



UNIVERSITY OF NIŠ
FACULTY OF OCCUPATIONAL SAFETY
Department of Preventive Engineering
Noise and Vibration Laboratory



"POLYTECHNICA" UNIVERSITY OF TIMISORA
FACULTY OF MECHANICAL ENGINEERING
Department of Mechanics and Vibration
Noise and Vibration Laboratory



BULGARIAN ACADEMY OF SCIENCES
Institute of Mechanics

29th INTERNATIONAL CONFERENCE



NOISE & VIBRATION

22 - 23, October 2026.
Niš, Serbia

**PROCEEDING OF ABSTRACTS
OF 29th INTERNATIONAL CONFERENCE
NOISE AND VIBRATION**



Niš, 22-23. 10. 2026.

NOISE & VIBRATION 2026

**PROCEEDING OF ABSTRACTS OF 29TH INTERNATIONAL CONFERENCE
„NOISE AND VIBRATION”**

Niš, October 22-23, 2026

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Prof. Momir Prašćević, Ph. D.

Prof. Darko Mihajlov, Ph. D.

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Department of Preventive Engineering
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CONTACT ADDRESS

Faculty of Occupational Safety in Niš

Noise and Vibration Laboratory

Republic of Serbia, 18 000 Niš, Čarnojevića 10a

Tel. +381 18 529 747, +381 18 529 748

E-mail: momir.prascevic@znrfak.ni.ac.rs

darko.mihajlov@znrfak.ni.ac.rs

petar.jovanovic@znrfak.ni.ac.rs

TOPICS OF INTEREST

- ▣ Noise generation and propagation
- ▣ Noise control
- ▣ Environmental noise
- ▣ Vibration generation and propagation
- ▣ Vibration control
- ▣ Effect of noise and vibrations
- ▣ Analysis of noise and vibration
- ▣ Requirements

SCHEDULE OF EVENTS

Thursday

22. 10. 2026.

09.00 – 10.00	Registration
10.00 – 10.30	Opening ceremony
10.30 – 11.00	Coffee break
11.00 – 12.30	Presentation of papers
12.30 – 12.45	Break
12.45 – 14.00	Presentation of papers
14.00 – 16.00	Break
16.00 – 18.00	Presentation of papers
20.00	Dinner party

Friday

23. 10. 2026.

9.30 – 11.00	Presentation of papers
11.00 – 11.15	Break
11.15 – 13.00	Workshops
13.00 – 13.30	Summary and closing remarks

PROGRAMME

Thursday**22. 10. 2026.**

11.00 – 12.30	<i>Presentation of papers</i>
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Meeting place:	<i>Amphitheater</i>
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Chairman:	<i>Prof. Nikola Holeček, Ph. D.</i>
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Nicolae Herisanu, Bogdan Marinca, Vasile Marinca*Nonlinear vibration analysis in the presence of Hertzian impact by means of the optimal auxiliary functions Method***Alexander Andonov, Tihomir Trifonov***Results of modeling the propagation of sound in the sound channel in the waters of the Black Sea***Viktor Grinchenko, Tihomir Trifonov, Volodymyr Matsypura***Measurement of hydrophone sensitivity in a small volume water-air chamber***Branko Radičević, Mišo Bjelić, Mladen Rasinac, Stefan Pajović***Interdependence of noise level measurement results obtained using instruments of different accuracy classes***Marko Milivojčević, Aleksandra Pavlović, Vera Petrović, Dejan Ćirić***Acoustic diagnostic method for early detection of incomplete combustion in individual cylinders of gasoline engines with indirect fuel injection***Nikola Holeček***Noise from garden tools: Measurement-based characterization, exposure assessment and implications for low-noise design*

Thursday

22. 10. 2026.

12.45 – 14.00 *Presentation of papers*

Meeting place: *Room 7*

Chairman: *Prof. Branko Radičević, Ph. D.*

Vasile Bacria, Nicolae Herisanu

Ensuring acoustic comfort in a closed space for human well-being

Andreja Milojković, Ivan Mijailović, Aleksandar Milojković

Acoustic comfort in hospitality architecture: Architectural integration of acoustic wall panels in hotel and resort interiors

Violeta Stojanović, Zoran Milivojević, Dijana Kostić

Comparative evaluation of C_{80} prediction models in a small lecture hall using RIR-derived experimental values

Petar Jovanović, Momir Praščević, Darko Mihajlov

Frequency-dependent joint assessment of sound absorption and transmission loss of acoustic materials

Nikola Mišić, Milan Protić, Miomir Raos, Marjan Popović

Temporal and phase-resolved assessment of total heat release and specific mass loss of acoustic materials

Vesna Nikolić, Tamara Miladinović

Noise and learning: Cognitive and pedagogical perspectives

Thursday	22. 10. 2026.
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16.00 – 18.00	<i>Presentation of papers – 3rd session</i>
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Meeting place:	<i>Room 7</i>
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Chairman:	<i>Prof. Dragan Cvetković, Ph. D.</i>
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Momir Praščević, Darko Mihajlov, Petar Jovanović

Environmental vibration assessment criteria for transport and construction sources: A comparative review of selected European practices

Darko Mihajlov, Petar Jovanović

Strategic environmental noise management: An evaluation of action planning and the case of Novi Sad agglomeration

Aleksandar Gajicki, Emir Ganić

Verification of strategic noise map for Belgrade Nikola Tesla airport based on noise measurements

Mirjana Bonić, Zoltan Vidaković, Momir Praščević

Environmental noise monitoring strategies for estimating annual noise indicators: Practices in the Republic of Serbia

Mirjana Deljanin Milutinović, Mladena Lukić

Explainable machine learning for environmental noise assessment in urban areas

Jana Pumpalović, Emir Ganić, Bojana Mirković

Impact of approach procedures on noise exposure around Belgrade airport

Damir Savković, Aleksandar Milenković, Danica Boljević

Noise in the zone of influence of HVAC systems output units – method and place of installation

Friday

23. 10. 2026.

9.30 – 11.00 *Presentation of papers – 4th session*

Meeting place: *Room 7*

Chairman: *Prof. Valentina Golubović-Bugarski, Ph. D.*

Valentina Golubović-Bugarski, Biljana Vranješ, Davorin-Rino Šikman

Assessment of whole-body vibration exposure of dump truck drivers in a mining company

Ana Vukadinović, Jasmina Radosavljević

Mitigation of hand-arm and whole-body vibration exposure among construction workers

Dragan Stojadinović, Aleksandar Đurić, Snežana Jovanović, Miroslav Jovanović, Sreten Perić

Experimental assessment of crew vibration exposure during artillery firing

Saša Čenić, Jovan Miočinović

Case study: Occupational noise and whole-body vibration exposure of backhoe-loader operator during exploratory mining

Jovan Miočinović

Calculation of occupational noise levels from ammunition firing based on testing in accordance with SRPS EN ISO 9612

Jelena Radenković, Jovan Miočinović

Case study: Occupational noise exposure in a bank cash processing centre

11.15 - 13.00	<i>Workshop</i>
Meeting place:	<i>Room 7</i>
Title:	<i>Technical Framework for the Development of Implementing Regulations on Environmental Noise Protection in the Process of Harmonisation with the Environmental Noise Directive (END)</i>
Moderator:	<i>Prof. Momir Prašćević, Ph. D.</i>
13.00 - 13.30	<i>Summary and closing remarks</i>
Meeting place:	<i>Room 7</i>

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22. 10. 2026.

11:00 – 12:30

Amphitheater

1st SESSION

Chairman

Nikola Holeček, Ph. D.

Nicolae Herisanu^{1,2}, Bogdan Marinca¹, Vasile Marinca^{1,2}

¹ Politehnica University of Timișoara, Romania

² Center for Advanced and Fundamental Technical Research, Romanian Academy
Timișoara Branch, Timișoara, Romania

NONLINEAR VIBRATION ANALYSIS IN THE PRESENCE OF HERTZIAN IMPACT BY MEANS OF THE OPTIMAL AUXILIARY FUNCTIONS METHOD

Abstract – The dynamic behavior of mechanical systems where surfaces touch according to Hertzian elastic contact theory, where the contact force is proportional to indentation, imply nonlinearity induced by dynamic characteristics, as emphasized in this study. The phenomenon of a viscoelastic Hertzian impact is examined using a continuous nonlinearity of local deformation in the presence of Hertzian contact. The present model consists on two components: compression and restitution phases. Using the principle of conservation of energy during the two phases, a transcendent equation is achieved for the calculation of the hysteresis damping coefficient. The nonlinear differential equations corresponding to the two phases are solved by means of the Optimal Auxiliary Functions Method (OAFM) and the obtained results are compared with numerical results for validation purposes.

Key words: Hysteresis damping coefficient, OAFM, Impact model, Hertzian contact

Alexander Andonov¹, Tihomir Trifonov²

¹ St. Cyril and St. Methodius University of Veliko Tarnovo, Faculty of Mathematics and Informatics, Bulgaria

² Vasil Levski National Military University, Department of Communication and Information Systems, Bulgaria

RESULTS OF MODELING THE PROPAGATION OF SOUND IN THE SOUND CHANNEL IN THE WATERS OF THE BLACK SEA

Abstract – Sound propagation models for underwater sound channels were developed based on the models established at the I. Sikorsky National Technical University of Ukraine. This paper presents the physical and mathematical models and their software implementation. The developed software classes were used to generate acoustic ray diagrams using actual sound speed profile data from the Black Sea. The winter and summer ray diagrams differ because of seasonal variations in the sound channel. Numerical calculations were performed, and the results were analysed.

Key words: Sound propagation, Sound channel, Sound speed profile, Mathematical model, Acoustic ray diagram

Viktor Grinchenko¹, Tihomir Trifonov², Volodymyr Matsypura¹

¹ Taras Shevchenko National University of Kyiv, Ukraine, Active Member of the National Academy of Sciences of Ukraine

² Department of Communication and Information Systems, Vasil Levski National Military University, Veliko Tarnovo, Bulgaria

**MEASUREMENT OF HYDROPHONE SENSITIVITY IN A SMALL VOLUME
WATER-AIR CHAMBER**

Abstract – A design of a small volume water-air acoustic chamber for hydrophone calibration is described. Analytical results and practical recommendations are presented. The functionality of the chamber has been experimentally demonstrated.

Key words: Water-air acoustic chamber, Hydrophone, Calibration, Analytical results

Branko Radičević, Mišo Bjelić, Mladen Rasinac, Stefan Pajović

University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo, Serbia

**INTERDEPENDENCE OF NOISE LEVEL MEASUREMENT RESULTS OBTAINED
USING INSTRUMENTS OF DIFFERENT ACCURACY CLASSES**

Abstract – This paper compares noise-level measurements obtained with instruments of different accuracy classes. Reference measurements were performed using a Class 1 sound level analyser and comparative measurements using a Class 2 sound level meter. Simultaneous measurements were conducted under field conditions during operation of a water-treatment plant and drilling rigs, and during residual-noise measurements. Two residual-noise conditions were considered: steady noise and noise intermittently affected by a distant source. Linear regression models for correcting Class 2 results were developed from paired measurements. The coefficients of determination were 0.9976 and 0.9988, indicating a very strong linear relationship. The proposed approach enables estimation of noise levels equivalent to Class 1 measurements, provided that the correction function is established beforehand and applied only under defined conditions.

Key words: Noise, Measurement, Accuracy classes, Sound level meter, Linear regression, Correction

Marko Milivojević¹, Aleksandra Pavlović¹, Vera Petrović², Dejan Ćirić³

¹ The Academy of Applied Studies Polytechnic, Belgrade, Serbia

² The Academy of Technical and Art Applied Studies, Belgrade, Serbia

³ University of Niš, Faculty of Electronic Engineering, Niš, Serbia

ACOUSTIC DIAGNOSTIC METHOD FOR EARLY DETECTION OF INCOMPLETE COMBUSTION IN INDIVIDUAL CYLINDERS OF GASOLINE ENGINES WITH INDIRECT FUEL INJECTION

Abstract – Existing diagnostic systems can detect misfire events in individual cylinders of gasoline internal combustion engines. However, an experienced diagnostician can often recognize irregular or incomplete combustion from the exhaust sound before a sufficiently pronounced misfire is detected and stored as a diagnostic trouble code. This phenomenon may be particularly noticeable in bi-fuel gasoline/LPG vehicles, where operation on gaseous fuel can place higher electrical demands on the ignition system. The proposed method combines the crankshaft position sensor signal with the acoustic signal measured at the exhaust outlet. The CKP signal is used as a rotational and temporal reference, while diagnosis is performed primarily from the time-domain acoustic waveform. A vehicle-specific calibration procedure, performed by deliberately disabling a known cylinder, compensates for the effective delay introduced by the exhaust system and measurement chain and allows an abnormal acoustic event to be associated with the corresponding cylinder. The method is intended as a low-cost, non-invasive supplement to conventional onboard diagnostics and can be implemented using a conventional two-channel oscilloscope and microphone.

Key words: Acoustic diagnostics, Incomplete combustion, Misfire, LPG, Crankshaft position sensor, Exhaust sound

Nikola Holeček

University of Ljubljana, Faculty of Chemistry and Chemical Technology

NOISE FROM GARDEN TOOLS: MEASUREMENT-BASED CHARACTERIZATION, EXPOSURE ASSESSMENT AND IMPLICATIONS FOR LOW-NOISE DESIGN

Abstract – Garden tools are a widespread but insufficiently quantified source of environmental and occupational noise, particularly in residential environments. Their acoustic impact is often underestimated due to variability in operating conditions and limited comparability of declared emission data. This paper presents a systematic experimental analysis of noise emissions from selected garden tools under realistic operating regimes. A-weighted sound pressure levels (L_{Aeq}) were obtained through in-situ measurements, while sound power levels (L_{WA}) were estimated using standardised engineering approaches, incorporating sound propagation effects such as geometrical divergence and atmospheric attenuation. The results are critically compared with manufacturers' declared values and relevant occupational exposure limits, revealing notable discrepancies under real-use conditions. The analysis includes both broadband levels and indicative spectral characteristics, enabling a more comprehensive assessment of user exposure and environmental impact. A comparative evaluation between petrol-powered and battery-powered devices shows consistently lower emission levels for battery tools, along with more favourable acoustic signatures. These findings are relevant not only for exposure reduction but also for the design and optimisation of low-noise equipment. Furthermore, the study highlights the role of personal protective equipment and discusses the potential of digital and sensor-based measurement systems for continuous noise monitoring and data-driven improvement of acoustic performance. The presented approach contributes to improved measurement practices, more realistic risk assessment, and supports the development of quieter technologies in line with sustainable engineering principles.

Key words: Environmental acoustics, Garden tool noise, Sound power level (L_{WA}), L_{Aeq} , Noise exposure, Measurement methods

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22. 10. 2026.

12:45 – 14:00

Room 7

2nd SESSION

Chairman

Branko Radičević, Ph. D.

Vasile Bacria¹, Nicolae Herisanu²

¹ Politehnica University of Timișoara, Romania

² Center for Advanced and Fundamental Technical Research, Romanian Academy
Timișoara Branch, Timișoara, Romania

ENSURING ACOUSTIC COMFORT IN A CLOSED SPACE FOR HUMAN WELL-BEING

Abstract – Inside buildings, technical devices and installations operate, generating noise and vibrations that are very harmful to human life and health. To ensure a comfortable living environment for humans inside buildings, it is necessary to identify the sources of noise and vibrations that operate, determine the propagation mode of these noxious phenomena, measure the characteristic levels, and compare them with the admissible values. To this end, the characteristic parameters of the noise generated by equipment and installations operating within buildings were experimentally determined, and the degree of harmfulness is established by comparing these values with permissible limits. After performing these activities, the way in which the space inside the buildings is affected is assessed. Based on the results obtained, the necessary measures to ensure acoustic comfort in enclosed residential spaces, as well as their effectiveness are determined. The paper presents in detail the results of the research undertaken by the authors in this field.

Key words: Noise level, Acoustic comfort, Sources of noise, Enclosed spaces

Andreja Milojković^{1,3}, Ivan Mijailović², Aleksandar Milojković¹

¹ University of Niš, Faculty of Civil Engineering and Architecture, Niš, Serbia

² University of Niš, Faculty of Occupational Safety, Niš, Serbia

³ University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

ACOUSTIC COMFORT IN HOSPITALITY ARCHITECTURE: ARCHITECTURAL INTEGRATION OF ACOUSTIC WALL PANELS IN HOTEL AND RESORT INTERIORS

Abstract – Acoustic comfort is an important component of guest experience in hotels and resorts, where rooms, restaurants, conference spaces, lobbies, and wellness facilities have different acoustic requirements. This paper reviews the architectural integration of acoustic wall panels using selected research, standards, and technical documentation. It examines material properties, mounting conditions, panel placement, and their relationship with reverberation, speech intelligibility, and interior design. The reviewed evidence indicates that performance depends on room characteristics and operating conditions, so laboratory absorption ratings cannot be translated directly into universal noise reduction values. Particular attention is given to spa and wellness areas, distinguishing dry rooms from swimming pool environments that require suitable materials and mounting systems. A design framework connects problem identification, acoustic objectives, panel selection, maintenance requirements, and outcome assessment. The review highlights opportunities and limitations of wall panels and the need for further measurements in hotel settings, supported by guest and staff evaluations.

Key words: Acoustic comfort, Noise control, Hospitality architecture, Acoustic wall panels, Interior acoustics, Hotel and resort design

Violeta Stojanović¹, Zoran Milivojević¹, Dijana Kostić²

¹ The Academy of Applied Technical and Preschool Studies, Niš, Serbia,

² Šargan Inženjering, Niš, Serbia

COMPARATIVE EVALUATION OF C_{80} PREDICTION MODELS IN A SMALL LECTURE HALL USING RIR-DERIVED EXPERIMENTAL VALUES

Abstract – This paper presents a comparative evaluation of the Barron–Lee and Gao models for predicting the clarity index C_{80} in the A2 lecture hall at the Academy of Applied Technical and Preschool Studies, Niš, Serbia, to assess their applicability to a small lecture hall with a short reverberation time. Predictions at 500 Hz and 1000 Hz were compared with experimental values derived from measured room impulse responses. The analysis included the spatial distribution of C_{80} , linear regression as a function of source–receiver distance, model deviations, and root-mean-square errors. Both models yielded nearly identical predictions and showed decreasing trends with increasing source–receiver distance, but their predictions did not follow the experimental variations in C_{80} among individual measurement positions. The Gao model had a slightly lower RMSE than the Barron–Lee model at the frequencies analysed. Both models showed better overall agreement with the experimental values at 1000 Hz.

Key words: Room acoustics, Clarity index C_{80} , Room impulse response, Prediction models, Spatial variability

Petar Jovanović, Momir Prašević, Darko Mihajlov

University of Niš, Faculty of Occupational Safety, Niš, Serbia

FREQUENCY-DEPENDENT JOINT ASSESSMENT OF SOUND ABSORPTION AND TRANSMISSION LOSS OF ACOUSTIC MATERIALS

Abstract – Acoustic materials may be required to reduce both reflected and transmitted sound, but high sound absorption does not necessarily imply high transmission loss. This study presents a joint frequency-dependent evaluation of six polymeric, cellular and fibrous materials using impedance-tube measurements. Normal-incidence sound absorption coefficients were determined by the two-microphone transfer-function method, while transmission loss was obtained using the four-microphone transfer-matrix method. To compare the two acoustic functions, arithmetic band means were calculated over 500 – 1600 Hz and 2000 – 5000 Hz and represented in a joint SAC-TL performance map. The flax/polypropylene specimen showed the strongest high-frequency absorption, reaching $\alpha = 0.84$ at 5000 Hz, but only 4.3 dB transmission loss. In contrast, a cellular NBR specimen reached 37.6 dB transmission loss with $\alpha = 0.23$. Open-cell TPE specimens occupied an intermediate region. The joint map distinguishes transmission-loss-oriented, absorption-oriented and intermediate responses and provides a compact basis for comparative material screening without introducing an arbitrary combined performance index.

Key words: Sound absorption coefficient, Transmission loss, Impedance tube, Acoustic materials, Performance map

Nikola Mišić¹, Milan Protić¹, Miomir Raos¹, Marjan Popović²

¹ University of Niš, Faculty of Occupational Safety, Serbia² MIPHEM d.o.o., Belgrade, Serbia**TEMPORAL AND PHASE-RESOLVED ASSESSMENT OF TOTAL HEAT RELEASE AND SPECIFIC MASS LOSS OF ACOUSTIC MATERIALS**

Abstract – Acoustic materials are primarily developed to improve sound absorption and noise control, while their response to thermal exposure is often considered to a lesser extent. This study evaluated the temporal and phase-resolved behaviour of eleven acoustic materials through total heat release (THR), specific mass loss (SML), and flaming duration. The specimens were tested using a mass loss calorimeter at an external heat flux of 50 kW/m². The experimental records were divided into pre-ignition, flaming, and post-flaming periods. Marked differences were observed in the amount, duration, and temporal development of heat release. Sample S1 exhibited the highest THR_{total} and SML_{total}, reaching approximately 121.5 MJ/m² and 5.97 kg/m², respectively, whereas S7 showed the lowest values. Flaming duration alone did not explain the cumulative thermal contribution, since materials with similar durations exhibited substantially different THR values. Visible flaming accounted for most of the heat release and mass loss in the majority of samples. However, S3 showed the most pronounced post-flaming response, with approximately 14 % of THR_{total} and 6.2 % of SML_{total} occurring after flame extinction. The results demonstrate that THR, SML, flaming duration, and their temporal distribution should be considered jointly when comparing the fire-response characteristics of acoustic materials.

Key words: Acoustic materials, Total heat release, Specific mass loss, Mass loss calorimeter, Fire-response characteristics

Vesna Nikolić, Tamara Miladinović

University of Niš, Faculty of Occupational Safety, Serbia

NOISE AND LEARNING: COGNITIVE AND PEDAGOGICAL PERSPECTIVES

Abstract – Noise is one of the most significant environmental factors affecting cognitive processes and learning efficiency. Research indicates that increased noise levels lead to reduced concentration, greater fatigue, and lower academic achievement. The aim of this paper is to analyze the effects of noise on the learning process through a review of relevant literature and empirical studies. Special attention is given to the psychological and physiological consequences of noise exposure, as well as pedagogical strategies for mitigating its negative effects. Findings suggest that systematic control of the acoustic environment – through architectural, technological, and methodological measures – can substantially improve students' concentration, motivation, and academic performance. It is concluded that integrating noise reduction measures into educational institutions is essential for enhancing the quality of teaching and achieving better learning outcomes.

Key words: Noise, Learning, Concentration, Academic Performance, Acoustic environment

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22. 10. 2026.

16:00 – 18:00

Room 7

3rd SESSION

Chairman:

Dragan Cvetković, Ph. D.

Momir Prašćević, Darko Mihajlov, Petar Jovanović

*University of Niš, Faculty of Occupational Safety in Niš, Serbia***ENVIRONMENTAL VIBRATION ASSESSMENT CRITERIA FOR TRANSPORT AND CONSTRUCTION SOURCES: A COMPARATIVE REVIEW OF SELECTED EUROPEAN PRACTICES**

Abstract – Unlike environmental noise, environmental vibration is not governed by a harmonized EU-wide regulatory framework. Environmental vibration from road traffic, railways, metro systems, construction and blasting is regulated through heterogeneous standards, statutory provisions and project criteria. This review compares European approaches for occupants, structures and vibration-sensitive uses, supported by selected international benchmarks. The analysis separates source, propagation path, receptor, descriptor, frequency treatment, exposure rule, measurement position and legal status. Particular attention is given to metro-induced ground-borne vibration and the associated re-radiated ground-borne noise, i.e. audible sound radiated inside buildings by floors, walls and ceilings excited by vibration transmitted through the ground and building structure. The principal descriptors include weighted RMS acceleration, vibration dose value, peak particle velocity, KB indices, v_{max}/v_{per} , the Spanish L_{aw} index, and logarithmic vibration velocity levels. Verified numerical criteria are compared only when they use the same assessment descriptor and a sufficiently comparable measurement context. The results show that national values cannot be reliably ranked or converted unless their measurement and decision contexts are aligned. A minimum reporting matrix is proposed to support transparent cross-country comparison and future European guidance.

Key words: Environmental vibration, Ground-borne vibration, Railway and metro, Construction vibration, Human response, Building damage

Darko Mihajlov, Petar Jovanović

*University of Niš, Faculty of Occupational Safety in Niš, Serbia***STRATEGIC ENVIRONMENTAL NOISE MANAGEMENT: AN EVALUATION OF ACTION PLANNING AND THE CASE OF NOVI SAD AGGLOMERATION**

Abstract – Environmental noise management in urban areas requires a transition from strategic noise mapping to the development and implementation of effective noise action plans. In Serbia, this process is still at an early stage. The draft Noise Action Plan for the Novi Sad Agglomeration, developed in 2025, is the first and, to date, the only noise action planning document prepared for an agglomeration in Serbia. It therefore provides an important case for examining the practical implementation of strategic environmental noise management at the national level. This paper critically evaluates the Novi Sad draft Action Plan within the framework established by Directive 2002/49/EC and contemporary approaches to environmental noise management. The analysis focuses on the proposed noise mitigation measures, protection of quiet areas, institutional and financial implementation challenges, and the potential integration of citizen perception, environmental health equity, and the noise footprint concept into action planning. The results identify both the strengths of the proposed planning framework and several areas requiring further development, particularly regarding implementation mechanisms, inter-sectoral coordination, financing, and broader criteria for evaluating the urban acoustic environment. The Novi Sad case provides a basis for discussing future noise action planning in other Serbian agglomerations and the further development of strategic environmental noise management in Serbia.

Key words: Environmental noise, Noise action plans, Environmental Noise Directive, Novi Sad, Strategic noise management, Serbia

Aleksandar Gajicki¹, Emir Ganić²

¹ Saobraćajni Institut CIP d.o.o.

² University of Belgrade – Faculty of Transport and Traffic Engineering

VERIFICATION OF STRATEGIC NOISE MAP FOR BELGRADE NIKOLA TESLA AIRPORT BASED ON NOISE MEASUREMENTS

Abstract – Strategic noise maps represent an important tool for assessing environmental noise exposure and supporting the development of noise mitigation measures in accordance with Directive 2002/49/EC and national legislation. In order to ensure the reliability of acoustic modelling results, verification of strategic noise maps based on field measurements is of particular importance, especially in the case of airports where aircraft operational characteristics and meteorological conditions significantly affect environmental noise levels. This paper presents the verification of the strategic noise map for Belgrade Nikola Tesla Airport using data obtained from the continuous Noise and Track Keeping (NTK) monitoring system established in the airport surroundings. In 2023, aircraft noise was monitored at six measurement points using Class 1 sound monitoring equipment compliant with IEC 61672 requirements. The verification process included adjustment of measured results to national legislative noise periods, classification of recorded sound events, and comparison between measured and calculated equivalent noise levels for different operational conditions and time periods. The analysis showed that aircraft noise was the dominant source only at selected monitoring locations, while at other points community noise significantly influenced measured levels. Due to operational and spatial limitations of some monitoring locations, two measurement points considered representative for aircraft noise exposure were used for the strategic noise map verification. The differences between the measured and calculated equivalent noise levels for the day and evening periods were generally below 2 dB, while slightly greater deviations were identified during the night-time period. The results confirm that the acoustic model and the strategic noise map represent airport operations with satisfactory accuracy and provide a reliable basis for environmental noise management and action planning.

Key words: Environmental noise, Airport, Noise indicators, Noise measurements, Aircraft noise, Acoustic modelling

Mirjana Bonić¹, Zoltan Vidaković¹, Momir Prašević²

¹ Public Health Institute of Subotica, Subotica, Serbia

² University of Niš, Faculty of Occupational Safety in Niš, Serbia

ENVIRONMENTAL NOISE MONITORING STRATEGIES FOR ESTIMATING ANNUAL NOISE INDICATORS: PRACTICES IN THE REPUBLIC OF SERBIA

Abstract – Annual environmental noise indicators require measurements or estimates representative of the full reference year, yet the monitoring strategies used by local authorities differ substantially. The availability of monitoring records was checked across 145 local self-government units in the study area; monitoring data were identified and analysed for 59 units (40.7 %), primarily for 2023, with records from 2013 – 2024 used where necessary. Short-term mobile measurements using the 3+2 approach were reported for 42 of these 59 units (71.2 %), whereas permanent monitoring was identified only in Niš. Indicator estimates were available for 597 sites in 55 units; approximately 80 % of the sites were measured exclusively on weekdays. Among acoustically zoned sites with available results, exceedances occurred for 40.8 % of daytime, 32.9 % of evening and 57.8 % of night-time values. The measured-cycle averages are estimates of annual indicators whose representativeness depends on the timing and duration of sampling. More systematic coverage of weekends, seasons and source conditions, together with explicit reporting of sampling limitations, would strengthen annual assessments and comparisons across municipalities.

Key words: Environmental noise, Noise monitoring strategy, Noise indicators, Acoustic zones, Local self-government, Republic of Serbia

Mirjana Deljanin Milutinović, Mladena Lukić

*University of Niš, Faculty of Occupational Safety, Serbia***EXPLAINABLE MACHINE LEARNING FOR ENVIRONMENTAL NOISE
ASSESSMENT IN URBAN AREAS**

Abstract – Road traffic noise is a major environmental concern, while continuous monitoring is often limited by resource requirements. This study evaluates machine learning for equivalent noise level (L_{eq}) predictions using long-term monitoring data and spatial characteristics of measurement sites. A dataset of 5,763 L_{eq} values from 15 locations in Niš, Serbia, was analysed using Linear Regression, Random Forest, and Extreme Gradient Boosting. Extreme Gradient Boosting achieved the lowest mean absolute error (MAE = 0.742 dB), although its overall advantage over a baseline model was limited. Shapley additive explanations showed that spatial characteristics had the strongest influence on model predictions and indicated possible dependencies among spatial predictors. The results suggest that machine learning can complement conventional noise monitoring by estimating L_{eq} during unmeasured periods at previously monitored locations, while its application to unseen locations requires further validation.

Key words: Environmental noise monitoring, Road traffic noise, Machine learning, Shapley additive explanations

Jana Pumpalović, Emir Ganić, Bojana Mirković

*University of Belgrade – Faculty of Transport and Traffic Engineering***IMPACT OF APPROACH PROCEDURES ON NOISE EXPOSURE AROUND
BELGRADE AIRPORT**

Abstract – Aircraft noise is a major environmental concern in areas surrounding airports, where frequent aircraft operations can result in substantial noise exposure for local communities. At Belgrade Nikola Tesla Airport, noise exposure is particularly relevant due to the volume of air traffic, the airport's location, and the spatial distribution of aircraft flight paths in the surrounding area. The aim of this study was to quantify the impact of different approach and landing procedures on noise levels, the area affected by specific noise levels, and the number of residents exposed to aircraft noise. For the purpose of the analysis, the Eurocontrol IMPACT software was used to model and compare a conventional approach, Continuous Descent Operations (CDO), a steeper approach with a 4.5° descent angle, and the Multiple Aiming Points concept. For the latter concept, the displacement of the aiming point from the standard position of 1500 m from the runway threshold was analysed, together with the landing distance required by the Airbus A319 and the applicability of this concept to different types of jet aircraft. The impact of the procedures was evaluated using Sound exposure level (SEL), Maximum A-weighted sound level (L_{Amax}), and Equivalent continuous sound level (L_{eq}), while noise contours were spatially analysed and compared in QGIS. The study demonstrated several possible approach and landing options and provided a basis for assessing their applicability in reducing noise exposure, which may support airports, airlines, air navigation service providers, and relevant authorities in noise management and mitigation planning.

Key words: Aircraft noise, Airport, Noise indicators, Noise exposure, Approach procedures

IMS Institute ad, Belgrade, Serbia

**NOISE IN THE ZONE OF INFLUENCE OF HVAC SYSTEMS OUTPUT UNITS –
METHOD AND PLACE OF INSTALLATION**

Abstract – *When installing the output units of HVAC systems in commercial facilities, it is necessary to pay particular attention to the installation position and conditions to avoid noise disturbance in the surrounding environment, both outdoors and indoors, within the zone of influence. For the system to function properly, the output units should be installed where the flow of fresh air is as good as possible, usually outdoors and most often on the building facade. However, the noise they generate must not disturb people in the surrounding area. The acoustic zone to which the outdoor location belongs should also be taken into account. This paper examines the topic through examples of HVAC system noise measurements at retail outlets selling mass-market goods in a chain of stores belonging to the same owner.*

Key words: *Noise, HVAC system, Reference measuring point, Installation*

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23. 10. 2026.

9:30 – 11:00

Room 7

4th SESSION

Chairman:

Valentina Golubović-Bugarski, Ph. D.

Valentina Golubović-Bugarski¹, Biljana Vranješ¹, Davorin-Rino Šikman²

¹ University of Banja Luka, Faculty of Mechanical Engineering, Banja Luka, Bosnia and Herzegovina;

² ArcelorMittal Europe - Long Products

ASSESSMENT OF WHOLE-BODY VIBRATION EXPOSURE OF DUMP TRUCK DRIVERS IN A MINING COMPANY

Abstract – The technological processes associated with ore extraction are highly complex and include the transportation of extracted material from mining sites to processing facilities using continuous and discontinuous transport systems. Discontinuous systems involve various types of vehicle-based transport, with dump trucks being among the most commonly used means of ore haulage. Dump truck operators are exposed to various occupational hazards, including physical hazards such as noise and mechanical vibration. Particular attention should be given to whole-body vibration, which is transmitted to the operator through the vehicle seat during machinery operation and represents a significant occupational exposure factor. Risk assessment involves the systematic identification and evaluation of hazards and harmful factors to which workers are exposed, providing a basis for determining occupational risk and implementing appropriate occupational health and safety measures. Since physical hazards can be objectively quantified using specialised measurement equipment, measured exposure levels can be compared with permissible limit values established by applicable standards and legislation. This paper presents an analysis of whole-body vibration exposure and the associated occupational risk for dump truck operators in a mining company.

Key words: Whole-body vibration, Dump truck operator, Risk assessment, Preventive measures

Ana Vukadinović, Jasmina Radosavljević

University of Niš, Faculty of Occupational Safety, Serbia

MITIGATION OF HAND-ARM AND WHOLE-BODY VIBRATION EXPOSURE AMONG CONSTRUCTION WORKERS

Abstract – In the construction sector, mechanical vibration exposure occurs routinely during the operation of heavy machinery (e.g., excavators, bulldozers, vibratory rollers, cranes, and other machinery) and hand-held power tools (e.g., pneumatic jackhammers, angle grinders, sanders, and chainsaws). Depending on the operational interface, workers absorb localised high-frequency energy via hand-arm vibration (HAV) or systemic low-frequency energy via whole-body vibration (WBV). This paper analyses the primary sources and mechanical propagation mechanisms of HAV and WBV in construction environments. Regulatory frameworks and standardisation directives – including European Directive 2002/44/EC, national rulebooks, and ISO standards (ISO 2631, ISO 7096, ISO 10819) – are detailed, outlining daily exposure action values (EAV) and exposure limit values (ELV). Furthermore, the etiology of occupational vibration disorders, such as Hand-Arm Vibration Syndrome (HAVS) and lumbar spine degeneration, is evaluated. Finally, an integrated hierarchy of risk mitigation controls encompassing engineering isolation, preventive maintenance, organisational work scheduling, and personal protective equipment (PPE) is synthesised.

Key words: Hand-Arm Vibration, Whole-Body Vibration, Construction Machinery, Occupational Safety, Hierarchy of Controls, Health Exposure Limits

Dragan Stojadinović¹, Aleksandar Đurić², Snežana Jovanović¹, Miroslav Jovanović³, Sreten Perić²

¹ Technical Test Center, Serbian Army, Ministry of Defense, Belgrade, Serbia

² Military Academy, Ministry of Defense, Belgrade, Serbia

³ ZF Serbia, Pančevo, Serbia

EXPERIMENTAL ASSESSMENT OF CREW VIBRATION EXPOSURE DURING ARTILLERY FIRING

Abstract – The vibrations generated during the firing of artillery systems have a significant impact on crew safety and occupational health. This paper presents the results of experimental measurements and analyses of shock-induced vibrations in artillery systems equipped with 125 mm guns, as well as 122 mm and 155 mm gun-howitzers, in accordance with the relevant standards and Directive 2002/44/EC. The results indicate that the maximum recorded shock accelerations reached approximately 8.55 g, while the measured vibration levels remained within the permissible limits for short-term exposure. The findings also show that vibration intensity depends not only on the weapon calibre but also on the structural characteristics of the artillery system. The use of appropriate personal protective equipment is therefore recommended to further reduce the risk associated with crew exposure to shock-induced vibrations.

Key words: Vibrations, Measurements, Assessment, Risks, Crew

Saša Čenić^{1,2}, Jovan Miočinović¹

¹ TEHPRO d.o.o. Belgrade, Serbia

² The Academy of Applied Studies Polytechnic, Belgrade, Serbia

CASE STUDY: OCCUPATIONAL NOISE AND WHOLE-BODY VIBRATION EXPOSURE OF BACKHOE-LOADER OPERATOR DURING EXPLORATORY MINING

Abstract – An occupational noise and whole-body vibration assessment was conducted at an exploratory mining site at the workplace position of a backhoe-loader operator. The exposure to noise and whole-body vibration in the working environment was determined and evaluated in accordance with national regulations and relevant standards. The results were compared with data provided by the equipment manufacturer and guidelines from relevant literature.

Key words: ISO 9612, ISO 2631, Occupational noise exposure, Whole-body vibration, Earthmoving machinery

Jovan Miočinović

TEHPRO d.o.o. Belgrade, Serbia

**CALCULATION OF OCCUPATIONAL NOISE LEVELS FROM AMMUNITION
FIRING BASED ON TESTING IN ACCORDANCE WITH SRPS EN ISO 9612**

Abstract – *In the production of weapons and ammunition, personnel involved in testing products in the shooting range are directly exposed to gunshot noise. Testing by direct measurement at the test shooter's workplace requires special equipment. In this paper, the determination of noise exposure and evaluation were performed based on measurements at positions near the shooter's position using equipment that meets the requirements of SRPS EN ISO 9612 and the calculation of occupational noise levels based on measurements. Based on the approximation model and measurement technique, the measurement uncertainty for the test results was estimated and the results were compared with the results of reference tests from the literature.*

Key words: *Gunshot noise, Occupational noise exposure, ISO 9612, Measurement uncertainty, Noise level calculation*

Jelena Radenković, Jovan Miočinović

TEHPRO d.o.o. Belgrade, Serbia

**CASE STUDY: OCCUPATIONAL NOISE EXPOSURE IN A BANK CASH
PROCESSING CENTRE**

Abstract – *Noise testing and occupational noise exposure assessment were performed across 27 locations within the main, regional, and local cash processing centres of three banks. Conducted periodically over a 12-year period in accordance with national regulations and relevant standards, the study evaluated noise levels both for the level range above the given risk of hearing damage and for the one underneath the risk considered to be disruptive to work. This paper compares the longitudinal results of these assessments and variations to highlight occupational health risks and environmental trends in specific banking environments.*

Key words: *ISO 9612, DIN 45645-2, Occupational noise exposure, Hearing damage risk, Disruptive noise assessment, Cash processing centre*

Authors

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