ANNEX
TO ENVIRONMENTAL IMPACT ASSESSMENT STUDY OF THE HIGHWAY TABANOVCE-KUMANOVO

June, 2012

This Annex has been developed on the basis of the Contract concluded between the Agency of State Roads (no. 07-1813 of 03.04.2012) and Consultant Menka Spirovska (no. 03-46 of 03.04.2012), authorized Environmental Impact Assessment Expert.

Environmental Impact Assessment Expert

Menka Spirovska

/CERTIFIED TRANSLATION FROM MACEDONIAN INTO ENGLISH/

REPUBLIC OF MACEDONIA

MINISTRY OF ENVIRONMENT AND PHYSICAL PLANNING

Skopje

Number 07- 2038/73

29.07.2009

CERTIFICATE

for completed expert examination for acquiring the status of expert in environmental impact assessment for projects

SPIROVSKA Ariton MENKA, biologist from Skopje, born on 28.12.1951, in Skopje, Republic of Macedonia, on 10.09.2009, has passed the **expert examination for acquiring professional title in environmental impact assessment for projects** before the Commission for passing expert examination for environmental impact assessment of projects, under the Ministry of Environment and Physical Planning, and acquired the **status of expert in environmental impact assessment of projects** having fulfilled the conditions specified in Article 85 paragraph 2 of the Law on Environment, and thus acquiring the right to be **included** in the List of experts for environmental impact assessment of projects kept by the Ministry of Environment and Physical Planning of the Republic of Macedonia.

This Certificate is issued on the basis of Article 85 of the Law on Environment ("Official Gazette of the Republic of Macedonia" No. 53/05, 81/05, 24/07 and 159/08).

Ministry of Environment and Physical Planning

Minister,
Dr. Nexhati Jakupi
/signature eligible/

Commission for passing of expert examination for environmental impact assessment of projects

President,
Jadranka Ivanova MSci
/signature eligible/

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CONTENT

1 BACKGROUND

The Agency of State Roads-Skopje carried out the project for reconstruction and upgrade of the road section Tabanovce-Kumanovo which is part of Corridor X to the level of highway, in a total length of 7.62 km.

In order to establish the impact on the environment and health of the population from the implementation of the project, EIA Study has been prepared by the Consulting Company „RI OPUS" Skopje, in which the possible impacts on the environment and health have been identified, and measures for their mitigation or elimination have been taken into consideration. Also, in the EIA Study the aspects from the noise have been developed.

For overcoming of the identified impacts of noise, in the EIA Study as a measure it is envisaged erection of protective walls (concrete or metal made) at locations passing through populated places, Dolno Konjare and part of Tabanovce.

Taking into account possible impacts to the environment and human health, originating from increased level of noise caused by the traffic, due to the vicinity of the existing residential zones (with permanent and occasional residence), on part of the route in Tabanovce and Dolno Konjare, the Investor prepared Main Design[1] for protection against noise on Tabanovce-Kumanovo road section of E75[2].

The document had a task to identify the level of noise, generated by the increased traffic (prospection-2031year), and propose mitigation measures. On the basis of detailed analysis and calculations, construction of protection barriers has been proposed. The lack of elaboration of other alternatives/options for noise reduction in the Noise Study, involves consideration of additional alternative measures for noise reduction in parts of the route, where sensitive receptors are considered to be, in regard to affected population.

In that regard the Agency of State Roads, as orderer of the service, requested the Consultant Menka Spirovska, authorized environmental impact assessment expert, to prepare Annex to EIA Study, to include appropriate alternative measures for noise reduction during the operational phase of the Project and carry out the procedure of consultation with the affected population whose housing buildings are located in adjacent proximity of the road section.

The Terms of Reference (TORs) define the activities to be covered in this Annex, as follows:

- Analysis of alternatives, including initially proposed solutions for construction of barriers and different possibilities for such barriers designing, confirmation of approved solution both from noise reduction and economic points of view;
- Detailed consideration of identified alternative measures for noise reduction related to the road operation. This should involve detailed analysis of the results from the proposed mitigation measures with indication of the basis leading to such conclusions;

[1] Special Noise Study
[2] Developed by DIWI Consult International Macedonia DOOEL Skopje

- Description of the legal framework as grounds for the resulting proposed solution for noise reduction;
- Review of the Environmental Impact Assessment Study/Environmental Management Plan to include this alternative approach; the Annex should thus include: (i) details, proposed mitigation measures and expected results with reference to noise levels inside and around houses (explanation of these assessments), (ii) analysis of alternatives that will show the reason for which the proposed alternative has been selected, (iii) legal basis for the proposed alternative.

The goal of identifying additional alternative measures for mitigation of noise impacts caused by the traffic is to determine the most appropriate solution that will ensure full protection against increased level of noise on affected population and also acceptable from economic and sustainable point of view for the Investor.

It is of particular importance to note that in the period of implementation of this assignment, the project has been completed, i.e. the main road Tabanovce-Kumanovo has been reconstructed and upgraded. The traffic is carried out continuously on two roadways, and analyzed alternatives are related to the operational phase of the Project.

2 SUMMARY OF THE FINDINGS OF THE NOISE STUDY

The Main Design for Protection against noise (**Noise Study**) is based on the national and European regulations on noise, the measurements on ten measuring points along the route in Tabanovce and Dolno Konjare, current and projected trafic frequency in the period from 2010 to 2031 and predicted noise levels due to the trafic.

2.1 Measured noise levels at most sensitive receptors

During the preparation of the Noise Study for reconstruction and upgrading of the road section Tabanovce-Kumanovo, several measurements were conducted of the generated noise by the existing traffic.

The measurement points are located at two parts of the road, near the village of Dolno Konjare (4 measuring points) and the village Tabanovce (6 measuring points). Based on conducted measurements, it was concluded that noise levels exceed the limit values at certain locations. The table below shows detailed description of measuring points and measured noise levels.

Table 1 Noise measuring points

No.of MP[3]	Description of measuring points	Leq [dB(A)]	
		day	night
1	Distance from the left lane is 5 m from the end asphalt edge and 3 m from a wall of auxiliary structure – shed, behind which there is individual house with ground floor and floor.	66.1	62.7
2	Distance from the right lane where the traffic takes place is 24 m from the end asphalt edge and 8 m from a wall of individual house.	61.4	60.0
3	Distance from the right lane where the traffic takes place is 19 m from the end asphalt edge, 4 m from a wall of auxiliary structure and 12 m from individual house.	63.2	59.5
4	This measuring point is in the yard of a private ground floor house at 24 m from the right lane, where the traffic takes place, to the auxiliary structure located at direct proximity to the left lane at 9 m from the asphalt edge.	62.7	66.7
5	Distance from the right lane where the traffic takes place is 37 m from the end asphalt edge and 10 m from individual ground floor house.	53.3	57.8
6	Distance from the right lane where the traffic takes place is 30 m from the end asphalt edge and 14 m from individual ground floor house.	53.3	54.6
7	Distance from the right lane where the traffic takes place is 15 m from the end asphalt edge and 19 m from individual ground floor house.	61.8	58.5
8	Distance from the right lane where the traffic takes place is 44 m from the end asphalt edge and 12 m from individual ground floor and floor house.	56.9	54.2

[3] MP (measuring point)

9	Distance from the right lane where the traffic takes place is 39 m from the end asphalt edge, 8 m from auxiliary structure and 21 m from individual ground floor and floor house. This measuring point is positioned around 3 m lower relative to the level of the roadway.	49.3	62.1
10	This measuring point is positioned between the highway and a local road at 42 m from the right lane where the traffic takes place and 4 m from the local road behind which, at 23 m, there is a commercial building of ground floor and floor. For this point, it may be concluded that the noise from the local road is predominant relative to the noise from the highway.	70.1	53.3

The data in the above Table are only evidence of generated noise levels which are not taken into consideration in the later stage of calculations of the forecasted noise levels related to predicted traffic. Estimation of the noise levels, generated by the traffic have been done on the base of: (a) competent traffic load; (b) characteristics of the traffic flows; (c) spatial conditions on the current section of the road and (d) characteristics of the transverse and (e) longitudinal sections of the road, all related to the buildings on the both side of the road.

On the base of those calculations, the following figures for the expected noise levels have been produced:

Table 2 Computational values of equivalent noise levels

Position	2011		2021		2031	
	Ld	Ln	Ld	Ln	Ld	Ln
1+260	60	53,67	62,25	56	64	57,78
1+304	60	53,67	62,25	56	64	57,78
1+310	57,2	50,99	59,57	53,29	61,3	55,1
1+940	70,99	64,76	73,34	67,09	75,11	68,87
1+987	70,99	64,76	73,34	67,09	75,11	68,87
2+60	62,35	60,96	69,54	63,04	71,27	65,07
2+340	62,35	60,96	69,54	63,04	71,27	65,07
2+330	61,17	54,94	63,52	57,27	65,11	59,05
2+367	74,15	68	76,5	70,25	78,27	72,03
2+720	74,15	68	76,5	70,25	78,27	72,03
7+388	65,53	59,3	67,08	61,63	69,65	63,41
7+470	65,53	59,3	67,08	61,63	69,65	63,41
7+830	60,57	56,04	62,92	56,67	64,69	58,45
8+388	60,57	56,04	62,92	56,67	64,69	58,45

On the base of done measurements of noise levels (used as the indicators that the noise levels are above the regulated limit values) and computational values of equivalent noise levels the

mitigation measures for the expected noise are proposed-construction of the noise barriers without assessment of other alternatives.

The Noise study (Main design for protection against noise) determines the positions at which it is considered that the mitigation measure has to be applied:

- at km 1 + 260 to km 1 + 304, left of the highway where 2 buildings are located;
- at km 1 + 310 to km 1 + 315, right of the highway where 1 building is located;
- at km 1 + 940 to km 1 + 987, left of the highway where 4 buildings are located;
- at km 2 + 060 to km 2 + 340, left of the highway where group of buildings is located;
- at km 2 + 330 to km 2 + 350, right of the highway where 1 building is located;
- at km 2 + 367 to km 2 + 720, left of the highway where group of buildings is located;
- at km 7 + 388 to km 7 + 470, left of the highway where 2 buildings are located;
- at km 7 + 830 to km 8 + 388, left of the highway where group of buildings is located.

3 LEGAL FRAMEWORK AND DEFINED LIMIT VALUES

3.1 National legal framework

The Law on Protection against Environmental Noise (Official Gazette of RM no. 79/07, 124/2010, 47/11) is fully in line with the applicable EU legislation. The Law on Protection against Environmental Noise is the law regulating the basic principles of environmental noise management. The Law has been harmonized with the EU recommendations concerning the establishment of a general legal framework to regulate environmental noise in integrated and comprehensive manner. It has transposed the requirements of Directive 2002/49/EC of the European Parliament and the Council of 25 June 2002 concerning environmental noise assessment and management.

This Directive is the legal act of the European Union that should provide, *inter alia,* the grounds for preparation and implementation of the existing group of measures related to noise emitted from major sources, especially road and railroad means of transportation and infrastructure, aircrafts, equipment used outdoors and in industry and mobile machinery, as well as preparation of additional measures for short and long period.

Besides the Law on Protection against Environmental Noise, the national legal framework treating the problems originating from noise includes:

- Law on Environment (Official Gazette of RM no. 53/05, 81/05, 24/07, 159/08, 83/09, 47/10, 124/10, 51/11);
- Rulebook on the limit values of environmental noise levels (Official Gazette of RM no. 147/08);
- Decision on determination of the cases in which and conditions under which the peace of citizens is considered disturbed by harmful noise (Official Gazette of RM no. 1/09);
- Rulebook on the locations of measuring stations and measuring points (Official Gazette of RM no. 120/08);
- Rulebook on the application of noise indicators, additional noise indicators, manner of noise measuring and methods for environmental noise indicators assessment (Official Gazette of RM no. 107/08);
- Rulebook on the manner, conditions and procedure for establishment and operation of networks, methodology and manner of monitoring, as well as conditions, manner and procedure of monitoring information and data acquisition concerning the state in the area of noise (Official Gazette of RM no. 123/09);
- Decree on agglomerations, main roads, main railroads and main airports for which strategic noise maps should be prepared (Official Gazette of RM no. 15/11);
- Order for compulsory type approval of motor vehicles with at least four wheels with regard to noise (Official Gazette of RM no. 16/97).

➢ **Plans and strategies at local level**

- National Transport Strategy for the Period 2007-2017.

3.2 International legal framework

- Directive 2002/49/EC concerning environmental noise assessment and management;
- Directive 1991/101/EEC concerning adaptation to technical progress of Directive 70/157/EEC on the permissible sound level and exhaust gases from motor vehicles.

3.3 Defined noise level limit values

In accordance with the Decision on determination of the cases in which and conditions under which the peace of citizens is considered disturbed by harmful noise (Official Gazette of RM no.1/09) and the Rulebook on the limit values of environmental noise levels (Official Gazette of RM no. 147/08), the peace of citizens is considered disturbed by harmful noise when the limit values of the core environmental noise caused by various sources are higher than those shown in Table 3.

Table 3 Noise levels above which the peace of citizens is considered disturbed

Area differentiated by the extent of protection against noise	**Noise level in dB(A)**		
	Ld	**Le**	**Ln**
Area of first extent	50	50	40
Area of second extent	55	55	45
Area of third extent	60	60	55
Area of fourth extent	70	70	60

The day in terms of this Decision covers the period from 07.00 to 19.00 hours, evening covers the period from 19.00 to 23.00 hours, and night covers the period from 23.00 to 07.00 hours.

According to Article 3 of the Rulebook on the locations of measuring stations and measuring points (Official Gazette of RM no. 120/08), the areas for protection against noise depending on the type of activity and sensitivity of the population staying therein are divided into four extents:

- **Area with first (I) degree of noise protection** is the area intended for tourism and leisure activities, area near hospital institutions and area of national parks and natural reserves.
- **Area with second (II) degree of noise protection** is the area intended primarily for stay, i.e. residential area, areas near educational facilities, facilities for social welfare and accommodation of children and elderly, and facilities for primary health care, playgrounds and public parks, grean areas, recreation areas and local parks.
- **Area with third (III) degree of noise protection** is the area where interventions in the surrounding are permitted where the noise will be less disturbing, , i.e. trade – business – residential areas, which are intended both for living and working, (mixed area), areas for agricultural activities and public centres where administrative, trade, service and catering activities are performed.
- **Area with fourth (IV) degree of noise protection** is the area where interventions in environment causing noise disturbance are permitted: areas that have no residential

buildings, intended for industrial and craftsman activities, production activities, transport activities, storage and servicing, communal activites that produce stronger noise.

Structures positioned close to the highway belong to the group of areas with third extent of protection against noise. According to Article 3 of the Rulebook on the locations of measuring stations and measuring points (Official Gazette of RM no. 147/08), the limit values of core environmental noise indicators for noise caused by different sources, for area with third extent of protection, shall not be higher than:

L_{day} – 60 dB(A) **$L_{evening}$ – 60 dB(A)** **L_{night} – 55 dB(A)**

According to Article 6 of the Rulebook on environmental noise level limit values, in areas outside urbanized locations, the limit values for areas exposed at intensive road transport are as follows:

L_{day} – 60 dB(A) **$L_{evening}$ – 55 dB(A)** **L_{night} – 50 dB(A)**

The areas along Tabanovce-Kumanovo highway are mostly rural; however, along the route near Dolno Konjare and Tabanovce, there is a group of housing buildings, as well as individual buildings intended for permanent and temporary residence.

According to Article 4 of Rulebook on environmental noise level limit values, the limit values of the basic values of noise indicators inside the premises where people reside, especially vulnerable population groups are placed, and for health protection from adverse effects, is shown in Table 4.

Table 4 Noise limit values in prémisses

Types of premises	**Noise level expressed in dB(A)**		
	Ld	**Le**	**Ln**
Hospital room, intensive care units, operating rooms	30	30	30
Rooms in residential buildings, facilities for recreation of children, bedrooms in homes for the elderly and pensioners, hotel rooms	35	35	35
Practices in health facilities, conference halls, cinemas, theaters and concert halls	40	40	35
Classrooms, reading rooms, lecture theaters, lecture, facilities for research work	40	40	40
Operating rooms in administrative buildings, offices	50	50	50
Lobby of theaters and cinemas, hairdressing and beauty salons, restaurants, pastry	55	55	55

Under the Decree on agglomerations, main roads, main railroads and main airports for which strategic noise maps should be prepared (Official Gazette of RM no. 15/11), this road section is

not part of the planned road sections in the Republic of Macedonia which require compulsory preparation of strategic noise map.

Table 5 The limit values for environmental noise levels according to IFC standards amount

Land use type (recipient)	**Noise level (Leq)**	
	Day (7:00-22:00)	**Night (22:00-07:00)**
Residential area	55	45
Commercial/industrial area	70	70

4 OVERVIEW OF THE ORIGINALY PROPOSED MITIGATION MEASURE FOR NOISE REDUCTION (MAIN DESIGN FOR PROTECTION AGAINS NOISE) AND EXPLANATION OF THE NEED FOR ALTERNATIVE SOLUTION

4.1 Originally proposed mitigation measures for noise reduction

Sound barriers of different heights have been proposed for the analyzed part of the road section (Chapter 2), as shown on the table below. The height of the barriers has been determined in line with the conditions of the transversal cross-section and height of the recipient, so that the highest point of the window on the floor falls in the shadow of the proposed barrier.

Table 6 Proposed sound barriers

Start of the barrier	Start of buildings	End of buildings	End of barrier	Total length of barrier	Distribution of buildings relative to highway	Height of the barrier
1 + 210	1 + 260	1 + 304	1 + 375	165 m	left	3.0 m
1 + 280	1 + 310	1 + 330	1 + 370	90 m	right	2.0 m
1 + 870	1 + 940	2 +340	2 + 359	488 m	left	4.0 m
2 + 360	2 + 367	2 +720	2 + 784	424 m	left	5.0 m
2 + 290	2 + 330	2 +340	2 + 389	99 m	right	2.0 m
7 + 348	7 + 388	7 + 470	7 + 525	177 m	left	2.5 m
7 +779	7 + 830	8 + 388	8 + 388 8 + 457	609 m 679 m	left	2. m

Comment: The wall required for the buildings on station from 1+940 to 1+987 as overlapping with the wall required for the buildings on station 2 + 060 to 2 + 340 as well as wall of the buildings on stations 2 +367 and 2 + 720, should be continuous. Therefore, the length of the wall will be 912 m.

Based on calculations obtained for noise levels on road sections where limit values of core noise indicators have been exceeded, barriers for protection against noise have been proposed to be of absorbing material (aluminum) in the lower zone, with a height of 0.5 and 1 m, and reflective transparent barriers (polycarbonate) in the upper zone.

The developer of the Main design carried out calculations for noise attenuation by each barrier. The values of attenuation and the expected decreasing of noise levels are shown in Table 7.

Table 7 Predicted noise levels at receptor points with sound barrier

No	Position	Barrier attenuation dB(A)	2011		2021		2031	
			Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
1	1+260	8,80	51,2	44,87	53,45	47,2	55,20	48,98
2	1+304	8,80	51,2	44,87	53,45	47,2	55,20	48,98
3	1+310	14,00	43,2	36,99	45,57	39,29	47,30	41,10
4	1+940	15,45	55,54	49,31	57,89	51,64	59,66	53,42
5	1+987	15,45	55,54	49,31	57,89	51,64	59,66	53,42
6	2+60	19,10	43,25	41,86	50,44	43,94	52,17	45,97
7	2+340	19,10	43,25	41,86	50,44	43,94	52,17	45,97
8	2+330	14,48	46,69	40,46	49,04	42,79	50,63	44,57

9	2+367	18,98	55,17	49,02	57,52	51,27	59,29	53,05
10	2+720	18,98	55,17	49,02	57,52	51,27	59,29	53,05
11	7+388	13,40	52,13	45,9	53,68	48,23	56,25	50,01
12	7+470	13,40	52,13	45,9	53,68	48,23	56,25	50,01
13	7+830	10,57	50	45,47	52,35	46,1	54,12	47,88
14	8+388	10,57	50	45,47	52,35	46,1	54,12	47,88

In the Main design, the developer gives summary of financial estimation for the proposed barriers which is shown in the table below:

Table 8 Financial estimate for sound barriers proposed under the project for protection against noise

No.	Item	Amount in MKD	Amount in EUR
I	Station km 1+210 – km 1+375 on the left roadway	13.482.706,75	219.231,00
II	Station km 1+280- km1+370 on the right roadway	4.441.143,00	72.213,71
III	Station km1+870 - km2+359 on the left roadway	54.453.394,85	885.421,05
IV	Station km2+360 - km2+783 on the left roadway	70.811.708,15	1.151.409,89
V	Station km2+290 - km2+389 on the right roadway	4.916.562,00	79.944,10
VI	Station km7+348 - km7+525 on the left roadway	11.963.604,05	194.530,15
VII	Station km7+779 - km8+457 on the left roadway	45.033.911,10	732.258,72
TOTAL WITH VAT INCLUDED:		205.103.029,90	3.335.008,62

4.2 Analysis of proposals contained in the Main design for protection against noise (Noise Study)

The Main design for protection against noise (Noise study) is focused on construction of sound barriers towards the most exposed residential buildings at the highway section, which is subject of the project. Calculations of expected noise levels were made for selected recipients and the need for protection measures application was defined.

The approach of the Main design is logical and professional, though certain corrections and supplements are needed:

1. The highway already exists in the space and there is increased noise level. The Main design does not show the extent of noise contribution generated by the reconstructed highway compared to the status before its reconstruction;
2. It does not take into account that, upon highway reconstruction, transport will be carried out mainly on two lanes mutually separated by a distance of around 20.5 m, and the increased of noise level at receptor points on the left side will be smaller;
3. No other alternative solutions for noise mitigation have been considered (the Study does not analyze alternative materials for the barriers, nor alternative solutions for noise decreasing).

In order to overcome this incompliance, the Consultant made new calculations of noise levels, so that the road is divided into two parallel segments (Figure 1). Frequency of traffic at individual segments was determined under the assumption that it was equal in both directions. It was assumed that the values of the average elevation differences of recipients relative to the line of the source were calculated correctly in the Main design, because the latter does not include the elements[4] of the calculations.

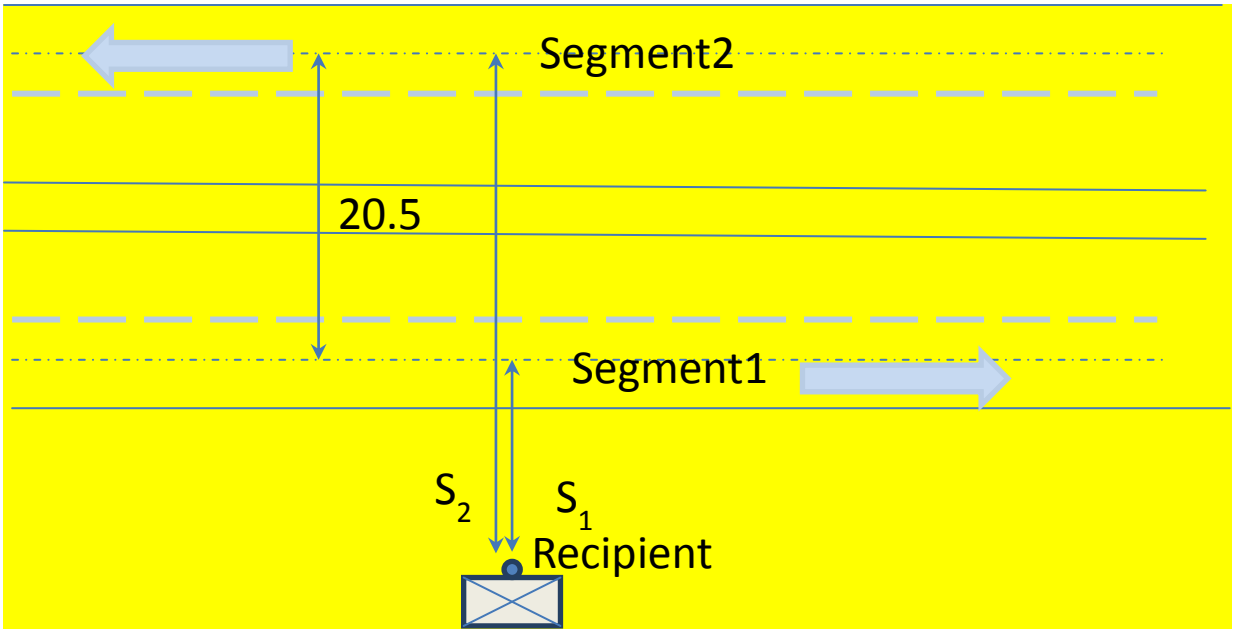

Figure 1 Division of road in segments

Table 9 Assessed traffic noise levels at fourteen sensitive receptor point for the period 2009-2031

Position	2009		2011		2021		2031	
	Ld	Ln	Ld	Ln	Ld	Ln	Ld	Ln
1+260	51,23	43,98	58,82	52,55	59,41	53,18	61,95	55,68
1+304	51,23	43,98	58,82	52,55	59,41	53,18	61,95	55,68
1+310	48,18	40,93	56,17	49,90	56,37	50,13	59,10	52,83
1+940	62,13	54,89	68,40	62,14	70,32	64,09	72,27	65,99
1+987	62,13	54,89	68,40	62,14	70,32	64,09	72,27	65,99
2+60	58,11	50,86	64,71	58,44	66,30	60,06	68,38	62,11
2+340	58,11	50,86	64,71	58,44	66,30	60,06	68,38	62,11
2+330	53,58	46,33	60,49	54,22	61,77	55,54	63,99	57,72
2+367	65,57	58,32	71,63	65,36	73,76	67,52	75,62	69,34
2+720	65,57	58,32	71,63	65,36	73,76	67,52	75,62	69,34
7+388	60,64	49,52	63,56	57,30	64,96	58,72	67,12	60,85
7+470	60,64	49,52	63,56	57,30	64,96	58,72	67,12	60,85
7+830	55,61	44,49	59,30	53,03	59,93	53,69	62,45	56,18
8+388	55,61	44,49	59,30	53,03	59,93	53,69	62,45	56,18

[4] Elevations by which the average heights are calculated are not presented

The values of noise obtained by such conceptualized calculation are lower[5] than those in the Main design and the difference depends on the distance of the given recipient from the source, as well as on the average height h (m) According to this the noise levels with implementation of sound barriers presented in Table 10 are lower compared with the noise level values given in Table 7.

Table 10 Predicted noise levels at receptor points with sound barrier

No.	Position	Barrier attenuation dB(A)	2011		2021		2031	
			Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
1	1+260	8,80	50,02	43,75	52,36	46,12	53,15	46,88
2	1+304	8,80	50,02	43,75	52,36	46,12	53,15	46,88
3	1+310	14,00	42,17	35,90	44,51	38,27	45,10	38,83
4	1+940	15,45	52,95	46,69	55,29	49,06	56,82	50,54
5	1+987	15,45	52,95	46,69	55,29	49,06	56,82	50,54
6	2+60	19,10	45,61	39,34	47,95	41,71	49,28	43,01
7	2+340	19,10	45,61	39,34	47,95	41,71	49,28	43,01
8	2+330	14,48	46,01	39,74	48,35	42,11	49,51	43,24
9	2+367	18,98	52,65	46,38	54,99	48,75	56,64	50,36
10	2+720	18,98	52,65	46,38	54,99	48,75	56,64	50,36
11	7+388	13,40	50,16	43,9	51,56	45,32	53,72	47,45
12	7+470	13,40	50,16	43,9	51,56	45,32	53,72	47,45
13	7+830	10,57	48,73	42,46	49,36	43,12	51,88	45,61
14	8+388	10,57	48,73	42,46	49,36	43,12	51,88	45,61

It is very important to highlight that for the recipients on the left side of the road the difference of noise levels is smaller compared to those for on the right side. The reason for such a difference is the fact that half of the traffic on the highway will take place 20.5 m closer to the right-side receptors.

Undoubtedly, the up-grading of the road to a level of highway will lead to a significant increase of the noise level. Differences as high as 10 dB (A) are expected at most of the receptors taken into consideration in the Main design.

According to the assessment made by both the Main design for protection against noise and the Consultant –author of this Annex, measures for noise abatement are required for all the position listed above.

[5] different noise level compared with the noise levels values given in table 7.

4.3 Analysis of the applicability of the solution proposed by the Main design

The EIA expert, engaged for preparation of this Annex, undertook: (a) several site visits (b) check-measurements of noise levels on the most affected sites (c) analyzed all available documentation, related to the analyzed road section and (d) studied several international good practice for introducing mitigation measures for decreasing the noise levels, generated by high way traffic.

On the base of that, we are presenting the current situation and applicability of the proposed alternative for sound barriers on which base in the further chapters of this Annex we will analyze alternative solutions.

- ✓ *On station: km 1+210 to km 1+375 left of the roadway*, where structures are partially hidden behind a mount, around 3 m high, it is proposed to erect a barrier of 3 m in height. The barrier is not appropriate for the terrain configuration, because that segment already has tall natural barrier and application of alternative measure should be considered towards additional noise reduction.

Figure 2 Part of station km 1+210 to km 1+375

The predicted length of the barrier is 165 m with a height of 3 m and its cost is estimated at 13.482.706.75 denars or 219.231.00 €.

This barrier will cover two buildings, only one of which is inhabited, which means that the price of the protection against increased level of noise would amount as much as 219.231,00 € per building.

- ✓ *The barrier on the station km 1+280 to km 1+370 on the right side of the ro*adway is of 90 m in length and 2 m in height, covering only one building which is inhabited occasionally, while its cost is 4.441.143.00 denars or 72.213.71 €.

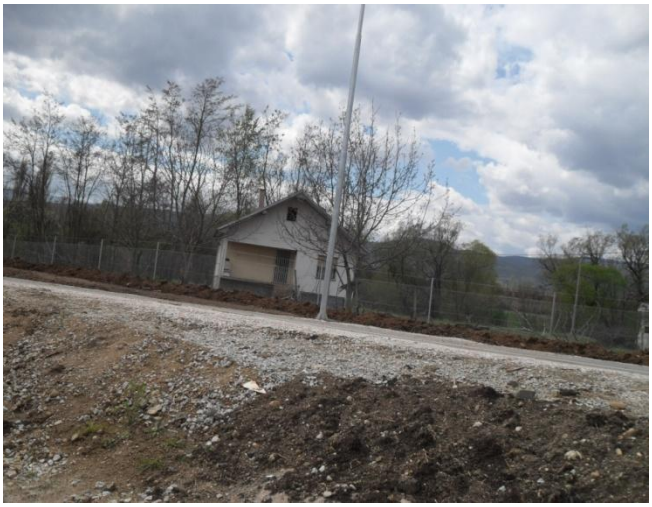

Figure 3 Part of the station km 1+280 to km 1+370

- ✓ *The barrier on the station km 2+290 to km 2+389 on the right side of the roadway* is of 99 m in length and 2 m in height, covering only one building and its cost is 4.916.562.00 denars or 79.944.10 €.

Figure 4 Part of the station km 2+290 to km 2+389

- ✓ *The barrier on the station km 1+870 to km 2+359 on the left side of the roadway* with a length of 488 m and height of 4 m costs 54.453.394.85 denars or 885.421.05 €, while on the station *km 2+360 to km 2+783* is of length of 424 m and height of 5 m and its cost is estimated at 70.811.708.15 denars or 1.151.409.89 €. These two barriers cover a group of structures and so the price calculated for protection against noise per individual structure would range from 50.000 to 80.000 €. It should be underlined that structures

are located in the immediate proximity to the highway (around 13 m). The highway itself is elevated above the level of the houses, and thus additional barrier with a height of 4-5 m would cause the effect of enclosure, which could affect the psychological perception of inhabitants to a greater extent than the received noise to which the inhabitants have been adapted considering the fact that they have lived for long by this road section.

Figure 5 Part of the station km 1+870 to km 2+359 and 2+360 до km 2+783

- ✓ *The barrier on station km 7+348 to km 7+525 on the left roadway* is of 177 m in length and 2.5 m in height, covering two buildings and it cost is 11.963.604.05 denars or 194.530.15 € or 97.000 € per building.

Figure 6 Part of the station km 7+348 to km 7+525

- ✓ *For the station km 7+779 to 8+388,* the proposed barrier is with a length of 609 m and height of 2.5 m and alternatively for km 7+779 to km 8+457 with a length of 675 m and height of 2.5 m. This barrier covers group of buildings (approximately 20 buildings). The

cost of this barrier on station km 7+779 to km 8+457 is 45.033.911.10 denars or 732.258.72 € or around 36 000€ per building.

Figure 7 Part of the station km 7+779 to 8+388 and 7+779 to km 8+457

CONCLUSION:

- Erection of sound barriers on the proposed route, considered from environmental point of view, is very efficient solution of environmental noise levels reduction.
- Presented calculations confirm that the level of noise in the affected area will be decreased by installation of sound barriers, thus being compliant with the legal framework (noise reducing up to 20 dB (A).
- On some position the terrain configuration is not suitable for setting barriers (position km 1+210 to km 1+375, there is a natural barrier).
- On some positions, where are located buildings away from about 13 meters (km 2 +290 to km 2 +389) the road, setting barrier is not suitable solution, due to the narrow space. On those positions, placing barriers can cause feelings of isolation and rejection by the residents.
- Analyzed from the financial point of view the sound barriers are unsustainable solution (quite an expensive investment), especially the positions which are located along one or two objects (km 1+210 to km 1+375, km 1+280 to km 1+370, km 2+290 to km 2+389).
- Nevertheless, installation of the sound barriers is accompanied by certain negative effects as well, such as: (a) disruption of visual characteristics, especially on stations where barriers of 5 meters in height have been proposed; (b) formation of shade towards housing buildings and feeling of being enclosed[6]; (c) hindering of natural air circulation.

[6] This regards especially cases where structures are positioned at lower elevation from the highway, and the highway itself is a visual barrier to them. In such cases, placement of additional barrier will create additional problem.

On the basis of the above presented observations, it may be concluded that the barriers, proposed in the Noise Study, are rather efficient in terms of reduction of ambient noise levels, nevertheless, observed from financial point of view, they represent unsustainable solution. Apart from the huge financial investment required for sound barriers construction, additional investments will be required in future for their maintenance (especially for polycarbonate barriers).

In order to be achieved protection from noise, caused by traffic on the highway against the local population further in this Annex will be considered alternative measures to reduce noise that may be applicable from technical and financial aspects, and also will also be eligible for the local population.

5 ALTERNATIVE MEASURES FOR NOISE REDUCTION

There is series of ways for reduction of noise from the traffic. Generally, these are divided into three categories:

1. reduction of noise at its source;
2. construction of sound barriers;
3. sound insulation of recipients (treatment of residential buildings).

In certain cases, noise reduction is impossible or faces difficulties in such processes, which are difficult to overcome, and concern:

- ✓ shortage of space for the measure implementation;
- ✓ disruption of aesthetic appearance;
- ✓ opposition to the measure by the population; and
- ✓ financial costs.

5.1 Reduction of noise at source

Reduction of traffic noise at source includes measures planned and implemented during highway designing and construction, as well as measures defined and implemented during exploitation. These measures include:

- Vertical and horizontal alignment of the road;
- Covering with the so called „quiet asphalt";
- Transport management.

Adequate road alignment and selection of appropriate materials during construction to acquire the so called „quiet asphalt" are one of the basic measures for noise reduction at source. Asphalt with rubber admixtures has demonstrated particularly good results.

A noise level reduction of 3-8 dB(A)) , (50-80%) compared to „normal"asphalt can be achieved by applying rubber asphalt.

Traffic control reduces the problems caused by traffic noise to a certain extent. Reduction of driving speed contributes to noise level reduction (reduction of speed limit on the highway by 20 km/h can contribute to notable noise level reduction from 2 to 3 dB (A)). Following measure will support the implementation of speed regime and thus provide the assessed noise reduction:

- Adjustment of road signalization to achieve constant speed and reduce the necessities for breaking or acceleration.

5.1.1 Analyse of alternative

In this case, analyze of the possibilities which could be applied in the phases of designing or construction, is not possible, because of the fact that these phases have already been completed and the highway is in its exploitation phase. At this moment, it could be recommended that in future, in case of possible reconstruction of the road section, the alternative for selection of appropriate construction materials is taken into consideration in order to obtain „quiet asphalt" which will certainly contribute to noise reduction (3-8 dB (A)).

The following measures for noise reduction can be considered in the phase of the highway exploitation:

- ✓ Reduction of vehicles driving speed-driving speed has significant impact on noise level. In the period of 2009 year, vehicles driving speed was restricted at 60 km/h, except on the road section before Tabanovce (around 5 kilometers to Tabanovce), where restriction was at 90 km/h. The level of noise covering the period of the day and three hours of the evening period expressed as L_{eq}(A) was within the range of 48.18 to 62.13 dB(A). Upon slight increase of the intensity and average speed of passenger cars of 100 km/h, and freight vehicles of 70km/h, the level of noise for 2011 ranges between 57.08 and 66.07 dB(A) for the same intervals and recipients. To reduce the noise level, it is recommended to reduce the vehicle driving speed by 20-30 km/h;
- ✓ Setting of adequate road signalization to inform drivers of speed limit in time and thus sudden breakings and accelerations contributing to noise level increase will be avoided.

This alternative measures will contribute to reduce the noise level by 2-3 dB(A). This is a noticeable reduction of noise.

5.2 Sound barriers

The Main design for protection against noise is focused on construction of polycarbonate sound barrier towards the most exposed residential buildings. Except polycarbonate barrier no other alternative materials or solution as sound barriers are taken into consideration.

As was mentioned in the chapter 4.3 polycarbonate sound barriers are rather efficient in terms of reduction of ambient noise levels (noise attenuation up to 8,8-19,10 dB(A), but observed from financial point of view (**3.335.008,62** €) they represent very expensive solution.

Due to the absent of elaboration of alternative materials (in the Noise Study) and high costs for implementation of polycarbonate barriers, the consultant analyzed the alternative materials for sound barrier, noise level reduction by its usage and financial viability, presented as follows.

Barriers can have a shape of:

1. Earth embankments along the road–earth bermes;
2. Tall, vertical barriers;

3. Combination of earth embankments and barriers; and
4. Formation of vegetation.

Earth embankments do not have great impact on visual effects, but they require huge volumes of earth due to their great dimensions and height.

Installation of vertical barriers requires less space, but there are limiting factors for height, due to certain technical and aesthetic requirements.

Vertical barriers may be manufactured of the following materials: wood, concrete, metal, plastic, recycled material etc. Design and materials used for sound barriers are based on the following factors such as aging, resistance to corrosion, resistance to strikes by stones, resistance of paint, fire resistance, etc.

The maximum value that may be achieved theoretically is 20 dB (A) for thin walls and 23 dB (A) for berme.

- ***Earth bermes and supporting structures***

If road construction activities generated larger amounts of inert waste material, earth bermes can be used as noise barriers. It will reach benefits in two aspects: (a) reduction of the noise levels and (b) reduction of the inert waste, which can be disposed around the road. Bermes design should be compatible with the surrounding landscape and terrain topography. This kind of barriers can be visually attractive, acoustically effective, but occupy major portion of land.

- ***Concrete***

Concrete is used in different ways for sound barriers construction. Concrete sound barriers are simple for maintenance, but prefabricated sound barriers are relatively expensive. As alternative, profiles of concrete may be used to form the lower part of the sound barriers (combination of concrete-plastics, concrete-aluminum).

- ***Metal***

Aluminum is very often used for commercial purposes because of the firmness and weight, large panels can be easily lifted up to 5 meters.

- ***Transparent materials***

Transparent materials enable the light to reach the houses adjacent to barriers. Transparency of the top of the barrier will reduce visual effect of high barriers. Establishment of transparent barriers facilitates drivers to orient by observing the surrounding area.

Potential problems that could be caused on birds may be avoided by use of acrylic material or a scheme of thin non-transparent strips. Transparent material causes noise reflection and their use can be limited where reflection could cause problem. Transparent panels should be protected against strikes by vehicles.

- ***Plastics***

Besides its use in transparent panels, plastics may be also used in adsorption panels and as supplementary materials for plantations. Plastic is prone to damages from fire and upon long exposition to solar light it becomes fragile.

- ***Recycled material***

Numerous recyclable materials are acceptable for production of noise barriers, such as: plastics in auxiliary structures, waste material from industrial processes, used tires as flowerpots/jardinières, household waste converted into compost. Recyclable materials could also have certain constraints in terms of suitability and sustainability.

- ***Vegetation***

Vegetation has to be sufficiently high, wide and dense, to reduce noise generated by traffic. Vegetation of sufficient density in a belt of 60 m in width is able to reduce the noise level by 10 dB (A). However, it is almost impossible in practice to plant and grow such vegetation belt along roads in order to achieve the said reductions. Given the fact that no significant noise level reduction can be achieved before vegetation reaches certain age, there is a view that plantation of these green belts is not significant and popular measure for noise reduction. Planting of trees and shrubs provide psychological benefits through visual coverage, provision of privacy or as aesthetic measure, but not as a measure for traffic noise reduction on highways.

5.2.1 Analyse of alternative

The implementation of sound barriers made by different materials analyzed above, led to conclusion that with the implementation of thus, the noise level will be reduced approximately 20 db (A). It means that the limit values, stipulated in the regulatory framework will be achieved. However, the barriers will change the landscape, disrupt visual characteristics on the terrain (especially on the positions where barriers of 4-5 meters in height have been proposed), format shades towards housing buildings and rise feeling of being enclosed. It doesn't matter what kind of material will be used, the effects will be the same as are described.

Besides advantages and disadvantages of sound barriers mentioned above, analyzed in the financial point of view, we can conclude that polycarbonate barriers preferred in the Main design is very expensive solution.

As a result of previously stated, the Consultant has been analyzed construction of sound barriers on identified stations with using alternative material, e.g. installation reinforced concrete barriers, as well as barriers of reinforced concrete mounting elements. These analyses are made only for financial costs comparison between solution given in the Main design and analyzed alternative materials. The financial costs of the analyzed sound barriers are presented in the following table:

Table 11 Financial estimation for sound barriers made from alternative material

Type of barriers	Amount in MKD	Amount in EUR	Disbalance with the preferred barriers in EUR
Reinforced concrete barriers	132.385.440	2.152.608.78	**1.182.399,84**
Reinforced concrete mounting elements	165.481.800	2.690.760.97	**644.247,65**
Preferred noise barriers in the Main design (Noise Study)	205.103.029,90	3.335.008,62	**0**

The financial analyzes shows that construction of barriers is very expensive solution. The preferred materials in the Noise Study, is the most expensive one. For all mention above, it can be concluded that installation of sound barrier cannot be the unique solution which has to be preferred as a mitigation measures for noise reduction.

Formation of vegetation, as mentioned in the previous chapter, as an alternative measure is not very practical in the context of reduction of the noise along the highway and also requires a long period of time to reach height able to contribute to noise level reduction.

5.3 Sound insulation of recipients (treatment of housing buildings)

In case where the construction of sound barriers is not justified, from esthetic, psychological or financial point or it is hardly feasible because of the proximity of housing buildings, the goal of noise reduction is to mitigate it in housing buildings and not in the environment, other alternatives for noise reduction should be considered. In such cases, we should consider the possibility for application of measures for housing buildings treatment (i.e. their sound insulation-soundproof windows and doors).

Installation of proper type of windows provides an acoustic improvement in the residential facilities. The level of noise reduction depends on: a) the frame design, b) glazing, c) composition of glass pane type, d) distance between glass panes and e) seals.

The noise transfer through and around windows can be reduced by using thicker glazing, double glazed system and high quality window perimeter seals[7].

The ability of windows to reduce the noise level is given in the following table:

Table 12 Noise reduction by windows

Type of structure	Windows	Reduction of outside noise
All	Opened	10 dB(A)
Light frame	One glass (closed)	20 dB(A)

[7] The larger glazed area means the greater sound transmission through the window

Built in	One glass (closed)	25 dB(A)
	Two glasses (closed)	35 dB(A)

There are several different materials commonly used for window frames (timber, aluminum, PVC etc.), however, the type of material does not usually have a significant influence on noise reduction properties, due to its small surface. The effect of perimeter window seals are the critical issue in window frames.

PVC windows have a very good cost-benefit ratio. PVC windows offer clear-cut cost advantages, both in procurement and throughout the entire life cycle. Timber frames are approximately 20-30 % more expensive than PVC profiles, and aluminum windows cost 30 % more again representing the most expensive alternative. Based on the high energy-saving potential and minimal maintenance throughout the entire service life of more than 50 years, costs are also saved in the long-term.

In the following table are given approximately prices of the windows and doors produced from different material, PVC, aluminum and timber.

T**able 13** Comparison of the prices

Dimension	**Type**	**Price in €**		
		PVC	**Aluminum**	**Timber**
window				
80x40 cm	standard	160	200	190
140x140 cm	double	250	325	300
200x140 cm	triple	400	520	480
doors				
80x210 cm	standard	250	325	300
160x220 cm	double	360	450	432

There are a number of glazing options available: single, double, triple, and secondary glazing.

Secondary glazing, involves the installation of an additional internal glazed window. It offers much improved sound insulation, thermal insulation and enhanced window security performance.

This new, fully independent secondary window frame goes on the inside or room side of the existing or primary window. Fitting secondary double glazing will not therefore impact on the external appearance of the building.

Where space permits, it may be cheaper and less disturbing to owners to install second, „separate window“ in the same frame opening.

The noise reduction depends on the thickness of the glass. This is shown in the following table:

T**able 14** Thickness of the glass against noise reduction

Thickness of the glass (mm)	**Noise reduction dB(A)**
single glass 4 mm	30
single glass 10 mm	34
asymmetrical glass 4/16/4 mm	29
asymmetrical glass 6/15/4 mm	34
(4/16/4) thermo pane with double glazing	31-36
(4/16/4) thermo pane[8] with triple glazing	32-36

In the practice the most suitable glasses for noise reduction is thermo pane with double and triple glazing.

The window frame material can provide additional decreasing of noise level (up to 42 dB or much more). The soundproof systems besides noise reduction provide thermal isolation as well. The frame occupies a small surface in terms of the glass, but the both together contribute for significant noise protection.

Specific treatment of windows and doors involves the need for alternative ventilation (air conditioning) provision so that windows are closed during noisy periods of the day. The application of this alternative requires installation of ventilation system in buildings.

These types of measures for noise reduction do not provide benefits in terms of reduction of outside (ambient) noise, but in terms of internal noise reduction they can achieve the highest effects compared to all existing solutions for noise reduction (20-40 dB (A)).

Additional expected benefits, with implementation of this measure/alternative are: (a) reaching saving of energy in the improved facilities; (b) avoiding shade effects and (c) avoiding the feeling of enclosures and (d) avoiding significant visual changes.

5.3.1 Analyse of alternative

This alternative involves replacement of windows and doors on buildings exposed at the highest noise level, i.e. buildings positioned immediately next to the road.

Taking into account the efficiency of noise decreasing (20-40 dB (A), additional benefits in energy saving, landscaping, psychological effects and financial costs, this alternative is the most suitable one. The PVC windows and doors system and thermo pane glasses will reduce the noise level approximately of 36 dB (A).

[8] A "thermo pane" is a construction of double or more glasses, separated by a trapped air space and hermetically closed. The trapped air acts as an insulator, reducing noise level and heat loss through the glass

Considered from financial point of view, this alternative is by far more cost-effective compared to alternative for sound barriers construction (it seems to be about 16 times cheaper solution).

6 CONSULTATION WITH THE AFFECTED POPULATION, CONCLUSIONS AND PROPOSAL OF THE MOST APPROPRIATE SOLUTION

6.1 Consultation with the affected population

In the process of implementation of the assignment, the Consultant carried out field investigations and additional measurements of noise levels in the environment and interior of the most exposed buildings, as well as assessment of interventions required to protect the buildings (in the village Dolno Konjare and village Tabanovce).

During these visits, contacts were established with certain number of inhabitants–owners of exposed buildings, random passersby and curious people. In the following text we present summary overview of the most frequently given answers by the citizens to specific questions related to noise resulting from the traffic.

- To the question whether the highway generates noise that disturbs them during the performance of their everyday activities in the yard or inside the house, all consultant inhabitants had similar answers:
  - ✓ No,
  - ✓ We have got used to noise – there was a road here earlier as well,
  - ✓ Noise is not a problem, but there are other problems related to safety wire made fence and properties expropriation, etc.
- To the question, would you like to have sound barriers constructed to obtain better protection against noise, the most frequent answers were the following:
  - ✓ No, no way, because they will additionally obstruct our view;
  - ✓ No, because we will feel like in prison;
  - ✓ No, we are not happy with wire fence, not to mention some walls.
- Do you feel threatened by the traffic carried out on the highway while you are in the house yard or inside the house (in terms of incidents occurrence):
  - ✓ Almost all answers were identical, in a sense that they did not feel threatened or did not think of that.

In the course of the field visit to the route, within informal consultations with the local population, it was mentioned that sound barriers are not very much desired solution for overcoming the problem of noise, because the barriers will provoke other problems, such as: shadows effects; negative visual effects and feelings of enclosure. In addition to this, they do not feel the noise as a problem that needs to be settled, because they have lived by the road for long and it has become part of their everyday lifestyle.

Finally, we would note that during the assessment of the buildings, where according to the opinion of the Consultant certain improvements (implementation of measures) should be

provided, the residents did not allow access to buildings under the explanation that there was no need for any intervention and they had not have a problem with noise.

6.2 Findings

On the basis of the presented analysis we recognized:

- In the moment of implementation of this assignment, the analyzed route from the highway is reconstructed and it is already in use;
- The increased noise level along the highway is evidenced for years and the local citizens which are living near the road are most affected by the noise;
- The local citizens haven't got a feeling that they are affected by the road;
- During the designing process, the developer couldn't introduce the basic standards for designing of the highway, respecting the distance from the inhabited area due to the already existed road;
- Most of the cars and tracks which transit on the road are old and generate increased levels of noise;
- Permissible speed driving on the reconstructed road section is 130 km/h;
- The vicinity of the residential buildings to the road and the terrain condition, does not give many opportunities for implementing various solutions for reduction of environmental noise level which will be in compliance with the limit values (regulated in the National legal frame);
- Implementation of the alternative which promotes installation of barriers will be appropriate solution for the side of the road on which those will be installed, but not in the whole affected environment (both side of the road);
- Most of the interviewed people have presented the view of rejecting the barriers as a solution, describing that they will have negative feelings with it;
- At some parts of the road, the space between the road and the residential zones is so narrow, so the installation of the barriers is not save and possible;
- There are not recognized other sensitive receptors around the investigated route of the road. It means that the mitigation measures have to be applied only to the residential buildings (local population) in the village Dolno Konjare and village Tabanovce, as the most affected;
- According to the estimates made in the Main design for noise protection and Consultant-author of this Annex, it can be concluded that mitigation measures for decreasing of noise levels on all previous mentioned positions are required.

6.3 Proposal of the most appropriate solution

Due to the necessity to protect the most sensitive receptors-citizens, the most appropriate and sustainable solution is the application of the alternative measure-**treatment of housing buildings.** This will be acceptable for the local population, as well.

This alternative includes replacement of the existing windows and doors of the buildings, located in the first row, nearest to the road. It is estimated that about 70 residential facilities are the most affected by the increased noise level.

Due to the need to be successfully reached decreasing of the generated noise levels of about 36 dB it is recommended the following characteristics of the materials for successful implementation of the measure:.

- PVC windows and doors system with frame with 72 mm system, 5 chambers and 24 mm (4/16/4)* thermo pane with double glazing;
- proper air gap between the pane and
- usage of the additional construction material (gases for noise reduction-argon, krypton, etc.)

*The thermo pane glasses with dimensions 24 mm (4/16/4) with double glazing is the most applicable solution as a result of the weight of the glass. It must be taken into consideration that most of the existing buildings are old and the bigger weight of the glass and window systems may provoke damages of the facades/stability of the building.

Fitting secondary double glazing is recommended application, as well. It will not have an impact on the external appearance of the building. It is considered that this solution is cheaper than completely removal of the existing windows and doors.

Taking into consideration that in the most frequent periods of the day, the windows should be closed, it is recommended installation of air-conditioners.

On the basis of the number of buildings located along the main road, initial first rough calculations have been made to indicate that replacement of windows and doors, as well as installation of air-conditioners, will require approximately **12.300.000 denars or 200.000 €.**

Considered from financial point of view, this alternative is by far more cost-effective and efficient compared to alternative for sound barriers construction.

The implementation of this alternative will achieve:

- ✓ Lower level of noise in homes and the highest effects compared to all analyzed solutions;
- ✓ Avoiding effect of shade, feeling of enclosures and negative visual effect,

With implementation of this alternative it is expected to be reached the limit values defined in the Rulebook on environmental noise level limit values.

Table 15 Noise limit values in prémisses

Types of premises	**Noise level expressed in dB(A)**		
	Ld	**Le**	**Ln**
Rooms in residential buildings, facilities for recreation of children, bedrooms in homes for the elderly and pensioners, hotel rooms	35	35	35

Although the mentioned effects will be achieved, the environmental noise will remain unchanged. The increase of vehicle frequency on the highway in future will also increase the level of environmental noise and thus the identified problem of environmental noise will remain unsettled.

Additionally, for that reason is recommended:

- Reduction of vehicle driving speed by 20-30 km/h on stations where housing buildings in Tabanovce and Dolno Konjare are located. This measures will contribute for noise reduction of 2-3 dB (A);
- Placement of appropriate road signalization by which drivers will be informed in time on the permissible driving speed, thus avoiding sudden breakings and accelerations.

Also, in case of possible reconstruction of the road section in future, the alternative for selection of appropriate construction materials should be taken into consideration in order to obtain „quiet asphalt" which will certainly contribute to noise reduction from 3-8 dB (A).

Implementation of the environmental standards and best technology in the vehicle production industry will benefit on decreasing of the noise levels generated by the traffic in the future.

7 REVISED ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Potential Impacts/Issues	Mitigation Measures	Implementation Schedule	Responsibility for implementation	Responsibility for supervision	Monitoring indicators	Type and Frequency of monitoring and reporting
Air pollution	Monitoring of air quality in Tabanovce	Once a year in winter	Fund for International and regional roads	Ministry of Environment and Physical Planning (MEPP) and Agency for State roads	Thresholds for polluters in the Law and subsequent regulations	Annual report to MEPP
Endangered wildlife	Removal, inventory and bring back original vegetation close to its habitat	After finishing of the Construction	Construction com- pany	Fund for International and regional roads	Number, type and age of plants, trees, shrubs brought back on site	Records annexed to the report on construction works
Construction waste and debris	Appointment of a waste manager during construction	Continuously during construction tin works	Construction com- pany	Fund for International and regional roads; MEPP	Identification forms and transport lists kept and updated	Records annexed to the report on construction works
Cultural issues	Compensation with local population	Prior to start up of construction	Fund for International and regional roads	Ministry of Finance	Previously commonly applied compensation measures	Report by the Fund to the Ministry of Finance
Socio-economic benefits	Employments (seasonal)	During construction	Construction company	n/a	Number of workers	n/a
Noise	Analyze alternatives for minimization of the generated noise levels along the most affected sections	During construction	Agency for state roads Contracted Consultant	MEPP in communication with the Agency for state roads	Prepared Annex to the EIA Study, related to the noise	Once, The Report for the implementation of the project to WB by the Agency for State roads
	Communication with the most affected inhabitants in Tabanovce and Dolno	Operational phase	Contracted Consultant	Agency for state roads	2 separate consulting meetings are performed (v.	Reports to the Agency for State roads

	Konjare				Tabanovce and v. Dolno Konjare)	
	Implementation of the most applicable alternative for minimization of the indoor noise levels	Operation phase	Agency for state roads	State environmental inspectorate in cooperation with Local environmental inspectorate	the noise levels in the residential facilities are in the prescribed limit values	once after implementation of the measure/ Report to the WB and MoEPP
	Monitoring the effects of the improvements/monitoring of indoor noise levels	Operation phase	Agency for state roads	State environmental inspectorate in cooperation with Local environmental inspectorate	Residents do not complain of noise generated by road. There is no any grievance applied to the Investor	One year after implementation of the measure. Report to the WB and MoEPP
	Implementation of the measure for minimization of the outdoor/environmental noise levels: 1. Reduction of the speed driving on the most affected sections (to the nearest houses). 2. Installation of the barrier (reinforced concrete barrier New Jersey in the length of 25-30 m) on the most affected section in Dolno Konjare (7+348 to km 7+525)	Operation phase, after 3-5 years of operation	Agency for state roads	State traffic inspectorate/Ministry of interior affairs	The outdoor noise levels are reduced	Once, after implementation of the measure/Report to the WB, MoEPP
Air pollution	Vegetation buggers along high quality agricultural land	Immediately after construction	Fund for International MEPP and regional roads	Ministry of Agricul-ture, forestry and water economy	Concentrations of air sediment polluters in soil	n/a
Endangered	- Vegetation control	Once a year, in	Fund for	Ministry of	Quantity of	n/a

wildlife	under bridges, under-passes and ducts - Maintenance of coastal vegetation	autumn	International MEPP and regional roads	Agriculture, forestry and water economy	removed biomass	
Storm water drainage from motorway surface	Monitoring of quality of effluent	Once a year, in summer (low river flow)	Fund for International MEPP and regional roads	MEPP	Thresholds for water polluters in the Law and subsequent regulations	MEPP
Socio-economic benefits	Industry, trade development	Project implementation	Private entrepreneurs	n/a	Purchasing power of population	n/a
Hazards	Plan for Hazard Management	Project implementation	Fund for International MEPP and regional roads	MEPP	Number of accidents and hazards	Annual reporting to MEPP (Law on Environment)

8 APPENDIX I

CONSULTATION PHASE

PUBLIC CONSULTATION PROCESS

8.1 General information for citizens in villages Dolno Konjare and Tabanovce

In order to achieve greater transparency in the process of preparation of the Annex to the environmental impact assessment study of the highway Tabanovce-Kumanovo and involvement of affected local population in the consultation process, the Consultant prepared informative material to inform the local population about the measures which could be implemented for minimization of the noise impact.

The informative set contents:

- General announcement-information for the time and place where the public hearing will be hold (20 announcements were submitted to the presidents of the local communities in villages Dolno Konjare-Mr. Branislav Aleksic and Tabanovce-Mr. Sasa Angelkovic, and placed on prominent public buildings (shops, local community, entrance to the religious temples etc.) and
- Short Information about the measures which could be apllied for noise reduction, generated by the traffic by highway E-75, section Kumanovo-Tabanovce (70 sets) were submitted to the presidents of the local communities in villages Dolno Konjare-Mr. Branislav Aleksic and Tabanovce-Mr. Sasa Angelkovic, and delivered to the most affected residents.

8.1.1 General Announcement for the citizens of the village Dolno Konjare

АГЕНЦИЈА ЗА ДРЖАВНИ ПАТИШТА

Број 02 -2655/2

25.05 2012 год.

СКОПЈЕ

ИЗВЕСТУВАЊЕ

Се известуваат сите жители на МЗ Долно Коњаре, општина Куманово дека на ден 28.05.2012 (понеделник) во 12.00 часот во просториите на Месната заедница, ќе се одржи состанок со сопствениците на објекти за живеење, кои се наоѓаат на првата линија (најблиску) до автопатот Е75, делница Куманово-Табановце.

На состанокот ќе се презентираат можните мерки за намалување на ефектите од бучавата, која е предизвикана од сообраќајот, што се одвива на оваа делница.

Состанокот го организира Агенцијата за државни патишта.

Со почит,

ДИРЕКТОР

Љупчо Георгиевски

АГЕНЦИЈА ЗА ДРЖАВНИ ПАТИШТА СКОПЈЕ

Изготвил/Одобрил: С.Богданова,Инж.за заштита на животна средина

Ул. "Даме Груев" бр.14; Тел. 389 2 3118-044; 3228-454; Факс 3220-535; 1000 Скопје; Пош.фах. 216

8.1.2 General Announcement for the citizens of the village Tabanovce

АГЕНЦИЈА ЗА ДРЖАВНИ ПАТИШТА

Број 02 - 2655/1

25 . 05 2012 год.

СКОПЈЕ

ИЗВЕСТУВАЊЕ

Се известуваат сите жители на МЗ Табановци, општина Куманово дека на ден 29.05.2012 (вторник) во 12.00 часот, во просториите на Месната заедница, ќе се одржи состанок со сопствениците на објекти за живеење, кои се наоѓаат на првата линија (најблиску) до автопатот Е75, делница Куманово-Табановце.

На состанокот ќе се презентираат можните мерки за намалување на ефектите од бучавата, која е предизвикана од сообраќајот, кој се одвива на оваа делница.

Состанокот го организира Агенцијата за државни патишта.

Со почит,

ДИРЕКТОР

Љупчо Георгиевски

Изготвил/Одобрил: С.Богданова,Инж.за заштита на животна средина

Ул. "Даме Груев" бр.14; Тел. 389 2 3118-044; 3228-454; Факс 3220-535; 1000 Скопје; Пош.Фах. 216

8.1.3 Short Information about the measures which could be apllied for noise reduction, generated by the traffic (highway E-75, section Kumanovo-Tabanovce)

Агенцијата за државни патишта-Скопје спроведе проект за реконструкција и надградба на делницата Табановце-Куманово што е дел од Коридорот X, на ниво на автопат, во вкупна должина од 7.62 km.

Со цел да се утврди влијанието врз животната средина и здравјето на населението од имплементацијата на Проектот подготвена е ОВЖС студија во која се идентификувани можните влијанија врз животната средина и здравјето на населението и мерки за нивно намалување или елиминирање. Во Студијата се разработени и аспектите на бучавата.

За надминување на идентификуваните влијанија од бучавата во ОВЖС Студијата предвидена е мерка поставување на заштитни ѕидови (бетонски или метални) на локации кои поминуваат низ населените места, односно во Долно Коњаре и дел од Табановце.

Сметајќи дека жителите, кои имаат свои куќи во непосредна близина на Автопатот, може да бидат засегнати од зголеменото ниво на бучава предизвикани од сообраќајот, Инвеститорот подготви и Основен проект за заштита од бучава Табановце-Куманово делницата од E75[9].

На база на детални анализи и пресметки и спомнатиот проект предлага изградба на заштитни бариери. Недостатокот на разработка на други алтернативи/опции за намалување на бучавата во Основниот проект за заштита од бучава, наложи разгледување на дополнителни алтернативни мерки за намалување на бучавата во подрачјата на делницата, каде се смета дека има осетливи рецептори, односно афектирано население.

За таа цел, Агенцијата за државни патишта, како нарачател на услугата, побара од Консултатот Менка Спировска, овластен експерт за оцена на влијанијата врз животната средина, да подготви Анекс, во кој ќе бидат разгледувани соодветни алтернативни мерки за намалување на бучавата во оперативната фаза на Проектот и да спроведе процедура на консултации со засегнатото население чии објекти за живеење се наоѓаат во непосредна близина на делницата.

Целта за анализа и утврдување на дополнителни, алтернативни, мерки за намалување на влијанијата од бучавата предизвикани од сообраќајот е изнаоѓање најсоодветно решение кое ќе обезбеди целосна заштита од зголеменото ниво на бучава врз засегнатото население, а исто така за Инвеститорот ќе биде прифатливо од аспект на оддржливост и економски аспект.

Ангажираниот консултант, врз основа на достапната документација и опсервациите, направени на лице место, констатира:

[9] Подготвен од стран на DIWI Consult International Macedonia DOOEL Skopje

- Анализираната делница од автопатот е реконструирана и истата е во употреба;
- Зголемено ниво на бучава долж трасата на автопатот е евидентно со години и локалното население, кое живее близу до автопатот, е изложено на зголемено ниво на бучава;
- Локалното население нема чувство дека е загрозено од бучавата од патот;
- Во текот на процесот на проектирање, проектантот не можел да ги примени основните правила за проектирање на автопат во однос на почитување на оддалеченоста на зоните за домување, бидејќи станувало збор за веќе постоечки пат;
- Повеќето од автомобилите и тешките возила кои транзитираат по автопатот се стари и генерираат зголемено ниво на бучава;
- Дозволената брзина на движење на возилата по реконструираната делница изнесува 130 km/h;
- Оддалеченоста на објектите за домување од автопатот и теренските услови, не даваат можност за имплементација на различни решенија за намалување на нивото на бучава во животната средина, која ќе биде во согласност со дозволените гранични вредности за ниво на бучава (регулирана во националната правна рамка);
- Имплементацијата на алтернативи кои промовираат инсталација на звучни бариери ќе биде соодветно решение за намалување на нивото на бучава на онаа страна каде што ќе биде поставена бариерата, но не и на животната средина засегната од зголемено ниво на бучава, во целост (на двете страни од патот);
- Повеќето од интервјуираните луѓе се изјаснија дека се против поставување на звучни бариери, нагласувајќи дека тие може да предизвикаат негативно чувство кај жителите (чувство на затвореност, ќе се ограничат визурите, нема да има струење, ќе се промени пределот);
- На одредени делови од автопатот, просторот помеѓу автопатот и зоната за домување е толку тесна, така што поставување на бариери не е возможно ниту безбедно;
- Не се сретнати други осетливи рецептори во предметното подрачје и долж трасата на автопатот. Ова значи дека мерки за намалување на нивото на бучава треба да се имплементираат само во објектите за домување кои се најзасегнати (локалното население) во селата Долно Коњаре и Табановце.
- Подобрувања треба да се направат на сите објекти, кои се во првата линија, најблиску до автопатот.

За да се провери размислувањето на засегнатите жители, Агенцијата организира состанок на кој подетално ќе се презентираат мерките за намалување на бучавата. После овие консултации ќе се донесе одлука за примена на најсооддветна мерка, која ќе биде прифатлива за сите заинтересирани страни.

8.2 Meetings with the affected citizens

8.2.1 Lists of participants

DOLNO KONJARE

Листа на учесници

	Име и презиме	Институција	Позиција	Контакт бр.	e-mail
1.	Сотир Кузмановски	Пензионер	Пом. инж.	424 785	
2.	Благица Димитриевска			412 834	
3.	Алексиј Звонко	Пензионер.	Пензионер.	429 549	
4.	Алексиј Браниславов	Сопствена фирма	Сопственик	415 227	
5.	Петрушевски Зоран	Оли-Травел	Работник	414 998	
6.	Зафировиќ Эротон		Невработен	432 158	
7.	Симоновиќ Сава		Пензионер	432 094	
8.					
9.	Трајковиќ Антей		Пензионер	429 601	
10.	Tomislav Kovachovski	Dixi-Germany	Надзор. инж.	072 204 959	
11.	Петковиќ Тодор	Невработен	Невработен	031/423-085	
12.	Виолета Трајановска	Деконс-ЕМА	админист. асистент	078 252 680	v.trajanovska@ema.com.mk
13.	Сашка Богданова	Агенција за патишта	инж. за животна средина	078330297	SASKA@roads.org.mk
14.	Јулијана Никова	Деконс ЕМА Скопје	консултант за жив. сред.	078252677	j.nikova@ema.com.mk
15.	Зоран Ристов	Институт		070/218233	
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TABANOVCE

Листа на учесници

#	Име	Институција	Позиција	Контакт бр.	e-mail
1.	Марјан Трајановиќ			075805526	mtrajanović@yahoo.com
2.	Неђо Анђелковић				
3.	Стоилко Павловски				
4.	Бојковска Светлана				
5.	Срби[illegible] [illegible]				
6.	[illegible]				
7.	Милорад Анђелковић				
8.	[illegible] Трајковић Боривоје				
9.	[illegible] Велковски Зоран				
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8.2.2 Minutes of meeting

8.2.2.1 Minutes of meeting (village Dolno Konjare)

On 28.05.2012 at 12.00 pm in the Local community in village Dolno Konjare was held public presentation of the content of Annex to environmental impact assessment study of the highway Tabanovce-Kumanovo.

The meeting was attended by the local citizens who are affected by the noise generated by the traffic on the reconstructed road, EIA Consultant, representatives from Agency of State Roads and the supervisor of the activities on the road.

The content of the Annex was presented by the Consultant engaged by the Agency for State roads.

After the presentation, the people affected by the traffic noise, expressed their opinions about the noise and how they perceive it and gave their suggestions.

Some of the comments and suggestions are given below.

Goran Petkovic: Our house is located 60 meters away from the highway. That is why the presented alternative for replacement of the windows and doors is a good solution. Barriers are not proper solution due to the small distance between the houses and the highway.

Sande Kuzmanovski: Installation of windows and doors are good solution for indoor noise reduction, for the facilities which are more distant from the highway. For others, more suitable solution is installation of noise barriers, especially for the facilities on the position km 7+348 to km 7+525. The argumentation of this opinion is that the vehicles driving on the highway with high speeds (about 130 km/h) generate increased noise level. My suggestion is reduction of the driving speed.

Goran Aleksic: My home is situated at the position km 7+348 to km 7+525 (the nearest object on the highway). The best solution for noise reduction and safe protection of these houses is installation of concrete barrier.

Branislav Aleksic: Sound barriers are proper solution for position km 7+348 to km 7+525, because this houses as a nearest to the highway is the most exposed on noise and installation of barriers are required from safety aspects.

The meeting ended at 13.00 pm after elaborate discussion.

Figure 8 Presentation of the ANNEX in village Dolno Konjare

8.2.2.2 Minutes of meeting (village Tabanovce)

On 29.05.2012 at 12.00 pm in village Tabanove was held public presentation of the Annex to environmental impact assessment study of the highway Tabanovce-Kumanovo. As a result of the lack of adequate space in the Local community, for that purpose, the presentation was held in the private home at one of the interested inhabitance of the village.

The meeting was attended by the local citizens who are affected by the noise generated by the traffic on the reconstructed road, EIA Consultant, representatives from Agency of State Roads and the supervisor of the activities on the road.

The content of the Annex was presented by the Consultant engaged by the Agency for State roads.

After the presentation, the people affected by the traffic noise, expressed their opinions about the noise and how they perceive it and gave their suggestions.

Some of the comments and suggestions are given below.

Stoilko Pavlovski: With reconstruction and upgrading of the highway the noise level is reduced, because with expansion of the road, part of the traffic is moved further from residential objects. Noise is not a big problem for the inhabitants and with replacement of the windows and doors complete protection of the indoor noise will be provided.

Marjan Trajanovic: Replacement of the windows and doors will contribute for noise reduction in the homes, but environmental noise in the future will remain. Increased noise level can provoke disturbance of the people which spare their time in the yards. Also, increased noise level could be a problem in future for the inhabitants of Tabanovce which are planning to build new residential objects. In that case, the Agency for State roads has to invest in the all new residential objects for installation soundproof windows and doors. Our request is installation of transparent sound barrier for position km 2+000 to 2+170.

Stole Trajanovic: He shares the same opinion as Marjan Trajanovic.

EIA Consultant: Agency for State roads is obliged to solve the problem related to the traffic noise only for the existing buildings. In the future, everyone who is interested for building of the new buildings have to take into consideration existence of the highway and noise generated by the traffic. The choice for construction of the buildings near to the highway is personal decision and problem with the noise everyone have to solve independently.

Apart from this opinion, almost all of the rest attendees (Trajanovic Borivoje, Milorad Angelkovic, Boris Dodevski, Bojkovska Svetlana, Velkovski Zoran) are agreed that replacing of the windows and doors is suitable solution for noise protection in their homes. According to their opinion, the barriers will provoke effects of shade and feeling of enclosures and this alternative as a solution for noise reduction was rejected.

Figure 9 Presentation of the ANNEX in village Tabanovce

8.3 Conclusions after public consultation

After the consultations with affected public and presentation of the content of the Annex to environmental impact assessment study of the highway Tabanovce-Kumanovo (villages Dolno Konjare and Tabanovce), the EIA Consultant presents conclusions which have to be implemented to reduce the noise impact on the human health and environment:

- Replacement of windows and doors and installation of air conditioners is acceptable solution for the most of the affected inhabitants from villages Dolno Konjare and Tabanovce. For that purposes the Agency of State roads will undertake activity for preparation of tender dossier with required technical details about proposed mitigation measures;
- At the position 7+348 to km 7+525 in village Dolno Konjare, the owner of the closest house proposed installation of sound barriers (option-concrete barrier) in addition to the replacement of the windows and doors. The same requirements were highlighted by the residents of village Tabanovce on the position km 2+000 to km 2+170. Their proposal is installation of the sound barriers (mixed: metal and transparent). ***The consultant recognized that the request from the citizens of village Dolno Konjare is acceptable and realistic, due to the fact that the barriers will contribute in terms of noise reduction and protection of assets and human life (against incidental thrown at vehicles).*** For implementation of the measure, the consultant proposes installation of reinforced concrete barriers "New Jersey Barrier"- (NJB) in the length of 25-30 m at the position km 7+348 to km 7+525. The precise length and height of the barriers will be determinate in accordance with the present conditions of the terrain. For that purposes the Agency of State roads will undertake activity for preparation of tender dossier with technical information of a need.
- Reduction of driving speed on the highway (from 130 to 100 km/h) on the sections near the mentioned villages and installation of signs are acceptable mitigation measures for additional noise reduction by all consulted residents and it should be implemented.