) under D1 | by bridging over D1 |
| Construction costs excl. VAT | Eur | 112,736,000 | 96,251,000 |
| Financial saving | Eur | - | 16,485,000 |
| Length of bridges on D4 | m | 1,672 | 1,462 |
| Length of bridges over D4 | m | 324 | 108 |

| | | | |
|---|---|---|---|
| embankment | m3 | no change | increasing by 1,254,000 m3 |
| excavation | m3 | 88,000 | 0 |
| permanent land use | m2 | no change | no change |
| temporary land use | m2 | no change | no change |

***Further conditions for the construction of the proposed options***

In terms of designed options the following adaptations of the Bratislava road system should be considered (related investments that are within the competence of Bratislava city):

- to adapt the existing Svornosti st. by extending to the four-lane road, including adjustments to strategic interchanges with Slovnaftská and Popradská street to elevated junctions,
- build a new four-lane "radial road", which will interconnect Bajkalská st. from the intersection on D1 Prievoz and D4 through the Ketelec intersection (defined in the planning documentation as an extension of Bajkalská st.).

The above adjustments are defined and protected in the form of binding regulations in updated and currently valid zoning plan of Bratislava of 2007, respectively its amendments 01 of 2008.

**Phasing of construction:**

The construction of the entire D4 highway is proposed to be implemented in the following stages, in sections:

- Section I Jarovce – Ivanka North, resp. Rača interchange*
- Section II Ivanka North, resp. Rača interchange* – Záhorská Bystrica,
- Section III Záhorská Bystrica – Devínska Nová Ves (extension to 4-lane),
- Section IV Devínska Nová Ves - nat. border SK/A

(* According to the Feasibility study, a recommendation to extended section I to the Rača interchange of Section II.)

The assessed section of Jarovce - Ivanka north, respectively Rača crossroad is recommended to be built as first, because after it is put into operation, the greatest positive impacts on other roads in the southern and south-eastern part of Bratislava are expected, as follows:

- partial traffic relief of the D1 highway inside the city (especially in Ružinov, Prievoz, on a busy bridge over the Danube, in Petržalka),
- diversion of transit traffic to the D4 highway ring,
- partial diversion of traffic between outskirts on the outer edge of the City of Bratislava,
- a favourable impact on the 3rd class road network is expected (decreased congestion), for example between Podunajské Biskupice and municipalities of Most pri Bratislave - Zálesie - Ivanka pri Dunaji, which currently replace the missing outer ring road of the city,
- if the construction of a part of the section Ivanka North - Rača crossroad (Section II) began in Section I, this would have a positive impact not only on Rybničná street - through a reduction of traffic load (currently assumes the function of the missing outer ring of the town), but also on internal part of Vajnory, where there would be a significant reduction in congestion of a new urbanization (Čierna voda), as car traffic would have already been caught up on the D4 highway.

In there were problems in preparing Section I., i.e. passing across the Danube, it is recommended to begin the construction of Section I from "Rovinka" interchange and end it on D1 in "Ivanka - North" EI, respectively we recommend to start building at the same time with part II. of the section

from "Ivanka - North" EI to "Rača" EI. This would solve a substantial part of the traffic issues in the eastern part of Bratislava, that would also accelerate urban development in Vajnory suburb (CEPIT, a new planned urbanization at the former airport in Vajnory, removing unwanted traffic in the urban area of Vajnory from the direction of Čierna voda).

**The construction costs of the proposed options excluding VAT:**

Option C red: 624,529,483 EUR

Option E green: 646,615,144 EUR

**Identified impacts of the expressway on the environment:**

Population

The impacts on the population are mainly health risks and disturbance to well-being and quality of life, that is directly related primarily to the hygiene of the environment, which is characterized in case of a construction by increased noise, vibration and emissions production, and also indirectly to road safety.

In terms of these results of the noise study, exceeding hygienic limits of noise from traffic will occur in some sections of the assessed options. For that reason the technical measures were proposed to ensure the population against the effects of noise in the form of noise barriers (screens), being part of the draft measures.

Based on the traffic intensity forecast on the D2 highway, respectively D1 (regardless of the construction of D4), roads in cad. area of Jarovce and Vajnory will be considerably loaded in the near future due to the increase in traffic and it is therefore necessary to address the relevant transport junction area of Jarovce, respectively Ivanka north together with the D4 highway to forecast traffic intensity for each branch of said interchanges including sections of D2 and D1 highway.

Following the results of the dispersion study, the residents nearby the D4 highway route will not be influenced by excessive air pollution from traffic, allowable concentrations of pollutants in the air in a residential area are not exceeded even under the most unfavourable dispersion conditions and any measures do not need to be introduced.

The disruption of well-being and quality of life means primarily the negative effects on the fundamental factors in the environment for residents of municipalities (quality of housing, the quality of essential elements of the environment - notably air, water and environmental hygiene, subjective factors of perception of the environment). It is understood that during direct construction work of highways, the previously established way of life and the quality of the environment will change, and these changes are mostly negative, however, are temporary. Factors influencing the well-being and quality of life can be regarded as direct and indirect effects of construction activities associated with the construction of highway and implementation of related investments e.g .:

- increased intensity of freight transport with subsequent increase in noise, dust and general traffic especially in the area of construction yards and larger construction objects
- disruption of the long-term perception of landscape (new technical elements in the landscape).

After putting the structure into operation, however, the benefits of the activity will be immediately apparent for the inhabitants of affected municipalities by redistribution and subsequent reduction in transport intensity on the road network, which will occur as a result of the use of the new section of

the highway. Reducing traffic load will improve the quality of life and well-being especially for residents near the roads leading through the urban areas by reducing noise, vibration and emissions, by increasing traffic safety and accident risk.

Air

The activity assessed by the dispersion study will not significantly affect the current air quality in the affected area, on the contrary, diversion and redistribution of transport outside the central part of Bratislava to the open landscape will reduce the concentration of air pollutants in urban areas.

Surface water and groundwater

During the construction we can expect a threat to surface water quality in establishing the pillars of the bridges crossing surface streams and water areas in both options, respectively during necessary adaptation of Biskupické arm in option E.

D4 highway bridges the Danube and adjacent system of arms and channels at 3.0 to 4.8 km of option C, respectively at 2.7 to 4.6 km of option E, while the proposed bridge pillars will be directly installed in Jarovské arm. D4 highway then bridges the Little Danube and water area of gravel pit called Zelená voda at 16.8 to 17.5 km. The direct threat to the quality of surface water can be caused by leakage of pollutants directly into water from construction machinery, respectively during accidents.

During operation, the quality and mode of surface water is threatened in the affected flows due to the entry site of the waste water drained from the highway to the respective recipients (Danube, Little Danube, Šúrsky channel); according to the technical solution, however, it is considered before the outlet to purify the water in ORL, or hold them in the retention basins.

Given that the whole section of the assessed options crosses the area of highly permeable rocks (gravel sand sediments) and substantial underground water reserves, a part of the affected area is also one of the major sources of drinking groundwater (PWMA Rye Island) and close to the highway there are very important groundwater sources (WR Rusovce - Mokraď - Ostrovné lúčky, WR Rusovce), it is necessary to the pay attention to protection of groundwater during construction and operation.

Based on hydrogeological and protection limits within the technical solution, a road drainage has been designed for both assessed options, which in normal operation of the highway provides protection of ground water against negative influences. However, it is being considered a partial inlet of waste water from the road, respectively from the operation of the parking area into the rock environment by infiltrating, waste water will be purified in ORL according to the technical solution before the inlet, which will ensure the groundwater quality.

Soil

The highway route in option C will require permanent land use of approximately 143 ha, in the option E to be about 142 ha.

Fauna, flora and their habitats

In general, the impacts of the proposed options on the fauna, flora and their habitats can be divided as follows:

- primary (disappearance of habitat due to construction of roads),

- secondary (killing of animals, fragmentation of habitats, pollution by salting materials, exhaust fumes, noise, light, changes in the hydrological regime, climate etc.),
- tertiary (penetration of new, often invasive species into the environment, the construction of the highway will also bring the development of human settlements, technical infrastructure, industry, recreation etc.)

In assessed sections of the highway, it will in particular be the following impacts that may be seen during the preparatory work, the construction itself and then also during operation:

- direct damage and destruction of habitats,
- tree felling,
- killing of animals,
- creating a barrier in migration corridors,
- fragmentation of habitats,
- noise, light load of animals,
- air pollution.

In view of these impacts, both options will be identical, the difference is, however, in affecting the habitats.

In option C, the habitat of Community importance Ls1.1 Poplar and willow lowland floodplain forests (91E0 floodplain willow-poplar and alder forests) is to be directly destroyed in the approximate range of 26,430 $m^2$.

In option E, the habitat of Community importance Ls1.1 Poplar and willow lowland floodplain forests (91E0 floodplain willow-poplar and alder forests) is to be directly destroyed in the approximate range of 26,430 $m^2$.

The area includes all sites with habitats of Community importance in the routes of individual options, while for option E, the said habitat is located outside the ÚEV Biskupické floodplains and for option C, about 2/3 of the size of the destroyed habitat are situated in ÚEV Biskupické floodplains and 1/3 is beyond the territory. In option C, there will be a stronger (compared to option E) impact on the habitats of species of Community importance for which the ÚEV Biskupické floodplains is declared. This is particularly related to the habitats of species such as great capricorn beetle *(Cerambyx cerdo)*, and stag beetle *(Lucanus cervus)*.

Noise and light load around the highway will be particularly disturbing to wildlife. Hearing of many species is more sensitive than hearing of people. The reactions of each species present in the corridor of the highway on the mentioned stress factors are highly individual. Some species are unable to get adapted to these changes, but most of them prefer to avoid noisy areas. In general, we can say that the noise makes their mutual communication, mating and hunting difficult. In relation to wildlife, no exact values of noise are set up that would not have disturbing effect on them. Loading the vicinity of the highway with noise acting on wildlife is documented in a separate noise study. Based on the results referred to in the dispersion study we can conclude that the annual limit value for the protection of vegetation (30µg.$m^{-3}$ $NO_x$) will be not be exceeded when passing the proposed options of the highway through attacked habitats.

<u>Landscape and scenery</u>

The major part of the route of the assessed options consists of agricultural land near the Bratislava agglomeration, where the negative effect of the new line of highway in the are will not be manifested. The use of the narrow corridor from agricultural production to transport infrastructure will be changed in the highway corridor. However, given the strong pressure of urbanization around Bratislava, which requires another especially agricultural land use, the proposed highway is acceptable in the landscape and its negative impact will be manifested only in a short section of highway crossing through the territory of the Danube floodplains. The solution of highway in this section on the bridge will partially mitigate the negative impact on that area.

Protected areas of nature and landscape, NATURA 2000 areas

The highway route in terms of Act no. 543/2002 Coll. on nature and landscape protection, as amended, passes through the first to fifth level of protection.

In terms of impacts of the proposed highway on nature protected areas and NATURA 2000 areas, the following can be expected:

- direct land use of parts of protected areas,
- impact on migration,
- stress factors (noise and dazzling with spotlights) putting load on the affected parts of protected areas,
- air pollution in protected areas.

The overview of impact of the assessed options on protected areas of nature and landscape is presented as follows:

*Protected landscape area of Danube floodplains* - Option C red (4.7-5.2 km), E green (4.5-5.3 km) - the highway in both options is mostly conducted by the bridge, direct land use of the protected area, direct impact of noise and lighting.

*Nature Reserve of the Danube Islands* - Option C red - the highway is conducted by the bridge, out of the protected area, direct impact of noise and lighting (route runs close to the borders of NR - Jarovské arm). Option E green - the highway is conducted by the bridge, out of the protected area, out of the impact of noise and lighting.

*Nature Reserve of Gajc* - Option C red (4.8-5.1 km) - the highway is conducted by the bridge, direct land use of the protected area, direct impact of noise and lighting. Option E green - the highway is conducted by the bridge, out of the protected area, direct impact of noise and lighting (route runs close to the borders of NR).

*Nature Reserve of Kopáčsky Island* - Option C red - the highway is conducted by the bridge, out of the protected area, out of the impact of noise and lighting. Option E green - the highway is conducted by the bridge, out of the protected area, direct impact of noise and lighting.

*Nature Reserve of Topoľové hony* - Option C red - the highway is conducted by the bridge, out of the protected area, direct impact of noise and lighting. Option E green - the highway is conducted by the bridge, out of the protected area, out of the impact of noise and lighting.

*Site of Community Importance of Biskupické floodplains* - Option C red (4.8-5.1 km), E green (4.6-5.3 km) - the highway in both options is mostly conducted by the bridge, direct land use of the protected area, direct impact of noise and lighting.

*Site of Community Importance of Ostrovné lúčky* - Option C red - the highway is conducted by the bridge, out of the protected area, direct impact of noise and lighting (route runs close to the borders of NR). Option E green - the highway is conducted by the bridge, out of the protected area, out of the impact of noise and lighting.

*Protected Bird Area of Danube floodplains* - Option C red (3.0-5.4 km), E green (2.7-5.3 km) - the highway in both options is mostly conducted by the bridge, direct land use of the protected area, direct impact of noise and lighting.

*Ramsar site of Danube floodplains* - Option C red (3.0-3.2 km and 4.1-5.7), E green (3.9-5.3 km) - the highway in both options is mostly conducted by the bridge, direct land use of the protected area, direct impact of noise and lighting.

Impact of migration can be defined as the total effect on the movement of animals in the affected area of conservation. For terrestrial, semi-terrestrial, aquatic and semi-aquatic animals their migration will be restricted at minimum after putting into operation, given the technical solution of the highway (through the affected area the route is mainly conducted through bridges). Migration of avifauna will be affected mainly by the construction of the Danube Bridge as a partial barrier. To minimize stress factors (noise, dazzling) the recommendations indicate proposed noise barriers, which may also form screens against dazzling while ensuring their multi-functionality.

Protected water management area of Rye Island and water resources

The two proposed options are located in PWMA Rye Island practically in the same length in the section at about 4.0 to 16.9 km, their effect is the same and pose a risk of contamination of ground water reserves in the PWMA. Option C is conducted near protection zones of PHO 2 outdoor VZ Rusovce. A direct impact on water source is not expected, it can indirectly affect the quality of groundwater close to the water source.

Territorial system of ecological stability

Among the identified impacts on TSES the following can be stated for the evaluated options in terms of subregional and regional aspect, while the effect of negative factors will be similar as for the protected areas in the phase of construction and operation of highway.

*National bio-centre of NRBc Bratislava floodplains* - Option C red (2.9-7.2 km), E green (2.4-6.7 km) - the highway in both options is mostly conducted by the bridge, direct land use of the protected area, direct impact of noise and lighting.

*Provincial bio-corridor of PBK Danube and supra-regional bio-corridor of NRBk Little Danube* - Option C red, E green - passages through the corridors can be considered in both options for the same (width of the corridors can not be precisely defined), highway barrier action for migration, however, will be mitigated by the fact that the highway crosses the corridors at elevated level. The most significant effects will be felt during the construction and early operation. Migration of animals after a certain time will adapt to new conditions and bio-corridors will continue working.

Urban Complex and Land Use

Both options are under current LUD located outside the existing built-up area of Bratislava and affected municipalities and the construction does not require the demolition of permanent structures.

Conflict of the airport interests has been solved in the Feasibility study, at 21.1 km (red option stationing) the highway route is in contact with the radio-beacon, it will need to address the security of the object.

The impacts of the highway route on the objects of the Ministry of Defence were discussed with the authorities concerned, while the highway will be in contact with an underground unit of the Ministry of Defence at about 1.5 km (red option stationing).

The area of proposed options of D4 are predominant by agricultural land use, i.e. the most significant impact on agricultural production. The highway route passes from 8.250 to 8.600 km in red option through the gravel mining area of ANČETA company. Mining is to be completed this year and the mining pit will be backfilled with soil and landscaped in original condition. From 17.230 to 17.400 km (red option stationing) the highway is led through the current space of gravel mining in the cadastral area of Most pri Bratislave. Mining is to be completed in 2012, it is required to consider a bridge on D4, given that after the completion of mining in this area, there will remain a lake.

Cultural and historical monuments

Option C red at 10.350 km and option E green at 9.710 km crosses the protected cultural and technical monument - the original flood protection dike (implemented during the Austro-Hungarian Empire under the reign of Maria Theresa) as part of a secondary flood line (Upper Rye Island dike).

Territorial development

Both options collide with surfaces of prospective urbanization of the affected area, that is the cadastral area of Jarovce - areas of prospective civil amenities - green option at 1.600 to 2.500 km and red option at 1.500 to 2.860 km. Prospective areas of sports and recreation (ARST Jarovské arm) will be crossed by green option at 2.7 to 3.9 km, by red option at 3.0 to 4.1 km. At 17.0 to 17.9 km (red option stationing) both options intervene in a prospective recreation area of Zelená voda in the cadastral area of Most pri Bratislave.

Transport

Construction and operation of the D4 highway will unburden and redistribute traffic on the roads in Bratislava. For a certain period of time, the capacity of the busiest roads and highways will increase, including sections leading through the built-up area of the city. D4 highway service will have a positive impact on:

- improving transport operation service of the affected area,
- increasing traffic flow and safety,
- relief to the road system of Bratislava,
- improving the quality of life of the residents,
- reducing negative impacts on the environment,
- the overall increase in the value and development potential of the area,
- improving the delivery of functional levels of individual sections of the road system,
- increase in economic efficiency of the transit and partly source - target traffic to Bratislava

Other Impacts

When dividing the agricultural areas by the highway, their accessibility for maintenance shall be ensured. During construction and operation the access to the forestry activities shall be ensured.

Impact on the activities of hunters and fishermen in the affected area will be particularly important in the construction period, when the activity will be significantly restricted (establishment of a bridge directly in the waters of Jarovské arm, construction of the highway right in hunting areas). After completion of construction and during operation, mainly hunting activity will be partly reduced with respect to the occupation of hunting areas by the highway and due to excessive noise the game will probably move to quieter areas of the Danube floodplains, which will cause the changes to the frontier of the hunting grounds.

In terms of the impact of construction and operation of the road on water management, direct impacts related to crossing existing hydromeliorations can be considered significant impact.

According to Decree no. 211/2005 Coll. of the MoE, the important water management watercourses are the Danube under Bratislava at 1,708.2 to 1,850.2 rkm and above Bratislava at 1,872.7 to 1,880.2 rkm, the Little Danube and Šúrsky channel throughout the entire section. Within Gabčíkovo Water Dam, there is a seepage canal of Janíkov dvor - Jarovce - Rusovce - Čunovo. The water facilities are respected within the technical design of the D4 highway.

D4 highway route is situated near Šursky channel by digging groove (sealing bathtub). The flow administrator requires for ensuring the maintenance and protection of the channel to keep min. 10 m, and in exceptional cases 5 m wide operating strip from the foot of the dam until D4 highway.

The route crosses the flood protection dikes of the Danube and that is the right bank at 3.0 km (red option) and at 2.650 km (green option), left bank at 4.8 km (red option) and at 4.6 km (green option). The flow administrator requires for ensuring the maintenance and protection of the dike to keep min. 10 m wide operating strip from the foot of the dike.

At 3.1 km of the red option, the highway route passes nearby Bratislava water company and at 11.900 to 12.300 km (red option stationing) passes near the Slovasfalt´s packaging plant, but it is led out of their areas, the impact on listed buildings will only be during construction, however, their accessibility shall be ensured.

The proposed highway in the section of the Danube floodplains will have a negative impact on the current use of that area for recreation and sports activities especially during construction. The international Danube bike and hiking marked trails in the relevant territory will be negatively affected during construction . Positive impacts on the bike and hiking trails during operation will be ensured by linking both banks of the Danube in both options by a bridge, which will have a path for pedestrians and cyclists allowing access to the recreational area in between the dikes. Access for pedestrians and cyclists to the bridge over the Danube from the existing bike trails and paths is designed with a pair of ramps in three places.

At 5.9-6.1 km of the green option there is a garden settlement near the highway to which the access during construction shall be ensured, given that the field road, which now ensures the availability of the area, will be interrupted by the highway. During operation the technical solution designed a bridge over the highway on the field road. With regard to this, one garden in this section is located separately outside the village and right in the highway route, this will likely be destroyed.

In Most pri Bratislave at 17.0 to 17.9 km, the highway route extends into the area of the village recreation facilities with suburban area of Zelená voda, where the mined gravel pits are used for recreational purposes associated with swimming etc. However, there are no service facilities built in this area, recreational use is still just natural swimming. At present, gravel mining has been restored in the area, therefore the use of the site will be quite limited until the end of mining. With regard to the highway route through the said area, the use of Zelená voda for recreation will be limited by negative impacts, particularly noise.

In Ivanka - Farná, a dog training area of KŠK Rottweiler Ivanka is situated neat the proposed highway route at 19.9 to 20.2 km of the red option, which will be indirectly affected, particularly during highway construction.

In terms of impacts on infrastructure it is needed to include collisions with existing roads, railways and collisions with existing utilities as significant impacts of the highway construction. These are designed as forced investments and their range is given in the technical solution of proposed activity.

**Conclusions from the comparison of the assessed options:**

Based on a comparison of assessed options of the D4 in the section of Jarovce - Ivanka North, it is recommended to use **option E green in combination with Option C1 of Ivanka north interchange** for the following reasons:

- In terms of transport and transport relations it is virtually identical to Option C.
- The recommended option E is shorter and more preferred in terms of investment efficiency (revenues).
- Technical solution of the interchange in option C1 will not substantially restrict the operation of D1 during construction.
- In terms of health impacts on the population (noise), groundwater and community development it is slightly more favourable than the option C.
- Direct disposal of habitats of the recommended option has lower acreage, in shorter section intervenes in protected areas and avoids NR Gajc. It also has a shorter distance to the stressful factors for animals during operation.
- The proposed solution bridging the Danube better reflects the migration space in PBk Danube corridor, crossing the river Danube is upright and in a straight route, which simplifies the construction of viaducts (allows e.g. use of technology of bridge ejection).
- The recommended option allows connection of cycle trails and pedestrians trails from both Danube banks with peninsulas of Jarovské arm and thus its greater use for the sports and recreation.
- When shifting the Ketelec interchange closer to Slovnaft, it will reduce the length of planned urban collection road (extension of Bajkalská)
- The recommended option allows expansion of gravel mining in Ketelec.

**Meeting specific conditions specified in the Scope of Assessment:**

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| 1. Define the affected area in terms of impacts and concerns on the population. | The requirement is met - see chapters A.II.8. and 9., C.II.11, C.III.1. |
| 2. Complete crossing of D4 with R7 and insert the resulting solution of connection of D4 and | The requirement is met - see chapters A.II.8. and 9. |

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| R7 to the Assessment Report | |
| 3. Resolve routing of D4 near the Bratislava Airport and airport beacon in cooperation with the Civil Aviation Authority. Insert the resulting solution of this routing to the Assessment Report. | The requirement is met - see chapters A.II.8. and 9., C.III.11 and C.IV.2. |
| 4. Complete routing of D4 at 2 to 8 km in cooperation with the District Forestry Office in Bratislava. Insert the resulting solution of this routing to the Assessment Report. | The requirement is met - see chapters A.II.8. and 9. |
| 5. Complete routing of D4 in the protection zone of railway in cooperation with ÚRŽD, special section of Building Office in Bratislava . Insert the resulting solution of this routing and measures to the Assessment Report. | The requirement is met - see chapters A.II.8. and 9, C.IV.2. |
| 6. Deal with building paths for pedestrians and cyclists, transitions, or subways in the area affected by the highway | The requirement is met - see chapters A.II.8. and 9. |
| 7. Consult the D4 route in details with constituents of MD SR - Administration of real property and the construction in Bratislava and the MI SR. | The requirement is met - see chapters C.III.11. and C.IV.2. |
| 8. Verify the possibility of connection of the feeder from Zálesie to D4 so as to offer a complete downhill and exit to the highway, | The requirement is met - see chapters A.II.8. and 9. |
| 9. Develop a study of visualization of the proposed activity, describe the change in the landscape by the proposed activity, describe a detailed analysis of impacts of the proposed activity on the scenery, landscape image and landscape (visualization) and visibility analysis (graphically and in writing) and add situational sketch with scale or a description of distances from the nearest residential areas from the proposed activity. | The requirement is met - see chapter C.III., maps, text and image attachments. |
| 10. Give indicative areas where construction yards and landfills are to be established, and the route of access roads, respectively sites where their location is excluded, determine the place for equipment, material dumps, landfills and temporary dumps outside the protection zones | The requirement is met - see chapters A.II.8. and 9., maps. |

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| of water resources, inundations and protected water management area. | |
| 11. A more detailed description of handling the excavated soil (earth removal routes, locations of deposits of excavated soil etc.). | The requirement is met - see chapters A.II.8. and 9. |
| 12. Develop current noise study (especially for housing and recreation areas) and on that basis to design the sites and parameters of noise barriers. | The requirement is met - see text attachments. |
| 13. Develop a detailed hydrogeological survey to assess the impact of the highway on groundwater flow regime, especially in tunneled sections. Supplement the justification for the need to build highway sections in tunnels. Supplement assessment of the impact of the highway on flows that it crosses, and streams it runs in close distance. Add the method of installing the bridge over the Danube and affecting the flood protection dike. Pillars of the bridges crossing other flows to be placed outside the inundation zone. | The requirement is met - see chapters A.II.8. and 9., C.III.5. and 16., C.IV. and some text attachments.<br><br>(Notes of the assessment report processor: a detailed hydrogeological survey at the stage of the impact assessment in view of the option for routing the highway is not practically implemented, a purposeful hydrogeological report has been processed - text attachments. Detailed hydrogeological survey was recommended to be implemented in the next stage of PD for the chosen option.) |
| 14. Determine the outlet of highway sewage and a method of final disposal of rainwater. | The requirement is met - see chapters A.II.8. and 9. |
| 15. Compare the final option of the activity with the option if the activity is not being implemented (e.g. the appropriateness of the carrying cables of the main bridge displayed in visualization in a protected bird area) in several ways. | The requirement is met - see chapter C.II.18., C.IV., C.V. maps, text and image attachments. |
| 16. Assess specifically and in details the impact of activity on the territories included in the European system of protected areas and on priority habitats or priority species habitats. | The requirement is met - see chapter C.III., text attachments. |

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| 17. In the routing highway in the manner set out in the plan, to propose measures to ensure that the surrounding area is protected against noise and light and bridging the Danube and protected areas will not prevent migration and | The requirement is met - see chapter C.IV. |

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| exchange of genetic information and will not lead to a fragmentation of the territory. | |
| 18. Process and add compensatory measures to ensure reducing the impact on the gene pool, biodiversity, protected areas and species and TSES, describe the crossing points of migrating animals and suggest a way of technical solutions. | The requirement is met - see chapter C.IV. |
| 19. Describes the possibility of highway routing at 3 to 6 km on piles in each direction. | The requirement is met - see chapters A.II.8. and 9. |
| 20. The tunnel route of Ivanka pri Dunaji and highway objects needs to be moved as far as possible outside the protection zone of Šúrsky channel. | The requirement is met - see chapters A.II.8. and 9. |
| 21. Describe the impact of the D4 highway on hunting deer in the affected area. | The requirement is met - see chapter C.III. |
| 22. Prepare the appropriate visual presentation of proposed works for a public discussion (e.g. maps, photos, computer simulation of objects, etc.). | The requirement is met - maps and image attachments to be used for the presentation, in the context of the Assessment Report an information brochure is separately prepared, which will be available to the public hearing. |
| 23. Separately describe the compliance of the proposed activity with land-use documents of the affected municipalities and HTUs. | The requirement is met - see chapter C.II.19. |
| 24. Evaluate other justified comments submitted to the project. | The justified comments on the plan are processed in the relevant sections of the Assessment Report. |

# *X. LIST OF RESEARCHERS AND ORGANIZATIONS PARTICIPATING IN PROCESSING OF THE ASSESSMENT REPORT*

**Processor:**

**GEOCONSULT s.r.o.**
Miletičova 21, P.O.BOX 34
820 05 Bratislava

**Research team:**

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| RNDr. Ivan Jakubis | task coordinator, data on the impacts, characteristics of the current state of the environment, impact assessment, comparison of options, the draft measures and monitoring, image attachments |
| Mgr. Lenka Miškechová | basic data on the proposed activity, information on the impacts, characteristics of the current state of the environment, map documentation, text attachments |
| Ing. Juraj Fürst | basic data on the proposed activity, data on the impacts, traffic and transport relations, the draft measures, text attachments |
| Ing. Marek Šmelík | basic data on the proposed activity, data on the impacts, maps |
| Mgr. Peter Hujo | noise conditions, information on the impacts, the draft measures, text attachments |
| RNDr. Ivan Pirman | air, data on the impacts, text attachments |
| RNDr. Peter Krempaský | characteristics of the current state of the environment, impact assessment, the draft measures, comparison of options, draft monitoring, text and image attachments |
| RNDr. Ján Dzúrik | characteristics of the current state of the environment, impact assessment, the draft measures |
| Ing. arch. Igor Rumler | visualisation |

# *XI.THE LIST OF SUPPLEMENTAL ANALYTICAL REPORTS AND STUDIES AVAILABLE AT THE CLAIMANT AND USED AS BASIS FOR PREPARATION OF THE ASSESSMENT REPORT*

1. The list of main used documents being available at the claimant:

- D4 Highway Jarovce - Ivanka North, project plan, Geoconsult Bratislava, 2007
- R7 Expressway Bratislava - Dunajská Lužná, Assessment Report, Geoconsult Bratislava, 2008

- D1 Bratislava - Trnava, increase in capacity of the highway, study, Ateliér DS Bratislava, 2008
- The Feasibility and efficiency study for D4 Bratislava Jarovce - Ivanka North - Stupava South - nat. border SK/A, Dopravoprojekt Bratislava, 2009
- D4 highway, Ivanka North interchange with the D1 highway, optional solution, technical study, Geoconsult Bratislava, 2010

2. The list of used documents of the processor:

- Master Plan of Bratislava
- Master Plan of Bratislava region
- Master Plan of Most pri Bratislave
- Master Plan of Zálesie
- Master Plan of Ivanka pri Dunaji
- Regional territorial system of ecological stability of Bratislava - countryside
- Regional territorial system of ecological stability of the City of Bratislava
- Geobotanical map of the CSSR
- Regional maps of the environmental geofactors in the scale 1:50000
- Book of maps of Slovakia
- Geological map of Bratislava and surrounding areas
- Groundwater quality in Slovakia
- Surface water quality in Slovakia
- Population, households and houses census 2001
- Data from the websites of MoE SR and MoC SR, Bratislava, affected municipalities etc.

3. Opinions and statements to the project

4. The list of statements and opinions during processing the Assessment Report (see text attachments - ID documents)

- Minutes of the meeting dated 08 March 2010
- Statement to the meeting of 08 March 2010 - Ivanka pri Dunaji, Zálesie, Rusovce
- Supplement to the minutes of the meeting of 08 March 2010 - Podunajské Biskupice of 23 March 2010
- Opinion of the claimant NDS, a.s. to the supplementation of the minutes of Podunajské Biskupice of 09 April 2010
- Statement of Transpetrol, a.s. of 11 February 2010
- The scope of assessment of "D4 highway, section of Jarovce - Ivanka North, of 19 April 2008
- Letter of the Minister of transport, posts and telecommunications to the further preparation of the R7 expressway Bratislava - Dunajská Lužná of 08 September 2009

## *XII. DATE AND CONFIRMATION OF CORRECTNESS AND COMPLETENESS OF THE DATA BY SIGNATURE (STAMP) OF THE AUTHORIZED REPRESENTATIVE OF THE ASSESSMENT REPORT AND THE PROPOSER*

**Place of processing the Assessment Report:** Bratislava

**Date of processing the Assessment Report:** April 2010

**Confirmation of the data accuracy:**

Project coordinator:

RNDr. Ivan Jakubis

GEOCONSULT s.r.o.
Bratislava

Authorized representative of the claimant:

Ing. Juraj Čermák, CSc.

Chief Investment Officer

Národná diaľničná spoločnosť, a.s.
Bratislava

**Disclaimer**

This is an English translation of a document that was originally produced in the Slovak language. While we have exercised utmost care to make this translation accurate, it may contain typing or translation errors. Therefore, always consult the Slovak original before making decisions on the basis of this translation.

The name of this document in Slovak is *Správa o hodnotení navrhovanej činnosti*. The file name has not been changed.

We hereby confirm that the European Bank for Reconstruction and Development shall have no responsibility for the translated content.

Project Implementation Services, spol. s r. o.
Consultant under Consultancy Contract C31934