NOISE AND VIBRATION

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LIST OF ABBREVIATIONS

Short name	Full name
ΔL_{Amax}	The maximum A-sound pressure level difference defined with instrument impulse time-constant and slow time-constant in dB
A_0	Study limit
A_M	Vibration load for the judging time
A_{max}	Maximum vibration load
É, D, K, NY	Cardinal points (north, south, east west)
Ee	Forest area for healthcare-social and touristic destination
Eg	Forest area for economic/business destination
EKD	Preliminary Consultation Document
EOV	Unified National Projection System
Ev	Forest area to be protected
Gip	Industrial zone
Gksz	Commercial, services and business area
HÉSZ	Local construction regulation
ISO	International Standard issued by the International Organization for Standardization
K_a	Ground noise correction
K_b	Correction due to non-furnished premise
Kb	Mining area
Kc	Camping
K_f	Corrections factor applied for calculation of noise caused by traffic
Kh-Ht	Waste treatment and depository area - waste treatment and neutralisation
Kh-szv	Waste treatment and depository areas - waste water treatment
K_{imp}	Impulse correction
Kkö	Area for traffic and public buildings
Kmü	Agricultural area
KÖ	Traffic and public utility area
KöM-GM	Issued by the Minister of Environment - Minister of Economy
Kök	Track-based traffic areas
Köu	Traffic areas
Ksp	Sport area
Kt.	Issued by the general assembly
Kt	Cemetery
K_{ton}	Narrow gauge correction
KvVM-Eüm	Issued by the Minister of Environment and Water Management - Minister of Health
Kz	Specific green surface area
Kz - tem	Cemetery
Kz - vsp	Water sport facility
Kz -szp	Recreation park
Kz –szt	Recreation farms
Kz-e	Energy park
L_{A95}	Measured 95% A-sound pressure level
L_{Aa}	Lowest A-sound pressure level of ground noise
L_{Aeq}	Measured noise equivalent A-sound pressure level for the reference time
$L_{Aeq,\ measured}$	Equivalent A-sound pressure level
L_{AImax}	Maximum A-sound pressure level defined with instrument impulse (I) time-constant in dB
L_{AM}	Judging level
$L_{AMkö}$	Level of judging noise from public road traffic
L_{ASmax}	maximum A-sound pressure level defined with instrument slow (S) time-constant in dB
Lf	Rural residential area (village)
Lk	Small town residential area
Lke	Suburbia residential area (with gardens)
Ln	Urban residential area
L_p	Sound pressure level
L_{TH}	Noise load limit permitted in the vicinity of the plant
L_w	Noise sound power level
Má or Má-á	General agricultural area
Má-V	Agricultural area - protection zone for nature conservation

Short name	Full name
MAVIR	Magyar Villamosenergiaipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság Hungarian Power Transmission System Operator Plc.
Mk	Agricultural area with gardens
MSZ	Code of Hungarian Standard
MSZ ISO	Hungarian standard issued in conformity with the publications of by International Organization for Standardization
MVM	Magyar Villamos Művek Zártkörűen Működő Részvénytársaság Hungarian Electricity Plc.
Ökt.	Issued by the general assembly of the Municipality
P, G, AP	Major parking lot/site, garage block, bus railway station
Paks II.	Nuclear power plant units planed at Paks site
RMP	Vibration measuring point
SzT	Arrangement Plan
TSzT	Settlement structural plan
ÚT 2	Code for technical road system
Üü	Resort area
V	Water management area
V1	Danube riverbed and embankment
V3	Flood protection objects zone
V4	Water management wells, water management facilities
VE	Water management forest zone
Vk	Central mixed area
Vk	Water management community zone
Vmg	Agricultural zone
Vt	Settlement centre mixed area
Vt (in frame)	Water management area flood protection zone e
Z	Green area
Z1	Central park zone
Z2	Public park zone
Z3	Protected green area for agriculture
ZMP	Noise measuring point

15 NOISE AND VIBRATION

15.1 LEGAL BACKGROUND – AREA CATEGORY, LIMITS

15.1.1 LEGAL BACKGROUND

Laws

Act LIII. of 1995, general rules for the protection of the environment

Decrees

Decree 25/2004. (XII.20.) KvVM - detailed rules for preparing strategic noise load maps and action plans

Decree 27/2008. (XII.3.) KvVM-EüM - definition of ambient noise and vibration limits

Government Decree 284/2007. (X.29.) - certain rules on noise and vibration protection

Decree 29/2001. (XII.23.) KöM-GM - method for mitigating noise emission of outdoor equipments and noise emission measurement

Government Decree 314/2005. (XII.25.) - environmental impact study and integrated pollution prevention control (IPPC) licensing process

Decree 93/2007. (XII.18.) KvVM - method for defining noise emission limits and noise and vibration emission control

Bölcske Village Municipality General Assembly - resolution 21/2003. (XII. 21.) - Local Building Regulation

Dunaföldvár City Municipality General Assembly - resolution 18/2006 (XII.05.) amended with resolutions 12/2007. (V.05.) KT, 2/2009. (II.15.) KT 29/2009. (XII.18.) KT, 32/2011. (XII.30.) 14/2012. (IV.30.) and 17/2012. (V.31.) in Dunaföldvár Local Construction Regulation and Development Plan (In concise structure)

Dunaszentbenedek Village Municipality - resolution 2/2006.(II.16.) - local building regulation

Dunaszentgyörgy Village Municipality General Assembly - resolution 10/2005. (II.10.) - approval of the Local Structural Plan

Dunaszentgyörgy Village Municipality General Assembly - resolution 3/2005. (II.17.) - Local Building Regulation (In concise structure)

Előszállás Village - resolution 14/2011. (XII.01.) Sz. Ökt. - local building regulation

Fácánkert Village Municipality General Assembly - resolution 3/2005. (IV.22.) local Development Plan and Local Building Regulation

Géderlak Village Municipality - resolution 19/2004. (XII.1.) - Local Building Regulation

Paks Municipality - Settlement Structural Plan and description adopted by resolution 2/2003. (II. 12.) Kt., amended and edited in concise structure by virtue of resolution 79/2011. (XI. 23.) Kt.

Paks Municipality - resolution 24/2003. (XII. 31.) - Paks Local Building Regulation (In concise structure)

Paks Municipality - resolution 32/2008. (XII. 17.) - Local Noise and Vibration Protection Regulation (In concise structure)

Uszód Village Municipality General Assembly - resolution 12/2006. (VI.29.) - Local Building Regulation and Local Structural Plan and Settlement Development Plan approved by Resolution 34/2006.

Standards

We applied the following standards for preparing the studies and calculations:

Ambient ground noise and background noise:

MSZ ISO 1996-1:2009: Acoustics. Description, measurement and evaluation of ambient noise
MSZ ISO 1996-2:2009: Acoustics. Description, measurement and evaluation of ambient noise
MSZ ISO 1996-3:1995: Acoustics. Description, measurement and evaluation of ambient noise
MSZ 18150-1:1998: Study and evaluation of ambient noise

Noise caused by traffic:

MSZ 13-183-1:1992: Measuring noise caused by traffic. Public road noise
ÚT 2-1.302: Calculation of public road noise caused by traffic
ÚT 2-1.109: Traffic counting at national public roads crossings and defining traffic dimension

Baseline vibration:

MSZ 18163-2:1998: Vibration measurement. Study of ambient vibrations in buildings onto people
MSZ ISO 2041:1995: Vibration and impact. Definitions

Noise modelling:

MSZ 15036:2002: Sound propagation outdoor
MSZ 07-2904:1990: Calculating railway noise caused by traffic
ISO 9613-2:1996: Acoustics - Attenuation of sound during propagation outdoors

15.1.2 NOISE LOAD LIMITS

During the evaluation of results of noise load measurements we used the noise load limits presented in the following sub-points.

15.1.2.1 Noise caused by operation

Appendix 1 of Decree 27/2008. (XII.3.) KvVM-EüM describes the noise load limits arising from operational and recreation facilities in areas to be protected from noise.

	Area to be protected from noise	Limit of LTH for LAM judging level* (dB)	
		daytime 6-22 h.	at night 22-6 h.
1.	Resort area, health care areas among extraordinary areas	45	35
2.	Residential area (small town-type, suburban, rural, group housing), among extraordinary areas: area of education facilities, cemeteries, green area	50	40
3.	Residential area (metropolis-type construction), mixed area	55	45
4.	Economic/business area	60	50

Comment:
* to be interpreted in accordance with MSZ 18150–1 and MSZ 15036:2002 standards.

Table 15.1.2-1: Noise load limits of technology facilities at the points of the study

Limits shown in the above table will be modified as a result of defining the following zones in accordance with the Order nr.32/2008. (XII.17.) adopted by Paks Municipality on the regulation for local noise and vibration protection (we have also applied this regulation.

Area to be protected from noise/ noise protection zones	Construction zones in accordance with HÉSZ
1.: Zone	Üü - resort area Kz - Green area among extraordinary areas : Kz-szp, Kz-szt, Kz-tem
2: Zone	Lk - Small town-type residential area Lke - Suburbia residential area Lf - Rural residential area
3.: Zone	Ln - Metropolis-type residential area Vt - Settlement centre mixed area Vk - Central mixed area
4.: Zone	Gksz - Commercial, services and business area Gip - Industrial zone (only for residential buildings functioning in the area)

Table 15.1.2-2: Zone categories related to noise load

15.1.2.2 Noise caused by traffic

Appendix 3. of Decree 27/2008. (XII.3.) KvVM-EüM contains the limits for noise load caused by traffic on areas to be protected from noise, see in Table 15.1.2-3.

		Limit (LTH) for LAMkö judging level [dB]			
	Area to be protected from noise	Noise from minor roads that belong to the national public road network, access and feeder roads owned by local municipalities and suburban roads, minor railway lines and railway stations, airport and non-public stations		Nose from speedways that belong to the national public road network and main roads, inner area speedways owned by local municipalities, inner area primary and secondary main roads, bus / railway stations, main railway lines and railway station, airport and non-public stations	
		Daytime 6-22 h.	At night 22-06 h.	Daytime 6-22 h.	At night 22-06 h.
1.	Resort area, healthcare-related areas among special areas	55	45	60	50
2.	Residential area (small town-type, rural, group housing), areas of education facilities among special areas and cemeteries, green area	60	50	65	55
3.	Residential area (metropolis-type construction), mixed area	65	55	65	55
4.	Business area	65	55	65	55

Comment:
to be interpreted in accordance with Clause 1.1 of Appendix 3 of Decree 25/2004. (XII.20.) KvVM (detailed rules for preparing strategic noise load maps and action plans and Clause 1.1. of Appendix 5.

Table 15.1.2-3: Limits of noise load caused by traffic in areas to be protected from noise

15.1.2.3 Noise caused by construction

Power plant construction / demolishing operations will keep on going for a period longer than 1 year.

Appendix 2 of Decree 27/2008. (XII.3.) KvVM-EüM presents the limits of noise loads arising from construction or demolishing works on areas to be protected from noise, see in Table 15.1.2-4.

Area to be protected from noise	**Limit (LTH) for LAM judging level (dB) (construction time: longer than 1 year)**	
	daytime 6-22 h.	at night 22-6 h.
Resort area, health care area among extraordinary areas	50	35
Residential area (small town-type, suburban, rural, group housing), areas of education facilities among special areas and cemeteries, green area	55	40
Residential area (large city structure), a mixed area	60	45
Business area	65	50

Table 15.1.2-4: Limits for noise from construction and demolishing works

15.2 NOISE - AND VIBRATION LOAD BASELINE MEASUREMENTS

Processed results of noise and vibration load measurements provide the basis for preparing the environmental impact study, detailed modelling and delineating the impact zones in order that requirements specified in laws and standards can be met. We attached the complete documentations related to the measurements to the present KHT. The same document presents also the results of previous studies and assessments prepared prior to the measurements. [15-1]

15.2.1 SCOPE OF THE SURVEY

As part the specific program we have performed the following tasks:

- We have collected and assessed the noise- and vibration load measuring data available for the site and its environment.
- We have performed noise measurements in the area located within the future noise and vibration load impact zones on facades and along the work network to be protected at the site and on the planned power plant.
- We have also performed traffic count together with the noise measurements at public roads.
- We have performed vibration measurements on the assumed vibration load impact zone in order to define the baseline status.
- We have performed baseline noise measurements at two points in the residential areas next to the planned plant area.

15.2.2 BASELINE NOISE LOAD MEASUREMENTS

Regarding noise protection, the areas of study are located within Paks residential area, along Road no. 6 in inner suburban zones, and on areas north, east, west and east of Paks on the adjacent settlements that should be protected from noise.

We analysed noise levels at the following measuring points for preparing the documents for the environment protection licensing process for the new nuclear power plant units:

- ❖ 3 points at the borderline of the site (ZMP1, ZMP2, ZMP3)
- ❖ 1 point at the Ecopark area (ZMP4)
- ❖ 1 point at the residential buildings at Paks-Csámpa district next to the national highway nr. 6 (ZMP5)
- ❖ 3 points at the residential buildings at Paks-Csámpa district at the road connecting road nr. 6 with Forrásmajor (ZMP6, ZMP7, ZMP8)
- ❖ 3 points at the residential buildings in Paks city and at the residential buildings along Road no. 6 and the railway line in Paks-Kömlőd (ZMP9, ZMP10, ZMP11)
- ❖ 2 points in Paks city on Kölesdi road (ZMP12, ZMP13)
- ❖ 1 point in Dunaszentgyörgy village at the residential buildings next to highway nr. 6 (ZMP14)
- ❖ 1 point at Paks water sport facility (ZMP15)
- ❖ 3 points at the residential buildings in Uszód, Géderlak, Dunaszentbenedek (ZMP16, ZMP17, ZMP18)
- ❖ In front of the residential buildings at the Eastern and Western sides of Paks, Dankó Pista street (ZMP19, ZMP20)
- ❖ As supplementary measurements: 4 points in the area of Paks Nuclear Power Plant (ZMP22, ZMP23, ZMP24, ZMP25).
- ❖ As supplementary measurements: on the area to be protected at Paks-Csámpa next to Paks II.

Designated noise measuring points are displayed on the following overall layout figure:

Figure 15.2.2-1: Noise measuring points - overall layout figure

We held measurement for <u>noise caused by operation</u> at ZMP1-4 points for studying noise emitted by Paks Nuclear *Power Plant.*

We held measurements for ambient <u>noise caused by traffic</u> along road sections next to residential buildings on Highway 6., and on the connecting and minor roads at 7 points (ZMP5, ZMP9-14), and on the proposed measuring points (2 points: ZMP19-ZMP20), thus we identified total 9 ambient traffic noise measuring points. Traffic count was also held simultaneously with the public road noise measurements. Most of the designated measuring points are located on the potential supply routes. As detailed information is not available in the present planning phase we cannot precisely define the future supply routes, as to this effect detailed logistic plans would be required, but most presumably the maximum traffic would emerge on the northern and southern direction on the Main Road no. 6. The construction area can be reached using public roads from M6 Motorway at Paks-South junction through Paks on the Kölesdi road.

Other ambient noise measurements were performed at ZMP6-9 and ZMP15-18 points with the purpose to obtain background load data for the subsequent noise modelling process. We tried to obtain results from as large as possible circle around the planned Plant, because at this point and time we did not have exact information regarding the potential extension of the impact zone.

We decided to use five additional points supporting the noise modelling process, and four of these measuring points are located in the power plant area, and one (ZMP21) in Paks-Csámpa settlement in an object to be protected and located next to Paks II,. in the power plant area (ZMP25) at the estuaries of the warm water channel at river Danube, (ZMP24), at the spillover dam (ZMP22, ZMP23) and main transformers of the unit. We measured the noise caused by operation at the power plant area, and other environment noise at Csámpa village.

The following tables (Table 15.2.2-1., Table 15.2.2-2., Table 15.2.2-3.) present the noise limits to be observed at the relevant measuring points based on the area or zone categories defined in accordance with the applicable decrees, local structural plans, development plans and local building regulations:

Measuring points	EOV coord. (x,y)	Area to be protected from noise based on development plans and local structural plans	Judging sound pressure levels	Limit L_{TH} for L_{AM} judging level [dB]	
				daytime 6-22 h.	at night 22-6 h.
ZMP1	137038; 635205	Gip	L_{AM}	60*	50*
ZMP2	137281; 634924				
ZMP3	137601; 635181				
ZMP4	137721; 634612				
ZMP22	136617; 635222				
ZMP23	136317; 635243				
ZMP24	136720; 635588				
ZMP25	137637; 636517				

Comment:

The judging sound pressure level shown on the table is L_{AM}, thus the limits in the limit are shown in accordance with the values defined in Appendix 1 of Decree 27/2008. (XII. 3.) KvVM-EüM.

* as specified by Decree 32/2008. (XII. 17.) it applies only on residential buildings functioning in the area but there is no such building in the study

Table 15.2.2-1: Noise load limits at the designated measuring points – noise caused by operation

Measuring points	EOV coord. (x,y)	Area to be protected from noise development plans and local structural plans	Judging sound pressure levels	Limit L_{TH} for L_{AM} judging level [dB]	
				daytime 6-22 h.	at night 22-6 h.
ZMP6	137167; 633106	Lf	L_{AM}	50	40
ZMP7	137563; 632831				
ZMP8	138063; 632461				
ZMP15	138576; 635769	Kz**	L_{AM}	(50)	(40)
ZMP16	136252; 638378	Lf	L_{AM}	50	40
ZMP17	139982;639305	Lf	L_{AM}	50	40
ZMP18	138464; 637353	V***	L_{AM}	(50)	(40)
ZMP21	137175; 633792	Lf	L_{AM}	50	40

Comment:

The table presents the judging sound pressure level L_{AM}, thus the limits in the columns are the figures defined in Appendix 1 of Decree 27/2008. (XII. 3.) KvVM-EüM 1. Noise impact from Paks Nuclear Power Plant cannot be identified in these areas, but we also presented the limits of noise caused by operation for study of noise impact caused by Paks II..

** conservative approach, it is in fact not protected, and only areas identified in local decrees are under protection among the areas classified as „Z" green area, and among Kz green surface areas (Decree 32/2008. (XII. 17.)), where no Kz-vsp is shown as an area under protection

*** conservative approach for protecting the dam keeper house, though the water management area is in fact not under protection, there is no limit defined for it in the zone category system

Table 15.2.2-2: Noise load limits at the designated measuring points - other environmenti noise

Measuring points	EOV coord. (x,y)	Area to be protected from noise based on development plans and local structure plans	Judgement sound pressure levels	Limit L_{TH} for $L_{AMkö}$ judging level [dB]	
				daytime 6-22 h.	**at night 22-6 h.**
ZMP5	136547; 633605	Lf	$L_{AMkö}$	65	55
ZMP6	137167; 633106			60	60
ZMP7	137563; 632831				
ZMP8	138063; 632461				
ZMP9	142020; 635966	Lk	$L_{AMkö}$	65	55
ZMP10	143116; 636740				
ZMP11	146824; 637182	Lf			
ZMP12	140540; 634570	Lke		60	50
ZMP13	140502; 634298				
ZMP14	132232; 631781	Lf		65	55
ZMP19	140321;634388	Lke	$L_{AMkö}$	60	50
ZMP20	140186;634714			65	55

Comment:
The judging sound pressure levels LAMkö, shown in the table are presented in the limit columns as the limit values defined in Appendix 3 of Decree 27/2008. (XII. 3.) KvVM-EüM. The measuring points along public roads were selected in such a way that they can also represent the noise generated by operation and recreation facilities and can reach the residential buildings along these roads and with the help of these data the background load can be also determined later.
Base of reference of ZMP6-8, 12-13, 19 road types: „to noise arising from minor roads that belong to the national public road network, feeder roads and suburban roads owned by the local municipality, railway branch line and railway station, the airport, and non-public station" is at the ZMP5 traffic junction, but we showed a stricter limit in the present case.
Base of reference of ZMP-5, 9-11,14,20 road types: „to noise arising from roads and main roads, inner area speedways owned by the local municipality, inner area priority main roads and inner are subordinate main roads, bus and railway station, main railway line and railway station, airport, and non-public stops".

Table 15.2.2-3: Noise load limits at the designated measuring points – ambient noise caused by traffic

Ambient noise measurements

The baseline noise corrections were defined in conformity with the MSZ 18150-1:1998 standard as it follows

The purpose of the measuring series is prepare the baseline study prior the changes and prior to the implementation of a given noise source (or several noise sources) and building(s), and to define the existing noise status (baseline). Based on this we can find out the changes the planned nuclear power plant would cause into the environment and the judgment of this environment.

Ground noise correction:

$$L_{Aeq} = L_{Aeq,mért} + K_a + K_b$$

where

K_a baseline noise-correction
K_b premise correction due to unsettled premise, which is not applied in the present case

The baseline noise correction was calculated with the following correlationship:

$$K_a = 10\lg\left(1 - 10^{-0,1*\Delta L_A}\right)$$

where

$$\Delta L_A = L_{Aeq,mért} - L_{Aa}$$

If the ΔL_A deviation is lower than 3 dB, then the noise from the measured noise source equivalent A-sound pressure level cannot be determined independently from ground noise. In this case K_a correction cannot be applied and the result of the study cannot be determined. In this case the studied noise equivalent A-sound pressure level is lower than the ground noise A-sound pressure level. (Legend: NH)

Based on the implemented ground noise corrections we determined the L_{AM} judging sound pressure level for every point using the following correlationship:

$$L_{AM} = L_{Aeq} + K_{imp} + K_{ton}$$

where

LA_{eq} the studied noise equivalent A-sound pressure level for the reference time
K_{imp} impulse correction
K_{ton} narrow gauge correction, which is not applied in the present studies

Impulse correction should be applied if „the difference between impulse (I) detected by subjective judgement and the maximum A-sound pressure level measured with slow (S) time-constant is 3 dB or higher", i.e.

$$\Delta L_{Amax} \geq 3\ dB$$

$$\Delta L_{Amax} = L_{AImax} - L_{ASmax}$$

where

L_{AImax} maximum A-sound pressure level defined with instrument impulse (I) time-constant in dB
L_{ASmax} maximum A-sound pressure level defined with instrument slow (S) time-constant in dB

$$K_{imp} = \frac{2}{3}\ (L_{AImax} - L_{ASmax})\ \leq 6$$

We applied the above described conditions for the calculations to determine the impulse corrections.

Ambient noise caused by traffic measurements

We assessed the ambient noise caused by traffic in accordance with Clause 1.1 of Appendix 3 of Decree 25/2004. (XII.20.) KvVM on detailed rules for preparing strategic noise load maps and action plans.

Ambient noise caused by traffic was measured at total 9 measuring points using different measuring times.

Continuous (24 h) measurement was performed at ZMP20 measuring point, where „t" measuring time was identical with „T" judging time. Measuring result corrections were calculated for the total 24-hour judging time and also for the two times of the day.

Sampling-type measurement was performed at ZMP9 point. In this case the „t" measuring time was split up to several intervals: intervals for daytime measurements started from 6:00 a.m. with 4-hour continuous measuring intervals, whereas at night started from 22:00 hours with 2-hour measuring intervals. We applied the following intervals:

Daytime	At night
1 interval 6:00 h.	*1. interval 22:00 h.*
2 interval 12:00 h.	*2. interval 00:20 h.*
3 interval 17:00 h.	*3. interval 02:41 h.*

Measuring intervals follow each other steadily in respect of „T" judging time in accordance with Decree 25/2004. (XII.20.) KvVM and MSZ 13-183-1:1992 standard, and have the same length and partial results measured in the relevant interval have the same weight in arriving at the final measuring results.

Section noise measurements were held at ZMP5, ZMP10, ZMP11, ZMP12, ZMP13, ZMP15, ZMP19 measuring points.

Daytime measuring intervals was selected between 6-18 and 18-22 hours ensuring that the continuous 1-hour measurements can always fall between 6-10 , 14-17 and 18-22-hour period. Applying these measuring times we performed total three measurements at daytime. For the night period we selected the measuring intervals ensuring that they always fall between 22:00 and 06:00 hours, and reflect the two hours with the heaviest traffic. Thus we measured the continuous 1 hours starting at 05:00 a.m. and 22:00 at night.

We calculated corrections in accordance with Decree 25/2004. (XII.20.) KvVM and MSZ 13-183-1:1992 standard as described below. We determined the equivalent A-sound pressure levels measured in every interval adjusted with ground noise using the following correlationship:

$$L'_{Aeq} = 10\lg\left[\frac{1}{\sum_i t}\sum_i \left(t_i * 10^{0,1*L'_{Aeqi}}\right)\right] + K$$

where

L'_{Aeqi} equivalent A-sound pressure level adjusted with the baseline noise measured in the "' measuring interval, [dB].
t_i duration of "' measuring interval, [s].

K = 0 if the measurement was held with continuous measuring method and sampling-type measuring method or daytime interval-type measuring method.

K = -3 dB if the measurement was held with night interval-type measuring method.

The relevant A-sound pressure level calculated from public road traffic was defined from L'_{Aeq} defined as described above. The relevant A-sound pressure level was determined at every point depending whether the studied road section had reliable traffic data.

ZMP12 and ZMP13 measuring points are located in Paks on Kölesdi road, and we measured at ZMP19 point the noise of Kandó Kálmán street caused by traffic and we held a traffic count. Hungarian Public Road Management Plc. does not hold traffic count at these points, because these roads are managed by the municipality.

The noise for the given traffic status was determined at these points using the following correlationship.

$$L_{AM} = L'_{Aeq}$$

We defined the relevant A-sound pressure level at ZMP5, ZMP9, ZMP10, ZMP11, ZMP15, ZMP19, ZMP20 measuring points with the following correlationship:

$$L_{AM} = L'_{Aeq} + K_f$$

where

$K_f = L_{AeqM} - L_{Aeqm}$where

L_{AeqM} = *noise level calculated from the relevant traffic data*
L_{Aeqm} = *noise level calculated from traffic data counted simultaneously with the measurements*

Measuring time intervals of *noise load measurements*

Measuring point	Measurement starting date/time	Measurement closing date/time	Measurement duration	Comment
ZMP1	2012.05.08 13:13	2012.05.08 13:13	15 minutes	
ZMP1	2012.05.08 22:56	2012.05.08 23:11	15 minutes	
ZMP2	2012.05.08 13:30	2012.05.08 13:45	15 minutes	
ZMP2	2012.05.08 23:19	2012.05.08 23:34	15 minutes	
ZMP3	2012.05.08 11:08	2012.05.08 11:23	15 minutes	
ZMP3	2012.05.08 22:32	2012.05.08 22:47	15 minutes	
ZMP4	2012.05.02 11:46	2012.05.02 12:01	15 minutes	
ZMP4	2012.05.02 23:23	2012.05.02 23:38	15 minutes	
ZMP4	2012.08.29 9:24	2012.08.29 9:39	15 minutes	
ZMP4	2012.08.29 23:07	2012.08.29 23:22	15 minutes	
ZMP5	2012.05.18 5:00	2012.05.18 6:00	1 hour	
ZMP5	2012.05.18 7:00	2012.05.18 8:00	1 hour	
ZMP5	2012.05.18 14:00	2012.05.19 15:00	1 hour	
ZMP5	2012.05.18 18:00	2012.05.19 19:00	1 hour	
ZMP5	2012.05.18 22:00	2012.05.18 23:00	1 hour	

Measuring point	Measurement starting date/time	Measurement closing date/time	Measurement duration	Comment
ZMP5	2012.08.29 5:00	2012.08.29 6:00	1 hour	
ZMP5	2012.08.29 6:59	2012.08.29 7:59	1 hour	
ZMP5	2012.08.29 14:00	2012.08.29 15:00	1 hour	
ZMP5	2012.08.29 18:00	2012.08.29 19:00	1 hour	
ZMP5	2012.08.29 22:00	2012.08.29 23:00	1 hour	
ZMP6	2012.05.14 11:29	2012.05.14 11:44	15 minutes	
ZMP6	2012.05.15 23:12	2012.05.15 23:27	15 minutes	
ZMP6	2012.05.15 0:17	2012.05.15 0:20	15 minutes	
ZMP7	2012.05.14 11:03	2012.05.14 11:18	15 minutes	
ZMP7	2012.05.15 23:50	2012.05.15 23:55	15 minutes	
ZMP7	2012.09.11 5:00	2012.09.11 6:00	1 hour	
ZMP7	2012.09.11 8:33	2012.09.11 9:33	1 hour	
ZMP7	2012.09.11 14:00	2012.09.11 15:00	1 hour	
ZMP7	2012.09.11 18:00	2012.09.11 19:00	1 hour	
ZMP7	2012.09.11 21:59	2012.09.11 22:59	1 hour	
ZMP8	2012.05.14 10:38	2012.05.14 10:53	15 minutes	
ZMP8	2012.05.15 23:54	2012.05.16 0:09	15 minutes	
ZMP9	2012.05.16 6:00	2012.05.16 10:00	4 hours	
ZMP9	2012.05.16 12:00	2012.05.16 14:45	2 h. 45 minutes	The instrument broke up the first measurement to two random parts, 4 hours (2h. 45 min. + 1h. 15 min). Measurement repeated due to former technical problems
ZMP9	2012.05.16 14:48	2012.05.16 16:03	1 h. 15 minutes	
ZMP9	2012.05.16 17:00	2012.05.16 21:00	4 h.	
ZMP9	2012.05.16 21:59	2012.05.16 23:38	1h. 38 minutes	
ZMP9	2012.05.17 0:20	2012.05.17 2:20	2 hours	
ZMP9	2012.05.17 2:41	2012.05.17 4:41	2 hours	
ZMP9	2012.09.03 6:00	2012.09.03 10:00	4 hours	
ZMP9	2012.09.03 12:00	2012.09.03 16:00	4 hours	
ZMP9	2012.09.03 16:59	2012.09.03 20:59	4 hours	
ZMP9	2012.09.03 22:00	2012.09.04 0:00	2 hours	
ZMP9	2012.09.04 0:15	2012.09.04 2:15	2 hours	
ZMP9	2012.09.04 2:30	2012.09.04 4:30	2 hours	
ZMP10	2012.05.14 5:00	2012.05.14 6:00	1 hour	Afternoon measurement failed due to technical problem, and repeated measurement also failed.
ZMP10	2012.05.14 9:00	2012.05.14 10:00	1 hour	
ZMP10	2012.05.15 16:32	2012.05.15 17:32	1 hour	
ZMP10	2012.05.15 22:00	2012.05.15 23:00	1 hour	
ZMP11	2012.05.10 5:00	2012.05.10 6:00	1 hour	
ZMP11	2012.05.10 8:00	2012.05.10 9:00	1 hour	
ZMP11	2012.05.10 16:00	2012.05.10 17:00	1 hour	
ZMP11	2012.05.10 20:00	2012.05.10 21:00	1 hour	
ZMP11	2012.05.10 22:00	2012.05.10 23:00	1 hour	
ZMP11	2012.08.30 5:01	2012.08.30 6:01	1 hour	
ZMP11	2012.08.30 7:00	2012.08.30 8:00	1 hour	
ZMP11	2012.08.30 14:00	2012.08.30 15:00	1 hour	
ZMP11	2012.08.30 18:00	2012.08.30 19:00	1 hour	
ZMP11	2012.08.30 22:00	2012.08.30 23:00	1 hour	
ZMP12	2012.05.29 5:00	2012.05.29 6:00	1 hour	
ZMP12	2012.05.29 7:00	2012.05.29 8:00	1 hour	
ZMP12	2012.05.29 14:00	2012.05.29 15:00	1 hour	
ZMP12	2012.05.29 19:00	2012.05.29 20:00	1 hour	
ZMP12	2012.05.29 22:00	2012.05.29 23:00	1 hour	
ZMP13	2012.06.06 5:00	2012.06.06 6:00	1 hour	
ZMP13	2012.06.06 9:00	2012.06.06 10:00	1 hour	
ZMP13	2012.06.06 16:00	2012.06.06 17:00	1 hour	
ZMP13	2012.06.06 20:00	2012.06.06 21:00	1 hour	
ZMP13	2012.06.06 22:00	2012.06.06 23:00	1 hour	
ZMP14	2012.05.24 5:00	2012.05.24 6:00	1 hour	

Measuring point	Measurement starting date/time	Measurement closing date/time	Measurement duration	Comment
ZMP14	2012.05.24 8:00	2012.05.24 9:00	1 hour	
ZMP14	2012.05.24 14:00	2012.05.24 15:00	1 hour	
ZMP14	2012.05.24 18:00	2012.05.24 19:00	1 hour	
ZMP14	2012.05.24 21:59	2012.05.24 22:59	1 hour	
ZMP15	2012.05.02 12:20	2012.05.03 12:35	15 minutes	
ZMP15	2012.05.02 23:50	2012.05.03 0:05	15 minutes	
ZMP16	2012.05.02 14:49	2012.05.02 15:04	15 minutes	
ZMP16	2012.05.03 1:56	2012.05.03 2:11	15 minutes	
ZMP17	2012.05.02 14:01	2012.05.02 14:16	15 minutes	
ZMP17	2012.05.03 1:20	2012.05.03 1:35	15 minutes	
ZMP18	2012.05.02 15:24	2012.05.02 15:39	15 minutes	
ZMP18	2012.05.03 2:25	2012.05.03 2:40	15 minutes	
ZMP19	2012.06.21 5:00	2012.06.21 6:00	1 hour	
ZMP19	2012.06.21 7:00	2012.06.21 8:00	1 hour	
ZMP19	2012.06.21 14:00	2012.06.21 15:00	1 hour	
ZMP19	2012.06.21 20:00	2012.06.21 21:00	1 hour	
ZMP19	2012.06.21 22:00	2012.06.21 23:00	1 hour	
ZMP20	2012.06.19 6:00	2012.06.20 6:00	24 hours	
ZMP21	2014.01.23. 15:09	2014.01.23. 15:24	15 minutes	
ZMP21	2014.01.23. 22:05	2014.01.23. 22:20	15 minutes	
ZMP22	2014.01.23. 13:46	2014.01.23. 14:01	15 minutes	
ZMP23	2014.01.23. 14:07	2014.01.23. 14:22	15 minutes	
ZMP24	2014.01.23. 12:34	2014.01.23. 12:49	15 minutes	
ZMP25	2014.01.23. 11:51	2014.01.23. 12:06	15 minutes	

Table 15.2.2-4: Measuring time intervals

15.2.2.1 Summary of results

Baseline measurement results are used as reference for noise emission plans for defining the permissible noise load emission by construction technologies, machines and means of transportation used during the implementation phase in order that the compliance with limits can be ensured.

Noise measurements were trouble-freely performed throughout the measuring period, except some instable weather conditions. We could secure the standard measuring times, thus the assessment and the relevant measuring results are representative data.

Regarding ambient noise caused by traffic we can in general state that the noise caused by traffic on the frequented roads along residential areas is quite significant, and the traffic distribution and density can determine the ambient noise status of areas exposed to traffic. The baseline noise load of residential areas located next to heavy traffic roads is several times in excess to the noise load limits in effect in these areas. The heaviest traffic periods are between 05:00 and 08-09:00 a.m. and 15.00-18.00 hours, but traffic keeps on receding in most measuring points, and comes to a halt at night. Consequently, noise load and limit may be exceeded during these peak periods.

Baseline noise load in the environment of residential buildings at the Danube embankment area is always below the permitted noise load limits (no traffic is allowed).

The following Table 15.2.2-5, Table 15.2.2-6 and Table 15.2.2-7 tables present the summary tables showing the measured noise load data and noise load limits permitted to the area. It can be interpreted using Table 15.2.2-1, Table 15.2.2-2 and Table 15.2.2-3. (if the baseline limit is exceeded, it is marked with blue colour.)

Sr.Nr.	Measuring points	Area to be protected from noise based on local plans and structural plans	Judging sound pressure levels	Calculated judging sound pressure levels [dB]		Limit L_{TH} for L_{AM} judging levels [dB]	
				Daytime	At night	daytime 6-22 h.	at night 22-6 h.
1.	ZMP1	Gip	L_{AM}	55	54	60	50
2.	ZMP2			52	47		
3.	ZMP3			53	47		
4.	ZMP4			48	46		
4/a	ZMP4*			46	42		
22.	ZMP22			59,2			
23.	ZMP23			71,6			
24.	ZMP24			83,6			
25.	ZMP25			72,3			

Comment:
*repeated measurement

Table 15.2.2-5: Noise load and emission limits – noise caused by operationmeasurement summary table

Sr.Nr.	Measuring points	Area to be protected from noise based on local plans and structural plans	Judging sound pressure levels	Calculated judging sound pressure levels [dB]		Limit L_{TH} for L_{AM} judging levels [dB]	
				Daytime	At night	daytime 6-22 h.	at night 22-6 h.
6.	ZMP6	Lf	L_{AM}	49	45	50	40
7.	ZMP7		L_{AM}	48	46		
8.	ZMP8		L_{AM}	53	48		
15.	ZMP15	Kz	L_{AM}	41	53	(50)-	(40) -
16.	ZMP16	Lf	L_{AM}	55	45	50	40
17.	ZMP17	Lf	L_{AM}	68	48	50	40
18.	ZMP18	V	L_{AM}	45	45	(50)-	(40)-
21.	ZMP21	Lf	L_{AM}	68,6	54,6	50	40

Table 15.2.2-6: Noise load and emission limits – other environmenti noise summary table

Sr.Nr.	Measuring points	Area to be protected from noise based on local plans and structural plans	Judging sound pressure levels	Calculated judging sound pressure levels [dB]		Limit L_{TH} for L_{AM} judging levels [dB]	
				Daytime	At night	daytime 6-22 h.	at night 22-6 h.
5.	ZMP5	Lf	$L_{AMkö}$	70	63	65	55
5/a	ZMP5*		$L_{AMkö}$	73	66	65	55
7/a.	ZMP7*		$L_{AMkö}$	53	48	60	50
9.	ZMP9	Lk	$L_{AMkö}$	67	63	65	55
9/a	ZMP9*			65	59		
10.	ZMP10			62	57		
11.	ZMP11	Lf		68	65		
11/a	ZMP11*	Lf		73	65		
12.	ZMP12	Lke		68	61	60	50
13.	ZMP13			64	57		
14.	ZMP14	Lf		72	68	65	55
19.	ZMP19	Lke	$L_{AMkö}$	64	58	60	50
20.	ZMP20**			63		65	55
20/a	ZMP20***			64	66	65	55

Comment:
*repeated measurement
** for total 24 hours
***for daytime 16:00 and night 20:00 hours

Table 15.2.2-7: Noise load and emission limits – environmenti noise caused by traffic summary table

Corrections calculations are presented in Table 15.2.2-8 - Table 15.2.2-37.

Figures in bracket cannot be determined as prescribed by regulations, or were not applied due to correlationships.

> Comment: if ΔLA deviation is lower than 3 dB, then the noise equivalent A-sound pressure level from the studied noise source cannot be determined independently from ground noise. In this case K_a correction cannot be applied and the result cannot be determined. In this case the studied noise equivalent A-sound pressure level is lower than the ground noise A-sound pressure level. Impulse correction shall be applied if the „difference between impulse (I) as per subjective judgement and the maximum A-sound pressure level measured with slow (S) time constant is 3 dB or higher", *see* above.

Noise caused by operation was measured at ZMP-1 point, noise type was at daytime continuous, impulsive and at night continuous, permanent.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
51,1	-3,72	2,4	(48,7)	NH*	53,9	-5,87	1,3	(52,6)	NH*

**cannot be determined independently from ground noise*

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
55	51,1	4,07	6,1	58,1	64,2	54	53,9	(1,53)	(2,3)	56,5	58,8

Table 15.2.2-8: Corrections calculations day/night – ZMP1

Noise caused by operation was measured at ZMP-2, the noise type was daytime continuous, impulsive, at night continuous, permanent.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
47,2	-0,94	7,1	40,1	46,3	47,0	-4,9	1,7	(45,3)	NH*

**cannot be determined independently from ground noise*

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
52	46,3	5,40	8,1	66,7	74,8	47	47	(1,3)	(1,7)	55,7	57,4

Table 15.2.2-9: Corrections calculations day/night – ZMP2

Noise caused by operation was measured at ZMP-3 point, the noise type daytime was continuous impulsive and at night continuous, permanent.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
47,9	-0,85	7,5	40,4	47	47,3	-4,69	1,8	(45,5)	NH*

**cannot be determined independently from ground noise*

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
53	47,0	6	9,8	64,9	74,7	47	47,3	1,47	2,2	50,5	52,7

Table 15.2.2-10: Correction calculations day/night – ZMP3

Noise caused by operation was measured at ZMP-4 point, the noise type was both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
46,1	-0,19	13,7	32,4	45,9	44,4	-2,49	3,6	40,8	41,9

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
48	45,9	2,27	3,4	67,4	70,8	46	41,9	3,67	5,5	48,4	53,9

Table 15.2.2-11: Corrections calculations day/night – ZMP4

Noise caused by operation was measured at ZMP-4 point also for the 2nd measurement, the noise type was both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
41,1	-0,99	6,9	34,2	40,1	39,7	-1,75	4,8	34,9	38,0

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
46	40,1	6	13,5	55,4	68,9	42	38,0	4,47	6,7	51,4	58,1

Table 15.2.2-12: Corrections calculations day/night – ZMP4 – 2. measurement

Noise caused by operation was measured at ZMP-6 point, the noise type was both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
44,3	-1,02	6,8	37,5	43,3	39,8	-0,3	11,8	28	39,5

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
49	43,3	6	12,3	59,6	71,9	45	39,5	5,6	8,4	51,5	59,5

Table 15.2.2-13: Corrections calculations day/night – ZMP6

Noise caused by operation was measured at ZMP-22 point, the noise type was daytime continuous, impulsive.

Daytime				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]				
59,2	-3,86	2,3	56,9	NH *

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]					
59,2	59,2	1,93	2,9	62,6	65,5

**cannot be determined independently from ground noise*

Table 15.2.2-14: Corrections calculations daytime – ZMP22 —supplementary measurement

Noise caused by operation was measured at ZMP-23 point, the noise type daytime was continuous, permanent.

Daytime				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]				
67,9	-6,17	1,2	66,7	NH *

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]					
71,6	67,9	3,73	5,6	70,1	75,7

**cannot be determined independently from ground noise*

Table 15.2.2-15: Corrections calculations daytime – ZMP23 —supplementary measurement

Noise caused by operation was measured at ZMP-24 point, the noise type was daytime continuous, permanent.

Daytime				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]				
80,3	-4,89	1,7	78,6	NH *

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]					
83,6	80,3	3,33	5	82,0	87,0

**cannot be determined independently from ground noise*

Table 15.2.2-16: Corrections calculations daytime – ZMP24 —supplementary measurement

Noise caused by operation was measured at ZMP-25 point, the noise type daytime was continuous, permanent.

Daytime				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]				
72,3	-5,59	1,4	70,9	NH *

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]					
72,3	72,3	1,00	1,5	73,0	74,5

**cannot be determined independently from ground noise*

Table 15.2.2-17: Corrections calculations daytime – ZMP25 —supplementary measurement

Other ambient noise was measured at ZMP-7 point, the noise type was both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
45,5	-0,45	10,1	35,4	45,1	40,8	-0,44	10,2	30,6	40,4

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
48	45,1	2,6	3,9	67,9	71,8	46	40,4	6	9,3	51,5	60,8

Table 15.2.2-18: Corrections calculations day/night – ZMP7

Other ambient noise was measured at ZMP-8 point, the noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
47,5	-0,71	8,2	39,3	46,8	45,1	-0,38	10,8	34,3	44,7

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
53	46,8	6	11	57,7	68,7	48	44,7	2,93	4,4	57,4	61,8

Table 15.2.2-19: Corrections calculations day/night – ZMP8

Other ambient noise was measured at ZMP-15 point, the noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
35,9	-0,89	7,3	28,6	35,0	47,9	-1,22	6,1	41,8	46,7

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
41	35,01	5,47	8,2	42,9	51,1	53	46,7	6	12,4	58,4	70,8

Table 15.2.2-20: Corrections calculations day/night – ZMP15

Other ambient noise was measured at ZMP-16 point, the noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
48,6	-0,092	16,8	31,8	48,5	39,2	-3,12	2,9	36,3	39,2

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
55	48,5	6	9,2	65,4	74,6	45	39,2	6	9,4	52,2	61,6

Table 15.2.2-21: Corrections calculations day/night – ZMP16

Other ambient noise was measured at ZMP-17 point, the noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
63	-0,001	34,8	28,2	63	42,0	-0,15	14,8	27,2	41,9

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
68	63,0	4,73	7,1	83,6	90,7	48	41,9	6	9,6	60,0	69,6

Table 15.2.2-22: Corrections calculations day/night – ZMP17

Other ambient noise was measured at ZMP-18 point, noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
40,1	-0,584	9	31,1	39,5	38,9	-4,33	2	(36,9)	NH*

*cannot be determined independently from ground noise

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
45	39,52	5,33	8	52,3	60,3	45	38,9	6	12,2	49,2	61,4

Table 15.2.2-23: Corrections calculations day/night – ZMP18

Other ambient noise was measured at ZMP-21 point, noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	L_{Aeq} calculated	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	L_{Aeq} calculated
[dB]					[dB]				
63,3	-0,01	27,6	35,7	63,3	54,6	-0,03	21,6	33,0	54,6

L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}	L_{AM}	L_{Aeq}	K_{imp}	ΔL_{Amax}	L_{ASmax}	L_{AImax}
[dB]						[dB]					
68,6	63,29	5,33	8	74,5	82,5	54,6	54,6	1,80	2,7	71,4	74,1

Table 15.2.2-24: Corrections calculations day/night – ZMP21 —supplementary measurement

Noise caused by operation was measured at ZMP-5 point, noise type both daytime and night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
69,0	0,00	31,1	37,9	69,0	65,7	-0,01	28,4	37,3	65,7
68,7	0,00	31,7	37	68,7	63,8	0,00	30,2	33,6	63,8
68,7	-0,01	28,7	40	68,7					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
70	0,76	68,8	63	1,6	61,8

Table 15.2.2-25: Corrections calculations day/night – ZMP5

Ambient noise caused by traffic was measured at ZMP-5 measuring point, and the noise type both daytime and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
68,7	-0,01	27,9	40,8	68,7	65,5	-0,02	24,6	40,9	65,5
70,8	0,00	34,4	36,4	70,8	61,6	-0,01	26	35,6	61,6
71,7	0,00	36,4	35,3	71,7					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
73	2,28	70,57	66	5,16	60,96

Table 15.2.2-26: Corrections calculations day/night – ZMP5

Ambient noise caused by traffic was measured at ZMP-7 measuring point, with impulsive noise type both day and night .

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
54,3	-0,02	23,5	30,8	54,3	53,5	-0,05	19,6	33,9	53,5
51,5	-0,03	21,6	29,9	51,5	46,8	-0,05	19,2	27,6	46,7
53	-0,06	19,0	34	52,9					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
53	-	53,05	48	-	48,28

Table 15.2.2-27: Corrections calculations day/night – ZMP7 – 2. measurement

Noise caused by operation was measured at ZMP-9 point, noise type both daytime and night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
63,1	-0,03	22,1	41	63,1	53,0	-0,013	25,4	27,6	53,0
61,8	-0,03	21,2	40,6	61,8	51,5	-0,03	21,6	29,9	51,5
61,6	-0,04	20,5	41,1	61,6	56,8	-0,033	21,2	35,6	56,8
63,2	-0,01	27,4	35,8	63,2					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
67	4,65	62,5	63	11,3	51,3

Table 15.2.2-28: Corrections calculations day/night – ZMP9

Ambient noise caused by traffic was measured at ZMP-9 point, noise type both day and night continuous, impulsive.

L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	L_{Aeq} calculated	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	L_{Aeq} calculated
[dB]					[dB]				
62,4	0,00	31,8	30,6	62,4	51,2	-0,049	19,5	31,7	51,2
61	0,00	32,1	28,9	61,0	48,4	-0,035	20,9	27,5	48,4
59,4	0,00	30,0	29,4	59,4	51,0	-0,015	24,7	26,3	51,0

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
65	3,84	61,10	59	12,07	47,34

Table 15.2.2-29: Corrections calculations day/night – ZMP9 – 2.measurement

Ambient noise caused by traffic was measured at ZMP-10 point, noise type both day and night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
61	-0,045	19,9	41,1	61,0	57,6	-0,053	19,2	38,4	57,5
60,4	-0,004	30,3	30,1	60,4	51,1	-0,012	25,5	25,6	51,1

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
62	2,83	58,9	57	4,56	52,4

Table 15.2.2-30: Corrections calculations day/night – ZMP10

Noise caused by operation was measured at ZMP-11 point, noise type both day and at night was continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
68,1	-0,007	28,2	39,9	68,1	66,3	-0,013	25,1	41,2	66,3
67	-0,005	29,5	37,5	67,0	60,2	-0,05	19,1	41,1	60,1
63,9	-0,018	23,8	40,1	63,9					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
68	0,88	66,7	65	3,36	61,2

Table 15.2.2-31: Corrections calculations day/night – ZMP11

Ambient noise caused by traffic was measured at ZMP-11 point, noise type both day and night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
69,6	-0,003	31,9	37,7	69,6	66,0	-0,002	32,7	33,3	66,0
67,5	-0,001	35,9	31,6	67,5	62,1	-0,01	25,4	36,7	62,1
66,9	-0,003	31	35,9	66,9					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
73	4,54	68,16	65	3,98	61,47

Table 15.2.2-32: Corrections calculations day/night – ZMP11 – 2. measurement

Noise caused by operation was measured at ZMP-12 point, noise type both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
69,6	-0,004	30,2	39,4	69,6	66,3	0,00	29,4	36,9	66,3
68,5	-0,003	31,9	36,6	68,5	57,4	0,00	31,1	26,3	57,4
63,1	-0,003	31,3	31,8	63,1					

$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
68	-	67,8	61	-	60,8

Table 15.2.2-33: Corrections calculations day/night – ZMP12

Noise caused by operation was measured at ZMP-13 point, noise type both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
64,2	-0,024	22,5	41,7	64,2	61,7	-0,03	21,9	39,8	61,7
65,1	-0,021	23,2	41,9	65,1	56,1	-0,01	27,2	28,9	56,1
59,5	-0,026	22,3	37,2	59,5					

$L_{AMk\ddot{o}}$	K_f	$L_{Aeqk\ddot{o}}$	$L_{AMk\ddot{o}}$	K_f	$L_{Aeqk\ddot{o}}$
[dB]			[dB]		
64	-	63,5	57	-	56,7

Table 15.2.2-34: Corrections calculations day/night – ZMP13

Noise caused by operation was measured at ZMP-14 point, noise type both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
70	-0,002	33,1	36,9	70,0	70,1	0,00	33,9	36,2	70,1
70,2	-0,004	30	40,2	70,2	62,1	0,00	33,8	28,3	62,1
68,5	-0,003	32,3	36,2	68,5					

$L_{AMk\ddot{o}}$	K_f	$L_{Aeqk\ddot{o}}$	$L_{AMk\ddot{o}}$	K_f	$L_{Aeqk\ddot{o}}$
[dB]			[dB]		
72	2,0	69,6	68	3,72	64,7

Table 15.2.2-35: Corrections calculations day/night – ZMP14

Noise caused by operation was measured at ZMP-19 point, noise type both daytime and at night continuous, impulsive.

Daytime					At night				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
65,1	-0,014	24,8	40,3	65,1	62,9	-0,02	23,9	39	62,9
64,4	-0,015	24,7	39,7	64,4	55,1	-0,02	24,1	31	55,1
62	-0,011	26	36	62					

$L_{AMk\ddot{o}}$	K_f	$L_{Aeqk\ddot{o}}$	$L_{AMk\ddot{o}}$	K_f	$L_{Aeqk\ddot{o}}$
[dB]			[dB]		
64	-	64,0	58	-	57,5

Table 15.2.2-36: Corrections calculations day/night – ZMP19

Noise caused by operation was measured at ZMP-20 point, noise type both daytime and at night continuous, impulsive.

Total 24 h.					Daytime 16 hours				
L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$	L_{Aeq} measured	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]					[dB]				
61,5	-0,002	34,6	26,9	61,5	62,76	-6,83	1,01	(61,75)	NH

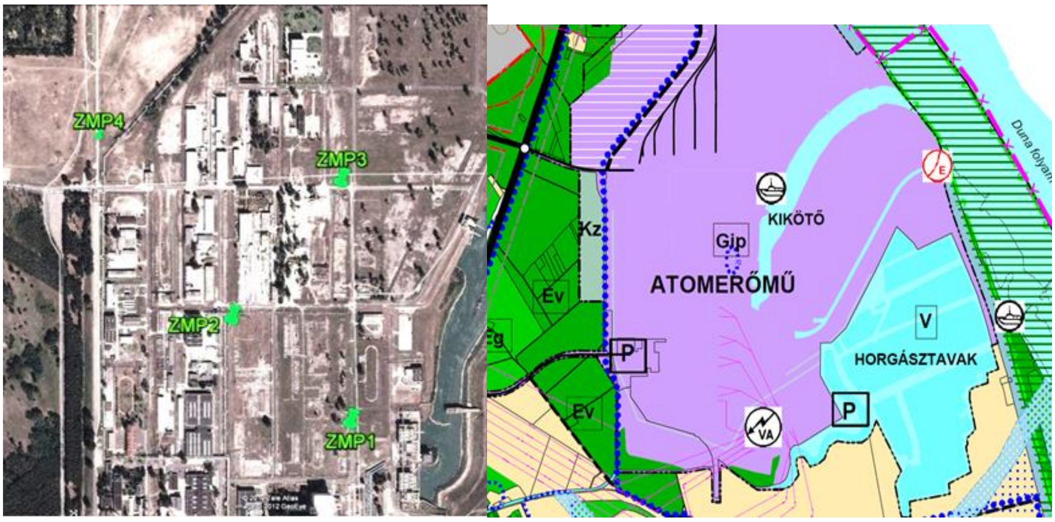
$L_{AMkö}$	K_f	$L_{Aeqkö}$	$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]			[dB]		
63	1,22	61,5	64	1,22	62,76

Nighti8 hours				
$L_{Aeq\ measured}$	K_a	ΔL_A	L_{Aa}	$L_{Aeq\ calculated}$
[dB]				
57	-6,61	1,07	(55,97)	NH

$L_{AMkö}$	K_f	$L_{Aeqkö}$
[dB]		
66	9,09	57,04

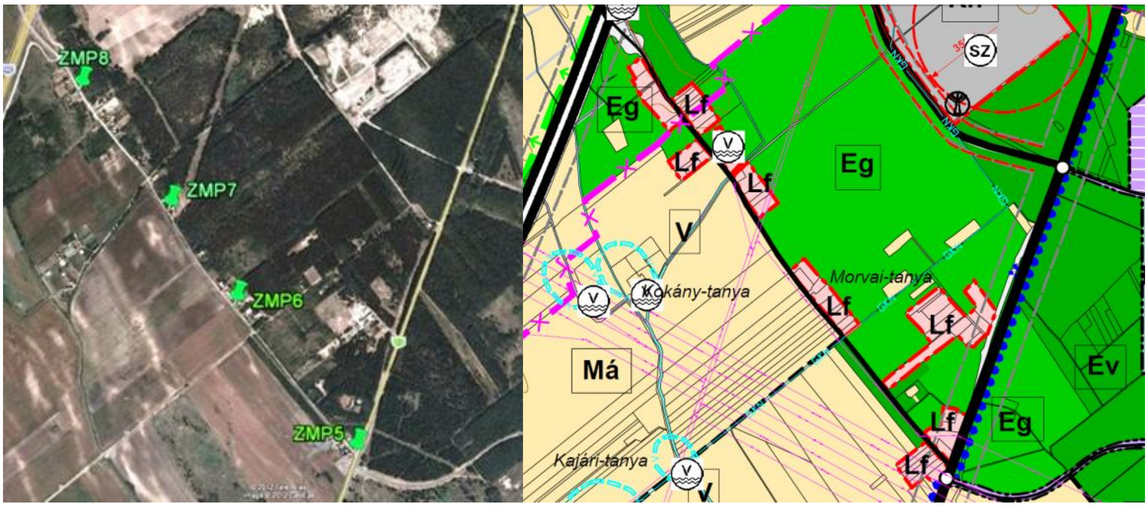
Table 15.2.2-37: Corrections calculations day/night – ZMP20

Location of the measuring points are presented in Figure 15.2.2-2 - Figure 15.2.2-12.



kikötő – port
atomerőmű – nuclear power plant
Duna folyam – River Danube
horgásztavak – fish ponds

Figure 15.2.2-2: TSzT cut-out section showing ZMP1-ZMP4 measuring points and their environment [15-9], [15-20]



Kokány-tanya – farm Kokány
Morvai-tanya – farm Morvai
Kajári-tanya – farm Kajári

Figure 15.2.2-3: TSzT cut-out section showing ZMP5-ZMP8 measuring points and their environment [15-9], [15-20]

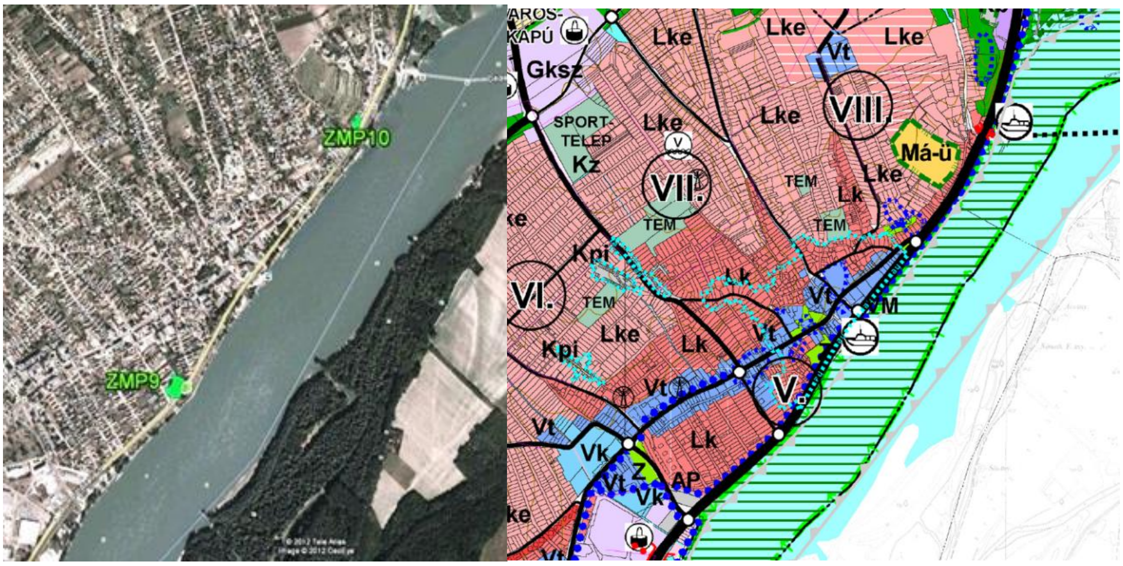


Figure 15.2.2-4: TSzT cut-out section showing ZMP9-ZMP10 measuring points and their environment [15-9], [15-20]

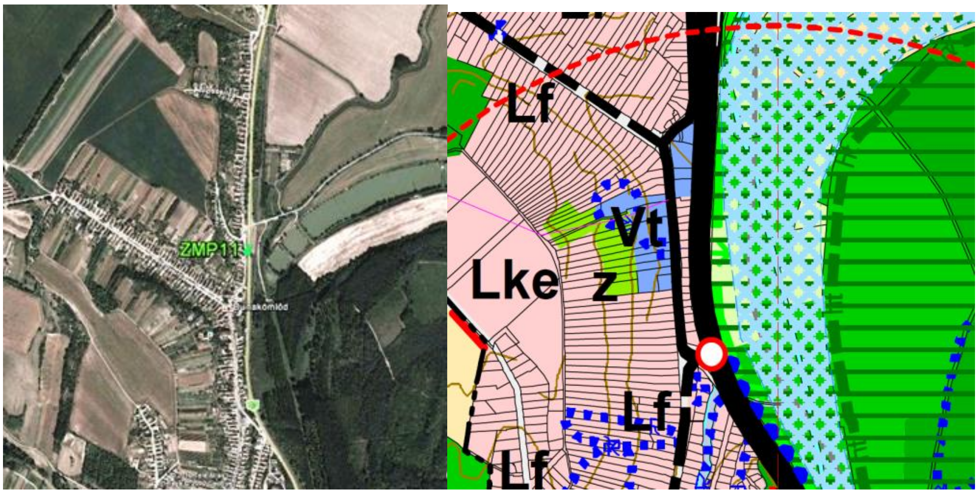


Figure 15.2.2-5: TSzT cut-out section showing ZMP11 measuring point and its environment [15-9], [15-20]

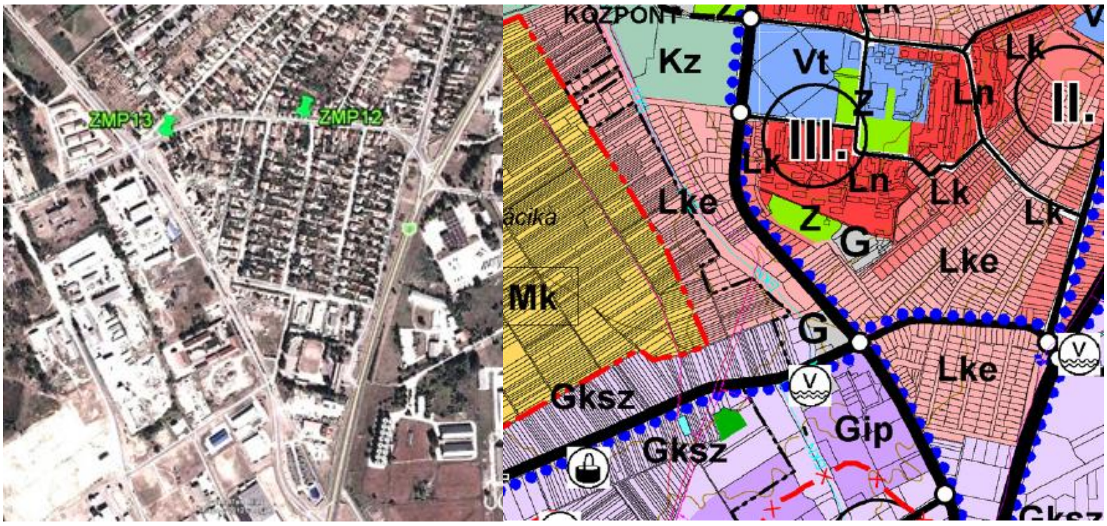
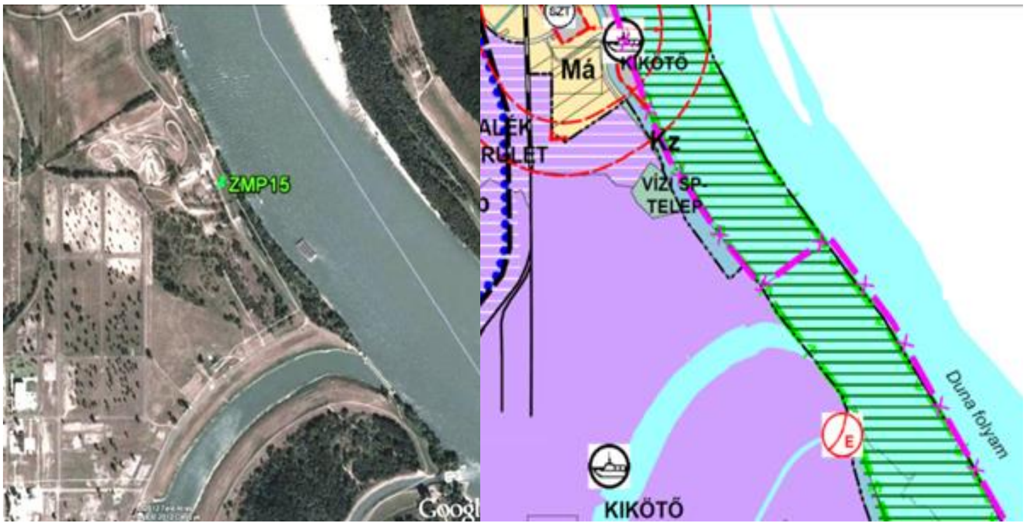


Figure 15.2.2-6: TSzT cut-out section showing ZMP12-ZMP13 measuring points and their environment [15-9], [15-20]

Figure 15.2.2-7: ZMP14 measuring point and TSzT cut-out section in the measuring point environment [15-9], [15-20]



kikötő – port
vízi sporttelep – water sports facility
Duna folyam – River Danube

Figure 15.2.2-8: TSzT cut-out section showing ZMP15 measuring point and its environment [15-9], [15-20]

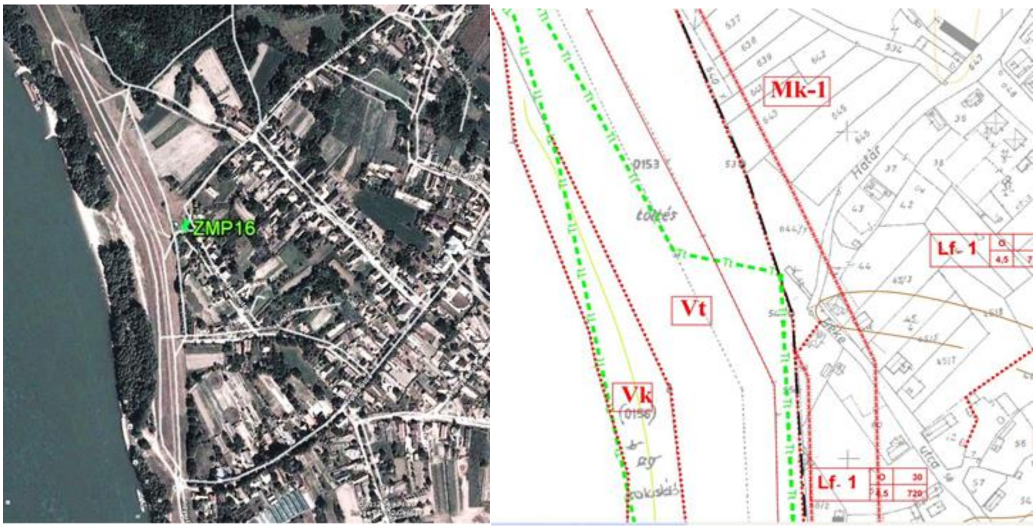
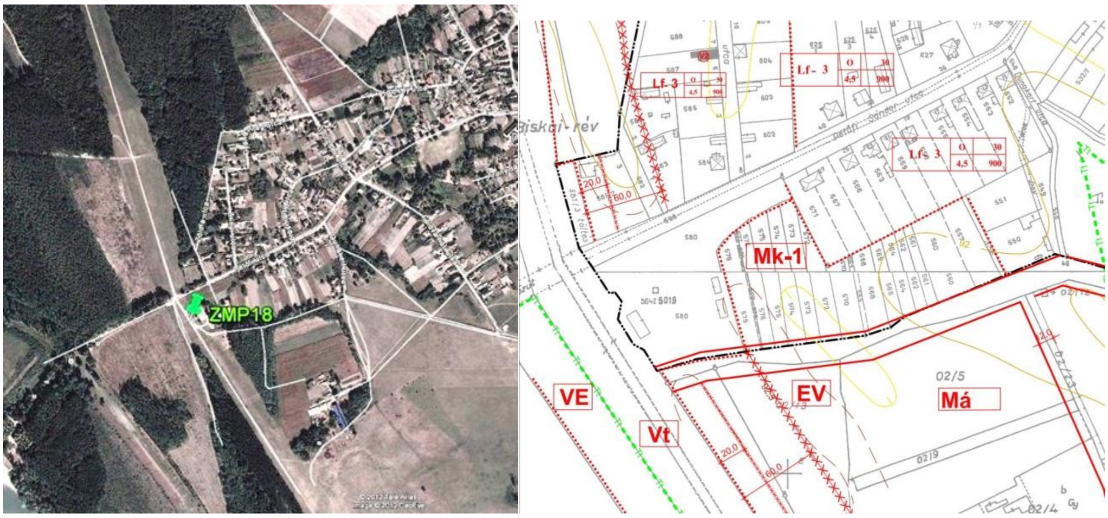


Figure 15.2.2-9: ZMP16 measuring point and SzT cut-out section in the point environment [15-9], [15-20]

Figure 15.2.2-10: ZMP17 measuring point and SzT cut-out sectiona in the point environment [15-9], [15-20]



Biskai-rév – Biskai Ford

Figure 15.2.2-11: ZMP18 measuring point and SzT cut-out section in the point environment [15-9], [15-20]

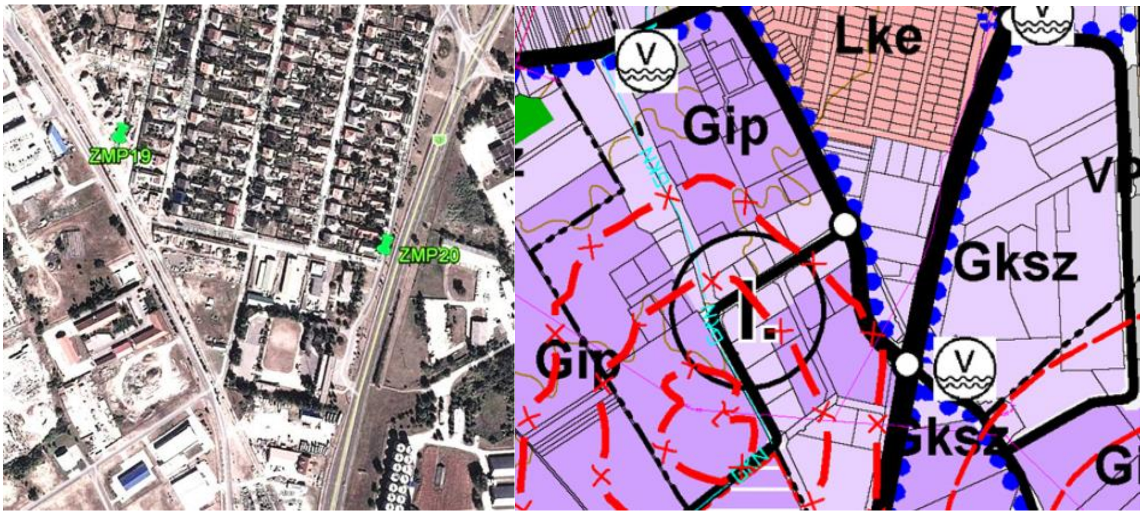
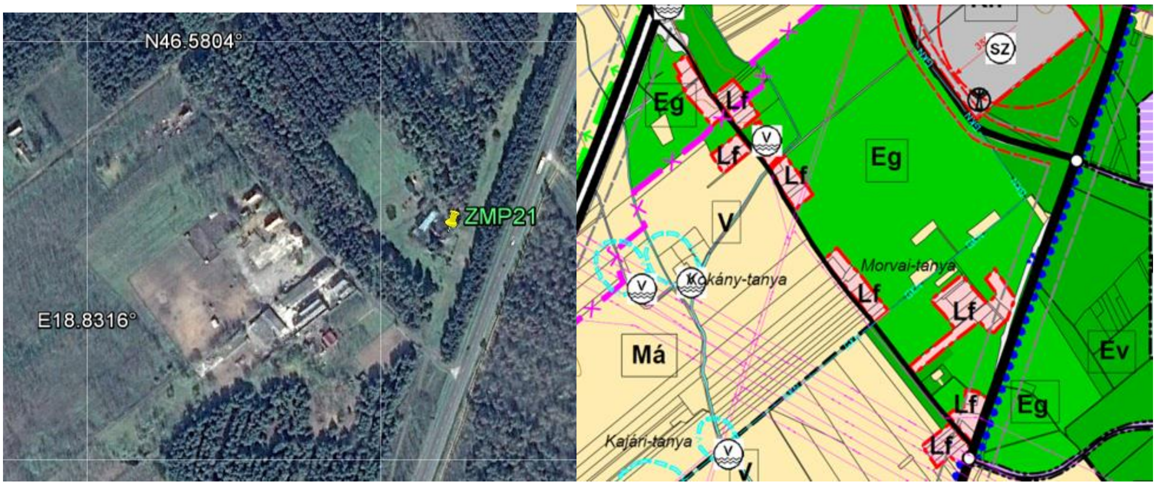
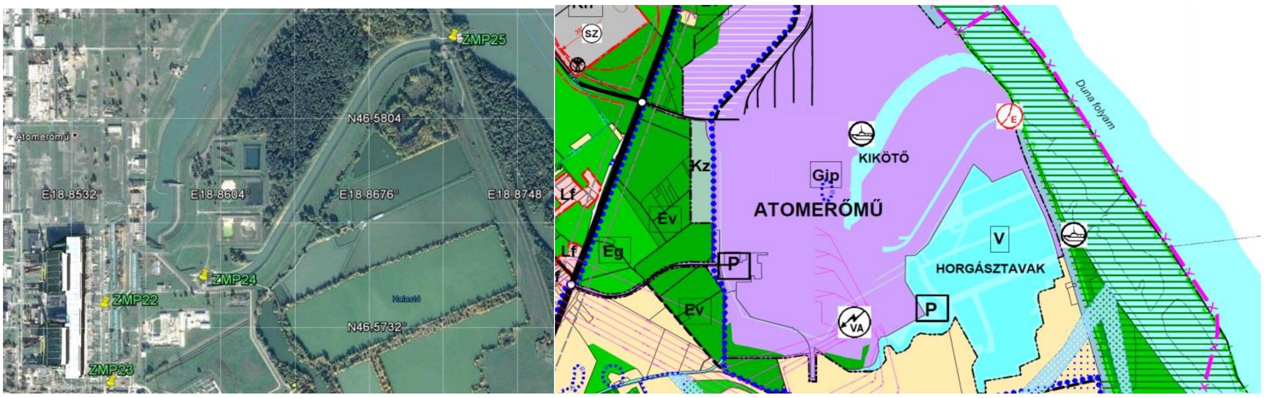


Figure 15.2.2-12: ZMP19-ZMP20 measuring points and TSzT cut-out section in the points environment [15-9], [15-20]



Kokány-tanya – farm Kokány
Morvai-tanya – farm Morvai
Kajári-tanya – farm Kajári

Figure 15.2.2-13: ZMP21 measuring point and TSzT cut-out section in the points environment [15-9], [15-20]



kikötő – port
horgásztavak – fish ponds
Duna folyam – River Danube
Atomerőmű – Nuclear Power Plant

Figure 15.2.2-14: ZMP22-25 measuring points and TSzT cut-out section in the points environment [15-9], [15-20] At ZMP15 measuring point the on noise load measured at night was significantly higher than the noise load measured at daytime. At the measuring point the difference between daytime and night noise load figures was ~12 dB. The high ground noise load at night was due to continuous cricket chirping. This is pre-dominant during spring and summer in green areas next to the River Danube, and permanent-type noise cannot be eliminated. As there was no other noise source disturbing the measurement process, the LA95 95% frequency value (~30 dB) can be also measured daytime, and this is characteristic to the entire environment of the measuring point.

The L_{A95} 95 % frequency value is shown on every measuring figure (*see:* appendix), thus it can be easily compared with the equivalent A-sound pressure levels.

As the measured data can demonstrate, the equivalent A-sound pressure levels measured at Paks northern and southern sides are very close to each other, i.e. the noise status in certain times of the day is very similar at the two studied areas. Thus we can conclude that noise load from traffic is almost identical at the northern and southern parts of the city.

Based on noise load figures and traffic count measured in Paks inner area we can state that almost identical (quite significant during peak traffic time) noise load hits the areas located next to the Main Road no. 6., like residential buildings on Kölesdi road. Thus we can state that limit will be excessed due to traffic noise in residential zones in various categories (Lf, Vt, Lk). The noise status of the analysed zones of the city will be certainly determined by noise load arising from traffic.

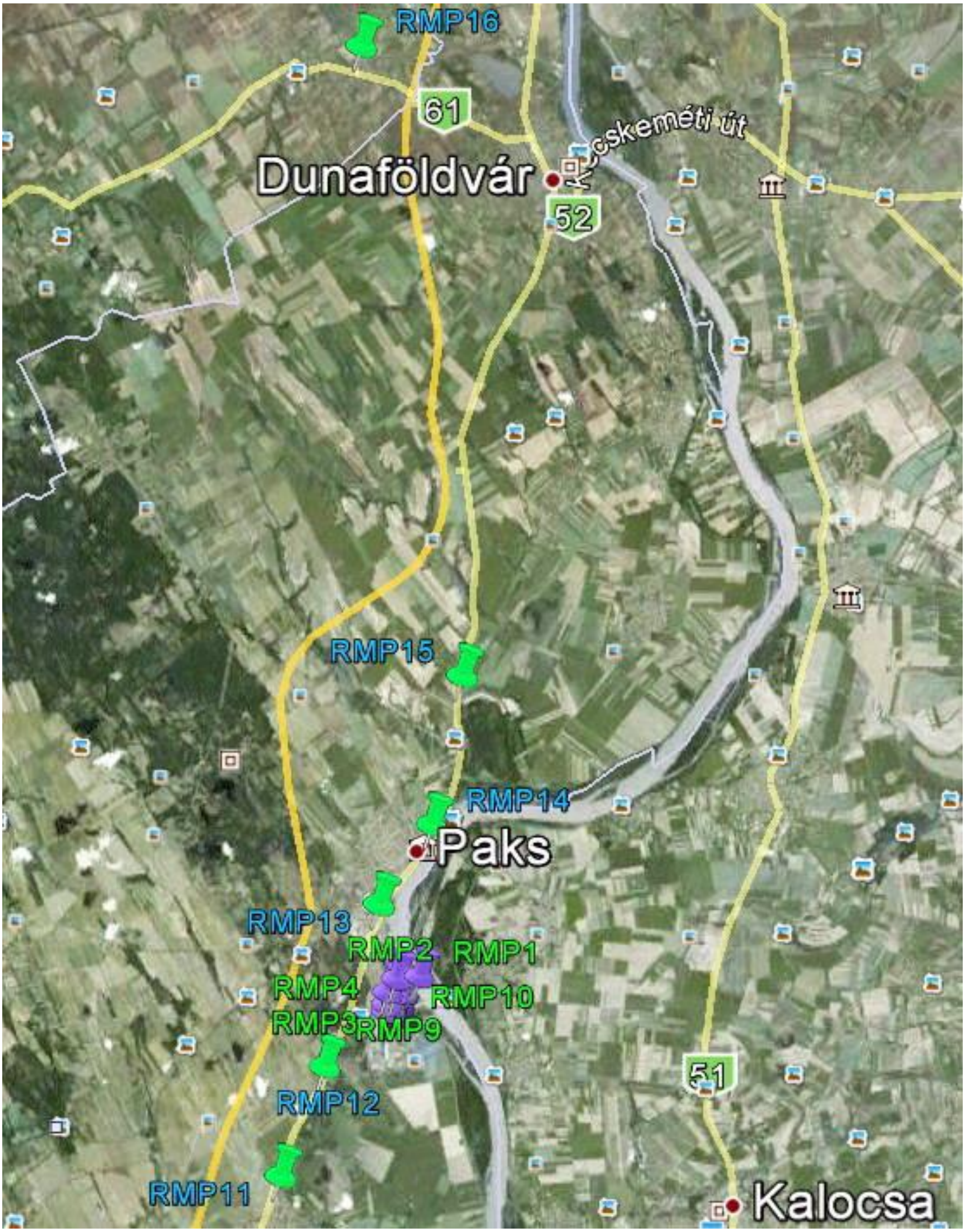
15.2.3 BASELINE VIBRATION LOAD MEASUREMENTS

Regarding vibration protection, the study area is delineated by the River Danube and cold water channel from the east, Highway nr. 6 from the west, the service road in Paks Nuclear Power Plant from the south, and agricultural area from the north.

We held vibration measurements in the vibration impact zone to define the baseline vibration level at the following measuring points involving typical objects that will most probably remain in place throughout decades. We used 16 measuring points for preparing the baseline study, see*:* Figure 15.2.3-1.

The following points were identified:

- 8 points at the site perimeter, 1 point next to the cold water channel, plus 1 reference point; RMP 1-10.
- 1 point in Dunaszentgyörgy at the residential buildings (next to Highway nr. 6); RMP 11.
- 1 point in Paks-Csámpa at the residential buildings (next to Highway nr. 6); RMP 12.
- 1 point in Paks at residential buildings located at Dankó Pista street and Tolnai road corner (next to Highway nr. 6 and the railway line); RMP 13.
- 1 point in Paks at residential buildings located at Vietnámi park and Dunaföldvári road (next to Highway nr. 6 and the railway line); RMP 14.
- 1 point in Paks-Duna-Kömlőd at residential buildings (next to Highway nr. 6 and the railway line); RMP 15.
- 1 point in Előszállás at the residential buildings (next to railway line); RMP 16.



Kecskeméti út – Road to town Kecskemét

Figure 15.2.3-1: Vibration measuring points overall layout figure [15-20]

Assessment of measuring results

The present documentation does not show the $a_{w,i}$ (weighted 30-second maximum + rms) data series measured at RMP 1-16 measuring point with regard to the volume of data. We present the calculated $a_{w,Max}$ (maximum vibration load) and $a_{w,M}$ (vibration load referring to the judging time) at every measuring point in three orthogonal directions.

Paks II. planned ***operation*** *and mobilisation area* ***at points*** *RMP1-10*

We selected the baseline vibration measuring points at northern, western, southern and eastern sides of Paks II. planned operation area, *see:* RMP2-9. We also selected a measuring point at the potential location of the cooling system of Paks II., next to the cold water channel, this is RMP1 measuring point. We selected a reference measuring point, marked as RMP10, *see:* Figure 15.2.3-2.

Figure 15.2.3-2: Vibration load measuring points in the construction area RMP1-RMP10 [15-20]

When the measurements were held (May 8, 2012.) the preliminary measuring coordinates did not change. The steel connecting element used for the on-the-spot vibration measurements had the same position as the measuring point shown on the preliminary photograph.

The on-the-spot surveys at Paks II. operation and mobilisation area were prepared on May 8, 2012.

We selected the measuring time at Paks II. planned operation area as 15 minutes daytime for the designated measuring points (RMP 1-10), because here there is no object to be protected against vibration load. Vibration may travel in the nuclear power plant area to a limited distance in the soil, nearly to 80 - 100 metres, and within this range there is no object to be protected against vibration load.

15.2.3.1 Summary of results

Baseline measurement results are used as reference for planning vibration emission in order to determine vibration load emission permissible for construction technologies, machines and means of transportation during the implementation phase and ensure compliance with these limits.

Vibration load limits

When the baseline vibration load measuring results were assessed, we used the following and presently effective vibration load limits.

Limits of vibration impacting people and load limits in buildings are specified in Appendix 5 of Decree 27/2008. (XII.3.) KvVM-EüM, *see:* Table 15.2.3-1.

Sr.Nr.	Building, premise		Vibration study limit (mm/s^2)	Vibration load limit (mm/s^2)	
			A_0	A_M	A_{max}
1.	Premise extremely sensitive to vibration (e.g.: operation room)		3,6	3	100
2.	Residential building, resort, old people home, accommodation building, hospital, sanatorium, recreation premises	daytime 06-22 h.	12	10	200
		night 22-06 h.	6	5	100
3.	Cultural, religious facilities and premises (e.g. concert hall, church), nursery, kindergarten, clinics		12	10	200
4.	Special premises in cultural, education, administration and office buildings (e.g.: classroom, computer room, library reading hall, engineering office, dispatcher centre), auditoriums of theatres, movies, community areas of high-class hotels		24	20	300
5.	Shopping zones of points of sale, catering zones of restaurants, spectator zones of sport facilities, corridors and halls of public buildings		36	30	600

Table 15.2.3-1: Vibration load limits in areas to be protected

Vibration load (A_M) relevant to judging time: vibration load was calculated for every measuring direction and for the total judging time, the unit of measurement: mm/s^2,

The maximum level of vibration load is (A_{max}): the maximum selected from the total series of 30-second maximum values of vibration load received from three directions, where the unit of measurement: mm/s^2,

Survey limit (A_0): maximum vibration level arising from an ambient vibration source as permitted by laws, and in this case the studied vibration can meet the requirements, in case of limit excess further studies are required to find out whether limits are met and the unit of measurement: mm/s^2,

Assessment of measuring results and decision on study roll-out: MSZ 18163-2:1998: vibration measurement. The maximum 30 second maximum values should be compared with aw, max A0, and Amax limits) as these values were measured in accordance with the standard titled "study of impacts of ambient vibrations in buildings onto people".

There are three options

a) If $a_{w,max} \leq A_0$ then the studied vibration can me the requirements.
b) If $a_{w,max} > A_{max}$ then the studied vibration cannot meet the requirements.
c) If $A_0 < a_{w,max} \leq A_{max}$ then the assessment shall go on in conformity with Point 3.5 of the standard referred above.

Based on decrees, local structural plans, development plans and local building regulations, the vibration load limits and vibration load maximum values at various measuring points are as it follows broken down to zone categories, see: Table 15.2.3-2:

Sr. nr.	Vibration measuring points	EOV coord. (x,y)	Vibration load maximum aw,max (mm/s2)	Area to be protected from vibration based on development plans and local structural plans	AM Vibration load limit (mm/s2)		A0 Vibration study limit (mm/s2)	
					day-time 6-22 h	at night 22-6 h.	day-time 6-22 h	at night 22-6 h.
1.	RMP1	138065;635871	1,25	Gip	20	20	24	24
2.	RMP2	137615;634937	2,88					
3.	RMP3	137247;634911	0,98					
4.	RMP4	137038;634910	0,67					
5.	RMP5	136941;635107	0,71					
6.	RMP6	136939;635202	0,90					
7.	RMP7	137217;635277	0,80					
8.	RMP8	137575;635407	0,80					
9.	RMP9	137591;635183	0,93					
10.	RMP10	137999;635192	0,74					
11.	RMP11	132269;631800	2,21N / 1,26É *	Lf	10	5	12	6
12.	RMP12	135457;633103	0,99N / 0,79É.*	Lf	10	5	12	6
13.	RMP13	140189;634715	1,04N / 0,72É.*	Lke	10	5	12	6
14.	RMP14	142501;636269	1,11N / 1,14É.*	Lf	10	5	12	6
15.	RMP15	146838;637170	1,55N / 1,30É.*	Lf	10	5	12	6
16.	RMP16	165197;634270	3,51N	Lf	10	5	12	6

Table 15.2.3-2: Vibration load limits and maximum vibration load at designated measuring points

Summary of baseline vibration load study

As prescribed in Point 3.5. of MSZ 18163-2:1998 standard aw, i ≤ 2 mm/s^2 values should be replaced with 0 mm/s^2 value. At this point we do not follow the recommendations offered in the standard, because the vibration load data measured and assessed at the designated measuring point are usually lower than 2 mm/s^2. The purpose of the present studies is to disclose the baseline vibration status in the Paks II planned operation area and on the area exposed to potential vibration impact. Thus we decided to publish all relevant measured and calculated data as the best approach.

When we assessed the baseline vibration load measurement results, we used the vibration load limits specified in Appendix 5 of Decree 27/2008. (XII. 3.) KvVM-EüM and in Clause 3.4 of the relevant standard. Thus we can state for all (RMP 1-16) studied measuring points that vibration arising from the vibration source (the existing nuclear power plant) during the period of the study (May 8., 9., 11, 2012.) and the vibration caused by public road and railway traffic in the planned impact zone of Paks II resulted in vibration load increase. After the assessment of all data measured during the baseline vibration load study we can state that the vibration load for the measuring/judging time is lower than the vibration load limit [aw, M < AM] in all the three orthogonal directions and the maximum vibration load is lower than the vibration study limit [aw, max < A0] in all the three orthogonal directions.

Having analysed the vibration 1/3-octave frequency analysis measured at *Paks II. planned operation area*, the typical frequency ranges (in all the three orthogonal directions) are 0,8-1,25 Hz; 20 Hz; 50 Hz.

The peaks near the 1 and 20 Hz range are vibrations caused by pieces of equipment running at various distances from the measuring points. The 50 Hz peak can be characteristically identified in the vibration spectrum at RMP5 and RMP6 measuring points, and these vibrations are generated by the main transformers of the unit. The main transformers of the unit are located ~90, ~40 meters from measuring points Nos. 5 and 6.

Large-size trucks and trains generate waves in the upper soil layers by their movement, and these flexible waves travel in the soil, are reflected and broken on various layers, and may interfere with direct waves travelling on the surface. Speed of propagation depends on the shape changing and shearing modulus and stratigraphic structure typical to the given layer. Mass of the moving body, speed and suspension of the large-size truck define the dynamic forces causing generation. Bumps on the road surface in the vicinity of the measuring point also have major impact onto the emerging vibration.

Having analysed the 1/3-octave frequency analysis of the vibration measured at *Paks II. expected vibration load impact area*, we can identify two typical frequency ranges in case of large-size trucks (in all the three orthogonal directions), and the amplitude usually remains below 1 mm/s^2, and the peak can at some points reach 2 mm/s^2. The peaks between 10-40 Hz and 125-250 Hz evolve due to mechanical vibrations caused by vehicles.

Having analysed the 1/3-octave frequency vibration measured *Paks II. expected vibration load impact area*, we can identify two typical frequency ranges in case of trains (in all the three orthogonal directions), and the amplitude usually remains below 2 mm/s^2, and the peak can in one point get close to 4 mm/s^2. The peaks between 6,3-40 Hz and 125-250 Hz evolve due to mechanical vibrations caused by the track and the train.

15.3 PRESENTATION OF AMBIENT NOISE IMPACTS MODELLING, BASELINE CRITERIA

15.3.1 GENERAL NOISE CALCULATION PARAMETERS

We determined the noise load and the impact area using SoundPlan 7.2 software.

We determined the noise load arising from operations using a calculation run to the specific point to be protected and located next to the noise sources. (for points located next to noise sources to be protected *see:* distance between areas to be protected and noise sources in Point 15.3.3.)

We prepared an outdoor raster map for determining the noise protection impact areas. We used 25 m raster distance for drawing the impact area raster grid, and we laid the raster grid 1.5 m above the ground level.

As the baseline parameter we used ISO 9613-2: 1996 standard, MSZ 07-2904:1990 standard and ÚT 2.1-302 standard in the program.

The ambient parameters were the following:

Barometric pressure	1013,25 mbar
Relative humidity	70 %
Temperature	10 °C

In the model we used the noise shielding of the neighbouring buildings, mitigation impact of vegetation (forests), and the impact of large extension water surfaces.

Based on ortophotos and digital surface lines the buildings actually in place in the region were identified with their heights, and displayed in 3 dimensions in the model.

We identified separate mitigation zones in the vegetation map, ands defined the forest heights based on the digital surface lines in the model. The ground effect was similarly applied e.g. by delineating the Danube water surface. (ground effect, G=0)

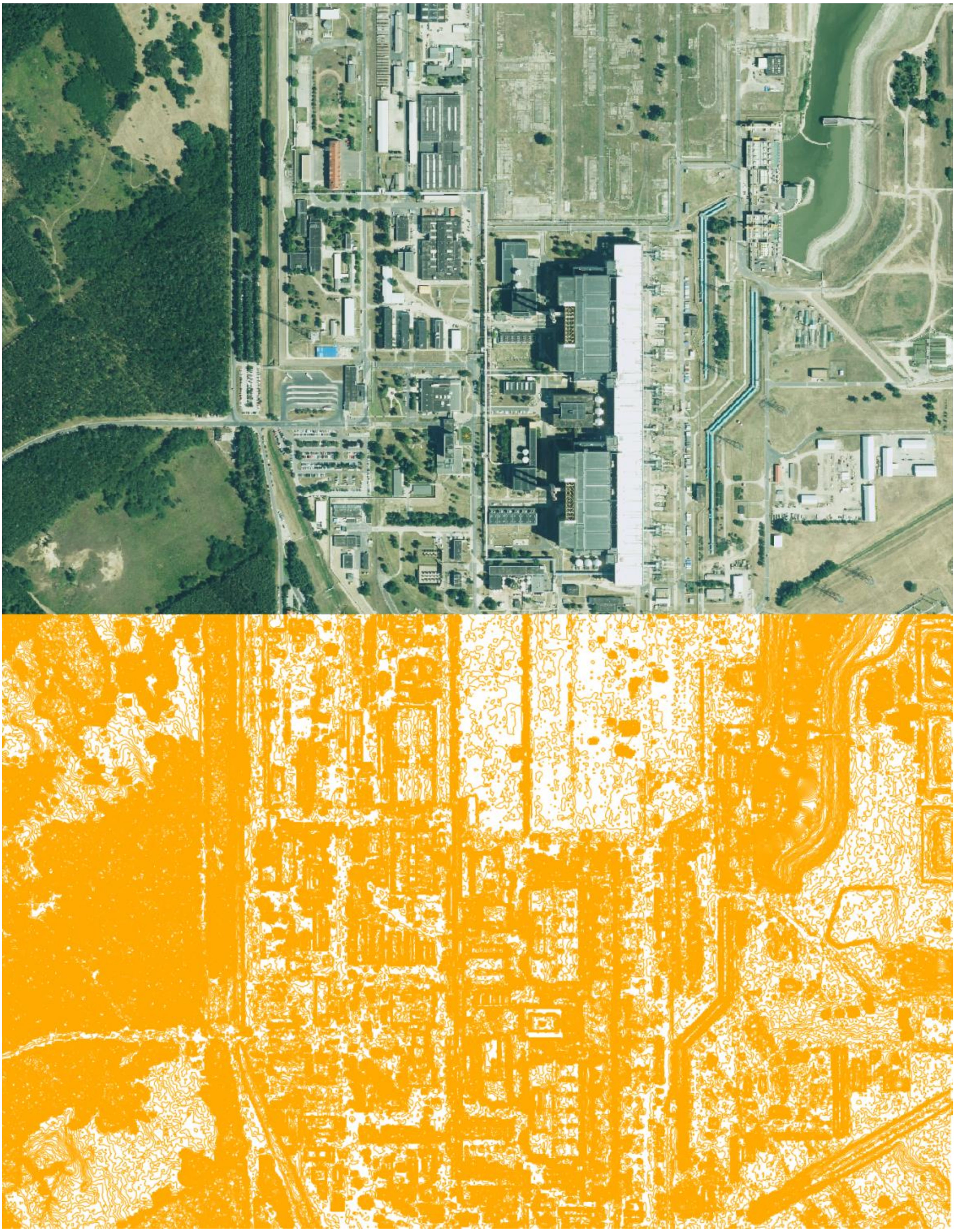
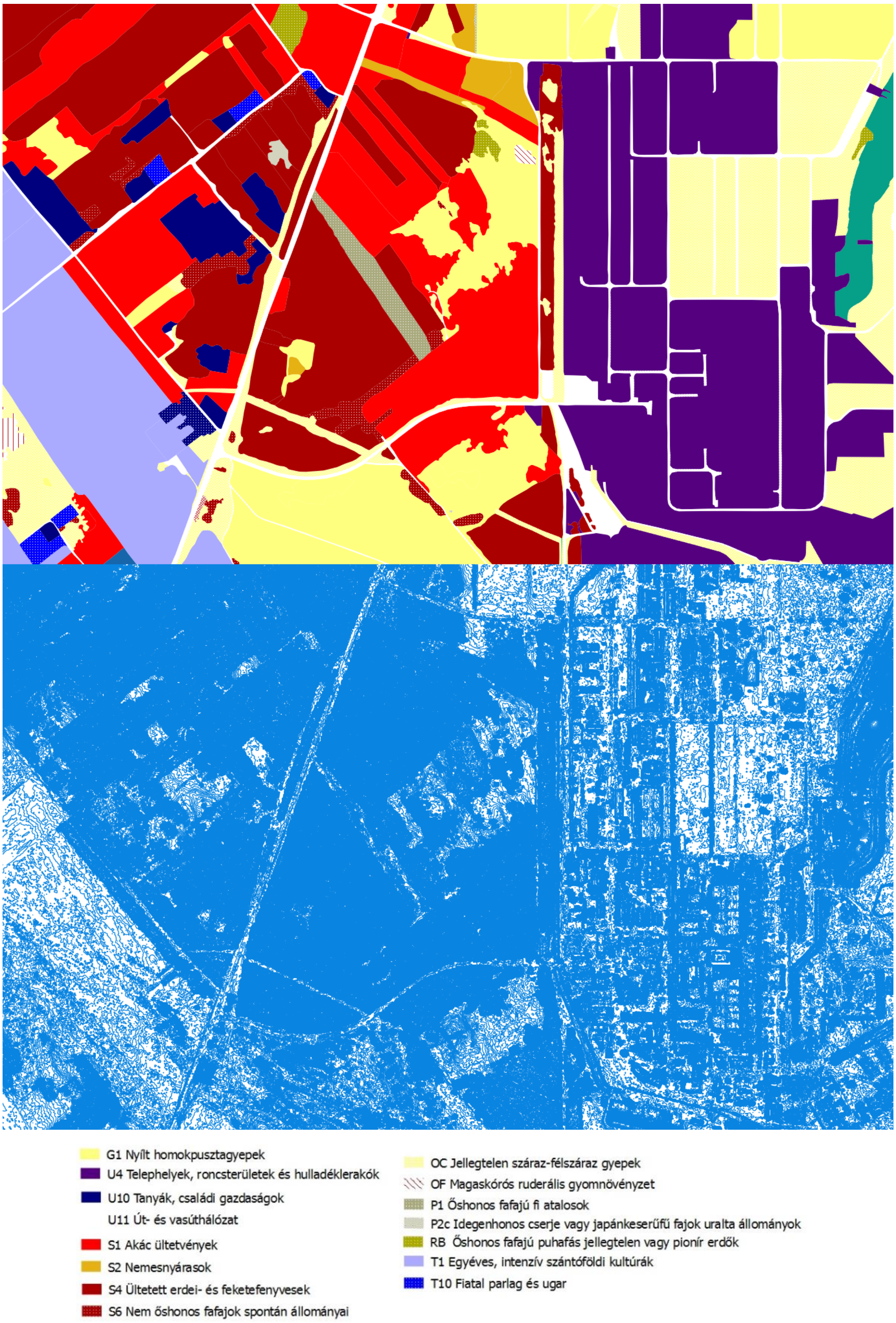


Figure 15.3.1-1: Matching ortophoto and digital surface taken on the area – cut-out section [15-10], [15-12]



G1 Open sand puszta lawns
U4 Sites, wreckage and waste depositories
U10 Farms, family farms
U11 Road and railway network
S1 Acacia plantations
S2 Noble aspen trees
S3 Planted forest and black pines
S6 Spontaneous forest of non-indigenous trees
OC undistinctive dry, semi-dry laws
OF High stalk ruderal weeds
P1 Indigenous young forests
P2 Alien shrubs or Japanese polygonum
RB Indigenous softwood undistinctive or pioneer forests
T1 One-year old intensive arable land cultures
T10 Young uncultivated land and wasteland

Figure 15.3.1-2: Mathcing vegetation map and digital surface taken on the area – cut-out section [15-12]

Maps used as geometric base data are made in digital format. The raster graphic map can store the information broken down to pixels, as the basic unit for the vector graphic map. The AutoCAD-based map for the power plant was prepared using EOV coordinate system (vectors, dxf format), and we handled them in geofile foils. We digitalised the settlement development plans (with scanning), and matched to the known EOV coordinate points. We applied geo-referred ortophotos as raster graphic picture. When the ortophotos were prepared, we also had shape files with 0,25 m contour density, and we used these files as basic data for the noise modelling program to calculate the noise levels, and developing a digital field model from the contours.

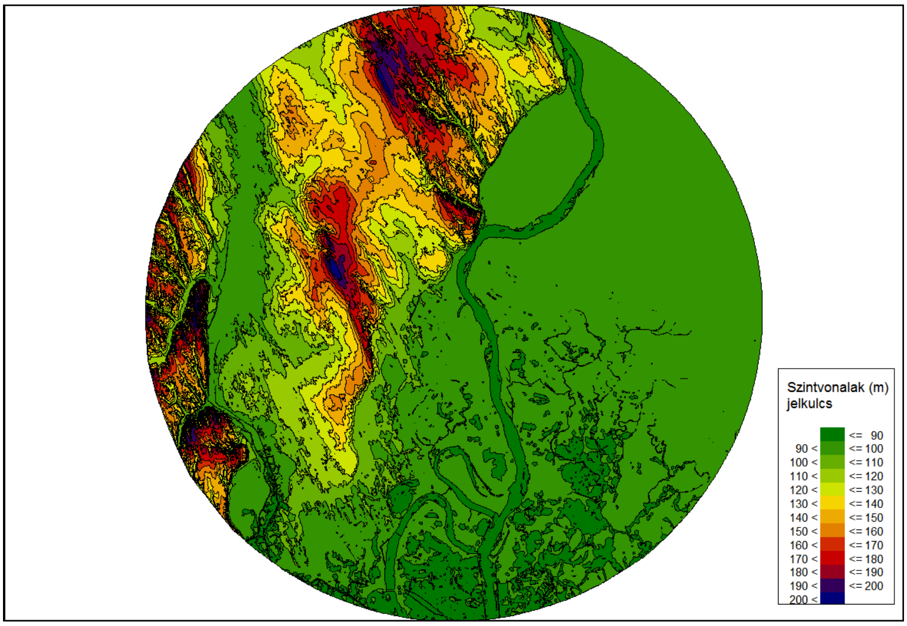


Figure 15.3.1-3: Paks II. 3 km environment: digital field model

Figure 15.3.1-4: Buildings and digital field displayed in a noise model

Maps prepared for the noise load modelling are optimised for A4 page, and they are equipped with scale for inserting them into text environment and due to zoom-out, but are not equipped with scale. These maps can present the noise sources, transmitters installed at the facades and areas and the noise levels using the bar figure presentation with 5 dB. scale. We describe the parameters applied individually on various noise calculations and noise modelling in details in the relevant sections.

15.3.2 DATA SERIES USED FOR BASELINE MODELLING AND BACKGROUND LOAD DETERMINATION

In this section we present data lines used for baseline noise measurements and noise modelling. Using the measuring results is a very complex exercise. Different values are used among the data generated at one-one measuring point depending whether we analyse compliance with the limits, or we define the background load for delineating the impact area. Limits depend upon the area categories, the noise type, the road type, the time of the day, or the duration of the construction – *see:* 15.1.2 section –, and special local regulations. Defining the background load is also a fairly complex exercise, and can be ensured with measurement or calculations. For all these, we present now the utilisation only at indication level, and the specifically applied values will be shown in the subsequent sections supported with detailed explanation. The relevant values used for the modelling present input data, thus the noise measurement should precede the modelling work, however we can find out the areas that will be indeed affected only after the model runs. Traffic lines might change during the planning phase, and new roads might open up and change like area categories, laws, etc., thus the expectation that the preliminarily performed baseline measurements can fully cover the total noise modelling needs can be hardly satisfied.

	Plant construction	Transmission line construction	Construction traffic	Plant operation	Transmission line operation	Plant traffic
ZMP1				(x)*		
ZMP2				(x)		
ZMP3				(x)		
ZMP4				(x)		
ZMP5	x		(x)	x		(x)
ZMP6		x			x	
ZMP7						
ZMP8						
ZMP9			x			(x)
ZMP10			x			(x)
ZMP11			x			(x)
ZMP12						
ZMP13						
ZMP14						
ZMP15						
ZMP16	x		x	x		
ZMP17						
ZMP18	x		x	x		
ZMP19						
ZMP20	x		(x)	x		(x)
ZMP21	x		(x)	x		(x)
ZMP22				(x)		
ZMP23				(x)		
ZMP24				x		
ZMP25				x		

Comment:

* data when shown in brackets are not numerical references, and presented only for information purposes. Reasons:

We defined the noise load arising from baseline road traffic in accordance with the EKD resolution – from database traffic count for 2012 by National Public Roads Cross-section Traffic [15-3], as these were the most up-to-date data available when the modelling work was performed. Thus, supporting the need for statutory requirement, we could use data averages from a significantly wider database, versus the data from the 5 road traffic measuring points related to the planned traffic, which may characterise maximum 1 day out of the 365 days of the year. Thus we used calculated results for the baseline load. The baseline load is not identical with the results of the baseline measurements, because we held the measurements during a given period (in a given day), whereas values generated from the traffic data used for the modelling give an average figure. The study points are only partly identical with the measuring points used for the baseline study, because it preceded the modelling phase, and the points finalised based on the modelling were modified or changed, and traffic lines were also modified during the planning process, and it was obviously not known before.

We prepared surfaces in the model for describing the noise load for the existing Paks Nuclear Power Plant in accordance with the data measured in the power plant area with the goal to get quantified figures (estimates) for the existing status.

Table 15.3.2-1: data series used for baseline noise measurements modelling

15.3.3 DISTANCE OF NOISE SOURCES AND STUDY POINTS

Table 15.3.3-1 presents the distance between the noise sources and the study points:

Noise source - study point	distance (m)
Paks II.[1] – 1 u (Dunaszentbenedek)	2590[2]
Paks II. – 2 u (Csámpa)	1330
Paks II. – 3 u (Csámpa)	1670
Paks II. -4 u (Paks)	2960
transmission line (sideline) – 5 u (Birító)	290
highway nr. 6 [3]– 1k (Dunaföldvár)	24
highway nr. 6 – 2 k (Dunakömlőd)	17
highway nr. 6 – 3 k (Paks)	19
highway nr. 6 – 4 k (Paks)	12
highway nr. 6 – 5 k (Csámpa)	29
highway nr. 6 – 6 k (Csámpa)	15
highway nr. 6 – 7 k (Csámpa)	13
highway nr. 6 – 8 k (Dunaszentgyörgy)	12
M6 Motorway – 9 k (Fácánkert)	440
M6 Motorway – 10 k (Tengelic)	450
M6 Motorway – 11 k (Gyapa)	370
shipping line – 1 h (Paks)	310
shipping line – 2 h (Paks)	180
shipping line – 3 h (Dunaszentbenedek)	810
shipping line – 4 h (Uszód)	400
railway – 1 v (Dunaföldvár)	67
railway – 2 v (Bölcske)	150
railway – 3 v (Dunakömlőd)	42
railway – 4 v (Paks)	29
railway – 5 v (Paks)	14

Comment:
1. Paks II central coordinates: 635119;137254;
2. In case of distances longer than 100 m we used a 5 m rounding up
3. distance from central coordinates of roads

Table 15.3.3-1: distance between Paks II., and line noise sources and points of study

	Distance from Csámpa 1 residential building (m)	Distance from Csámpa2 residential building (m)	Distance from Paks residential building (m)	Distance from Dunaszentbenedek residential building (m)
Steam generator	1277	1685	2755	2571
Steam generator	1239	1572	2993	2683
Main circulation pump	1301	1708	2757	2548
Main circulation pump	1264	1593	2995	2663
Turbine	1359	1761	2760	2493
Turbine	1322	1650	2993	2609
Generator	1397	1795	2766	2456
Generator	1360	1683	3000	2578
Condenser	1370	1767	2773	2459
Condenser	1333	1655	3010	2607
Compressor plant	1305	1735	2780	2517
Compressor plant	1272	1673	2789	2582
Compressor plant	1306	1627	3014	2634
Compressor plant	1243	1562	3025	2697
Turbine building-ventilation	1439	1825	2795	2427
Turbine building-ventilation	1408	1722	3028	2547
Primary line ventilation	1269	1658	2824	2594
Primary line ventilation	1244	1550	3059	2715
Safety cooling tower ventilators	1245	1682	2691	2589
Safety cooling tower ventilators	1264	1693	2693	2574
Safety cooling tower ventilators	1381	1694	2688	2442
Safety cooling tower ventilators	1402	1819	2690	2444
Safety cooling tower ventilators	1198	1553	2930	2696
Safety cooling tower ventilators	1214	1570	2930	2682
Safety cooling tower ventilators	1334	1333	1918	2566
Safety cooling tower ventilators	1349	1701	2923	2552
Primary line cooling water pumps	1275	1702	2695	2561
Primary line cooling water pumps	1369	1791	2687	2470
Primary line cooling water pumps	1228	1582	2929	2670
Primary line cooling water pumps	1318	1673	2917	2579
1 phase main transformer	1479	1871	2767	2380
1 phase main transformer	1476	1864	2782	2386
1 phase main transformer	1471	1855	2798	2395
1 phase main transformer	1445	1767	2997	2498
1 phase main transformer	1444	1760	3013	2507
1 phase main transformer	1443	1754	3030	2518
3 phase in-house operation transformer	1456	1744	3000	2403
3 phase in-house operation transformer	1451	1735	2787	2412
3 phase in-house operation transformer	1432	1744	3000	2521
3 phase in-house operation transformer	1422	1736	3022	2532
Condenser cooling water pumps	1590	1913	2991	2360
Auxiliary cooling water pumps	1594	1927	2961	2340
Water intake work	1592	1919	2976	2349
Spillover dam	1793	2073	3144	2254
Energy breaker engineering object	2818	3153	3139	1215
Recuperation water power plant	2780	3139	3018	1175
Diesel generator *	1202	1631	2714	2636
Diesel generator *	1154	1507	2950	2743

Comment:
* studied for emergency

Table 15.3.3-2: noise sources studied in noise model (in Paks II. area) and distance of study points

15.4 AMBIENT NOISE IMPACT DURING PAKS II. IMPLEMENTATION

15.4.1 IMPACT FACTORS CAUSING NOISE LOAD

Mobilisation area

Removal / relocation of vegetation from the mobilisation area
Removal / deposition of topsoil

Power plant area

Demolishing facilities in the power plant operation area
Removal / relocation of vegetation and removal / deposition of topsoil from the construction area
Foundation works, including also preparation of working pit/ditch and dewatering
Construction and technology assembly of buildings and water engineering objects

The routing for the 400 kV block line and 120 kV transmission line up to the new sub-station

Landscaping of site for the transmission line poles
Removal / deposition of topsoil
Foundation work
Installation of transmission line poles
Line assembly

Deliveries /supplies)

Supply of construction materials and human resources

15.4.2 DEMOLISHING AND CONSTRUCTION OPERATION ON THE IMPLEMENTATION AREA

15.4.2.1 Demolishing

When noise emission limits for demolishing works are determined, the limits defined in Appendix 2 of Decree 27/2008. (XII.3.) KvVM-EüM shall be followed as the construction period is longer than 1 year. Decree 32/2008. (XII.17.) of Paks Municipality defines the relevant zones and this has modified these limits, this was also taken into consideration in during the results.

The planned duration of the demolishing process might be longer than 1 year. Demolishing works will be typically performed daytime, but occasionally also at night. (However, the materials will be always transported daytime.)

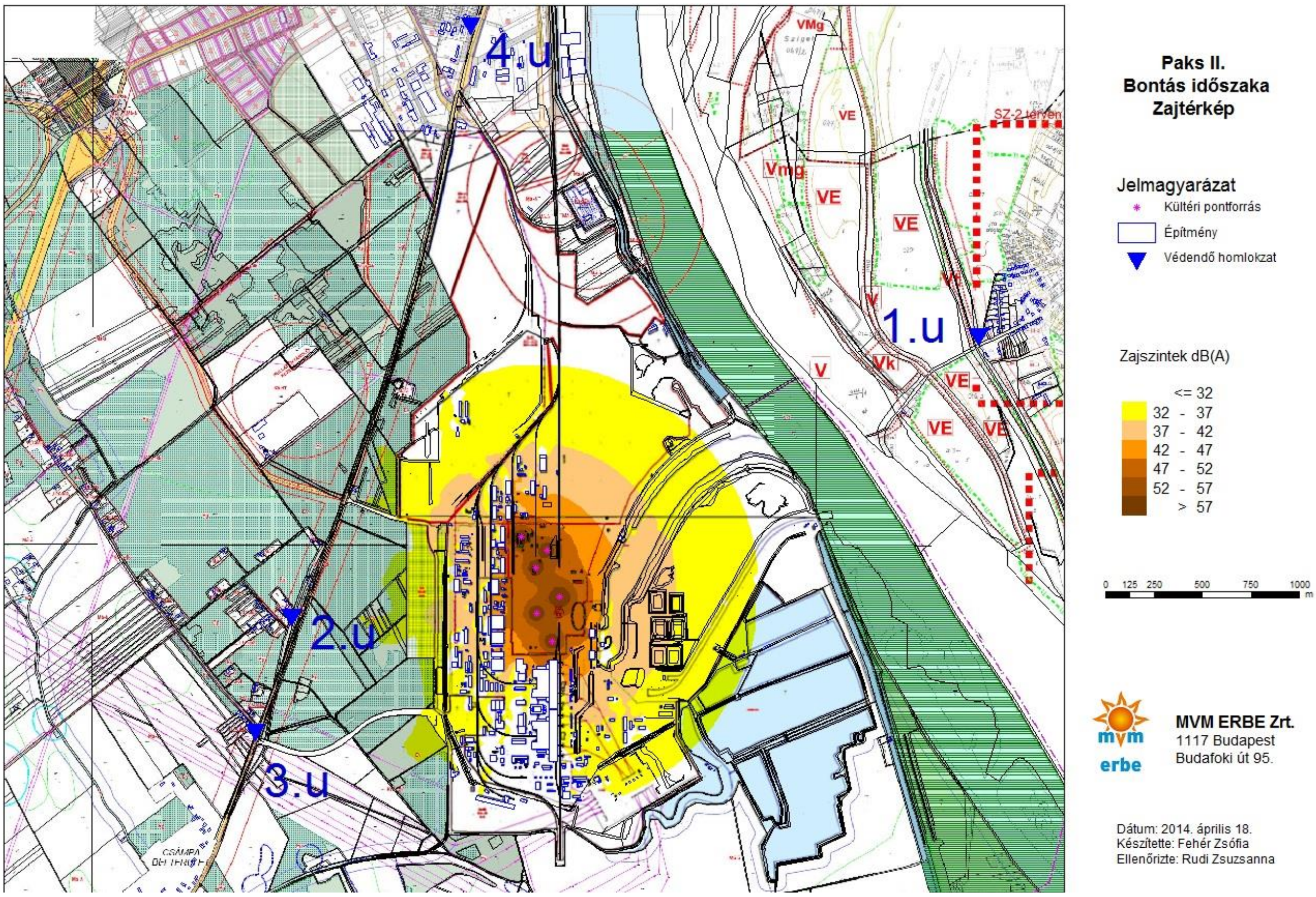
The following Table 15.4.2-1 presents the outdoor noise sources during the demolishing process:

	Description	Noise source sound power-level LWA dB(A)	Operation time [h/day]	pieces
Demolishing machines	Machine (rotation excavator, sand loader)	101	24	2
	Dredger equipped with hydraulic crusher head	101	24	3
	Crusher (with jaws or impact crusher)	105	24	1

Table 15.4.2-1: demolishing machines

We used the parameters described in details in section 15.3.2 for noise modelling.

Figure 15.4.2-1 presents the noise load during the demolishing period.



Jelmagyarázat: legend kültéri pontforrás - outdoor point source, építmény - building, védendő homlokzat - protected façade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-1: Noise load during the demolishing period [15-9]

15.4.2.2 Construction

15.4.2.2.1 Construction works in the operation area

The limits defined for noise emission due to construction in Appendix 2 of Decree 27/2008. (XII.3.) KvVM-EüM shall be followed as the construction period is longer than 1 year. Decree 32/2008. (XII.17.) of Paks Municipality defines the relevant zones and this has modified these limits, this was also taken into consideration in during the results.

Construction phases:

- landscaping period
- foundation work periods
- structure construction periods.

When we prepared the model, we used the most critical scenario for the construction period, when facilities next to the River Danube are implemented (this is the area locating next to Dunaszentbenedek, the area to be protected), and there will be works going on also in the central operation area. Works next to the channels and islands will be also performed during this phase. Machines that are presently installed along the River Danube will perform also the works in areas located further from the riverbank, and their movements will be random, and cannot be displayed with line sources, thus these were not displayed several times only the point located next to the area to be protected.

The planned implementation phase will be ~5 years. Construction works will be typically performed daytime, but works might be carried out also at night. Excavators and construction machines will be the pre-dominant noise sources during construction.

Noise sources

The noise emission data displayed in the following table for calculating the construction noise emission were taken into consideration based on experiences gained from operations similar to the planned construction and pursuant to Decree 29/2001. (XII.23.) KöM-GM:

Construction phases	Noise sources	Noise source sound power- level LWA dB(A)	Operation time [h/day]	pcs
landscaping period	Machines (rotation excavator, sand loader, dumper, etc.)	101	24	28
foundation work period	Machines (tipping truck, etc.)	101	24	12
	Concrete pump	86	24	2
	Pump	95	24	1
	Mobil crane	101	24	1
structure construction period	Machines (rotation excavator, sand loader, dumper, etc.)	101	24	24
	Electricity driven tower crane	70	24	10
	Diesel driven tower crane	108	24	2
	Mobile crane	101	24	1
	Dredger boat	85	24	1
	Gap bricklayer	94	24	1
	Concrete pump	86	24	2
	Platform vibrator	105	24	2
	Rod vibrator	87	24	2
	Truck crane	86	24	1

Table 15.4.2-2: construction machines

15.4.2.2.2 Transmission line construction

Construction phases:

- landscaping period
- earthwork period
- foundation work period
- pole installation-assembly, pole construction period
- cable/ line laying period

The construction period will take nearly 8-10 months, but works may take more than 1 year. Though construction is broken up to several phases, we apply the relevant limits for the entire construction process. (the goal of the breakdown to such phase is not to reduce the limits) Dominant noise sources during construction are earth machines, construction machines and means of transportation. Construction works are mostly performed daytime. Based on experiences gained from constructions similar to the planned construction and pursuant to Decree 29/2001. (XII.23.) KöM-GM the noise emission data are displayed in Table 15.4.2-2 for calculating the construction noise emission:

Construction phase	Noise sources	Noise source sound power- level LWA dB(A)	Operation time [h/day]	pieces
landscaping period	truck	96	16	1
	timber saw (for de-forestation)	110	16	2
	bulldozer earth machine	101	16	1
earthwork	hydraulic dredger with deep digging unit	101	16	1
	bulldozer and grabber earth machine	101	16	
foundation work period	grabber	101	16	1
	truck + trailer	96	16	1
	Jeep	79	16	2
	Welding aggregate (with welding equipment	99	16	1
	submerging vibrator	100	16	1
	Unimog (multi-function truck)	84	16	1
	concrete mixer	98	16	3
	pneumatic pile driver (air hammer)	105	16	1
	pile driver with internal combustion engine or comprised air	105	16	1

Construction phases	Noise sources	Noise source sound power- level LWA dB(A)	Operation time [h/day]	pieces
foundation work period	power generator aggregator	99	16	1
	high-speed disintegrator with gasoline engine	98	16	1
Pole installation and assembly, pole construction	truck-mounted crane	93	16	1
	Unimog	84	16	1
	truck + trailer	96	16	1
	jeep	79	16	1
	high-speed disintegrator with gasoline engine	98	16	1
structure construction period	Agricultural heavy-duty machine	92	16	1
	Unimog	84	16	1
	jeep	79	16	2
	line drawing machine group	99	16	2
	pneumatic press equipment	97	16	1
	high-speed disintegrator with gasoline engine	98	16	1

Table 15.4.2-3: transmission line construction machines

The table presents the quantity of machines for each phase. During the construction phase this machine group will continuously travel along the lines. For the calculations we analysed a situation where one-one machine group is operating both to west and east of M6 Motorway, thus we can define or estimate the noise load imposed to the nearest areas to be protected, and also the impact areas that will be delineated later for every zone category, because we can only assume the location of these machines. The route of transmission line is far away from residential areas, and there is only one are to be protected, Biritó village.

15.4.2.3 Noise load during the demolishing and construction phases

The noise load expected at the relevant points of study and caused by the construction of the planned Paks II. plant was calculated with Soundplan 7.2 program and the results are shown in the following table.

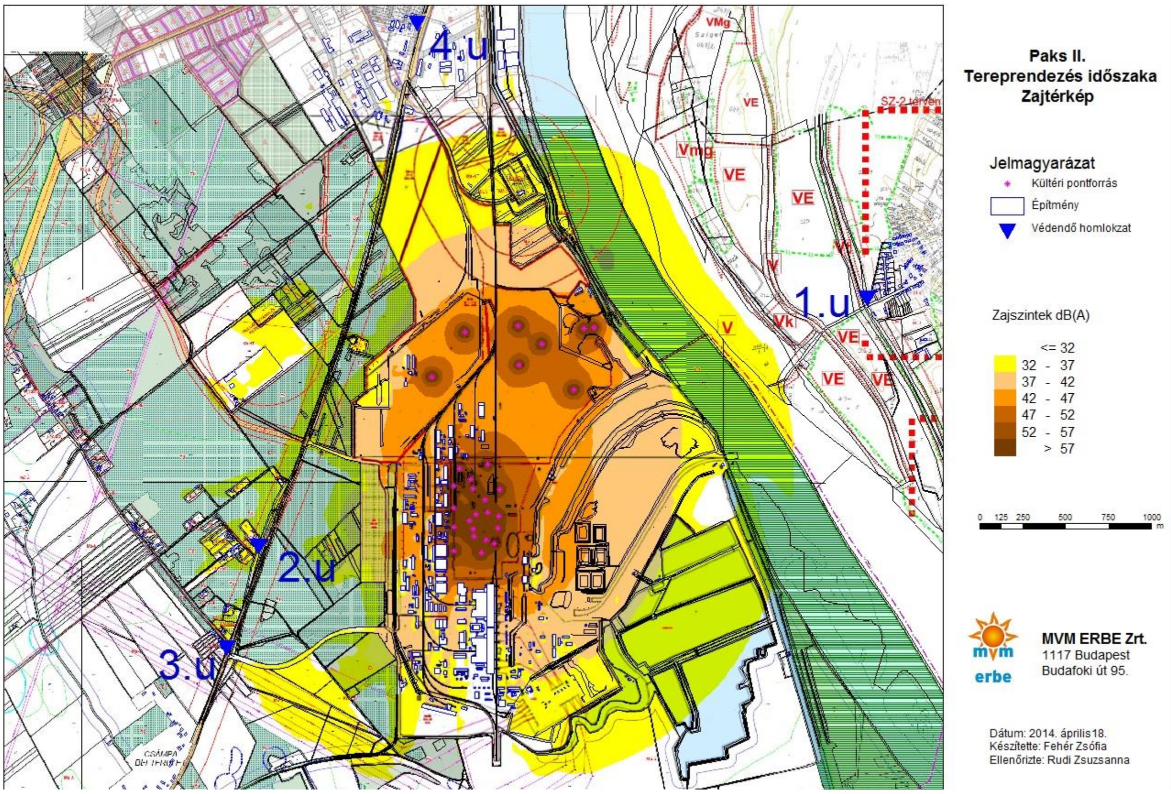
Code	To be protected	limit (dB) day/night	load (dB)			
			demolishing	landscaping	foundation work	structure construction
1.u	Dunaszentbenedek residential building	55/40	21,7	28,3	24,2	33,6
2.u	Csámpa residential building1	55/40	28,3	33,5	30,8	33,9
3.u	Csámpa residential building2	55/40	26,7	31,7	29,2	32,4
4.u	Paks residential building	55/40	20,1	27,5	22,6	28

Table 15.4.2-4: comparison of noise load and limits - for plant construction

As demonstrated by the calculation results, the *noise load limits can be ensured during every construction phase at the areas* and also the buildings to be protected.

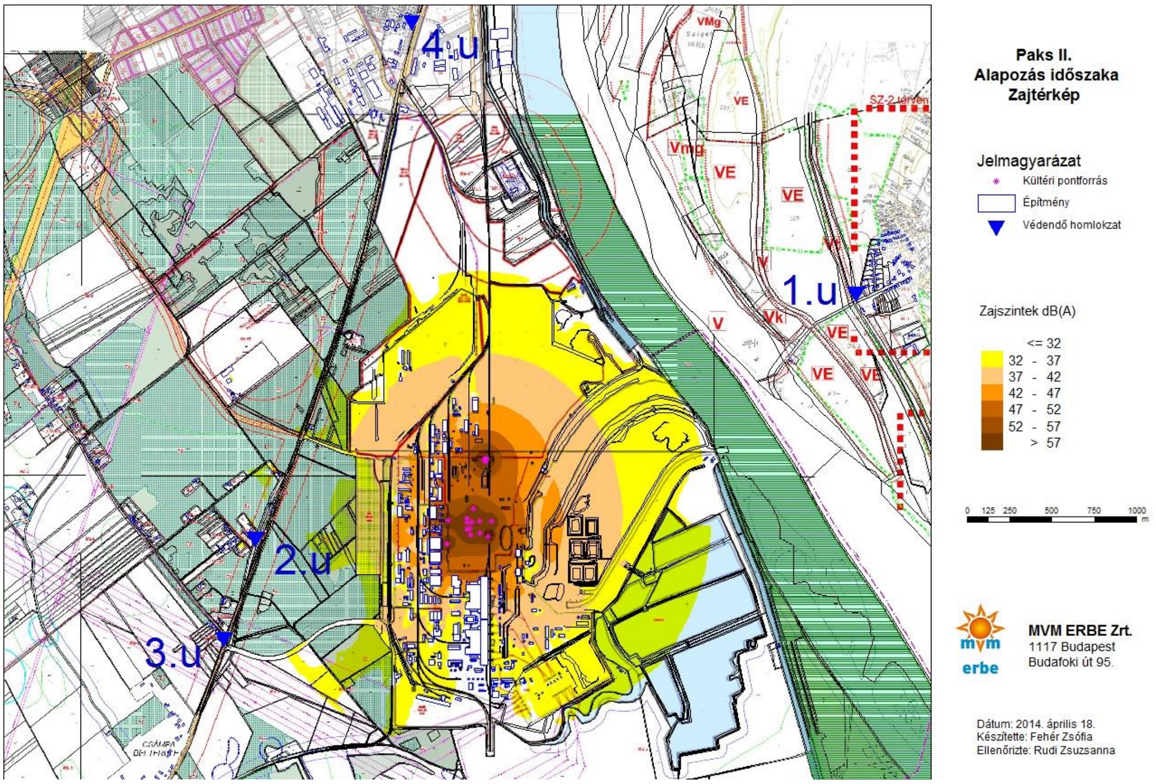
We run raster calculations with the Soundplan 7.2 program for the phases that cause significant noise load during the implementation process. The noise load maps present the noise load (this is not identical with the impact area). We could use only the assumed location of machines, and we could not calculate with the exact traffic routes within the plant area either, because not only proper roads will be used during the landscaping process, and this shall be taken into account for interpreting the modelling results and delineating the impact area.

The following figures (Figure 15.4.2-2., Figure 15.4.2-3, Figure 15.4.2-4.) present the noise load emerging during the relevant construction phases. We applied the same parameters as described in details in section 15.3.2.



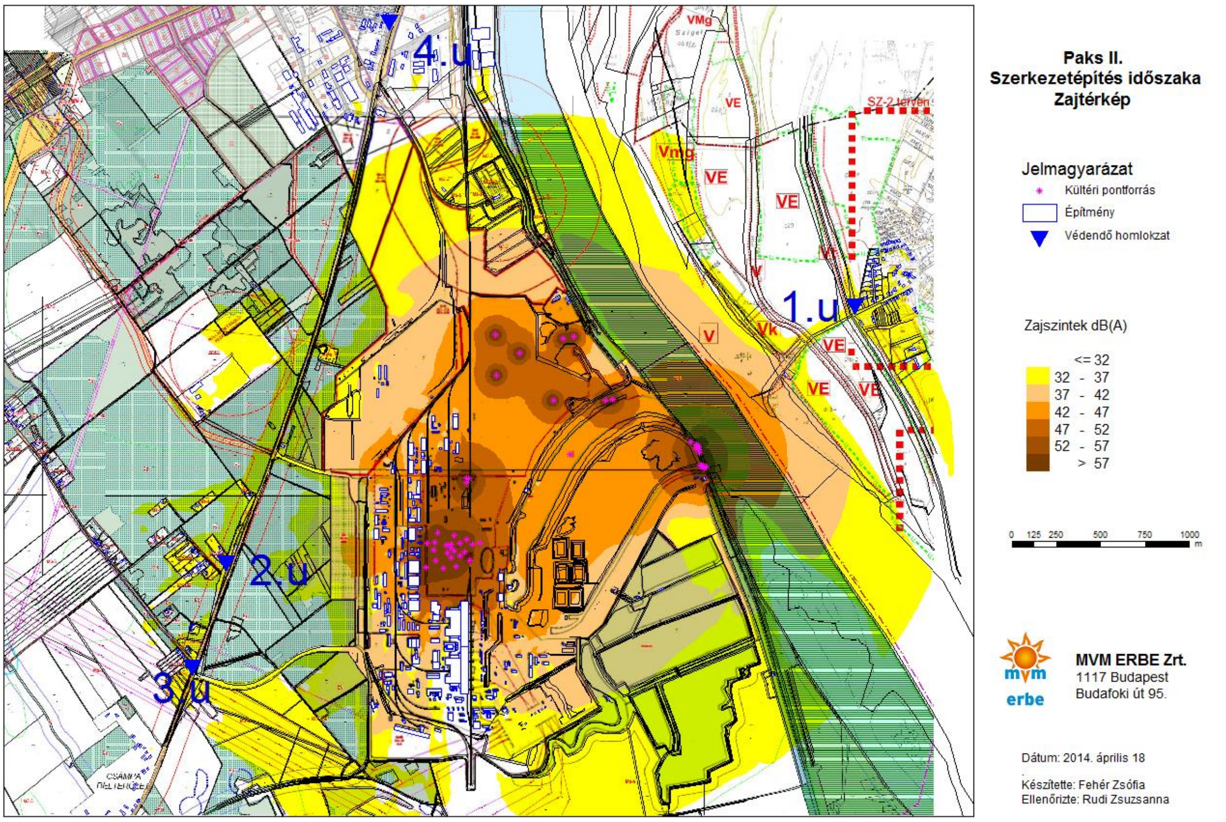
Jelmagyarázat – legend, kültéri pontforrás – outdoor point source, építmény – building, védendő homlokzat – protected facade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-2: Noise load during landscaping period [15-9]



Jelmagyarázat – legend, kültéri pontforrás – outdoor point source, építmény – building, védendő homlokzat – protected facade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-3: Noise load during foundation works [15-9]



Jelmagyarázat – legend, kültéri pontforrás – outdoor point source, építmény – building, védendő homlokzat – protected facade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-4: Noise load during structure construction works [15-9]

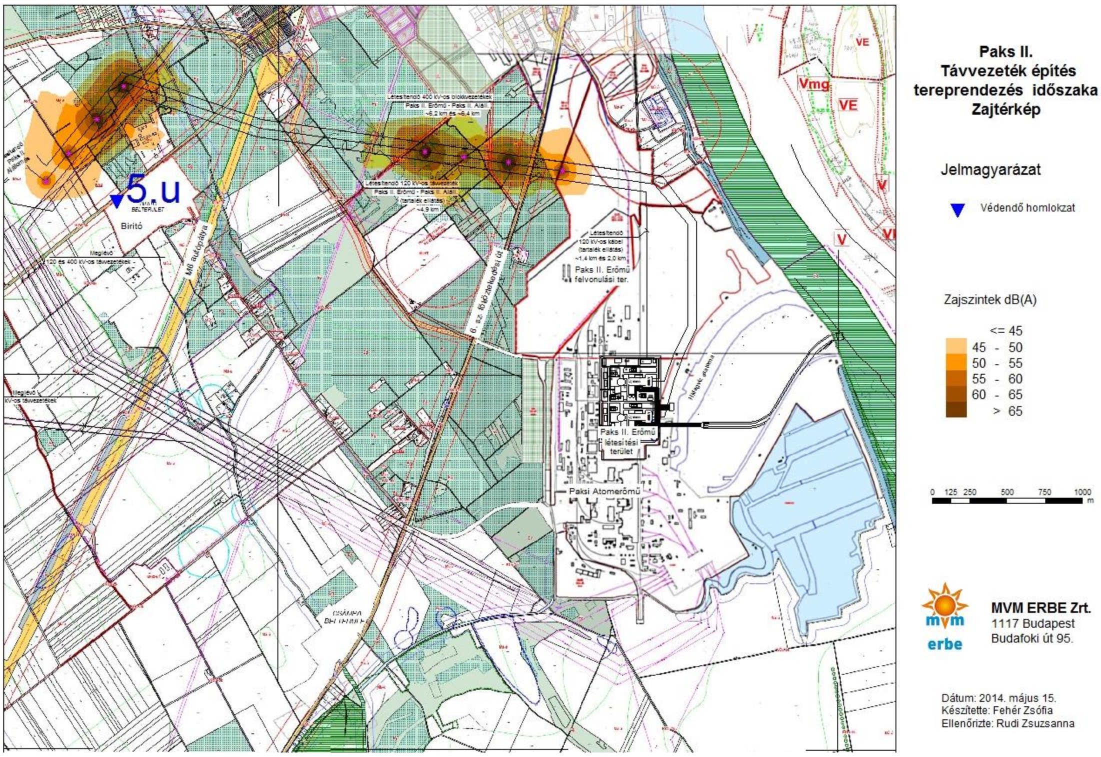
The noise load levels at the points of study expected from the construction of transmission lines for Paks II plant were calculated with Soundplan 7.2 program, as presented in the table below:

Code	area to be protected	limit (dB) day/night	load (dB)				
			terrain	earthwork	foundation work	pole assembly	cable/ line laying
5.u	Birító	55/40	37,7	33,9	38,7	30,7	33

Table 15.4.2-5: comparison of noise load and limits - for transmission line construction

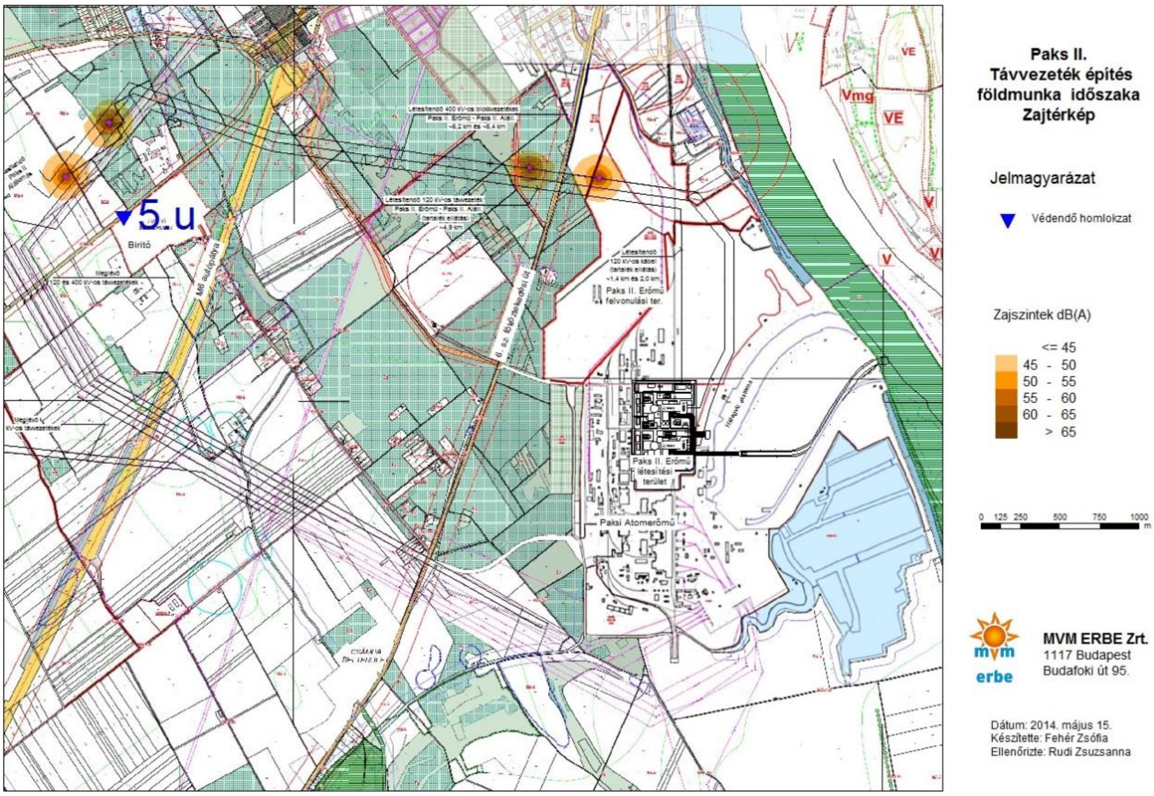
As calculation results can demonstrate, *compliance with noise load limits can be ensured in every phase during the transmission lines construction process.*

We prepared calculations for noise load during construction phases of transmission line that may cause significant noise and we also prepared the relevant noise load maps as presented in the following figures (Figure 15.4.2-5., Figure 15.4.2-9.).



Paks II Erőmű felvonulási ter. – Paks II Power Plant temporary construction area, zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-5: Transmission line construction - landscaping period [15-7], [15-9]



létesítendő 120 kV-os blokkvezetékek – envisaged 120 kV unit lines, létesítendő 120 kV-os távvezeték – envisaged 120 kV transmission line, tartalék ellátás – reserve power supply, Paks II Erőmű felvonulási ter. – Paks II Power Plant temporary construction area, zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat - protected façade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

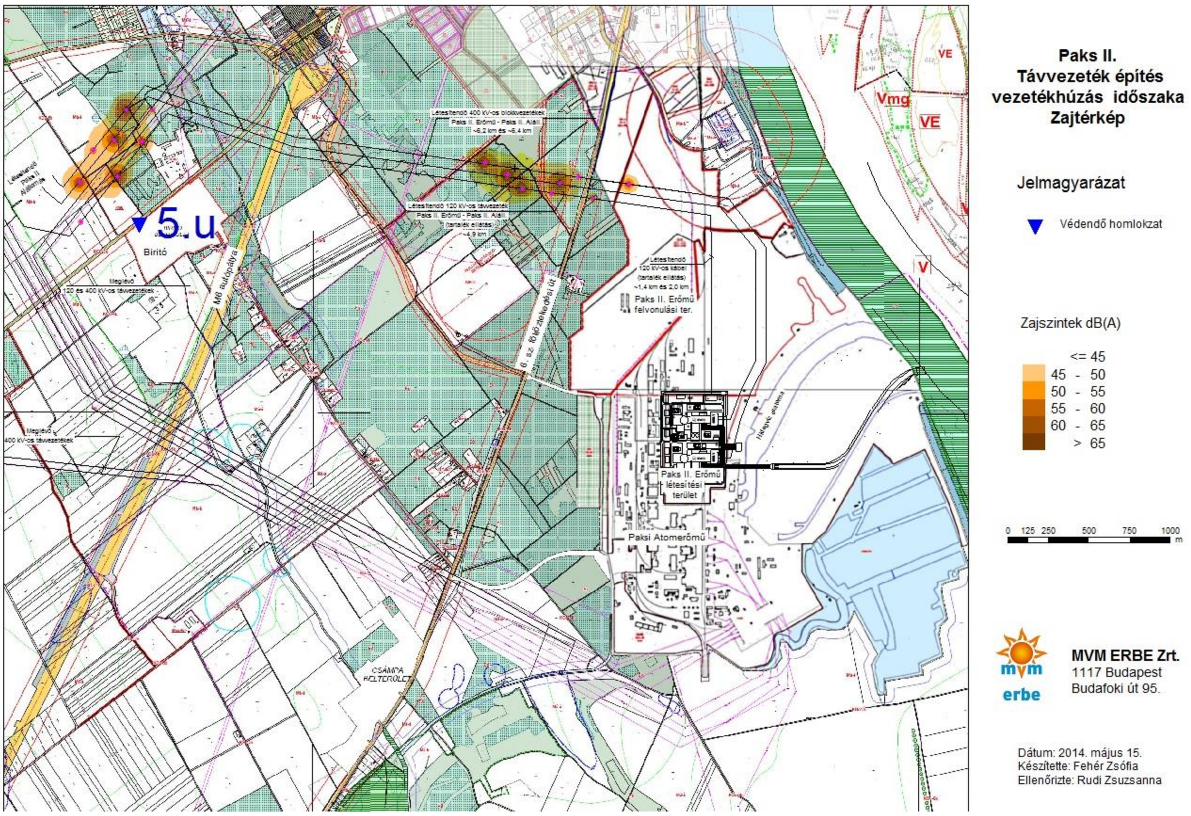
Figure 15.4.2-6: Transmission line construction - earthwork period [15-7], [15-9]

létesítendő 120 kV-os blokkvezetékek – envisaged 120 kV unit lines, létesítendő 120 kV-os távvezeték – envisaged 120 kV transmission line, tartalék ellátás – reserve power supply, Paks II Erőmű felvonulási ter. – Paks II Power Plant temporary construction area, M6 autópálya – M6 highway, zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat - protected façade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-7: Transmission line construction - foundation works period [15-7], [15-9]

létesítendő 120 kV-os blokkvezetékek – envisaged 120 kV unit lines, létesítendő 120 kV-os távvezeték – envisaged 120 kV transmission line, tartalék ellátás – reserve power supply, Paks II Erőmű létesítési terület – Paks II Power Plant construction area, M6 autópálya – M6 highway, 120 és 400 kV-os távvezetékek – 120 and 400kV transmission lines, Paks II Erőmű felvonulási ter. – Paks II Power Plant temporary construction area, zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat - protected façade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-8: Transmission line construction -pole assmebly and installation, pole construction period a [15-7], [15-9]



létesítendő 120 kV-os blokkvezetékek – envisaged 120 kV unit lines, létesítendő 120 kV-os távvezeték – envisaged 120 kV transmission line, tartalék ellátás – reserve power supply, Paks II Erőmű felvonulási ter. – Paks II Power Plant temporary construction area, zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat - protected façade, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.2-9: Transmission line construction - cable/ line laying period [15-7], [15-9]

15.4.3 TRAFFIC DURING DEMOLISHING AND CONSTRUCTION PERIOD

15.4.3.1 Limits to traffic

Appendix 3 of Decree 27/2008. (XII.3.) KvVM-EüM specifies the permitted equivalent A-sound pressure levels from traffic on protected areas involved into the planned development project.

The Decree specifies no limit for waterways and noise caused by ship traffic.

15.4.3.2 Traffic during the construction phase

Supplies will be transported using public roads, railway and water. This operation will also increase the traffic of passenger cars. Vehicles will move daytime at a steady distribution. Alternatives routes for public road traffic with the same probability:

- *M6 Motorway to north and south,*
- *highway No. 6 to north and south.*

We defined the traffic for sections of M6-os motorway and highway nr. 6 affected with demolishing and construction works using the traffic count data from the 2012 National Public Roads Traffic Database [15-3] in accordance with the EKD resolution, as these were the most up-to-date information available at the date of modelling.

Pursuant to the said database, the average daily traffic of highway No. 6 and M6 Motorway are presented in the following tables (Table 15.4.3-1, Table 15.4.3-2).

National highway nr. 6., Tolna County

				I.	I.	II.	III.	II.	III.	III.	III.	III.	II.
code	**section**	**border section**		**p c**	**s t**	**bus**	**a b**	**m h t**	**h t**	**trailer**	**s t**	**spec**	**m b**
4941	96+0	88+386	104+260	1873	651	45	0	102	82	100	82	1	16
1056	107+30	104+260	111+560	3414	790	130	32	89	33	71	99	1	60
8752	113+0	111+560	116+25	6050	1001	261	50	318	141	89	68	1	110
8753	120+0	116+25	120+273	3984	886	154	5	89	72	76	25	0	75
4952	123+0	120+273	130+679	3014	567	125	5	158	138	49	54	4	43
8754	131+800	130+679	131+974	2778	590	130	4	131	92	63	80	1	42
6341	134+500	131+974	135+539	3043	893	99	1	76	36	66	59	4	23
8755	136+300	135+539	137+300	5020	1214	186	18	245	194	175	191	2	42
8756	139+800	137+300	140+306	8858	1849	222	31	393	370	224	201	3	76

Table 15.4.3-1: Annual average daily traffic a highway nr. 6 on

Motorway M6, Tolna County

				I.	I.	II.	III.	II.	III.	III.	III.	III.	II.
code	**section**	**border section**		**p c**	**s t**	**bus**	**a b**	**m h t**	**h t**	**trailer**	**s t**	**spec**	**m b**
1258	91+270	86+400	97+225	4560	1108	37	0	160	159	131	536	2	4
1259	99+940	97+225	105+349	4646	1111	30	0	152	168	147	568	2	4
1260	107+700	105+349	113+53	4569	1094	35	0	168	175	169	576	2	4
1261	118+650	113+53	123+30	4490	1148	33	0	155	169	147	561	2	11
1263	124+800	123+30	130+550	4504	1090	29	0	159	165	148	562	2	11
1264	133+200	130+550	137+240	4635	1203	32	0	146	183	173	663	2	11
1266	139+400	137+240	142+393	3569	852	18	0	100	134	150	528	2	9

Legend: p c = passenger car, s t = small truck, a b = articulated bus, m h t = medium-heavy truck, h t = heavy truck, s t semi-trailer, m b = motorbike

Table 15.4.3-2: Annual average daily traffic on road M6

We calculated the annual average day and night traffic using the above data in accordance with ÚT 2-1.302 Road Management Technical Procedure, see in Table 15.4.3-3 and 15.4.3-4. The maximum road traffic was found during the landscaping phase, thus we showed the increase in the road noise load for the period that caused the maximum load.

code	**daytime traffic**			**night traffic**			**daytime traffic + increment**		
	I.	II.	III.	I.	II.	III.	I.	II.	III.
4941	144	9	15	28	2	3	188	19	31
1056	239	16	13	47	3	3	283	26	29
8752	401	39	20	79	8	4	445	49	36
8753	277	18	10	55	4	2	321	28	26
4952	204	19	14	40	4	3	248	29	30
8754	192	17	14	38	3	3	236	27	30
6341	224	11	9	44	2	2	268	21	25
8755	355	27	33	70	5	7	399	37	49
8756	609	39	46	120	9	12	653	49	62

Table 15.4.3-3: Annual average day and night traffic on road 6

code	**daytime traffic**			**night traffic**			**daytime traffic + increment**		
	I.	II.	III.	I.	II.	III.	I.	II.	III.
1258	312	10	39	85	5	26	356	20	55
1259	317	9	41	86	5	28	361	19	57
1260	311	10	43	85	5	29	355	20	59
1261	310	10	41	85	5	27	354	20	57
1263	308	10	41	84	5	27	352	20	57
1264	321	9	48	88	5	32	365	19	64
1266	243	6	38	66	3	25	287	16	54

Table 15.4.3-4: Annual average day and night traffic (vehicle /h.) on road M6

We determined the baseline traffic load from the above data using Soundplan 7.2 software. The program calculates the noise caused by traffic in accordance with the Hungarian regulations.

Further data used for the calculation:

- Speed of the vehicles at various road sections and vehicle categories;
- Relief, route lining
- Adjustment subject to road surface roughness
- Width of traffic lanes
- Two-way traffic

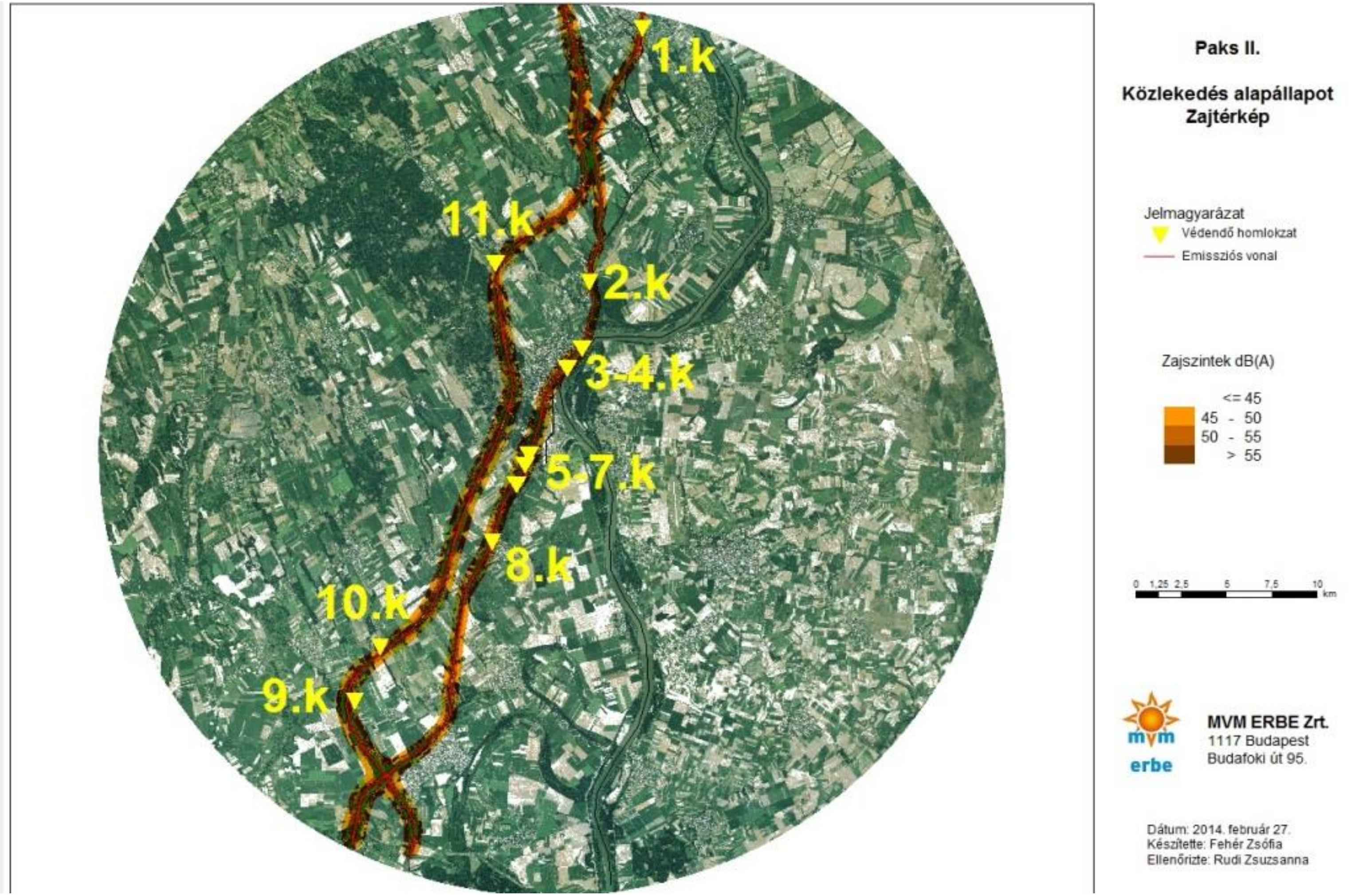
The excepted noise load arising from the construction of the planned Paks II plant and calculated with Soundplan 7.2 program at the relevant study points are presented at the table below (Table 15.4.3-5).

Code	Area to be protected	limit (dB) day/night	baseline load (dB) day/night	inc. load increment (dB) day/night	noise load change (dB) day/night
1.k	Dunaföldvár	65/55	57,8/50,9	59,9/50,9	2,1
2.k	Dunakömlőd residential building (ZMP11)	65/55	66,5/59,6	67,7/59,6	1,2
3.k	Paks residential building_2 (ZMP10)	65/55	63,9/57,1	65,4/57,1	1,5
4.k	Paks residential building_1 (ZMP9)	65/55	69,7/62,8	71/62,8	1,3
5.k	Csámpa residential building_1	65/55	64,4/57,7	65,1/57,7	0,7
6.k	Csámpa residential building_2 (ZMP5)	65/55	69/62,3	69,8/62,3	0,8
7.k	Csámpa residential building_3	65/55	69,8/62,9	70,9/62,9	1,1
8.k	Dunaszentgyörgy residential building	65/55	67,4/60,5	68,8/60,5	1,4
9.k	Fácánkert	65/55	47,1/43	47,9/43	0,8
10.k	Tengelic	65/55	43,1/38,9	43,9/38,9	0,8
11.k	Gyapa	65/55	47,3/43,1	47,9/43,1	0,6

Table 15.4.3-5: comparison of noise load and limits

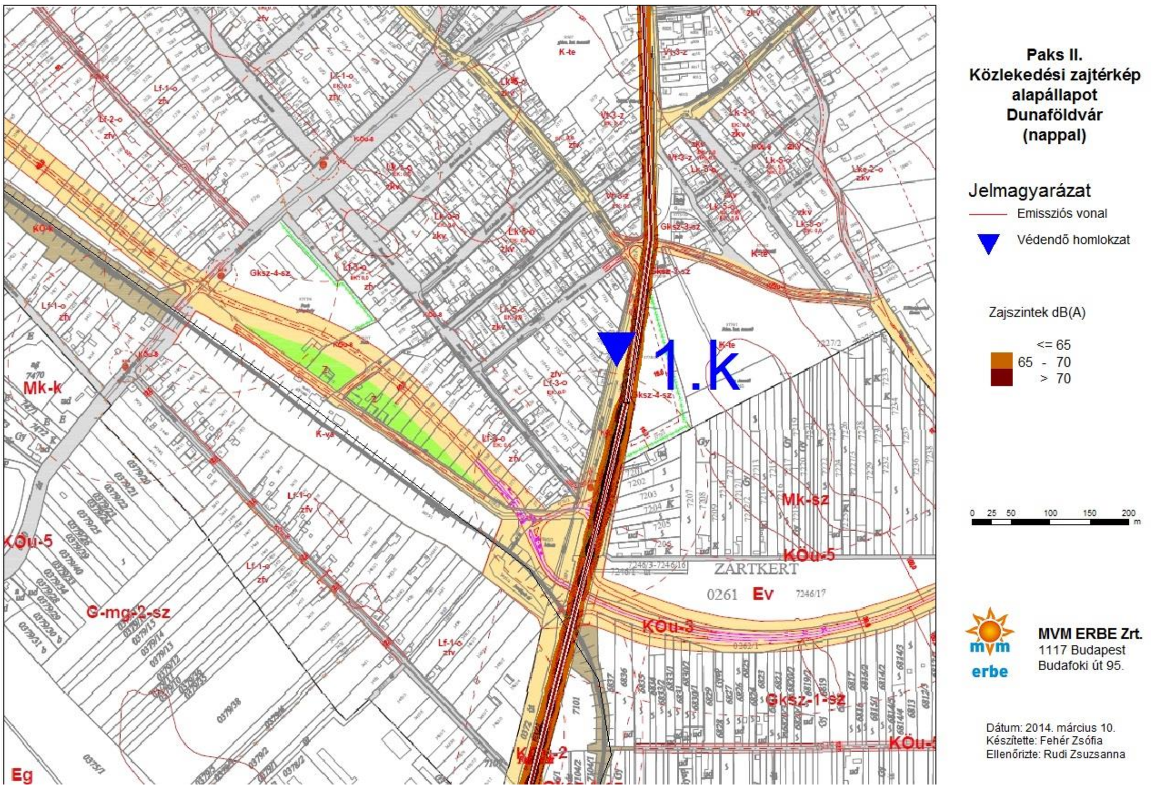
As calculation results can demonstrate *noise load limits* can be maintained at points to be protected along *M6 Motorway* (9-11.) both regarding the baseline load and also including the increment arising from *Paks II. implementation (i.e. 0,6-0,8 dB).* At the points to be protected next to highway nr. 6 (1-8.) the calculation results (and also the baseline measurements) at points to be protected along highway nr. 6 (1-8.) verify limit excess. *The traffic load increment arising from Paks II. implementation will presumably cause traffic increment, and thus the baseline load values will increase by 0,8-2,1 dB.*

The noise load increment emerging in the basic traffic and construction periods displaying for the relevant 25 km area cannot be visually detected (this is why we did not present separately the two statuses on the comprehensive ortophoto, see in Table 15.4.3-1) and the difference is very small even in the blow-up presentation, as demonstrated on the high resolution noise load maps, see in Figures 15.4.3-2 and 15.4.3-15.



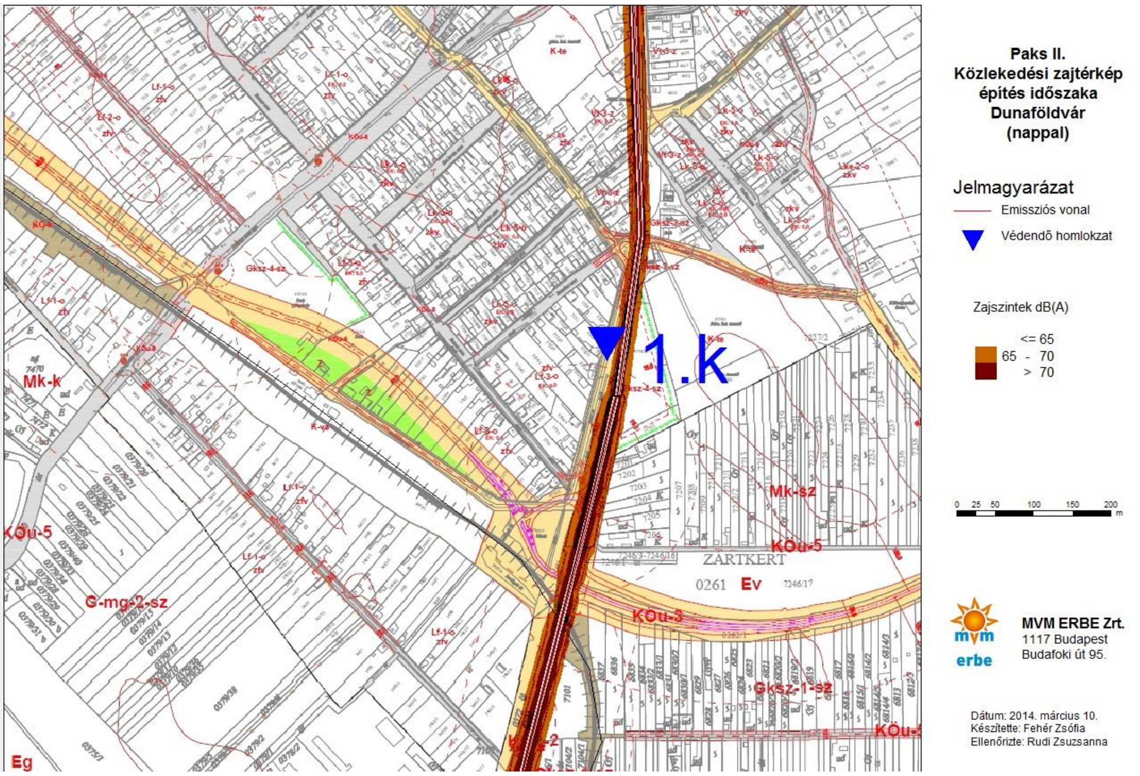
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat - protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure *15.4.3-1: Map of noise caused by traffic - baseline [15-10*



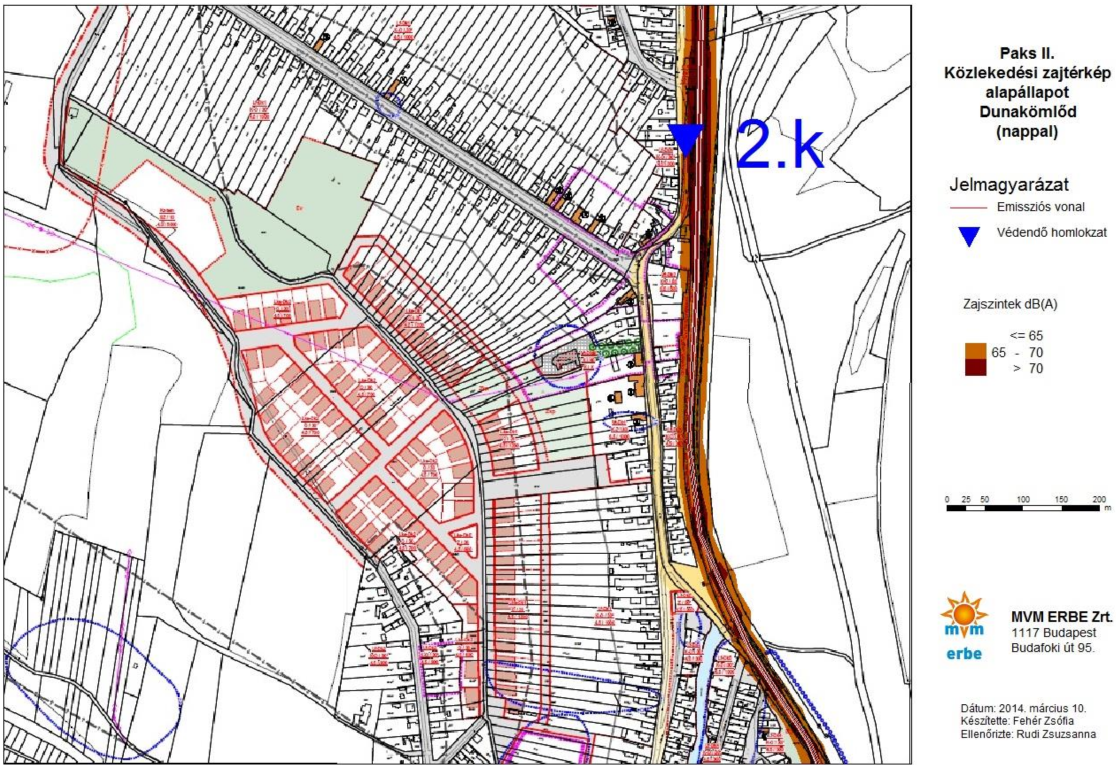
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-2: Map of noise caused by (day-time) traffic- baseline (Dunaföldvár) [15-9]



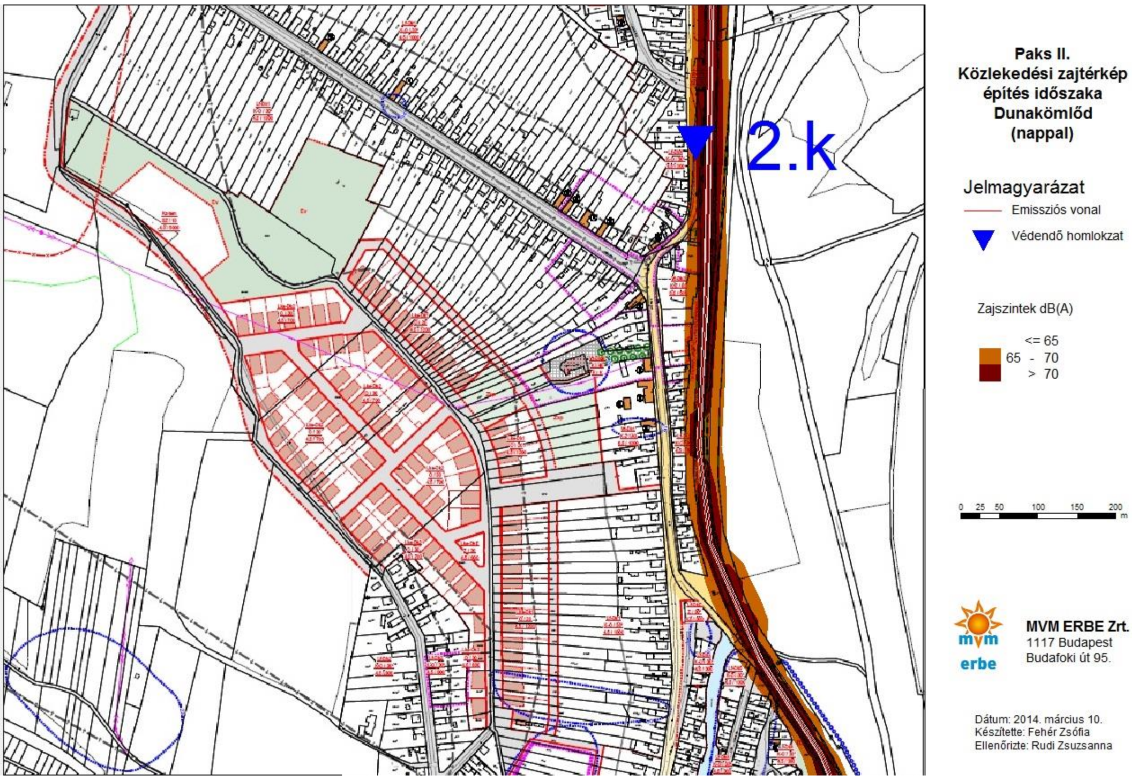
zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-3: Map of noise caused by (daytime) traffic - construction phase (Dunaföldvár) [15-9]



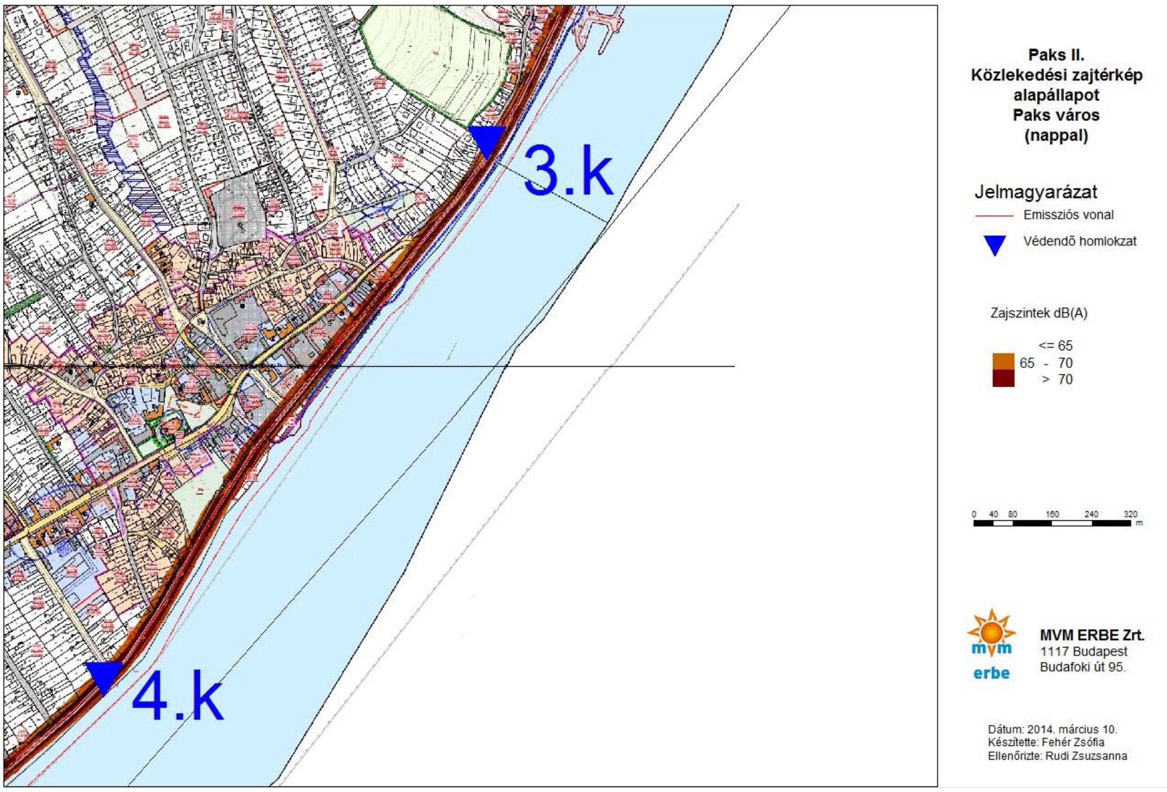
zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-4: Map of noise caused by day-time traffic - baseline (Dunakömlőd) [15-9]



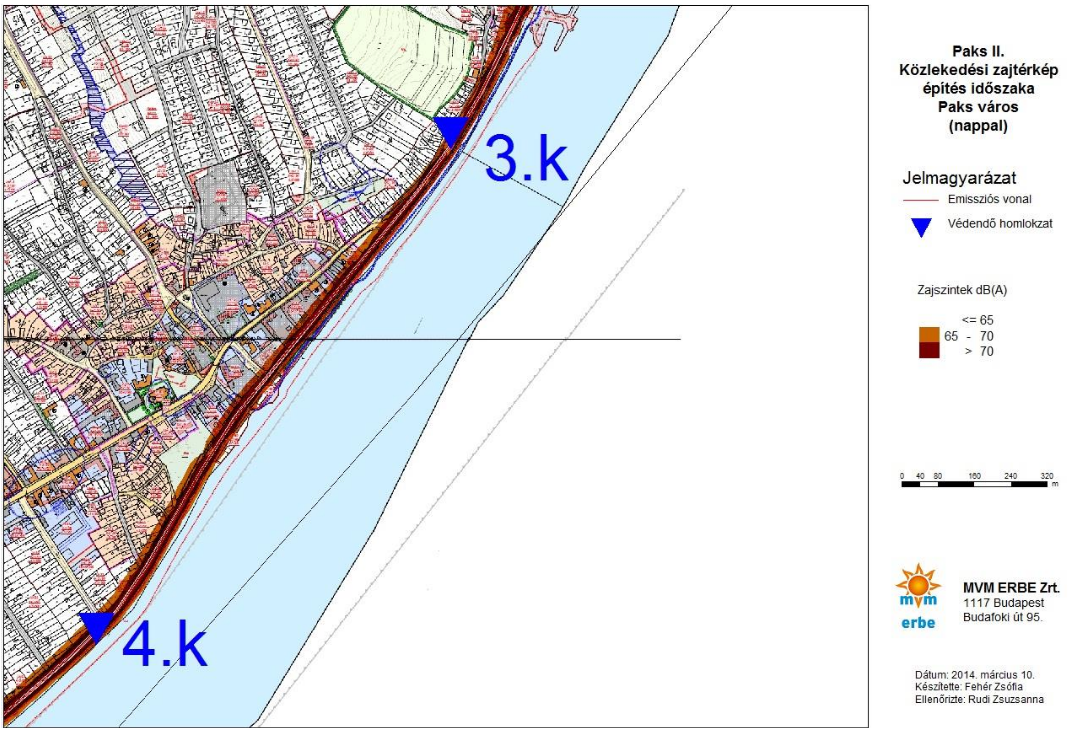
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-5: Map of noise caused by (day-time) traffic - construction phase (Dunakömlőd) [15-9]



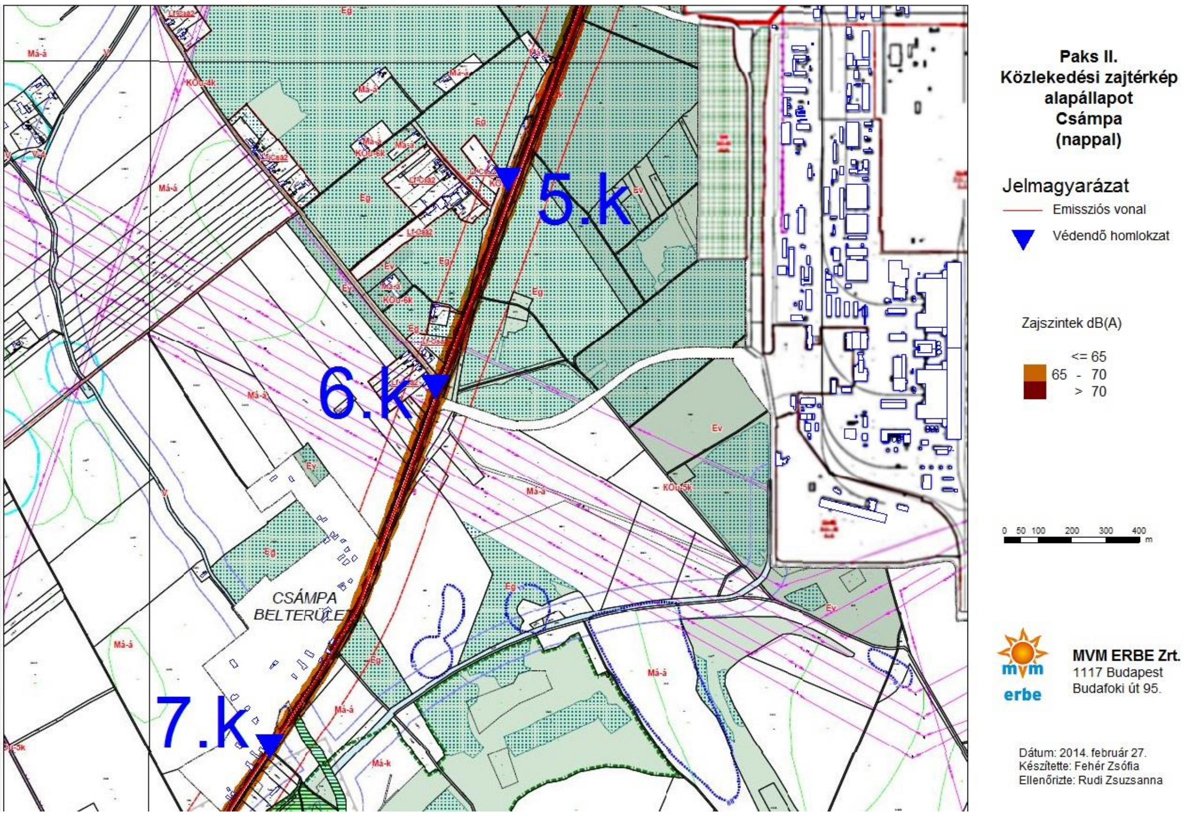
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-6: Map of noise caused by (daytime) traffic - baseline (Paks) [15-9]



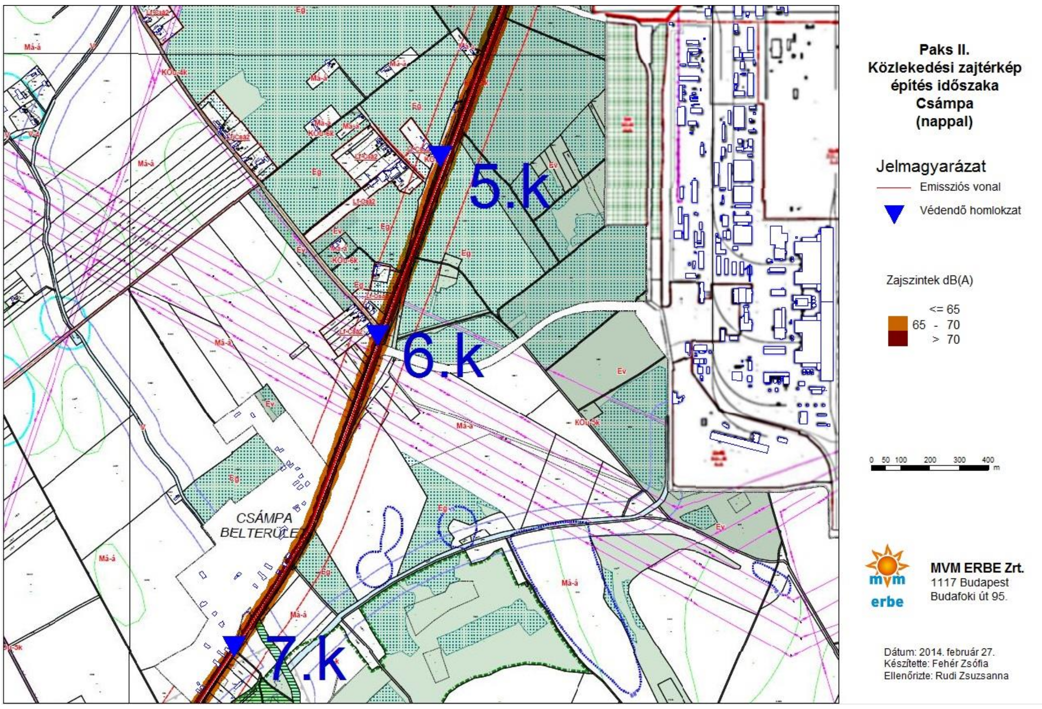
zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-7: Map of noise caused by (day-time) traffic - construction phase (Paks) [15-9]



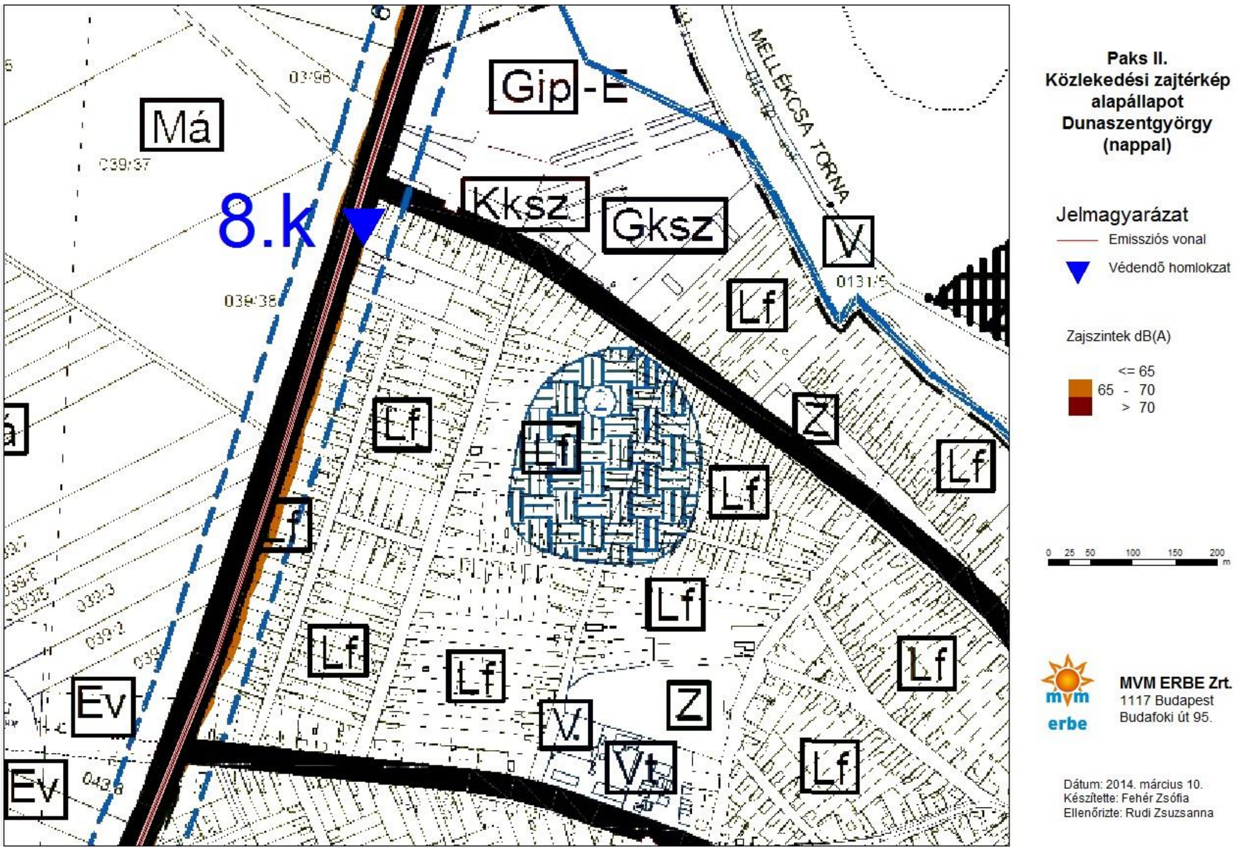
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-8: Map of noise caused by (daytime) traffic - baseline (Csámpa) [15-9]



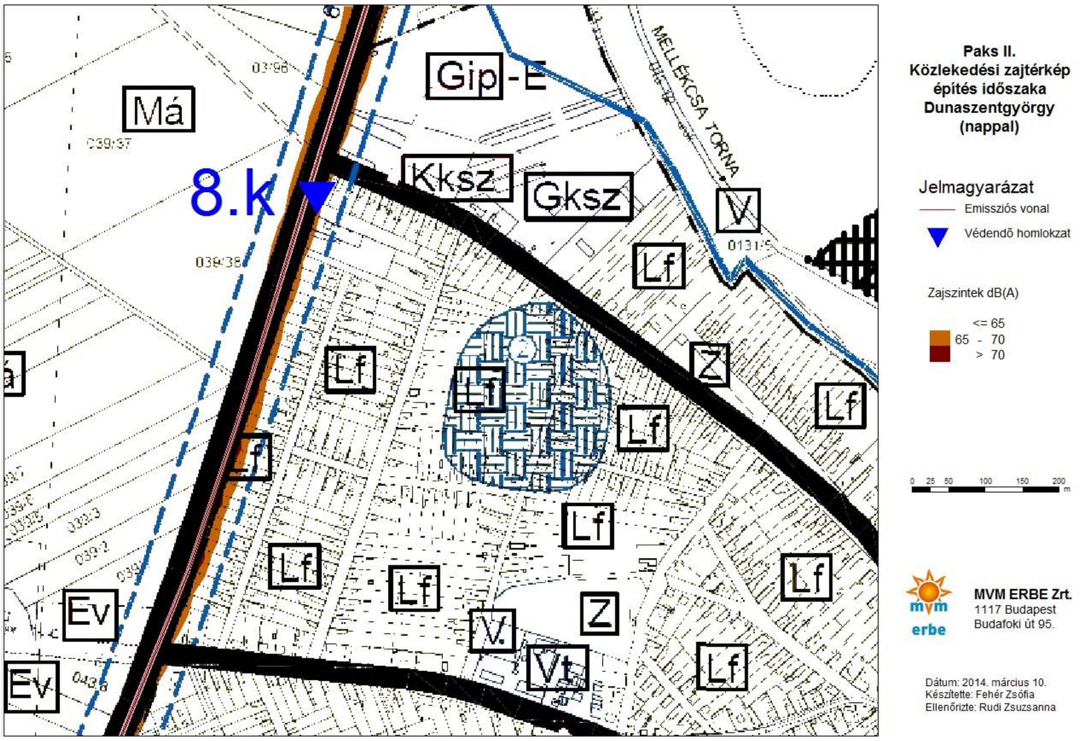
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-9: Map of noise caused by (daytime) traffic - construction phase (Csámpa) [15-9]



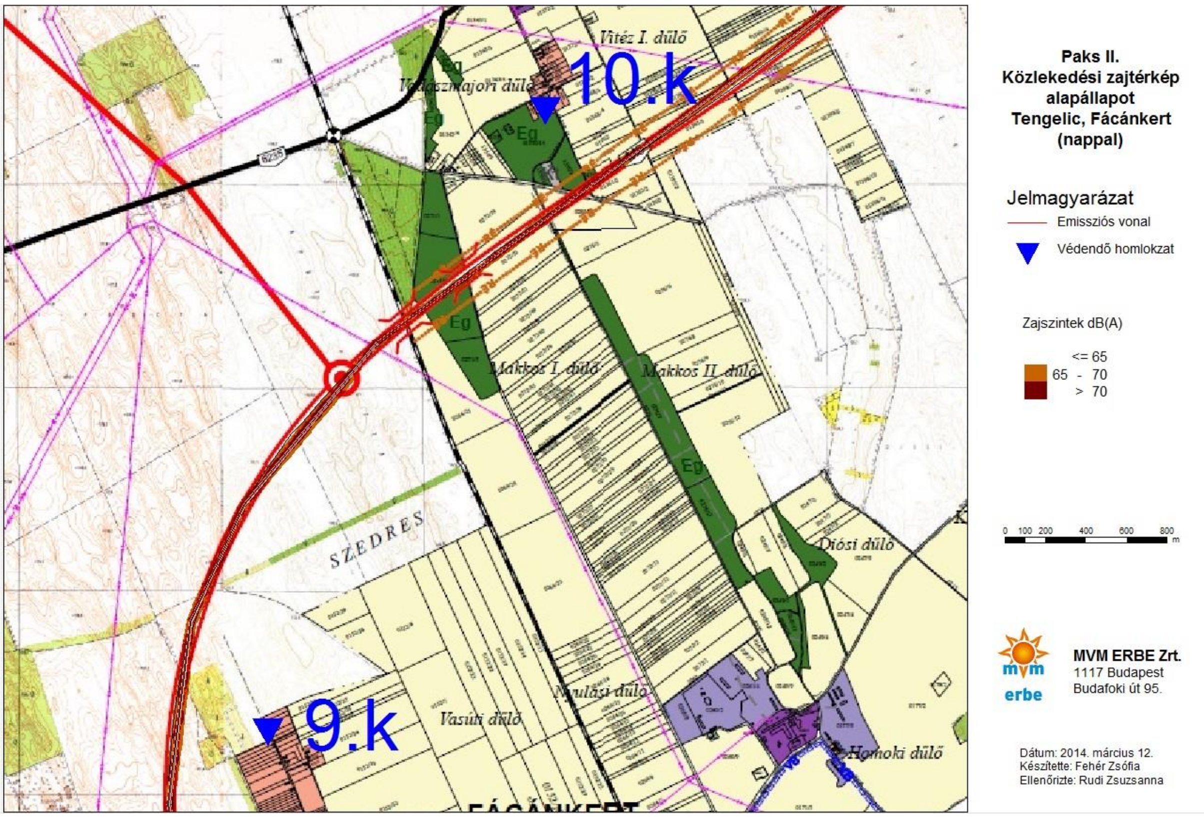
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-10: Map of noise caused by daytime traffic - baseline (Dunaszentgyörgy) [15-9]



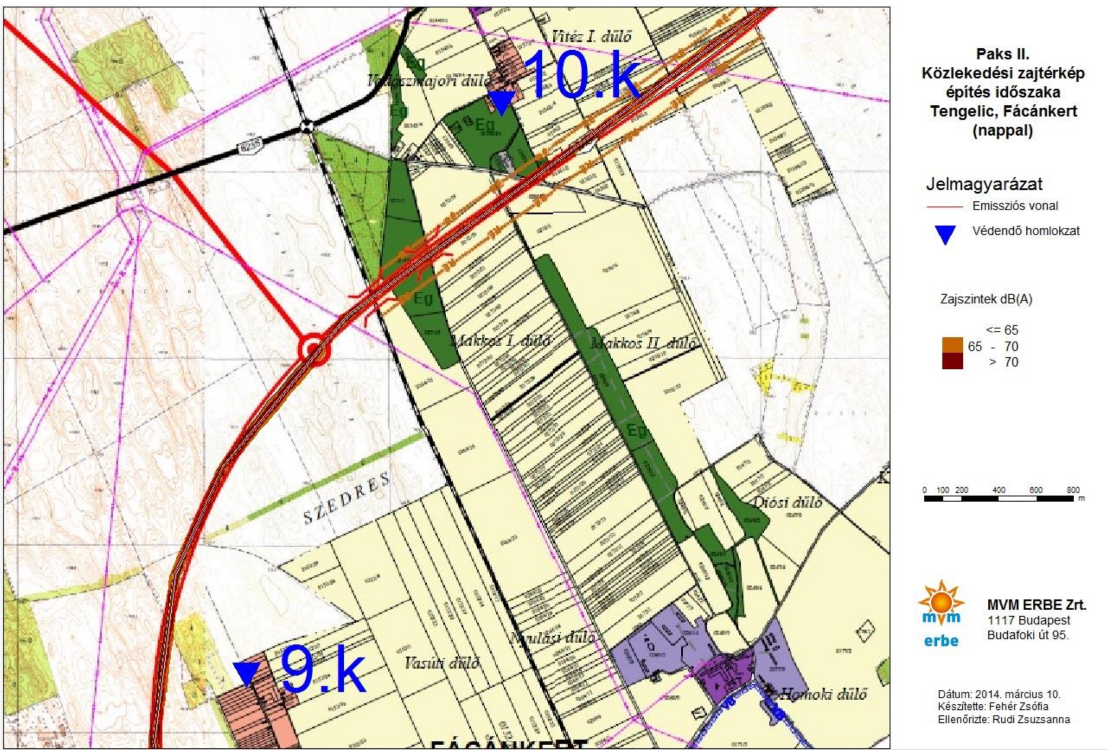
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected favade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-11: Map of noise caused by (daytime) traffic - construction phase (Dunaszentgyörgy) [15-9]



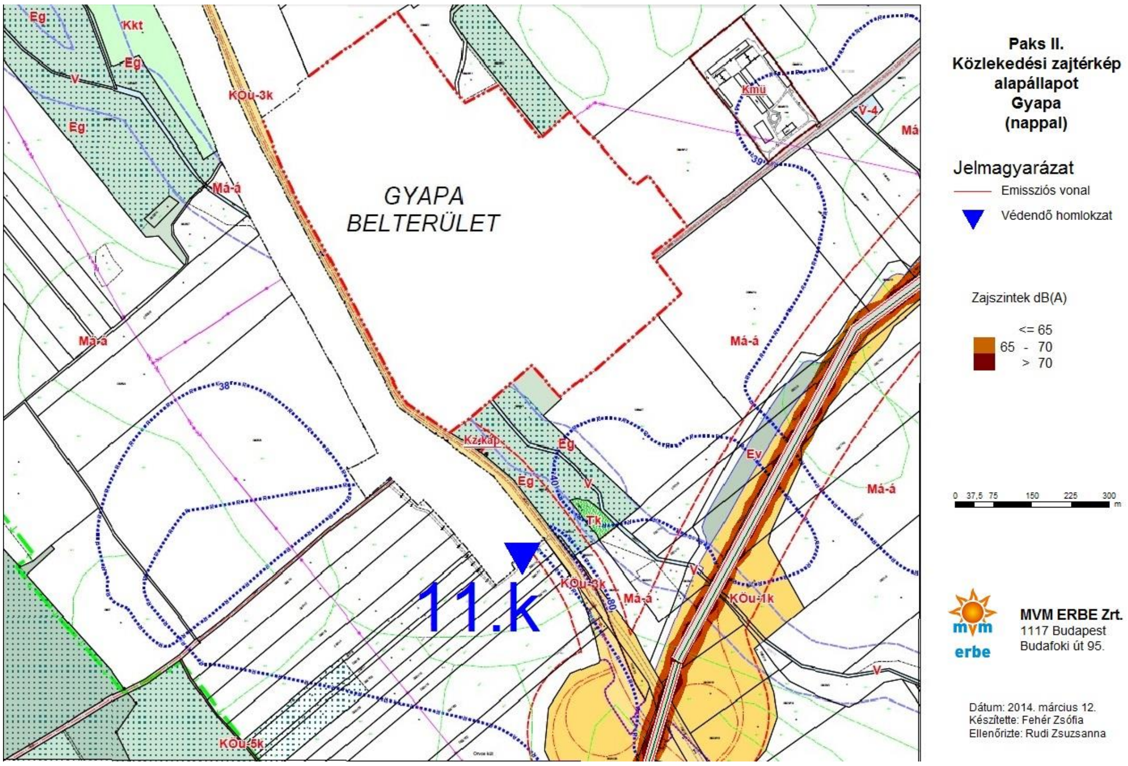
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-12: Map of noise caused by (daytime) traffic - baseline (Fácánkert, Tengelic) [15-9]



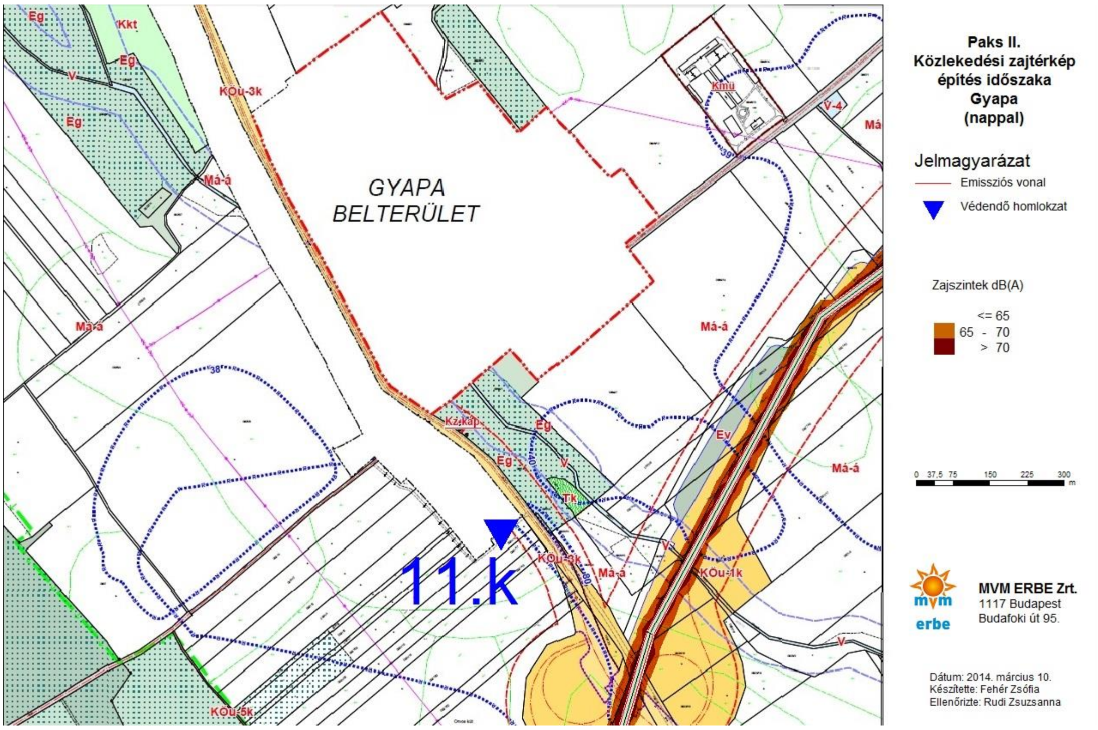
zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-13: Map of noise caused by (daytime) traffic - construction phase (Fácánkert, Tengelic) [15-9]



belterület – inner belt area, zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-14: Map of noise caused by (daytime) traffic - baseline (Gyapa) [15-9]



zajtérkép –noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-15: Map of noise caused by (daytime) traffic - construction phase (Gyapa) [15-9]

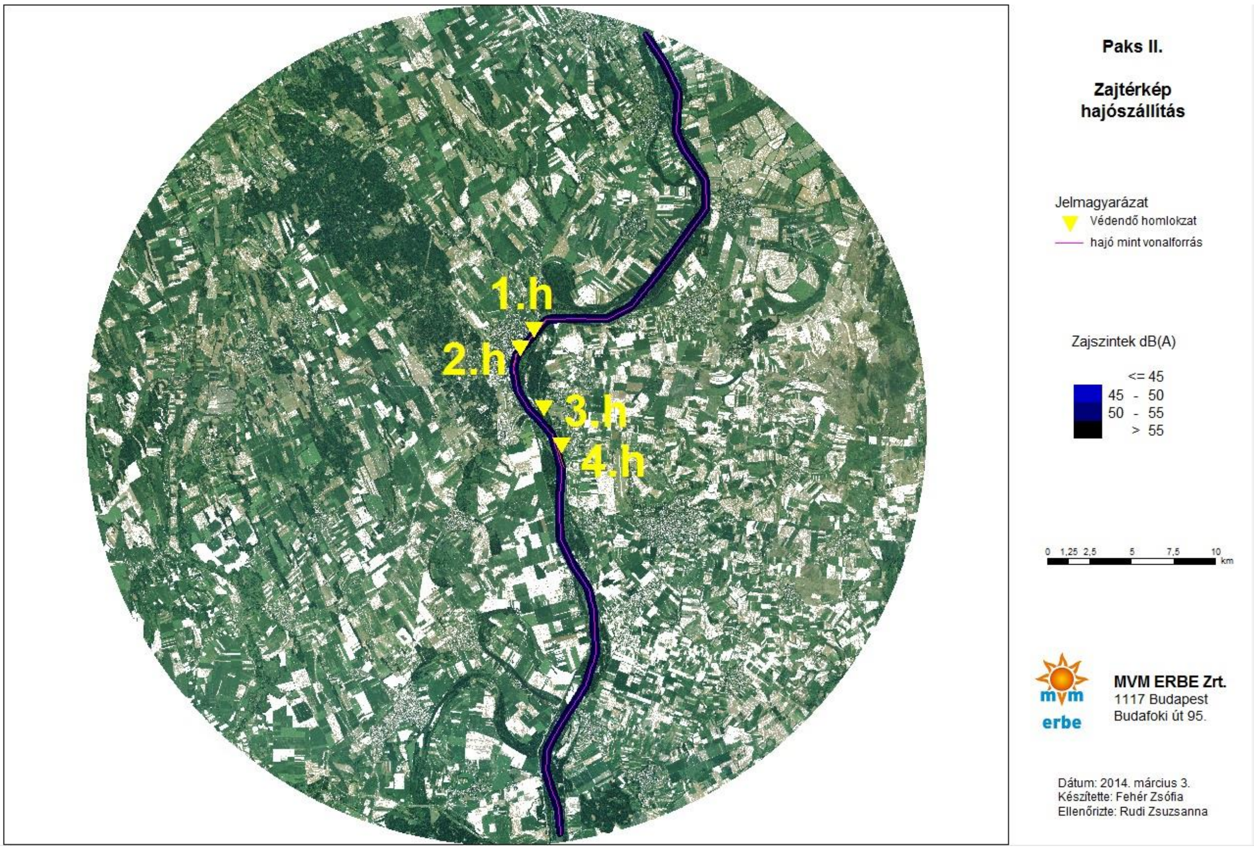
Ship traffic will occur during the foundation period, starting from and arriving at the power plant port to north and south directions along the River Danube. The shipping line is potentially 25 km on both directions but it might be longer (never crossing the national borders).

Decree 27/2008. (XII.3.) KvVM-EüM defines no limit to the ship traffic. Table 15.4.3-6 presents the ship traffic noise load:

Code	To be protected	limit	noise load (dB)
1.h	Paks residential building_1 (ZMP10)	-	44,6
2.h	Paks residential building_2 (ZMP9)	-	46,8
3.h	Dunaszentbenedek (ZMP18)	-	38,7
4.h	Uszód (ZMP16)	-	42,9

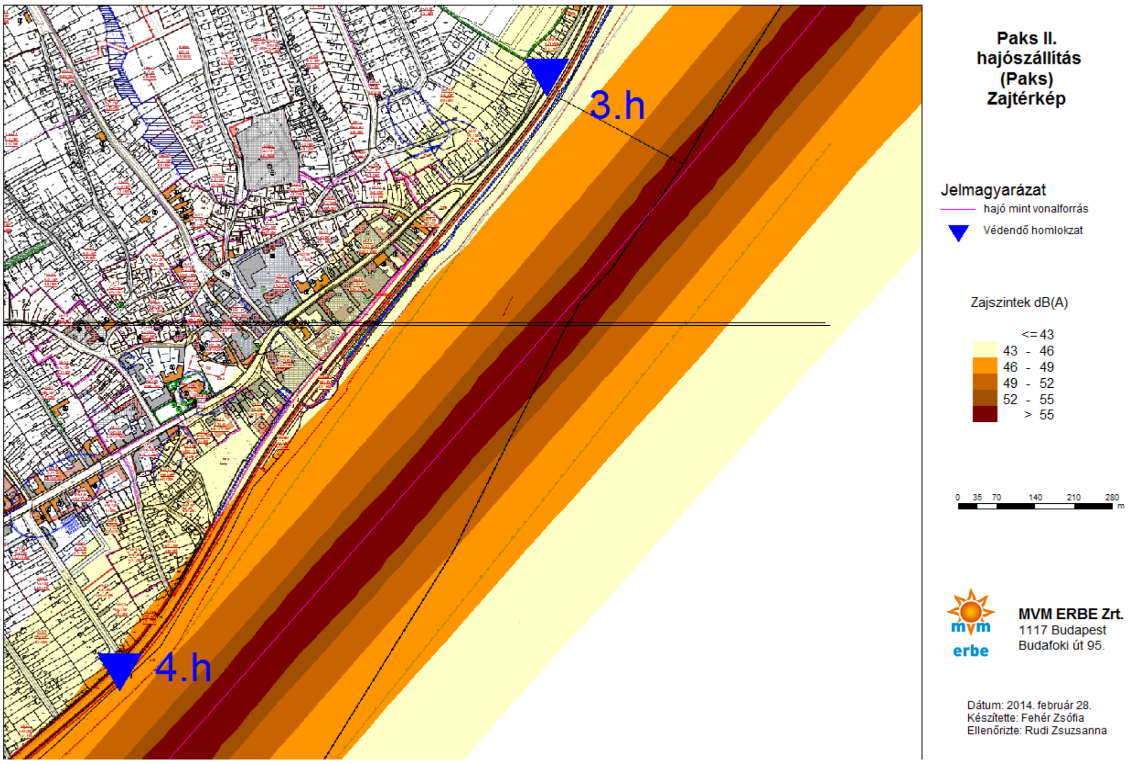
Table 15.4.3-6: A ship traffic noise loade

We prepared a noise load map for the ship traffic noise modelling, including comprehensive ortophoto (see in Figure 15.4.3-16.), high resolution noise load maps (see in Figures 15.4.3-17 and 15.4.3-8).



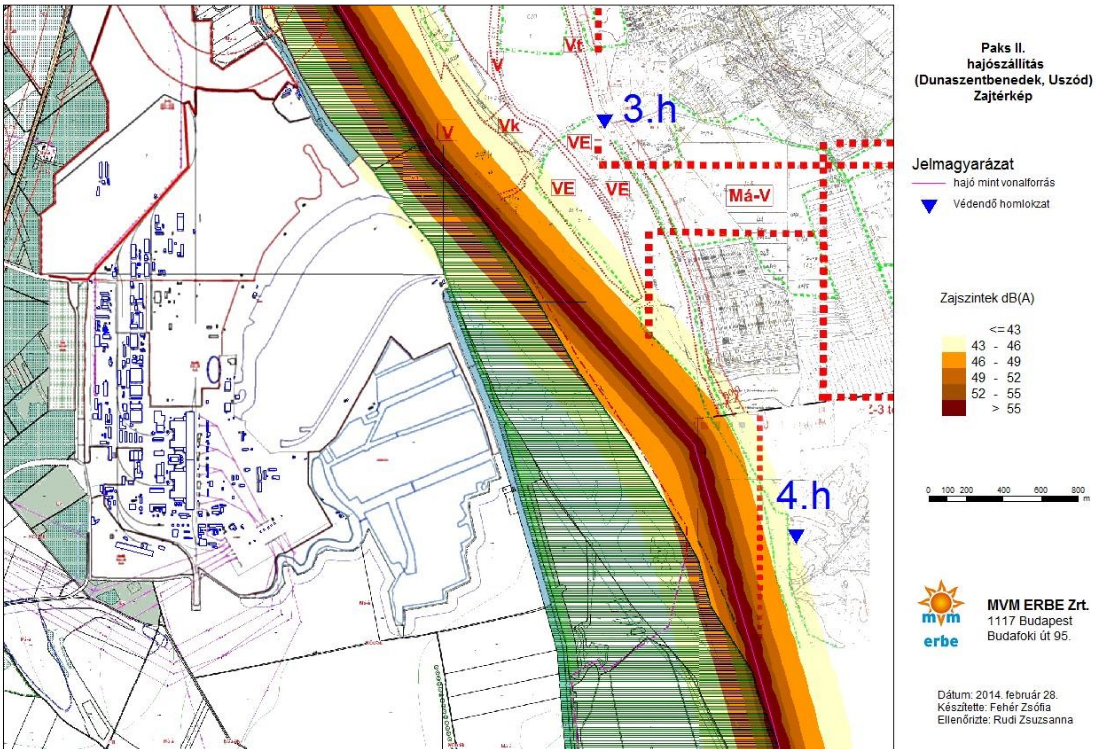
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, hajó mint vonalforrás – ship/barge as line sources , zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-16: Ship traffic - comprehensive noise load map [15-10]



zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, hajó mint vonalforrás – ship/barge as line sources , zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-17: Ship traffic – Noise load map (Paks) [15-9]



zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, hajó mint vonalforrás – ship/barge as line sources , zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-18: Ship traffic – Noise load map (Dunaszentbenedek, Uszód) [15-9]

The railway traffic will also occur during the foundation work period. We assumed daily one (1) freight train moving with 60 km/h speed (1 locomotive engine and 40 freight cars) for the noise calculation starting from Paks II. area towards Előszállás riding the existing railway branch line. The length of the freight train is nearly 580 m. The modelling program can automatically generate the results using the above data and track coordinates.

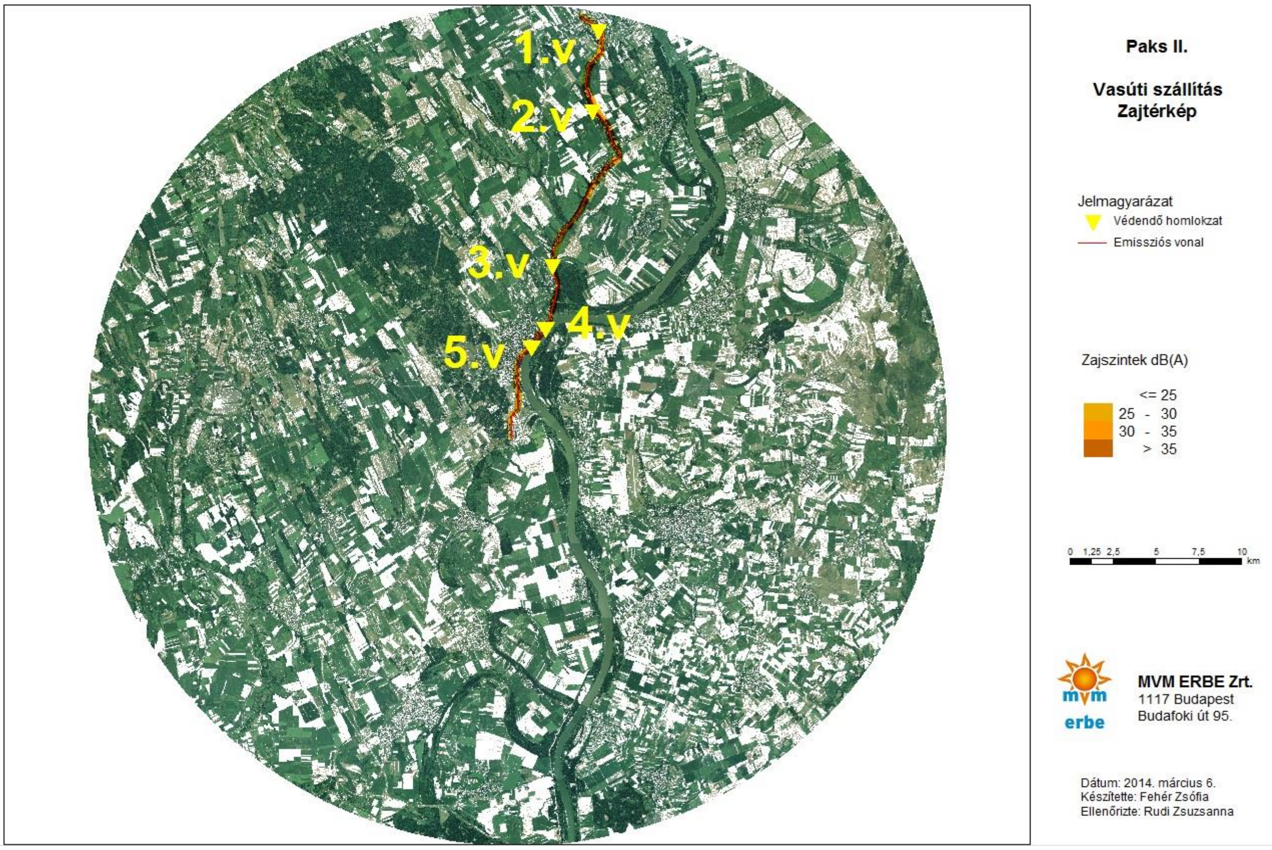
Table 15.4.3-7 presents the railway traffic noise load.

Code	To be protected	daytime limit (dB)	noise load (dB)
1.v	Dunaföldvár residential building	60	32,1
2.v	Bölcske residential building	60	27,8
3.v	Dunakömlőd residential building (ZMP11)	60	30,9
4.v	Paks residential building_1 (ZMP10)	60	38,2
5.v	Paks residential building_2 (ZMP9)	60	38,7

Table 15.4.3-7: railway traffic noise load

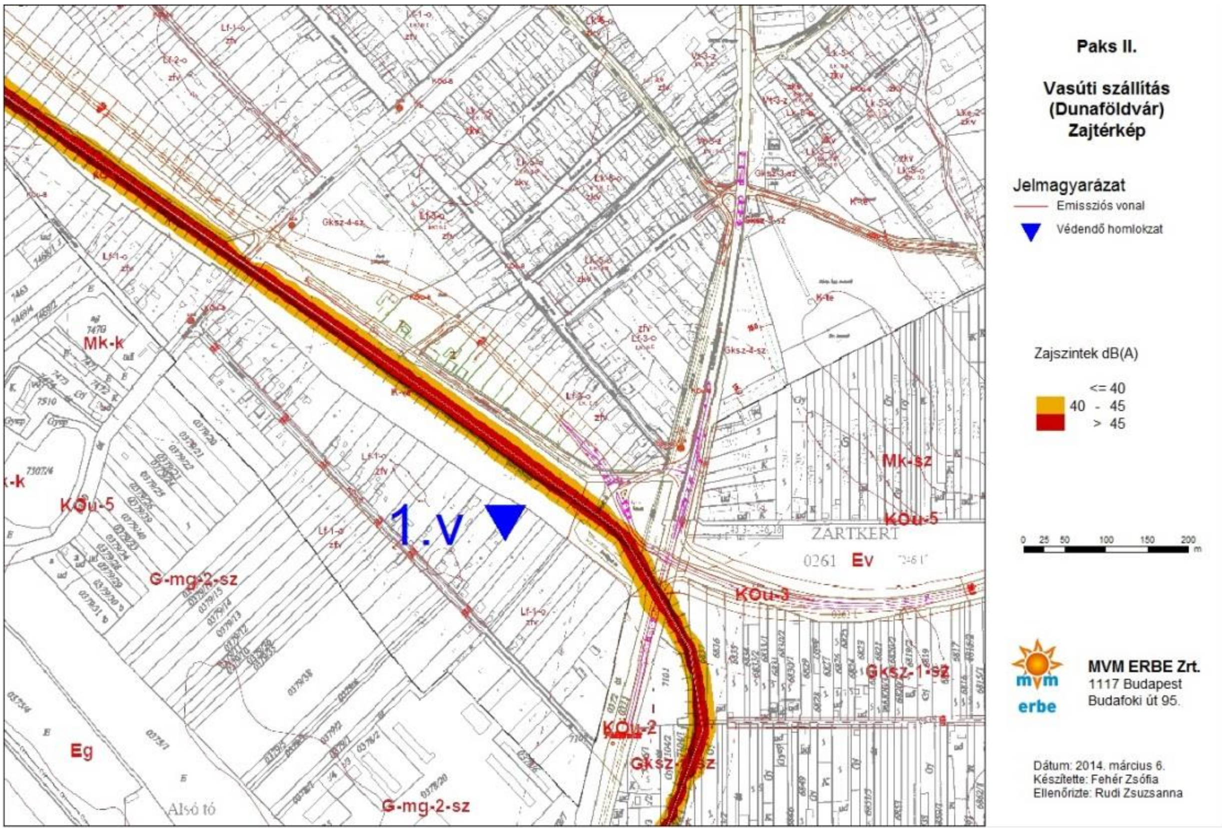
As demonstrated by the calculations, *the limits can be maintained at the areas to be protected during the construction period assuming daily one (1) freight train.*

We prepared a noise load map for the railway traffic noise modelling, including comprehensive figure, a noise load map for every settlement as presented below.



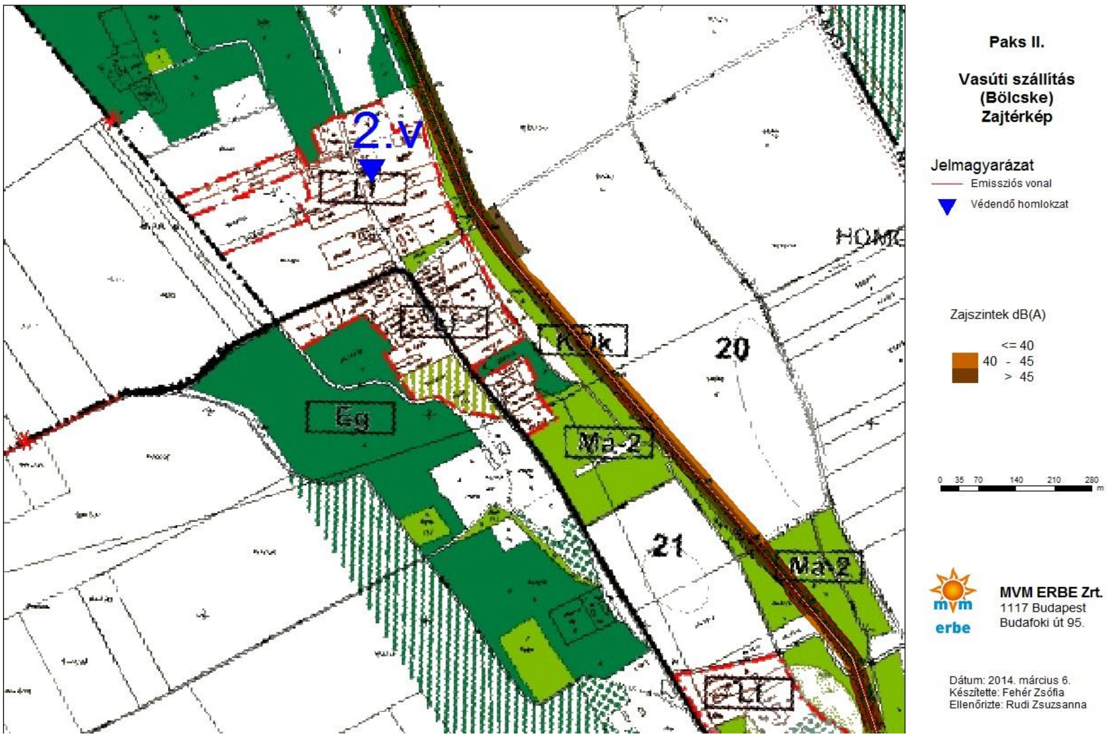
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-19: Railway traffic - comprehensive noise load map [15-10]



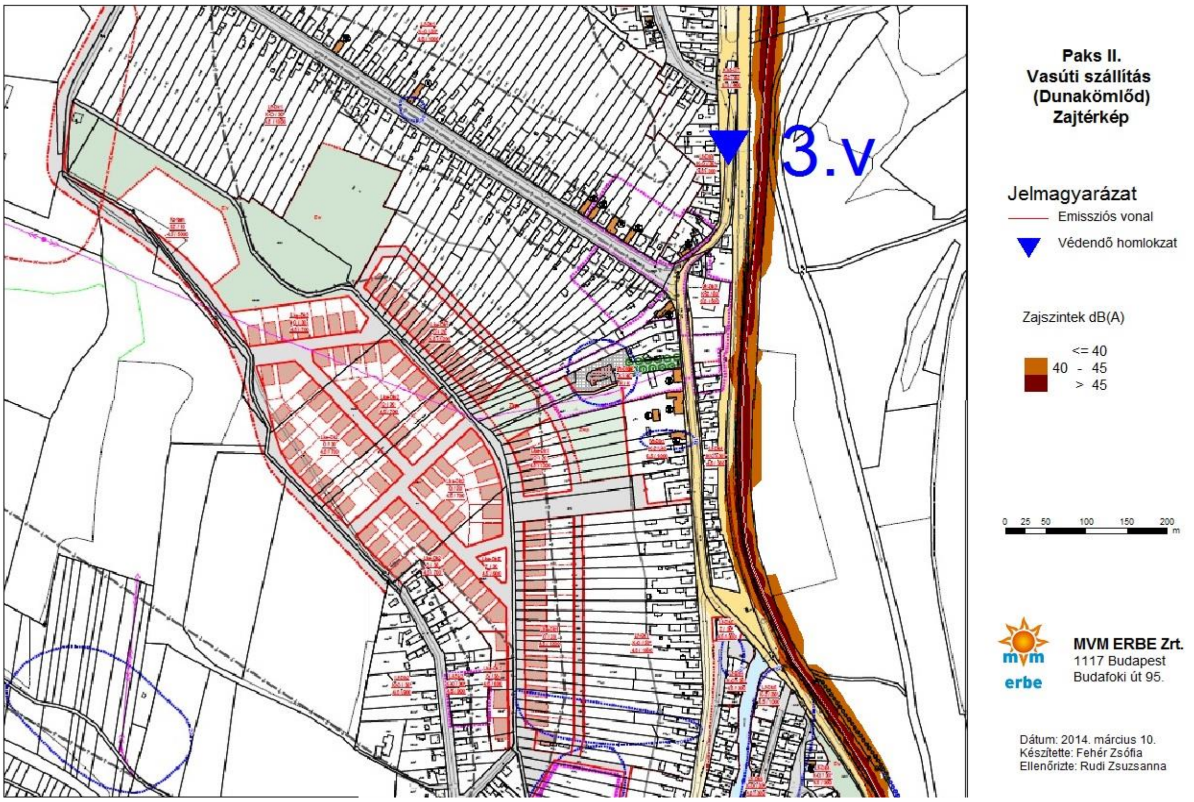
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-20: Railway traffic – noise load map (Dunaföldvár) [15-9]



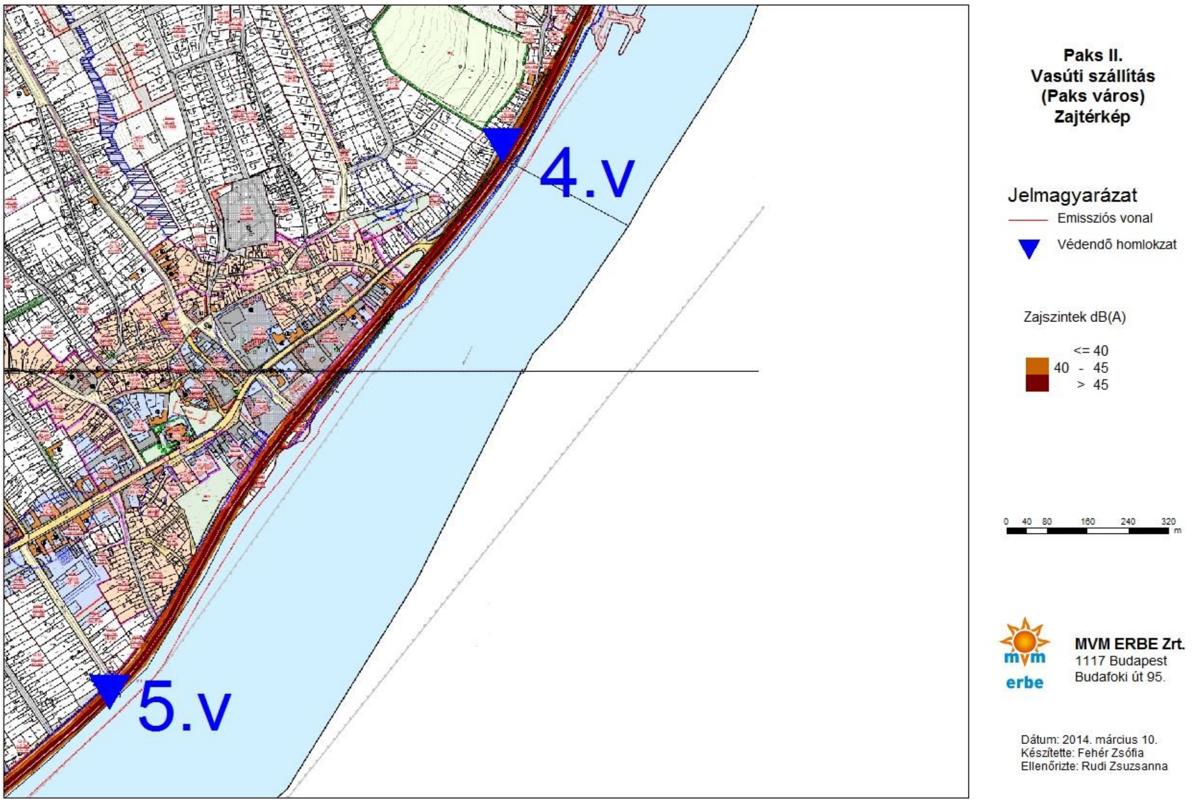
zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-21: Railway traffic – noise load map (Bölcske) [15-9]



zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-22: Railway traffic – noise load map (Dunakömlőd) [15-9]



zajtérkép – noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, emissziós vonal – emission line, zajszintek – noise levels, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.3-23: Railway traffic – noise load map (Paks) [15-9]

15.4.4 IMPACT AREAS OF IMPLEMENTATION

15.4.4.1 Direct impacts

As specified by Article 6 of Decree 284/2007. (X.29.), the borderline of the direct impact area defined from aspects of protection of noise caused by construction works is the line, where the noise load arising from the noise source:

a) is 10 dB lower than the noise load limit, if the background load is minimum 10 dB lower than the limit,
b) is equal with the background load, if the background load is lower than the noise load limit, but this difference is not higher than 10 dB,
c) is equal with the noise load limit, if the background load is higher than the limit,
d) is equal with the noise load limit defined for the resort area except in the environment of business zones that are not to be protected,
e) on areas of business zone that are not to be protected is daytime (6:00-22:00) 55 dB, and at night (6:00-22:00) 45 dB.

The following Table 15.4.4-1 presents that the background load at Csámpa, Paks, Dunaszentbenedek, Uszód - L_{A95} 95% A-sound pressure level.

To be protected	defined background load	background load (dB)
Csámpa (ZMP5)	L_{A95} 95% A-sound pressure level [1]	36,6~37
Paks residential building (ZMP20)	L_{A95} 95% A-sound pressure level	34,7~35
Dunaszentbenedek (ZMP18)	L_{A95} 95% A-sound pressure level	31,9 ~32
Uszód (ZMP16)	L_{A95} 95% A-sound pressure level	31,8 ~32

Comment:
1. *see:* survey of noise and vibration load baseline (appendix)

Table 15.4.4-1: background load on points to be protected

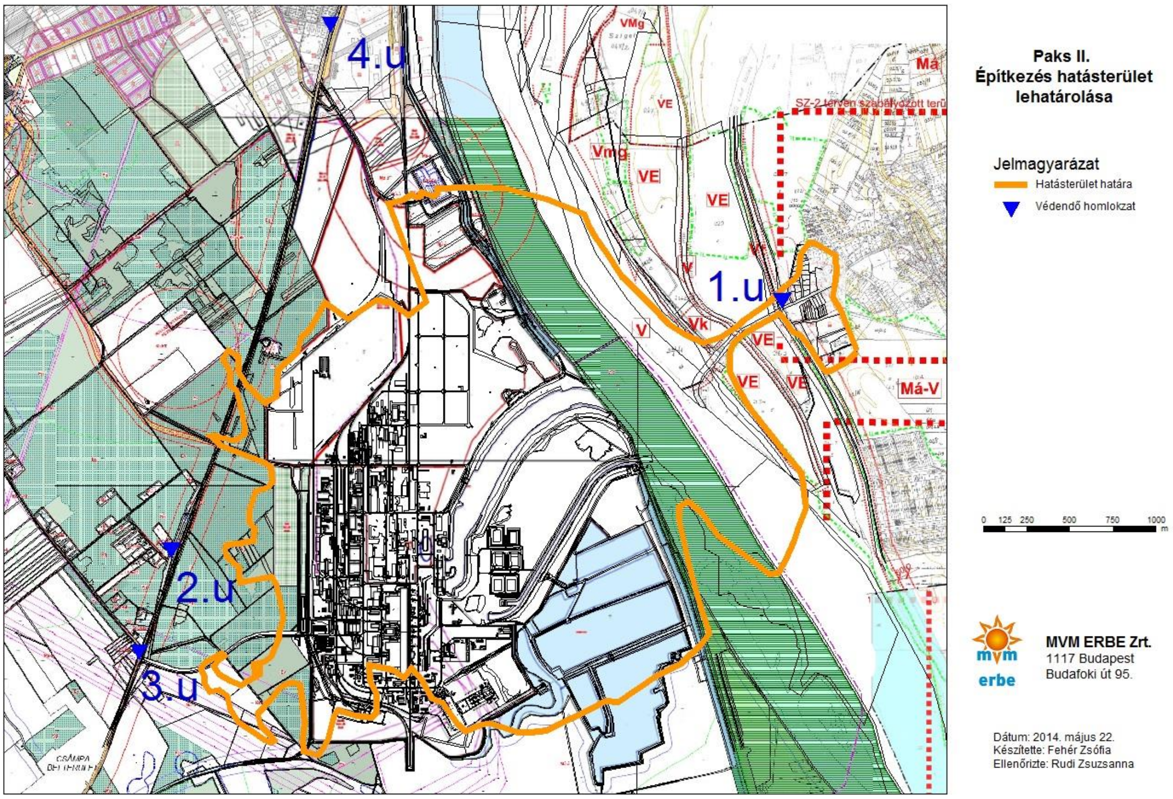
Considering the background load, the "a" and "c" criteria are not applicable on these settlements, and the "b" isolines do not reach those points in Paks, Csámpa, Uszód that are regarded as measuring references.

Impact areas affected by the implementation works in the operation area:

- North to Paks according to "e" criterion - 45 dB,
- towards residential area in Dunaszentbenedek according to "b" criterion towards East - 32 dB,
- to other directions (W, NW, N-NE, SE, S, SW, on non-residential areas of Uszód and Dunaszentbenedek) according to "d" point - 35 dB isoline (*see:* Table 15.1.2-4).

As the above presented raster maps showing the noise load point out the highest noise load figures will emerge during the landscaping and structure construction phases of the construction process. Based on these two peaks or maximum load we defined the aggregated impact area as shown on Figure 15.4.4-1.

We also attach the high resolution presentation of the relevant impact areas on A0 maps and on A1 overall layout map (for the implementation, operation, operational irregularity phase, and Paks II. + Paks Nuclear Power Plant co-operation).

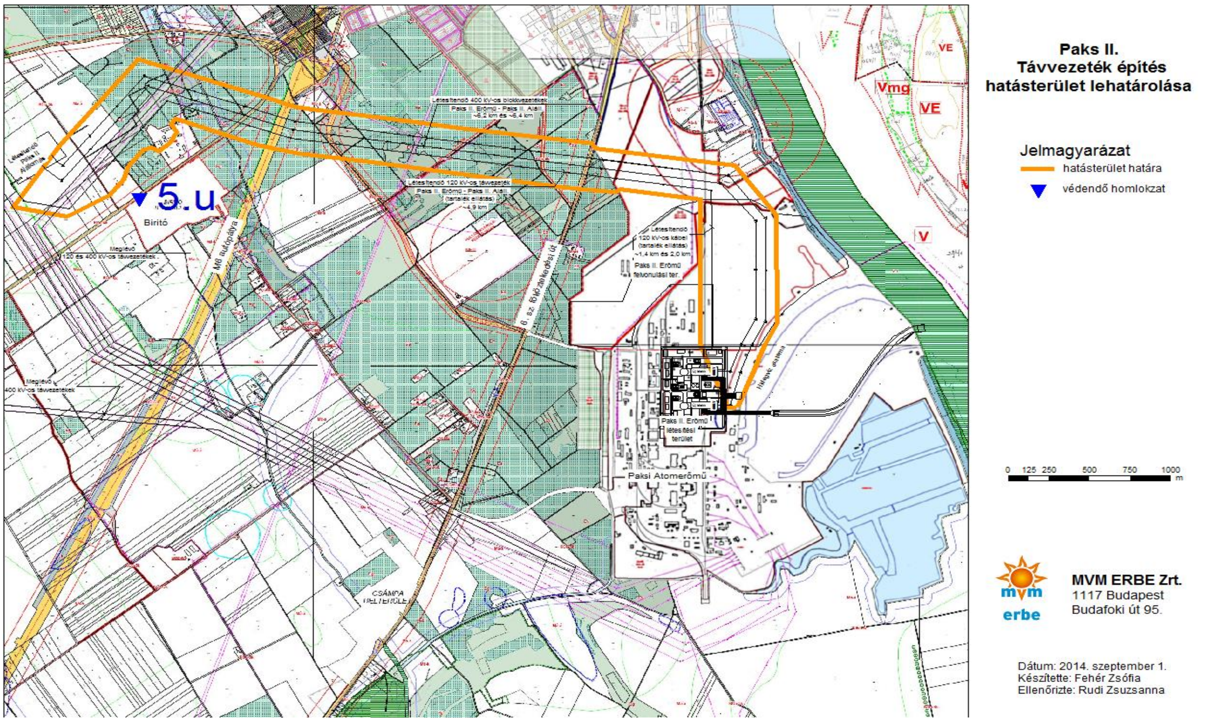


jelmagyarázat – legend, védendő homlokzat – protected facade, hatásterület határa – borderline of impact area, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.4-1: Aggregated construction impact area of the construction area [15-9]

The aggregated construction impact area covers the Paks Nuclear Power Plant site and non-residential adjacent areas, and the residential buildings along the River Danube River and on the western side of Dunaszentbenedek village.

We prepared the map showing the aggregated impact areas for the transmission line construction works by matching the noise load raster maps, covering the maximum possible noise load area, as shown in Figure 15.4.4-2.



jelmagyarázat – legend, védendő homlokzat – protected facade, hatásterület határa – borderline of impact area, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure *15.4.4-2: Transmission line construction aggregated impact area [15-7], [15-9]* Landscaping and foundation works will cause the maximum noise load during transmission line construction process. We calculated and estimated the impact area based on the said two phases.

Aggregated impact area assumed for the transmission line construction (assuming only daytime works, contrary to the plant constructions)

- for business zone not to be protected according to "e" criterion along isoline 55 dB,
- in zones not to be protected from noise according to "d" criterion along isoline 50 dB (see: resort area, daytime Table 15.1.2-4),
- towards Biritó residential area along isoline 45 dB.

In the last case we used "a" criterion: 10 dB lower than the noise load limit, if the background load is at least 10 dB lower than the limit. (reference for estimating the background load: ZMP6, where 27 dB L_{A95} 95% A-sound pressure level.)

The aggregated impact area for the transmission line construction is calculated cca. 70 m from the line in the business zone, cca. 100-150 m from the line in the environment not to be protected from nose, and 120-300 m towards Biritó (where the forest coverage is higher, the impact area is smaller, and where it is smaller, the impact area is larger, because the noise mitigating impact of the forest is ignored).

15.4.4.1.1 Public road traffic

During the construction period traffic will cause additional noise load, Article 6 of Government Decree 284/2007. (X.29.) provides the following definition for the relevant impact area:

- the area to be protected from noise is next to the traffic lines where the traffic and transportation activity can cause minimum 3 dB additional noise load change.

In case of noise caused by traffic source, the background load:

- if there are several sources of traffic, then it is equal with the aggregate noise load $L_{AM,közl}$ judging level of such noise from traffic sources,
- in case of noise of several types caused by traffic, it is equal with the aggregate $L_{AM,\ közl}$ value of such sources ,
- if there is no other noise impact detected from traffic, or the noise cannot be separately analysed independently of such other noises, it is equal with $L_{Aeq,\ measured}$ A-sound pressure level.

The change in noise load caused by road traffic during the demolishing and construction period is between 0,6-2,1 dB, thus we cannot define the road traffic impact area for the *construction and demolishing phases of the project as specified in the Decree.*

15.4.4.1.2 Railway and water traffic

The railway and ship traffic along the relevant section of the study is so low that the change in the noise load is practically zero during the most unfavourable period (this is how the maximum impact area evolves).

The background load on the adjacent area to be protected from noise is presented in Table 15.4.4-2:

	background load
Paks residential building_2 (ZMP9)	$L_{AM,\ közl}$= 65 dB
Paks residential building_1 (ZMP10)	$L_{AM,\ közl}$=62 dB
Uszód (ZMP16)	$L_{Aeq,\ measured}$=49 dB
Dunaszentbenedek (ZMP18)	$L_{Aeq,\ measured}$=40 dB
Dunakömlőd (ZMP11)	$L_{AM,\ közl}$= 68 dB

Table 15.4.4-2: Background load in areas to be protected from noise

The theoretical borderline of the impact area is an isoline that is calculated in such a way that we logarithmically added the baseline load relevant to each study point to the noise load, and analysed those cases where the baseline load can increase along the isoline with 3 dB, i.e.

- towards Dunaszentbenedek 43 dB
- towards Uszód 52 dB
- in case of Paks residential building_2 68 dB, and
- in case of Paks residential building_1 65 dB isoline.

This line is practically located nearly 20-25 m parallel with the ship cruising line towards Paks, 125 m towards Uszód and 640 m towards Dunaszentbenedek .

The theoretical border of the impact area cannot reach the area or building on the area to be protected in any of the studied settlements, thus the ship traffic (either periodical, or exclusively related to the foundation works – with very low intensity, and may include daily 1 towing ship with 6 barges) *will have no impact area.*

Traffic of one (1) freight train and its noise load will not increase the background load at the residential buildings in Dunakömlőd and Paks, so no impact area can be defined, and no baseline measurement was performed in Bölcske and Dunaföldvár. Assuming a lowed background load (we used measured reference figures in Uszód village), there is no impact area in Bölcske and Dunaföldvár regarding any area to be protected. This might be in theory applied onto the adjacent areas to be protected, but the border of the impact area does not reach the area to be protected, thus it cannot be applied for the area, and if we assume a higher background load then the impact area cannot be interpreted even in theory.

There is no impact area on the areas to be protected, and at facades to be protected arising from railway traffic (daily one freight train) during the implementation period.

15.4.4.2 Indirect impacts

Areas of indirect impacts: „the propagation area of advancing impact processes driven by changes in the environment status in the direct impact areas in accordance with those environmental elements and systems that are affected by any of the impact processes".

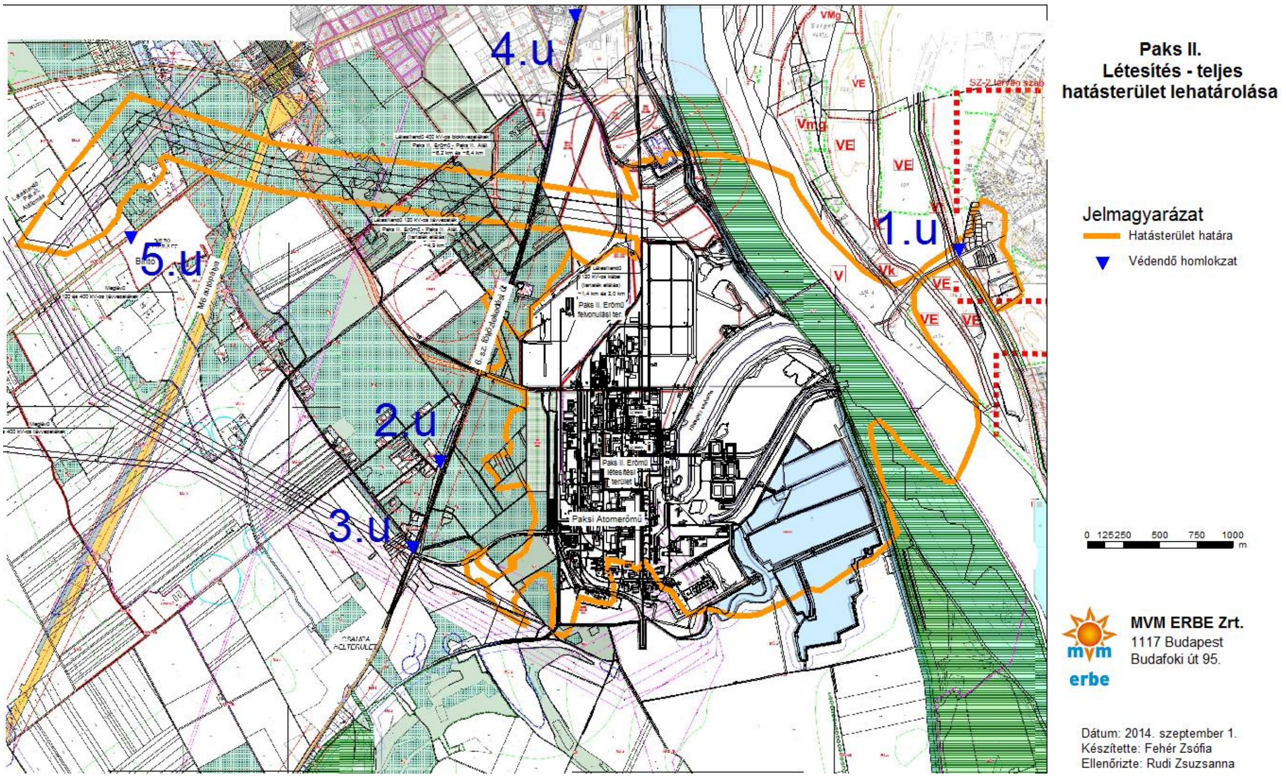
As described above, the traffic increment on highway nr. 6 may induce enhanced traffic impact towards M6 Motorway, and thus drivers of vehicles travelling or wishing to travel on highway nr. 6 (vehicles other than going into or leaving the power plant) may decide to rather avoid Road no.6 and prefer M6. Related to the power plant construction the traffic increment will have no major impact onto highway nr. 6, and will not lead to a situation where we may assume a major increase in the traffic (as a by-pass road) for M6 Motorway, because the model studied the option that the total traffic increment would select M6 Motorway as the by-pass road during the power plant construction phase, and the arising total was ignorable only for M6 Motorway.

15.4.4.3 Cross-border environmental impacts

No cross-border noise impact can be assumed arising from the Paks II. project implementation.

15.4.5 TOTAL IMPACT AREA OF THE IMPLEMENTATION

Figure 15.4.5-1 presents the aggregated impact area of the implementation as the totality of all direct and indirect impact areas.



jelmagyarázat – legend, védendő homlokzat – protected facade, hatásterület határa – borderline of impact area, dátum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.4.5-1: Total impact area of implementation [15-7], [15-9]

15.5 AMBIENT NOISE IMPACT OF PAKS II. OPERATION AREA

15.5.1 LIMITS FOR OPERATION

Appendix 1 of Decree 27/2008. (XII.3.) KvVM-EüM contains the limits for the operation. Decree 32/2008. (XII.17.) of Paks Municipality defines the zones and thus modifies the relevant limits, and this was also taken into consideration.

15.5.2 IMPACT FACTORS CAUSING NOISE LOAD

Power plant operation area

Outdoor and indoor pieces of equipment, including water facilities and water treatment engineering objects along the River Danube

Route of transmission lines

Transmission lines operation

Supplies

Transportation of operators
Periodical transportation (supply) of auxiliary materials, pieces of equipment and machines related to operation

15.5.3 ORDINARY OPERATION

Paks II. Power Plant facilities will be constructed on areas owned by Paks Nuclear Power Plant. The main indoor noise sources in Paks II. will be in the reactor building, the primary line auxiliary building, the turbine building, and the safety cooling towers. Diesel generators, auxiliary boiler located in separate buildings and the outdoor stand-by network transformer will only periodically operate if and when required.

The dominant noise sources in the reactor building will be the steam generators and the main circulating pumps. The primary line is installed in the steel containment, surrounded with a shielding building made of reinforced concrete. The primary line auxiliary building is also made of reinforced concrete structure, and it contains the compressor room and primary line ventilation unit, as noise sources. The turbine building is also made of reinforced concrete structure where the secondary line equipment operate; turbine, generator, condenser, and this building also contains a compressor room, and ventilators support the building ventilation. There are pump sheds with reinforced concrete structure located next to the safety cooling unit. Ventilators of the safety cooling unit will be outdoor noise sources, and 1- and 3-phase transformers will be installed on the transformer room, as additional and significant sources of noise emission. Further outdoor noise sources: spillover dam related to the cooling system, water intake work (including indoor noise sources in the sub-surface reinforced concrete building), and energy breaker engineering object and recuperation power plant, both to be constructed at the bank of the River Danube.

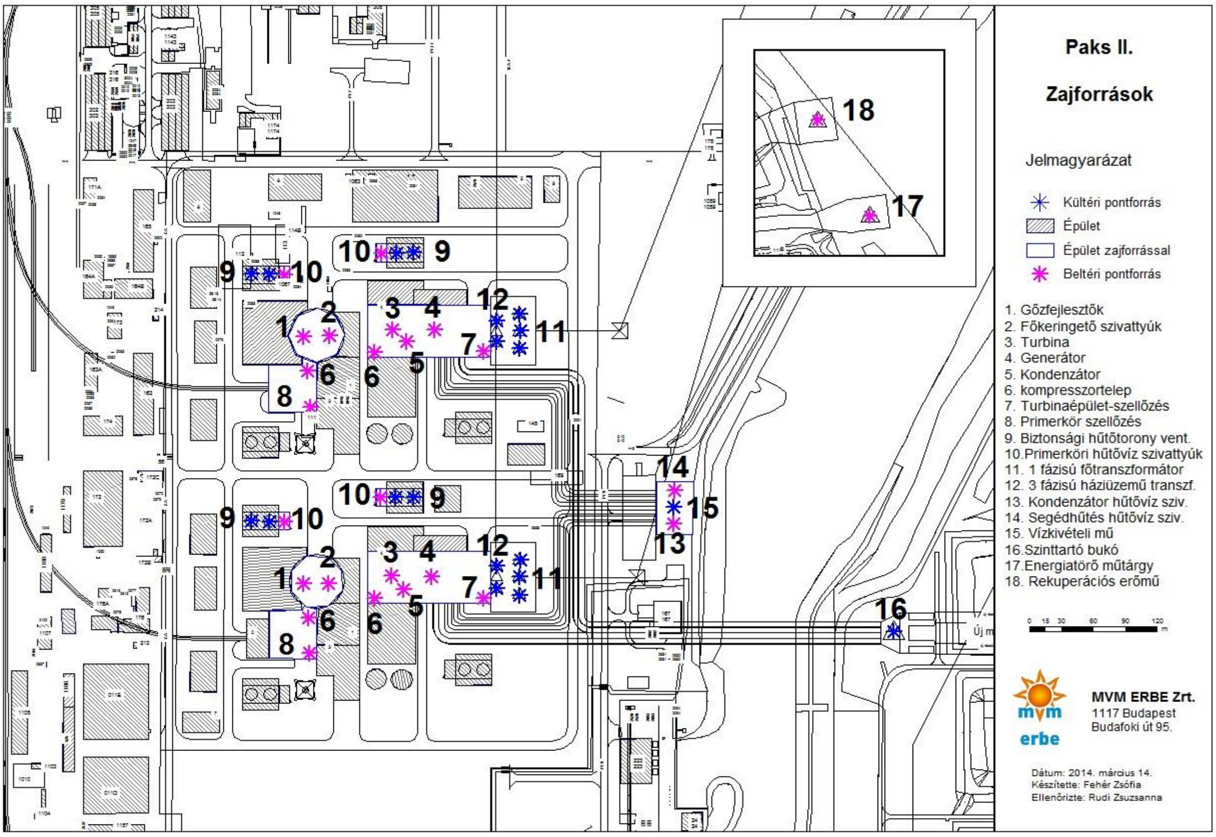
Table 15.5.3-1 presents the main noise sources.

Noise source code	Name of noise source	operation time (h./day)	location of operation	L_P dB(A)	L_W dB (A)
1	Steam generators (2)	24	in building	85	112
2	Main circulation pumps (2)	24	in building	85	108
3	Turbine (2)	24	in building	85	117
4	Generator (2)	24	in building	85	114
5	Condenser (2)	24	in building	80	107
6	Compressor room (4)	2	in building	80	100
7	Turbine building ventilation (2)	24	in building	60	93
8	Primary line ventilation (2)	24	in building	60	91
9	Safety cooling tower ventilators (8) [8 stand-by]	24 [0]	outdoor	(85) 67*	98
10	Primary line cooling water pumps (4) [4 stand by]	24 [0]	in building	80	97
11	1 phase main transformer (6)	24	outdoor	(90) 75*	100
12	3 phase in-house operation transformer (4)	24	outdoor	(80) 70*	92
13	Condenser cooling water pumps	24	in building	85	106
14	Auxiliary cooling water pumps	24	in building	80	97
15	Water intake work	24	outdoor	60	91
16	Spillover dam	24	outdoor	80	113
17	Energy breaker engineering object	24	outdoor	75	110
18	Recuperation water power plant	24	outdoor	78	113
19	Auxiliary boiler	0	in building	80	101
20	Diesel generator (4)	0	in building	100	121
21	Stand-by / ignition network transformer	0	outdoor	70	92

Table 15.5.3-1: Main noise sources

Comment: * The pieces of equipment shown in Table 15.5.3-1 were considered and presented on the basis of the noise modelling and noise abatement required for ensuring compliance with the relevant limits. The 1-phase main transformers shall be equipped with 15 dB, the 3-phase in-house operation transformers with 10 dB, and the safety cooling tower ventilators with 18 dB noise abatement.
We calculated the sound power levels from the sound pressure levels using the dimensions of noise sources, types of measuring surface, and the measuring distance. (mostly using Soundplan, where dimensions and surfaces can be well defined).

Location of noise sources active during ordinary operation is presented in the following Figure 15.5.3-1:



zajforrások – noise sources, jelmagyarázat – legend, kültéri pontforrás - outdoor point source, épület - building, épület zajforrással – building with noise source, beltéri pontfrorrás - indoor point source, datum – date, készítette – prepared by, ellenőrizte – reviewed by

1-Steam generator
2-Main circulation pumps
3-Turbine
4.-Generator
5-Condenser
6-Compressor plant
7-Turbine building-ventilation
8-Primary line ventilation
9-Safety cooling tower ventilators
10-Primary line cooling water pumps
12-3 phase on-house operation transformer
13-Condenser cooling water pumps
14-Auxiliary cooling water pumps
15-Water intake work
16-Spillover dam
17-Energy breaker engineering object
18-Recuperations hydro power plant

Figure 15.5.3-1: Location of noise sources [15-8]

We used the following data as characteristic to the weighted noise mitigation for building structures on the facade of existing operation buildings:

- operation buildings made of reinforced concrete: R_W = 50 dB
- reactor building and shaft of the underground water intake work: R_W = 60 dB

The expected noise load arising from the operation of the planned power plant and calculated with Soundplan 7.2 program at the facade to be protected is the following Table 15.5.3-2.

Code	To be protected	limit (dB) day/night	noise load (dB) day/night
1.u	Dunaszentbenedek_ residential building	50/40	38,9/38,9
2.u	Csámpa residential building1	50/40	34,3/34,3
3.u	Csámpa residential building2	50/40	32,7/32,7
4.u	Paks residential building	50/40	29,9/29,9

Table 15.5.3-2: Noise load of the power plant at the facade to be protected

As demonstrated above, the ***power plant noise emission of the power plant in the residential area will presumably remain within the noise load limits in effect in the relevant area.*** The noise mitigation solutions planned for the outdoor noise sources (see: transformers, safety cooling tower ventilators) shall be definitely applied in order that the limits can be ensured.

We defined the noise load and presented the raster map using the SoundPlan 7.2 software. We used in the program noise calculation parameters described in detailed in Section 15.3.1 (adjacent buildings noise shielding, mitigating impact of the vegetation, definition of forests, ground effect).

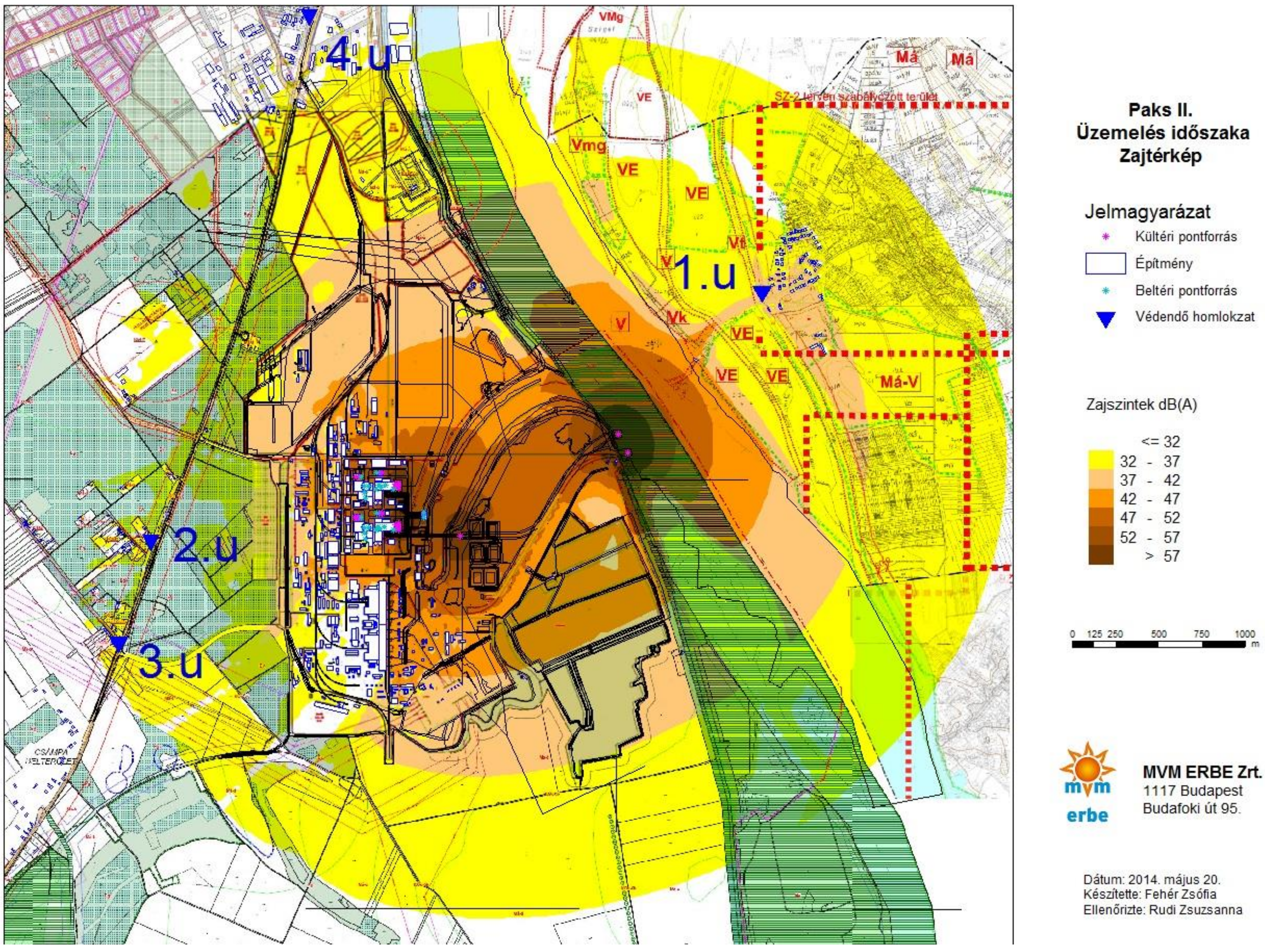
<u>The calculation contained the following steps:</u>

We defined the outdoor point sources.

The basic input data included coordinate data of the noise sources, operation time interval of the noise sources and sound power levels (L_W) calculated from the available sound pressure levels (L_P). We defined the noise emission on medium frequency (500 Hz).

Regarding the installation area, we defined the noise propagating from indoor to outdoor with a noise calculation prepared individually to every industrial building that contains noise source(s). We individually defined one-one façade and roof for the industrial buildings, also defining their materials with the relevant noise abatement factor.

The following Figure 15.5.3-2 presents the ready map:



zajtérkép noise load map, jelmagyarázat – legend, kültéri pontforrás - outdoor point source, építmény - structure, beltéri pontfrorrás - indoor point source, *védendő homlokzat – protected facade*, zajszintek – noise levels datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.3-2: Noise load during operation phase [15-8], [15-9]

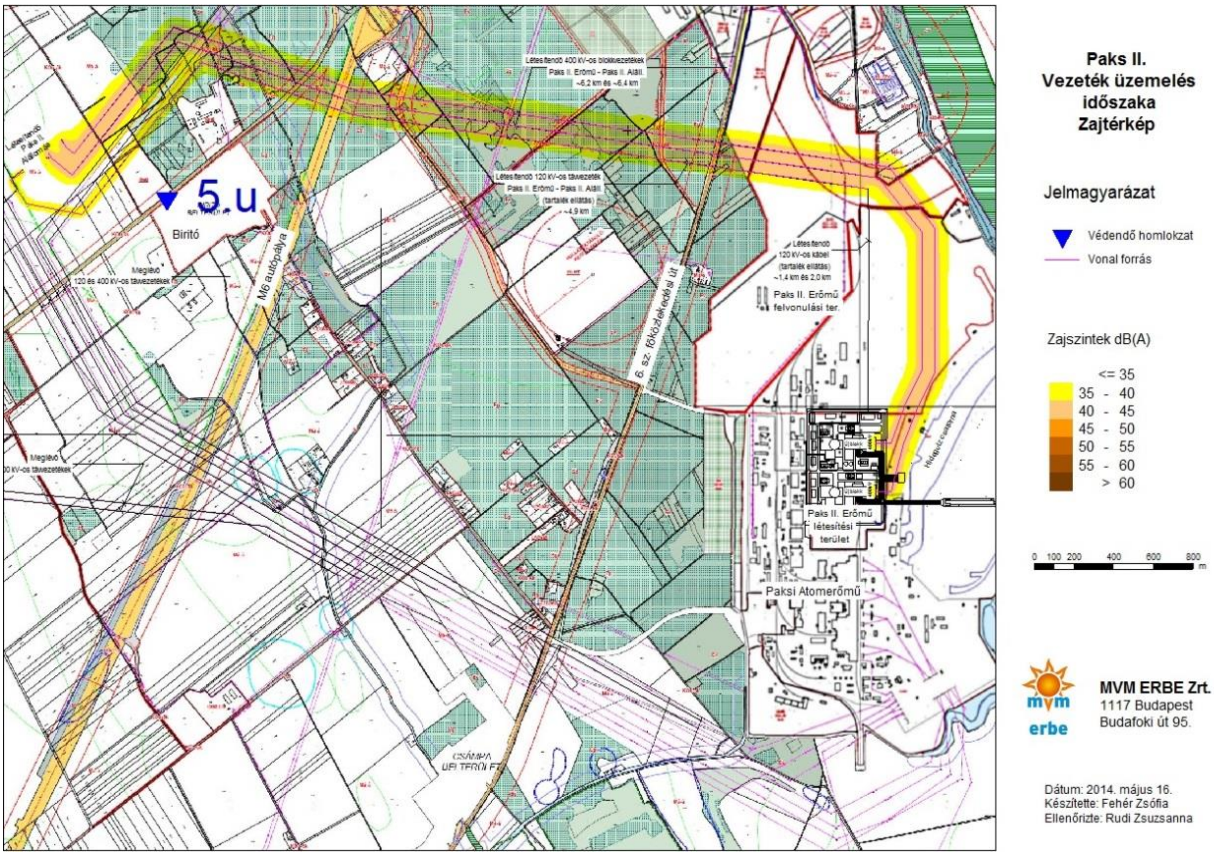
15.5.3.1 Noise impact of transmission lines operation

The 120 kV and 400 kV transmission lines have minimum noise impact. MAVIR Environment Protection Regulation defines the maximum noise level caused by operation, which is max. 40 dB at the edge of the safety zone and max. 55 dB below the line. The safety zone of the 400 kV transmission lines is 34,4 m, and 15,6 m for the 120 kV transmission line. The expected noise load calculated with the Soundplan 7.2 program using the maximum permitted limit defined for the nearest area to be protected and measured at the facade to be protected is presented in the following Table 15.5.3-2:

Code	To be protected	limit (dB) day/night	noise load (dB) day/night
5.u	Biritó residential building	50/40	23

Table 15.5.3-3: Noise load of the transmission line at facades to be protected

The following Figure 15.5.3-3 presents the noise load during the transmission line operation:



zajtérkép noise load map, jelmagyarázat – legend, védendő homlokzat – protected facade, vonal forrás - line source, zajszintek – noise levels, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.3-3: Noise load during transmission line operation [15-7],[15-9]

15.5.3.2 Limits applicable to traffic

Appendix 3 of Decree 27/2008. (XII.3.) KvVM-EüM defines the permitted equivalent A-sound pressure level arising from traffic during the operation phase on the area to be protected, *see:* Noise load limits.

15.5.3.3 Traffic during the operation period

The road traffic will increase during Paks II. operation phase. Alternatives having identical probability with vehicle traffic on road: M6 Motorway towards south, M6 Motorway towards north, highway nr. 6. towards north and south.

We defined the traffic for the relevant sections of the M6 motorway and Road no. 6. (in accordance with the EKD resolution) using data of the 2012 traffic count prepared by the National Public Road Cross-section Database [15-3]. (Table 15.4.3-1 and Table 15.4.3-2).

We calculated the annual average day and night traffic using data of the referred table in accordance with ÚT 2-1.302 Road Management Technical Procedure, including the traffic increment arising from Paks II. operation as shown in the following table.

Vehicles will not move at a steady rate daytime on the roads (except transportation by trucks), and 80% of the passenger cars typically use the road between 6-7 a.m. (arriving) and between 2-3 p.m. (leaving). (other vehicles were distributed for the daytime traffic at random for preparing the noise calculation, and we used traffic data shown in Table 15.5.3-4 and Table 15.5.3-5 under "other period " column.)

code	daytime traffic (vehicle /h.)			night traffic (vehicle /h.)			daytime traffic with increment (vehicle /h.)					
	I.	II.	III.	I.	II.	III.	I. 6-7 h, 14-15 h	II. 6-7 h, 14-15 h	III. 6-7 h, 14-15 h	I. other period	II. other period	III. other period
4941	144	9	15	28	2	3	180	18	19	146	10	16
1056	239	16	13	47	3	3	275	25	17	241	17	14
8752	401	39	20	79	8	4	437	48	24	403	40	21
8753	277	18	10	55	4	2	313	27	14	279	19	11
4952	204	19	14	40	4	3	240	28	18	206	20	15
8754	192	17	14	38	3	3	228	26	18	194	18	15
6341	224	11	9	44	2	2	260	20	13	226	12	10
8755	355	27	33	70	5	7	391	36	37	357	28	34
8756	609	39	46	120	9	12	645	48	50	611	40	47

Table 15.5.3-4: Annual average day and night traffic a highway nr. 6 on

code	daytime traffic (vehicle /h.)			night traffic (vehicle /h.)			daytime traffic with increment (vehicle /h.)					
	I.	II.	III.	I.	II.	III.	I. 6-7 h, 14-15 h	II. 6-7 h, 14-15 h	III. 6-7 h, 14-15 h	I. other period	II. other period	III. other period
1258	312	10	39	85	5	26	348	19	43	314	11	40
1259	317	9	41	86	5	28	353	18	45	319	10	42
1260	311	10	43	85	5	29	347	19	47	313	11	44
1261	310	10	41	85	5	27	346	19	45	312	11	42
1263	308	10	41	84	5	27	344	19	45	310	11	42
1264	321	9	48	88	5	32	357	18	52	323	10	49
1266	243	6	38	66	3	25	279	15	42	245	7	39

Table 15.5.3-5: Annual average day and night traffic az M6 Motorway

We defined the traffic baseline noise load from the above data using the Soundplan 7.2 software.

The program calculates the noise caused by traffic in conformity with the relevant Hungarian regulations. For the calculation we used further data:

- Speed of the vehicles at various road sections and vehicle categories;
- Relief, route lining
- Adjustment subject to road surface roughness
- Width of traffic lanes
- Two-way traffic.

The following Table 15.5.3-6 presents the noise load figures expected at the relevant study points and arising from the construction of the planned Paks II. Power Plant and calculated with the Soundplan 7.2 program.

Code	To be protected	limit (dB) day/night	baseline load (dB) day/night	inc. load increment (dB) day/night	noise load change (dB) day/night
1.k	Dunaföldvár	65/55	57,8/50,9	57,8/50,9	0/-
2.k	Dunakömlőd residential building (ZMP11)	65/55	66,5/59,6	66,6/59,6	0,1/-
3.k	Paks residential building_2 (ZMP10)	65/55	63,9/57,1	64/57,1	0,1/-
4.k	Paks residential building_1 (ZMP9)	65/55	69,7/62,8	69,8/62,8	0,1/-
5.k	Csámpa residential building_1	65/55	64,4/57,7	64,5/57,7	0,1/-
6.k	Csámpa residential building_2 (ZMP5)	65/55	69/62,3	69,1/62,3	0,1/-
7.k	Csámpa residential building_3	65/55	69,8/62,9	69,9/62,9	0,1/-
8.k	Dunaszentgyörgy residential building	65/55	67,4/60,5	67,5/60,5	0,1/-
9.k	Fácánkert	65/55	47,1/43	47,2/43	0,1/-
10.k	Tengelic	65/55	43,1/38,9	43,3/38,9	0,2/-
11.k	Gyapa	65/55	47,3/43,1	47,3/43,1	0/-

Table 15.5.3-6: Comparison of noise load and limits

Regarding the points to be protected along M6 Motorway (9-11.), the calculation results can clearly demonstrate that the noise load limits can be maintained both in case of the baseline load, and including the traffic increment arising from the operation of Paks II. The traffic increment arising from the operation of Paks II may add to the baseline noise load with nearly 0-0,2 dB noise load.

Regarding the points to be protected along highway No. 6 (1-8.), the calculation results (and also the baseline measurements) can confirm that the present baseline limit will be exceeded. The traffic increment arising from the operation of Paks II, may add to the baseline noise load presumably with nearly 0-0.1 dB. The A noise load increment calculated above are within the margin of error of the noise modelling program.

The traffic increment arising from additional traffic will not cause detectable changes in the noise load during the operation of Paks II.

15.5.4 IMPACT AREAS OF PAKS II. OPERATION

15.5.4.1 Direct impacts

In accordance with Article 6 of Government Decree 284/2007. (X.29.), the borderline of the direct impact area with regard to operation noise protection is the line, where the noise load arising from the noise source:

a) is 10 dB lower than the noise load limit, if the background load is minimum 10 dB lower than the limit,
b) is equal with the background load, if the background load is lower than the noise load limit, but the difference is lower than 10 dB,
c) is equal with the noise load limit, if the background load is higher than the limit,
d) is equal with the noise load limit form the noise source defined for the resort area in an environment that is not to be protected from noise except business zones,
e) is daytime (6:00-22:00) 55 dB, and at night (6:00-22:00) 45 dB in parts of the business zone that are not to be protected from noise.

The background load:

- if there are other noises sources due to operation or impact of noise sources detected at the designated measuring points, then the background load is equal with the aggregated noise load $L_{AM,\ üzem}$ judging level arising from the noise source of operation,
- if there are no other noises sources due to operation or impact of noise sources detected at the designated measuring points, then the background load is equal with L_{A95} 95% A-sound pressure level.

At points to be protected at Csámpa, Paks and Dunaszentbenedek neither can the sole impact of the existing power plant be detected nor other noise similar to noise emitted by nuclear power plant, thus the background load is at L_{A95} 95% A-sound pressure level. At Csámpa ZMP5 point the background load is L_{A95} 95% A-sound pressure level 36,6~37 dB, at Dunaszentbenedek at ZMP18 point 31,9 ~32 dB, at Uszód 31,8 ~32 dB, at Paks 34,7~35 dB.

At Csámpa, Paks, Dunaszentbenedek, Uszód the background load is L_{A95} 95% A-sound pressure level, *see:* Table 15.5.4-1.

To be protected	definition of background load	background load (dB)
Csámpa (ZMP5)	L_{A95} 95% A-sound pressure level [1]	36,6~37
Paks residential building (ZMP20)	L_{A95} 95% A-sound pressure level	34,7~35
Dunaszentbenedek (ZMP18)	L_{A95} 95% A-sound pressure level	31,9 ~32
Uszód (ZMP16)	L_{A95} 95% A-sound pressure level	31,8 ~32

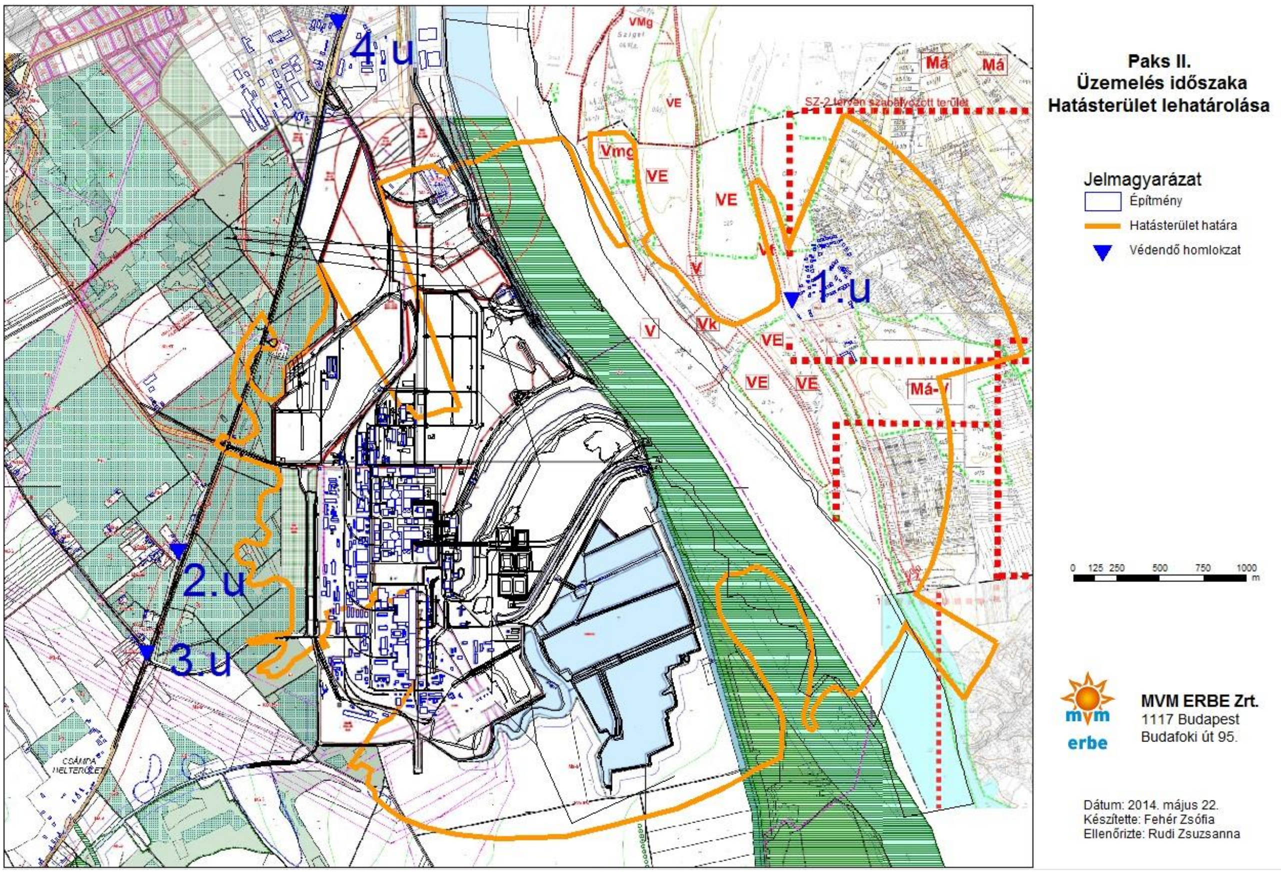
Table 15.5.4-1: A to be protected pointson meghatározott background load

In these settlements "a" and "c" criteria cannot be applied for the background load, as "b" isolines do not reach the reference points at Paks and Csámpa.

Borderline of the operation impact area

- towards Paks to north according to "e" criterion: 45 dB isoline,
- towards residential areas of Dunaszentbenedek and Uszód according to "b" criterion to east: 32 dB isoline,
- in other directions (W, NW, N-NE, SE, S, SW, on non-residential areas of Uszód and Dunaszentbenedek) according to "d" criterion: 35 dB isoline.

The following Figure 15.5.4-1 presents the impact area.



SZ-2 terven szabályozott terület – regulated area as per drawing No. SZ-2, jelmagyarázat – legend, építmény - structure, hatásterület határa – borderline of impact area, védendő homlokzat – protected facade, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.4-1: Impact area of operation [15-8], [15-9]

Impact area of Paks II. operation (without transmission lines) covers Paks Nuclear Power Plant site, adjacent non-residential areas, River Danube, certain real properties in Dunaszentbenedek village and partly NW corner of Uszód.

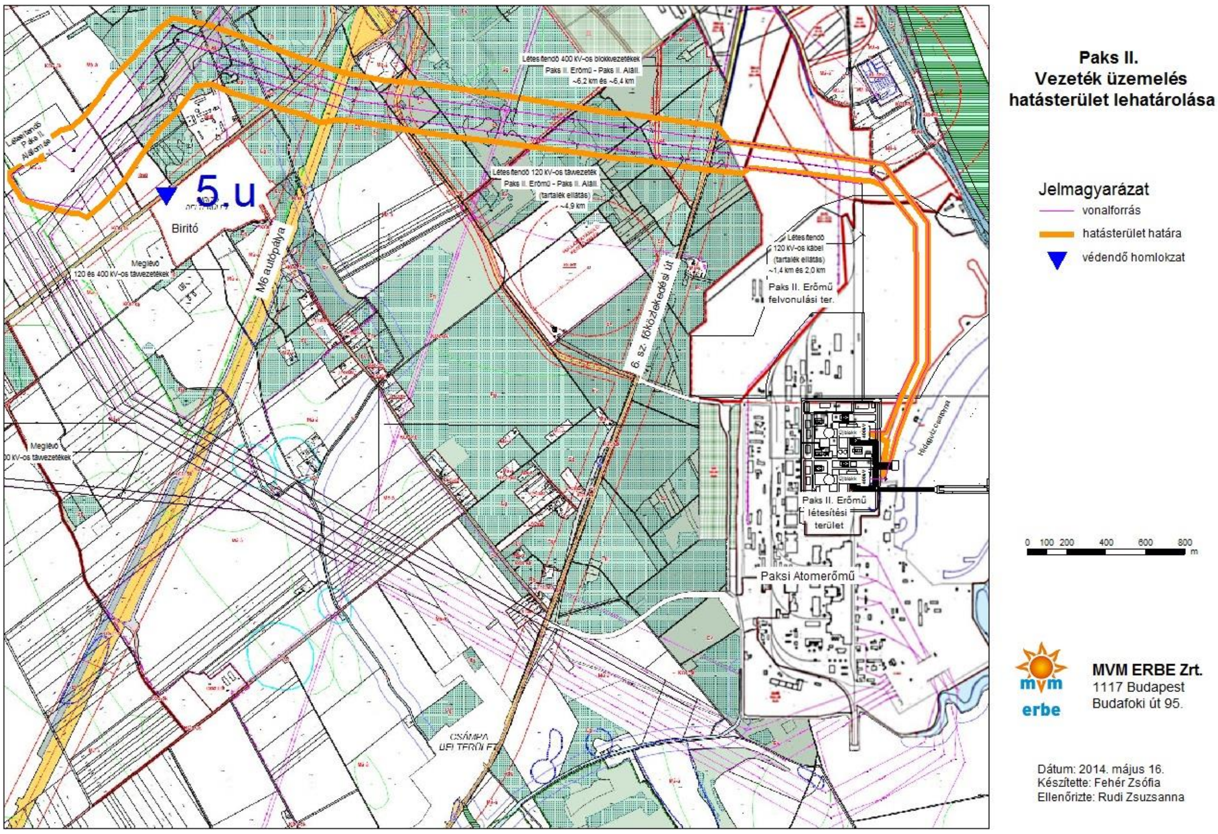
Borders of impact area of transmission lines operation:

- on part of the business zone area not to be protected according to "e" criterion: 45 dB isoline,
- in the environment not to be protected from noise according to "d" criterion: 35 dB isoline,
- to Biritó 30 dB isoline (*see:* rural residential area at night, Table 15.1.2-1).

Towards Biritó we used the "a" criterion: it is 10 dB lower than the noise load limit, if the background load is minimum 10 dB lower than the limit. (for estimating the background load ref.: ZMP6, where 27 dB L_{A95} 95% A-sound pressure level.)

The impact area during the transmission line operation in the business zone is the area directly below the lines, and in not protected areas it is 40-70 m measured from the lines, and towards Biritó max. 80 m.

Figure 15.4.3-2 presents the impact area of the transmission line operation area.



Létesítendő Paks II alállomás – envisaged Paks II substation, meglévő 120 és 400 kV-os távvezetékek – existing 120 and 400 kV transmission lines, létesítendő 120 kV-os távvezeték – envisaged 120 kV transmission line, létesítendő 120 kV-os kábel (tartalék ellátás) – envisaged 120 kV cable (reserve power supply), létesítendő 400 kV-os blokkvezetékek – envisaged 400 kV unit lines, Paks II erőmű felvonulási terület: temporary construction area of Paks II, Paks II létesítési terület – construction area of Paks II, Paksi Atomerőmű – Paks Nuclear Power Plant, 6. sz. főközlekedési út – Highway No. 6, jelmagyarázat – legend, vonalforrás – line sources, hatásterület határa – borderline of impact area, védendő homlokzat – protected facade, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.4-2: Impact area of transmission line operation [15-7],[15-9]

Definition of the impact area for the additional traffic noise during the operation period in accordance with Article 6 of Government Decree 284/2007. (X.29.):

- the area to be protected from noise and neighbouring with the traffic routes, where traffic and transportation activity will cause minimum 3 dB additional noise load.

The background load will be in case of noise caused by traffic:

- if there are also other sources of traffic detectable, then it will be equal with aggregated noise load $L_{AM,közl}$ judging level arising from these sources of noise caused by traffic,
- if the noise is caused by various sources from traffic, then it is equal with the aggregated $L_{AM, közl}$ value of these noise sources,
- if there is no impact detectable from other sources of traffic or it cannot be analysed with such other noises, it is equal with $_{LAeq,\ measured}$ A-sound pressure level.

The additional impact area hit by the noise caused by traffic and emerging during the operation phase of the project cannot be defined.

The 0,1 dB noise load increment emerging in the traffic baseline and during the operation period cannot be visually detected either for the 25 km radius region or in large blow, thus we did not present this additional noise on the map, and it can be regarded as identical with the baseline load.

15.5.4.2 Indirect impacts

Areas of indirect impacts: „propagation area of spreading impact processes that emerge on the direct impacts areas due to changes in the status of the environment according to those environmental elements and systems that are affected with any of the impact processes".

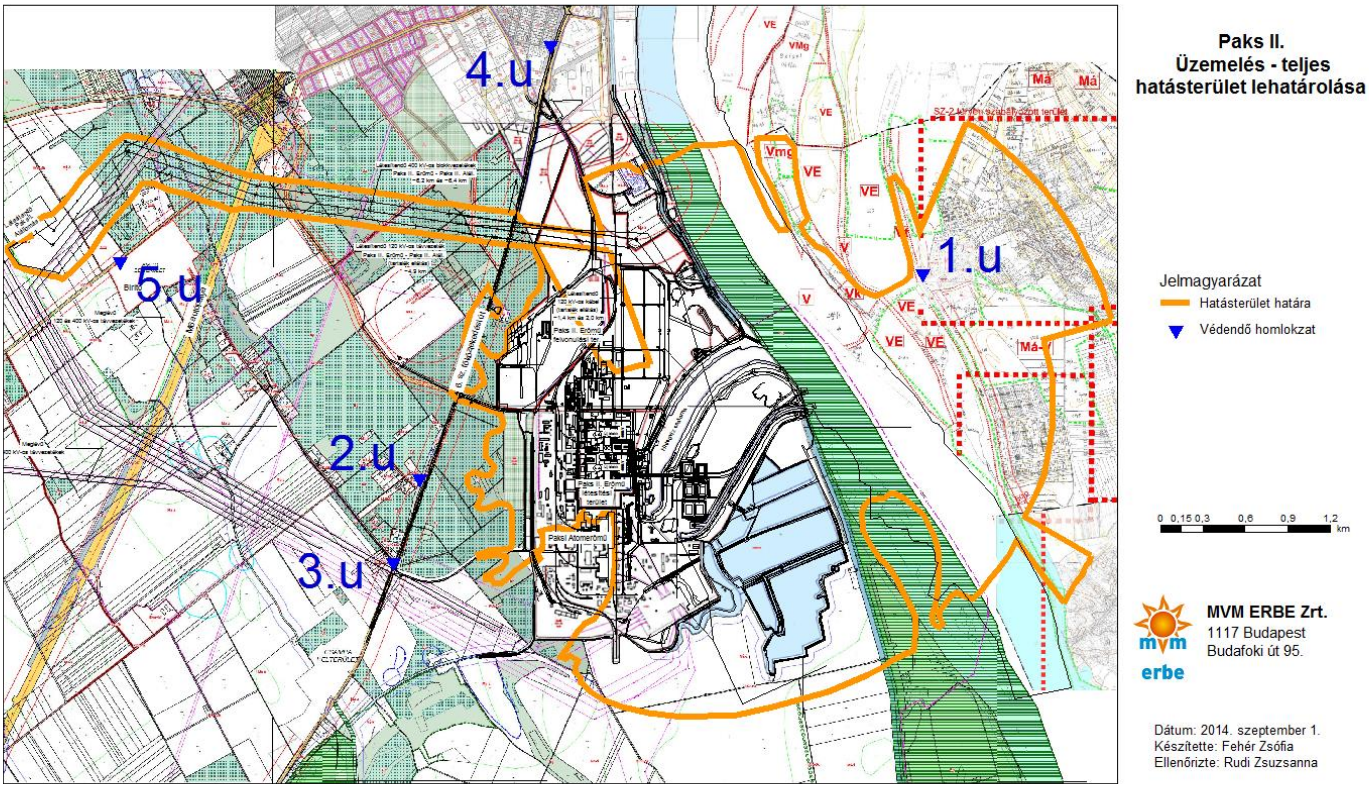
Accordingly, no impact area can be defined as indirect impacts that increase/mitigate traffic due to power plant operations causing noise impacts (*see also:* the basic concept of Section 15.4.4.2). (if e.g. traffic may increase die to tourism aiming at Paks II., this would not be the consequence of impact of Paks II. that may cause change to noise status)

15.5.4.3 Cross-border environmental impacts

We cannot presume any cross-border noise impact arising from Paks II. operation.

15.5.5 TOTAL IMPACT AREA OF PAKS II. OPERATION

The total impact area of the operation will be the totality of direct and indirect impacts areas, as presented by Figure 15.5.5-1.



Létesítendő Paks II alállomás – envisaged Paks II substation, meglévő 120 és 400 kV-os távvezetékek – existing 120 and 400 kV transmission lines, létesítendő 120 kV-os távvezeték – envisaged 120 kV transmission line, létesítendő 120 kV-os kábel (tartalék ellátás) – envisaged 120 kV cable (reserve power supply), létesítendő 400 kV-os blokkvezetékek – envisaged 400 kV unit lines, Paks II erőmű felvonulási terület: temporary construction area of Paks II, Paks II létesítési terület – construction area of Paks II, Paksi Atomerőmű – Paks Nuclear Power Plant, 6. sz. főközlekedési út – Highway No. 6, jelmagyarázat – legend, hatásterület határa – borderline of impact area, védendő homlokzat – protected facade, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.5-1: Total impact area of operation [15-7] ,[15-8], [15-9]

15.5.6 OPERATIONAL IRREGULARITIES, ACCIDENTS, CASES OF EMERGENCY

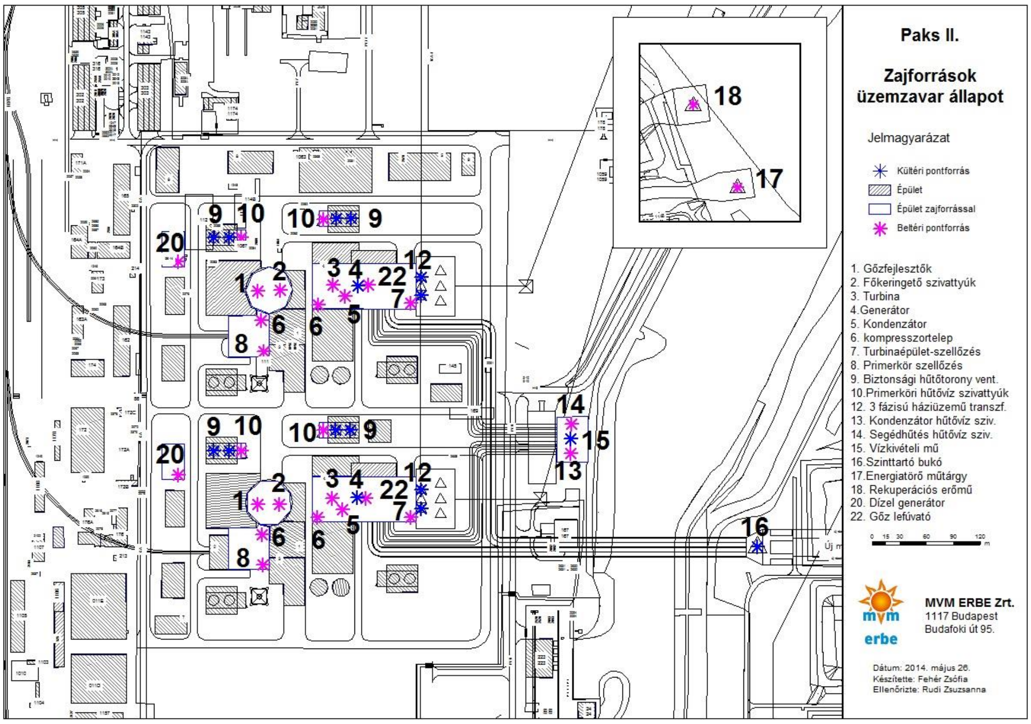
Regarding noise caused by operation any significant deviation from ordinary operation may occur if the external power supply is suspended (power outage or black-out), so we describe the relevant model in the following section.

Table 15.5.6-1 presents the noise sources that are in operation during an operational irregularity (emergency).

Noise source code	Name of noise source	operation time (h./day)	location of operation	L_P dB(A)	L_W dB (A)
1	Steam generator (2)	8	in building	85	112
2	Main circulation pumps (2)	24	in building	85	108
3	Turbine (2)	8	in building	85	117
4.	Generator (2)	8	in building	85	114
5	Condenser (2)	8	in building	80	107
6	Compressor plant (4)	8	in building	80	100
7	Turbine building-ventilation (2)	24	in building	60	93
8	Primary line ventilation (2)	24	in building	60	91
9	Safety cooling tower ventilators (2*4)	24	outdoor	67	98
10	Primary line cooling water pumps (4)	24	in building	80	97
12	3 phase on-house operation transformer (4)	8	outdoor	70	92
13	Condenser cooling water pumps	8	in building	85	106
14	Auxiliary cooling water pumps	8	in building	80	97
15	Water intake work	8	outdoor	60	91
16	Spillover dam	8	outdoor	80	113
17	Energy breaker engineering object	8	outdoor	75	110
18	Recuperations hydro power plant	8	outdoor	78	113
20	Diesel generator (2)	8	in building	100	121
22	Steam bleeder unit (2)	8	outdoor	100	115

Table 15.5.6-1: Noise sources during operational irregularity

Figure 15.5.6-1 presents the locations of the noise sources that are in operation during an operational irregularity (emergency):



jelmagyarázat – legend, kültéri pontforrás – outdoor point source, épület – building, épület zajforrással – building with noise source, beltéri pontforrás – indoor point source, datum – date, készítette – prepared by, ellenőrizte – reviewed by

1-Steam generators
2-Main circulation pumps
3-Turbine
4.-Generator
5-Condenser
6-Compressor plant
7-Turbine building-ventilation
8-Primary line ventilation
9-Safety cooling tower ventilators
10-Primary line cooling water pumps
12-3 phase on-house operation transformer
13-Condenser cooling water pumps
14-Auxiliary cooling water pumps
15-Water intake work
16-Spillover dam
17-Energy breaker engineering object
18-Recuperations hydro power plant
19-Diesel generator
20-Steam blow-off valve

Figure 15.5.6-1: Location of noise sources in case of operational irregularity (emergency) [15-8]

Operational status of units, when the external electricity network is totally collapsing (outage or black out) due to any system-operational irregularity or external or natural impact (e.g. storm, earthquake). As turbines will be reserve loaded or charged, some of the steam shall be released into open air through the reducer. In such cases diesel generators will be used for ensuring safe power supply for the relevant consumers.

During the calculations we considered the following as characteristic data for weighted noise abatement for building structures applied on the facades of the existing operation buildings:

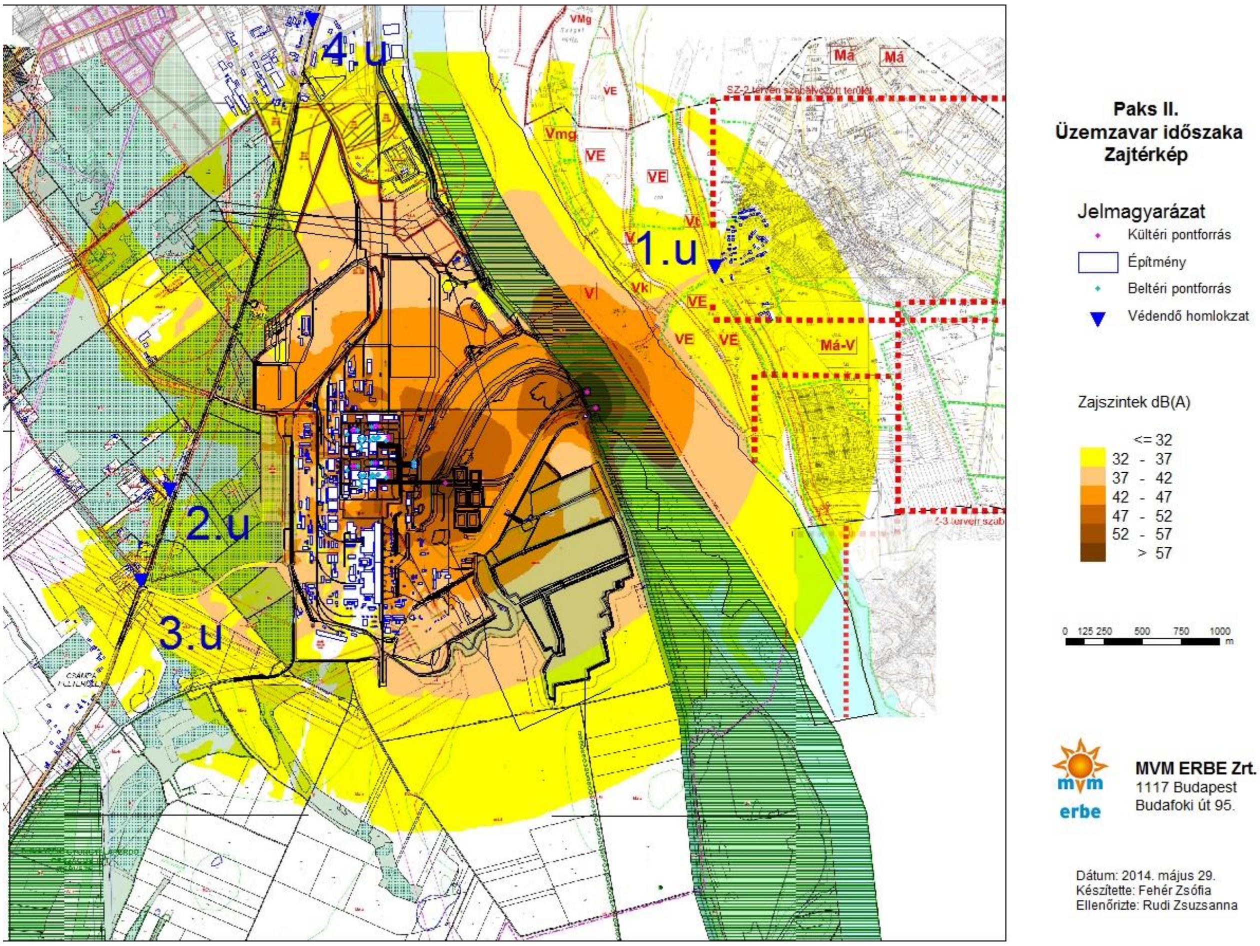
- reinforced concrete operation buildings: RW = 50 dB
- reactor building and shaft of underground water intake unit : RW = 60 dB.

The noise load expected at facade to be protected from operations of Paks II during an operational irregularity period was calculated with the Soundplan 7.2 program is presented in Table 15.5.6-2.

Code	To be protected	limit (dB) day/night	noise load (dB) day/night
1.u	Dunaszentbenedek_ residential building	50/40	36,5/21,2
2.u	Csámpa residential building1	50/40	35,7/25,9
3.u	Csámpa residential building2	50/40	32,5/28,4
4.u	Paks residential building	50/40	30,3/21,8

Table 15.5.6-2: Noise load of the power plant during operational irregularity at facade to be protected

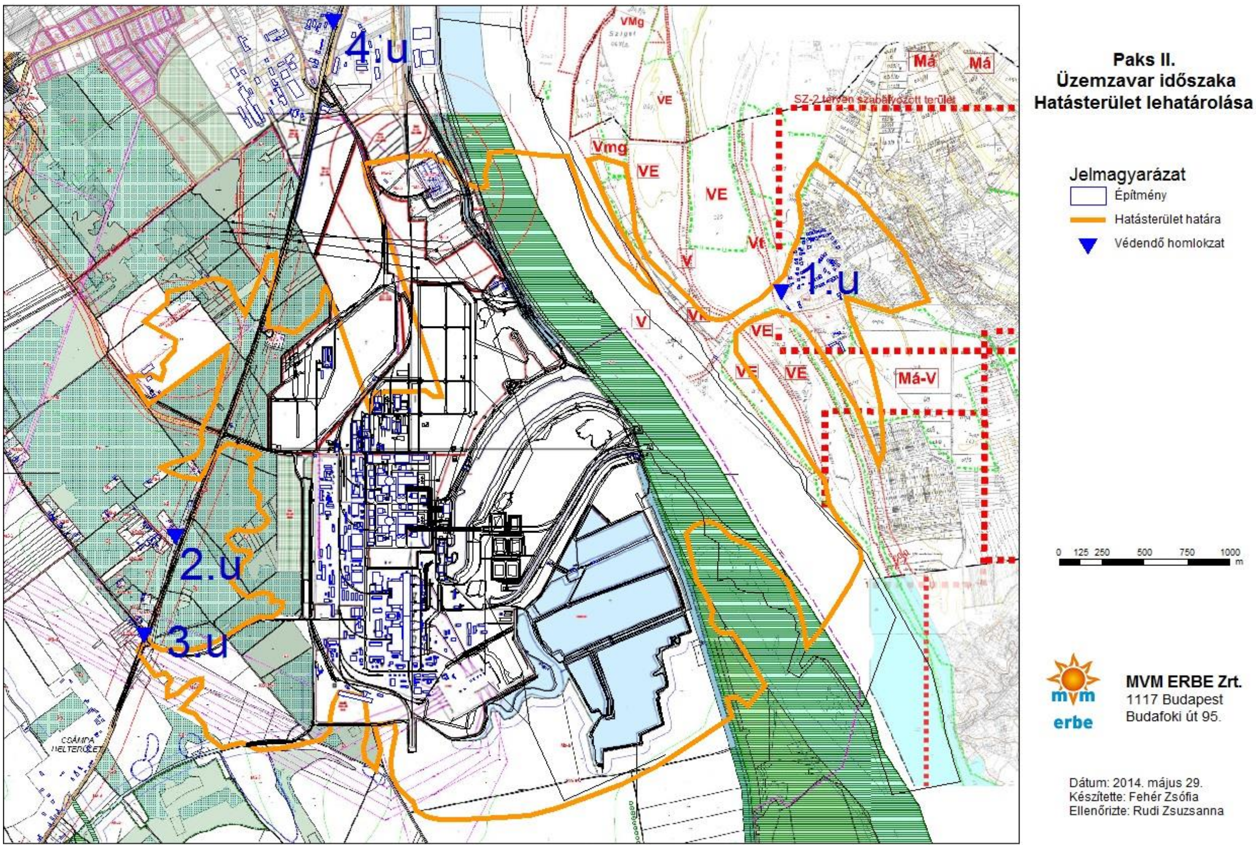
As shown above, ***noise emission of the power plant during operational irregularity will remain below the noise load limit permitted for residential area.*** Figure 15.5.6-2 presents noise load of Paks II during operational irregularity.



jelmagyarázat – legend, kültéri pontforrás – outdoor point source, építmény –structure, beltéri pontforrás – indoor point source, védendő homlokzat – protected facade, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.6-2: Paks II. noise load during operational irregularity status [15-8], [15-9]

Figure 15.5.6-3 presents the impact area during operational irregularity.



jelmagyarázat – legend, építmény – structure, hatásterület határa – borderline of impact area, védendő homlokzat – protected facade, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.5.6-3: Paks II. operational irregularity impact area [15-8], [15-9]

Borders of impact area during operational irregularity:

- towards Paks and north according to "e" criterion: 45 dB isoline,
- towards Dunaszentbenedek residential areas according to "b" criterion towards east: 32 dB isoline,
- and to other directions according to "d" point: 35 dB isoline.

(borderlines for the impact area were defined using the methodology analogue applied for the impact area of Paks II. operation period, and using the same background load data.)

The impact area of Paks II. operational irregularity will cover the site of Paks Nuclear Power Plant, and neighbouring unpopulated areas, River Danube, and certain lands in Dunaszentbenedek village.

15.6 AMBIENT NOISE IMPACT OF PAKS II. ABANDONMENT

Appendices 2-3 of Decree 27/2008. (XII.3.) KvVM-EüM define the noise load limits arising from abandonment for areas to be protected from noise. Government Decree 284/2007. (X. 29.) defines the method for delineating and defining the impact area for abandonment.

It is difficult to estimate the noise impact arising from Paks II abandonment as we cannot know the length of the relevant time period and the exact data related to the abandonment. Thus we cannot prepare an itemised list of the relevant impact factors either. If power plant machinery is demolished, we may calculate with the same noise load as during the power plant construction period. This includes works on the power plant area, and the traffic due to transportation of the demolished materials.

The direct impact area hit by noise load emerging during abandonment can be regarded as the area delineated for the structure construction phase of the construction period.

During the abandonment period we can forecast an additional noise load lower than 3 dB onto highway nr. 6. and M6. Motorway.

When abandonment operations are performed on the power plant area the noise load limits applicable onto areas and buildings to be protected can be maintained. The direct impact area during the abandonment period will cover the site of Paks Nuclear Power Plant, un-populated areas in the region, River Danube and residential building at the western side of Dunaszentbenedek village.

No increment in noise load levels arising from road traffic can be defined onto the impact area.

15.7 AMBIENT NOISE IMPACT OF PAKS II. AND PAKS NUCLEAR POWER PLANT CO-OPERATION

15.7.1 CO-OPERATION

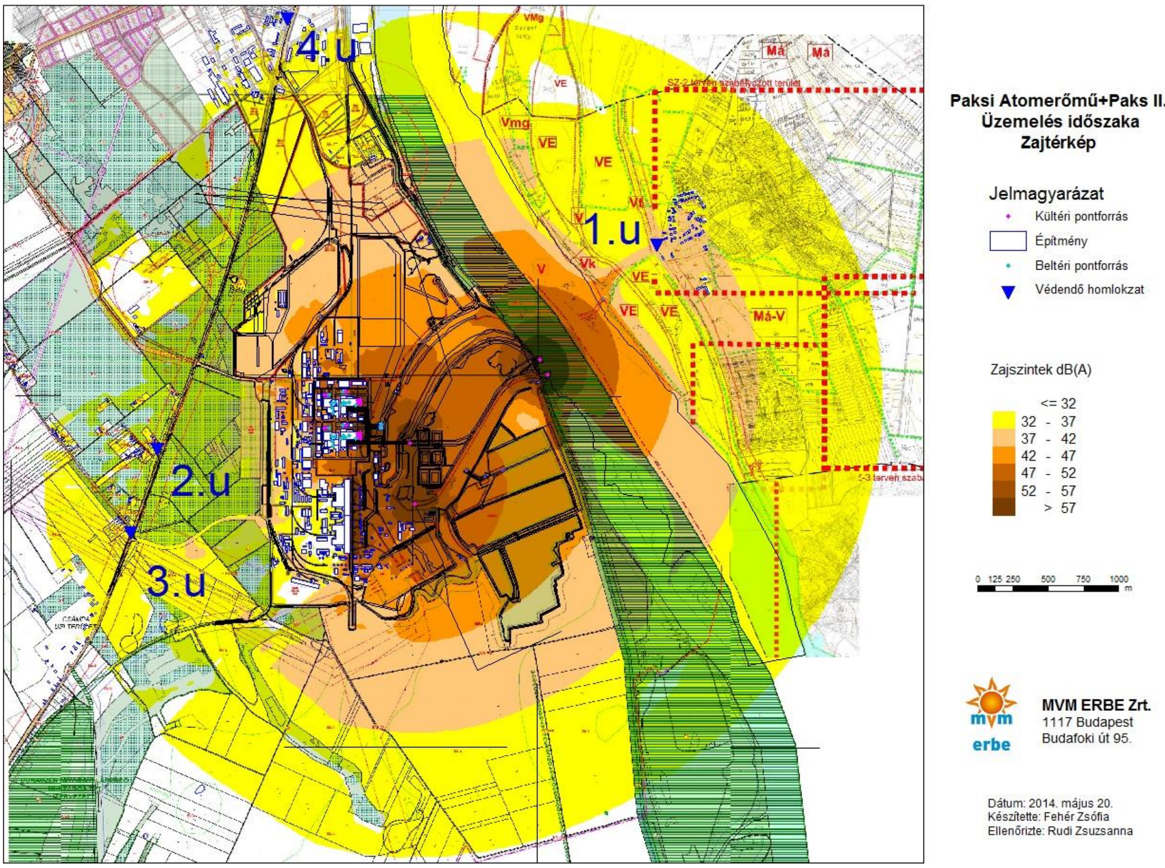
In addition to the planning data of Paks II., we also used the results of outdoor noise measurements performed on the site for preparing the model of aggregate impact of Paks Nuclear Power Plant and Paks II., which represent the noise load of the presently operating plant, and we defined these data individually for every area and point source (spillover dam) for the modelling process.

The excepted noise load arising from simultaneous operation of the planned Paks II. and the existing Paks Nuclear Power Plant at the facade to be protected was calculated with the Soundplan 7.2 program and it is presented in Table 15.1.2-1. The table also presents, for purposes of comparison, the values of noise load caused by Paks Nuclear Power Plant shown in the model prepared on the basis of baseline measurements.

Code	To be protected	limit (dB) day/night	noise load (dB) Paks Nuclear Power Plant day/night	noise load (dB) Paks Nuclear Power Plant + Paks II. day/night
1.u	Dunaszentbenedek_ residential building	50/40	31,6	39,3/39,3
2.u	Csámpa residential building1	50/40	30,9	34,4/34,4
3.u	Csámpa residential building2	50/40	31,4	33,1/33,1
4.u	Paks residential building	50/40	24,5	30,8/30,8

Table 15.7.1-1: Aggregated noise of Paks Nuclear Power Plant and Paks II. at the facade to be protected

Figure 15.7.1-1 presents the noise load arising from simultaneous operation of Paks Nuclear Power Plant and Paks II.



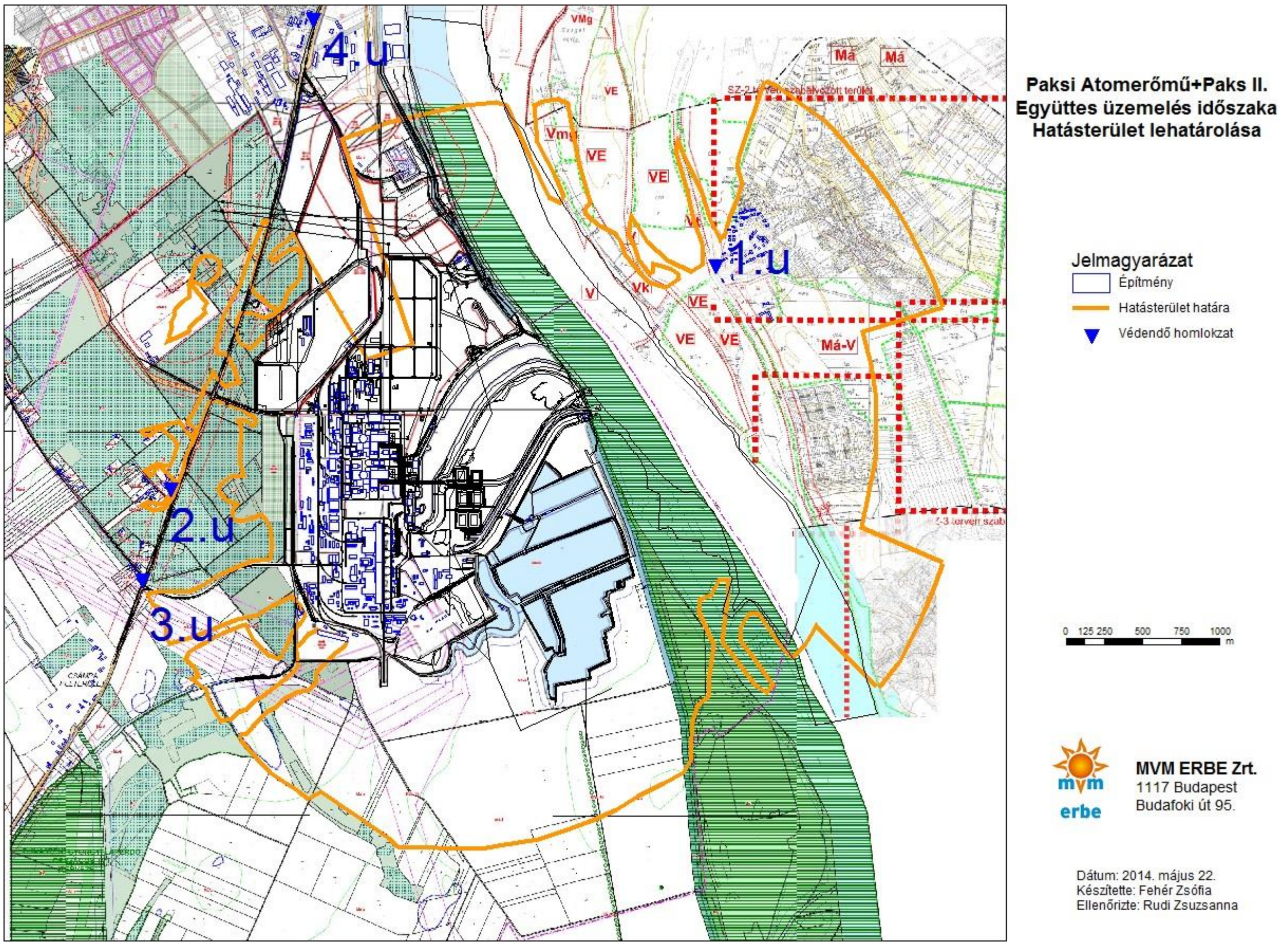
jelmagyarázat – legend, kültéri pontforrás – outdoor point source, építmény – structure, indoor point source, védendő homlokzat – protected facade, zajszintek – noise levels, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.7.1-1: Noise load during operation period of Paks Nuclear Power Plant and Paks II. [15-8], [15-9]

15.7.2 IMPACT AREA OF PAKS II. AND PAKS NUCLEAR POWER PLANT CO-OPERATION

15.7.2.1 Direct impacts

Figure 15.7.2-1 presents the impact area arising from simultaneous operation of Paks Nuclear Power Plant and Paks II.



jelmagyarázat – legend, építmény – structure, hatásterület határa – borderline of impact area, védendő homlokzat – protected facade, datum – date, készítette – prepared by, ellenőrizte – reviewed by

Figure 15.7.2-1: Paks Nuclear Power Plant and Paks II. együttes impact areae [15-8], [15-9]

Borderlines of Paks Nuclear Power Plant and Paks II.:

- towards Paks to north according to "e" criterion: 45 dB isoline,
- towards residential areas of Dunaszentbenedek and Uszód according to "b" criterion to east: 32 dB isoline,
- to other directions (W, NW, N-NE, SE, S, SW, on un-populated areas in Uszód and Dunaszentbenedek) according to "d" point: 35 dB isoline.

(borderlines for the impact area were defined using the methodology analogue applied for the impact area of Paks II. operation period, and using the same background load data.)

To aggregated impact area of simultaneous operation of Paks Nuclear Power Plant + Paks II. (disregarding the transmission lines) will cover the site of Paks Nuclear Power Plant, the un-populated areas in the region, River Danube, and certain lands in Dunaszentbenedek and Uszód village.

There is an impact factor connecting to the power plant operation: commuting to work of workers and staff required for the operation and traffic / transportation activities. If we compare the headcount of the existing power plant and the planned power plant, the latter will work with a lower headcount, thus the noise caused by traffic load arising from its operation will be most probably lower, and this will cause a hardly detectable change in the traffic and the impact area.

15.7.2.2 Indirect impacts

Indirect impacts spreading due to direct impact of noise load will not be significant, and we cannot define any impact area hit by traffic increasing/traffic mitigating indirect noise impacts causing noise from operation.

15.7.2.3 Cross-border environmental impacts

Based on the modelling we can state that we cannot presume any cross-border noise impact arising from the standalone operation of Paks Nuclear Power Plant and simultaneous operations of Paks I and Paks II.

15.8 PAKS II. AMBIENT NOISE MONITORING SYSTEM

The ambient noise monitoring system will analyse the noise load arising from the implementation and operation of Paks II in order to monitor compliance with the relevant noise load limits on the areas to be protected from noise. (it does not cover the workplace noise measurements.)

Paks II. will be constructed far away from all neighbouring populated settlements. The nearest residential building at Csámpa is located at a distance of 1330 m, in Paks at 2960 m, and at Dunaszentbenedek at 2590 m. There is no residential area in the direct vicinity of Paks II that would justify or require the noise measurements.

With the help of noise modelling we can present the noise impact and impact area to be protected at Paks II., however in reality noise load lower than 40 dB is so small that it cannot be clearly separated from other noises using on-the-spot measurements.

If the decision is to implement the monitoring system for certain reasons (important of the project, influencing the public opinion) we wish to call the attention onto the following regarding the operation of such system:

The baseline status can be recorded prior to the beginning of the construction of Paks II. After this date we can measure only the noise load arising from implementation works, because construction works will keep on rolling throughout several years as long as commissioning date arrives.

We recommend assessing noise load arising from implementation and operation works in the power plant area in the vicinity of the nuclear power plant at the following points to be protected:

- Csámpa at the nearest residential building
- Paks at the nearest residential building
- Dunaszentbenedek at the nearest residential building

Prior to measurements, a study and its eventual supplement will be required in addition to the monitoring with regard to potential structural changes in the settlement, because the study points shall always be located at areas to be protected next to the nuclear power plant, and on next roads next connected to supplies or traffic, where there is limit to noise from traffic. We recommend also retaining the points proposed in the present document in order that the reference points can be kept available, because eventual change tendencies can be presented only if the study points are constant.

Load shall be analysed at points in Csámpa and Paks arising both from operation and traffic. Naturally, we will not be able to clearly separate that the noise coming from which of the two nuclear power plants at the measuring points when the Paks Nuclear Power Plant and Paks II. simultaneously operate. Though by measuring the baseline load, we may estimate the future noise impact of Paks Nuclear Power Plant, but we will not have exact figure, because various factors, primarily the outdoor equipments, e.g. aging transformers or eventual changes if required may have negative and positive impacts onto the future noise load.

Paks II. noise monitoring schedule

- During the year preceding implementation in April, June and September
  - periodical noise measurement at points in Csámpa and Paks at night and daytime (1 h. in every section)
  - measurement at Dunaszentbenedek at night and daytime in every 15-15 minutes
- During the implementation period every year in April, June and September
  - periodical noise measurement at points in Csámpa and Paks at night and daytime (1 h. in every section)
  - measurement at Dunaszentbenedek at night and daytime in every 15-15 minutes
- During the first year of operation, and then in every five years in April, June and September of the year of measurement
  - periodical noise measurement at points in Csámpa and Paks at night and daytime (1 h. in every section)
  - measurement at Dunaszentbenedek at night and daytime in every 15-15 minutes.

We assume that during winter unfavourable conditions will prevail for noise measurements, and we do not propose performing such studies or surveys with regard to eventually extreme weather conditions.

When data are assessed, we should consider the annual traffic increments on highway nr. 6. (not arising from power plant operation), and analyse whether developments in the settlements can have major effect onto the noise status. (e.g. it shall be reported if Dunaszentbenedek village implements a major development program, new roads are built, etc.).

We recommend analysing noise load a rising from the implementation and operation of transmission lines connected to Paks II. at the following points to be protected:

- at the residential building at the very edge of Biritó village towards west.

Schedule for monitoring the noise caused by the transmission line:

- during the year prior to the implementation in April, June and September,
  - at the residential building at the very edge of Biritó village towards west at night and daytime in every 15-15 minutes
- during the implementation period every year in April, June and September,
  - at the residential building at the very edge of Biritó village towards west at night and daytime in every 15-15 minutes.

(the transmission line will be constructed only daytime, but the operation period can be used as analogue for calculating the noise load, if not only daytime measurement data are available from this period)

- During the first year of operation, and then in every five years in April, June and September of the year of measurement
  - at the residential building at the very edge of Biritó village towards west at night and daytime in every 15-15 minutes.

Measurements of noise from power plant area, including both implementation of the power plant and implementation of the transmission line shall be scheduled so that the measurements are held during actual work performance, when the dominant noise sources typical to the activity are in operation.

15.9 NOISE MITIGATION OPTIONS

To ensure low noise load we propose to use pieces and equipment and machines that emit the lowest possible noise. We also propose to prefer the use of M6 Motorway as the alternative route for traffic and transportation instead of highway nr. 6., and thus the load can be lower in the latter.

During the operation period the mitigated noise emission levels used for the noise modelling and as described in details in Point 15.5.3 will have to be implemented.

15.10 PAKS II. AMBIENT VIBRATION MONITORING SYSTEM

Vibration load monitoring is proposed along highway nr. 6 at the following two points:

- Paks-Csámpa residential buildings (RMP12), and
- in Paks at Vietnámi park and Dunaföldvári road corner, residential buildings (RMP14).

We selected the above two points, because at these points highway nr. 6. is located very close to the residential buildings (the distance between RMP12 measuring point to highway No. 6. is 8 metres, and between RMP14 measuring point and the road is 10 metres).

When assessing the vibration load monitoring only buses, trucks and large trucks shall be taken into account.

Time schedule for Paks II vibration monitoring:

- In June in the year preceding the construction works
- Every year in April and June during the construction phase
- Every year in April and June during the operation phase.

We propose to perform the baseline vibration measurements daytime (6^{00} - 22^{00}), in consecutive 4 hours representing the maximum vibration load, and at night (22^{00} - 6^{00}) in consecutive 30 minutes representing the maximum vibration load.

15.11 VIBRATION MITIGATION OPTIONS

The baseline vibration load measurements (as the basis for the EIS) demonstrated that the a measured and assessed vibration values never exceed the relevant limits. Based on experiences gained form the 2012, special care shall be dedicated during the construction and operation of the new power plant units to the status of roads leading to and from the power plant. During the measurement process we found that one-one minor bump, default, cavity or crack on the road surface could significantly increase the amplitude of the measured vibration, and the emerging vibration frequency also changed to a negative direction (i.e. we measured significantly higher amplitudes in low frequency range). This is why quality of roads shall be continuously monitored and improved or repaired if and when required both during the construction and operation phases during the construction and operation of the new power plant units.

15.12 BIBLIOGRAPHY

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Maps, aerial photos

[15-7] Implementation of MVM Paks II. Zrt. new nuclear power plant units at Paks site. 400 kV block lines. Layout map (1:10000)

[15-8] Paks II. layout map

[15-9] Geo-referred raster-graphic maps attached to local building regulations enlisted under Point 16.1.1 (List of Decrees)

[15-10] RGB cut-out section of digital ortophoto prepared by Eurosense Kft. in 2013.

[15-11] Eurosense Kft prepared an isoline figure in 2013.

[15-12] Digital surface model prepared by Eurosense Kft in 2013.

Softwares

[15-13] Soundplan 7.2

[15-14] AutoCad 2013 English
[15-15] AutoCad 2013 Raster Design
[15-16] Qantum GIS 1.8
[15-17] Microsoft Office 2010
[15-18] Garmin Basecamp
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