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Advanced Engineering and Technology

Part 2

Edited by
Dongkeon Kim, Jong Wan Hu,
Jongwon Jung and Junwon Seo



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Advanced Engineering and Technology

PART 2

Selected, peer reviewed papers from the
International Conference on
Advanced Engineering and Technology
(ICAET 2014),
December 19-21, 2014, Incheon, South Korea



Edited by

**Dongkeon Kim, Jong Wan Hu,
Jongwon Jung and Junwon Seo**

TTP

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Preface

The 2014 International Conference on Advanced Engineering and Technology (ICAET 2014) will take place in Incheon, at Incheon National University (INU), South-Korea, December 20-21, 2014. This conference is sponsored by Incheon Disaster Prevention Research Center (IDPRC) in INU. The ICAET 2014 is an annual international conference aimed at presenting current research being carried out in the fields of materials, structures and mechanical engineering. The idea of the conference is for the scientists, scholars, engineers and students from universities, research institutes and industries all around the world to present on-going research activities. This allows for the free exchange of ideas and challenges among the conference participants and encourages future collaboration between members of these groups. The conference will also foster cooperation among organizations and researchers involved in the merging fields and will provide in-depth technical presentations with abundant opportunities for individual discussions with the presenters.

The book is a collection of accepted papers. All these accepted papers were subjected to strict peer-reviewing by 2-3 experts referees including preliminary review process conducted by conference editors and committee members before their publication by Trans Tech Publication (TTP). This book is separated into twelve main chapters including 1. Metal and Alloy Materials and Technologies 2. Advanced Materials Engineering and Applications, 3. Materials Testing, Analysis and Processing Technology, 4. Structural Engineering, Dynamics and Applied Mechanics, Building Materials and Building Management 5. Mechanical Engineering and Design, Manufacturing Technology 6. Automation, Robotics and Control 7. Measurement, Monitoring and Detection, Identification and Advanced Systems 8. Communication, Graphic and Image Processing, Information Technologies Applications 9. Energy Control and Power Systems, Electrical and Electronic Engineering 10. Disaster Prevention and Mitigation Technology, Environmental Protection and Safety Management 11. Industrial Engineering, Production Quality and Management, The committee of ICAET 2014 should show our sincere thanks to all authors for their high-quality research papers and careful presentations. All reviewers should be also thanked for their careful comments and advices.

Thanks are all finally given to TTP as well for producing this volume.

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Table of Contents

Preface	xix
Committee	xx

PART 2

Improvement of Acoustic Properties and Dynamic Characteristics of Temporary Bridge Structures	
I. Skotnicova, N. Zdrzilova, R. Fojtik and P. Oravec.....	733
Study on the Vibration Control Based on the Piezoelectric Self-Sensing Vibration Damper	
G.Y. Pan and S.S. Wang	739
Analysis of Floor Impact Sound Propagation around the Adjacent Houses	
K.W. Kim, J.Y. Chung, J.O. Yeon and M.J. Kim	745
The Composite Reinforcement of LLC «SK»	
S. Kiski, Z. Teplova and A. Sokolov	749
Development of an Environmental Database for Construction Finish Materials Organized by Building Element	
R.H. Kim, S.H. Tae, C.U. Chae and J.H. Kim	758
Shear at the Interface between Composite Parts of Prestressed Concrete Section	
J. Navrátil and L. Zvolánek.....	763
Study on Finite Element Model for Impact Damage of Composite Structure	
H.B. Park.....	769
Numerical Analysis and Static Loading Test of Equipment Fixed on the Light-Weight Partition Wall	
M.C. Lee, R.Z. Wang, B.C. Lin and C.H. Huang	773
Reliability of Vibration Transfer Path Systems	
W. Zhao, P. Chen and Y.M. Zhang.....	778
The Effects of Water Saturation on Dynamic Mechanical Properties in Red and Buff Sandstones Having Different Porosities Studied with Split Hopkinson Pressure Bar (SHPB)	
E.H. Kim and D.B.M. de Oliveira.....	784
The Effects of Reservoir Area Extent on the Performance of a Vertical Well in a Reservoir Subject to Bottom Water Drive	
I. Eiroboyi and P.O. Obeta	790
Analysis of the Airborne Sound Insulation Performance of Floor Structures Based on the Intensity Method	
J.O. Yeon, K.W. Kim, K.S. Yang and M.J. Kim	796
Characteristic Evaluation of Impact Sound Reduction by Floor Coverings Using Floor Impact Sound in a Test Building	
J.O. Yeon, K.W. Kim, K.S. Yang and M.J. Kim	800
Analytical Homogenization for In-Plane Shear and Torsion of Honeycomb Sandwich Plates with Skin and Height Effects	
Y.M. Li, M.P. Hoang, B. Abbes, F. Abbes and Y.Q. Guo.....	804

Chapter 5: Mechanical Engineering and Design, Manufacturing Technologies

Study on the Cooling System of the Electronic Equipment in the Cabin of the Stratospheric Airship	
H. Shi, Y.L. Jiang and Y.F. Cai	815
Optimization of Plate Heat Exchangers with Intermittent Ridges	
V. Dvorak.....	820
The Design and Research of Automatic Micro-Pressure Relief Valves Used in Mine Rescue Cabin	
N.Y. Zhou, Y.L. Jiang, L. Xu, J. Li and H.X. Wang	828
An Innovative Method of Harnessing Hydraulic Energy for Mini Cost-Saving Water Treatment Plant Using Hydraulic Turbine: A Mathematical Approach towards Design and Analysis	
A.T. Din, V.K. Kher and C.F. Tan	833
Investigation of Sensitivity Effect Based on Mass and Stiffness Modification in Automobile Crankshaft	
R.M.S. Zetty, B.A. Aminudin, L.M. Aung, M.K. Khalid, H.M.Y. Norfazrina and N.M.R. Raihan	839
Cooling Rate Analysis of Thin Wall Ductile Iron Using Microstructure Examination and Computer Simulation	
R.D. Sulamet-Ariobimo, J.W. Soedarsono and B. Suharno.....	845
The Effects of Fluid Structure Interactions on the Dynamic Characteristics of the Reactor Internals Structure of SMART	
J.W. Lee and Y.S. Lee.....	851
Finite Element Analysis of Automobile Suspension Control Arm	
H.B. Zhang, R.J. Zhang and Y. Chang.....	859
Technological and Operational Aspects of Integrated Bladed Rotors Manufacture	
A. Kutin, S. Grigoriev, M. Turkin and M. Sedykh	864
Technology for Hydrothermal Destruction of Organic Fuel Materials	
Y. Mazalov, A. Pustovgar, V. Grigorev, A. Vedenin and A. Adamtsevich.....	873
Technological Limitations of Selective Laser Melting Method	
T. Tarasova and A. Nazarov	878
Results of the Study Rotor Wheels Supersonic Microturbines with a Large Angle of Rotation of the Flow	
A.Y. Fershalov, M.Y. Fershalov, Y.Y. Fershalov and T.V. Sazonov	884
Heuristics for an m-Machine Re-Entrant Permutation Flowshop with the Objective of Total Tardiness	
S.W. Choi.....	890
Effect of Oil Flow Velocity on Hydraulic Shock	
A. Bureček, L. Hružík and M. Vašina.....	896
CFD Analysis for the Turbulent Flow Distribution in a Fuel Assembly with the Split-Type Mixing Vanes by Using the Advanced Scale-Resolving Turbulence Models	
G.H. Lee and A.J. Cheong	902
Visualized Flow Structure inside an Odor-Removing Basin System with Multi-Stacked Porous Baffles	
W.H. Lee, K.W. Kim, J.H. Lee, J.H. Yoon, M.K. Kwak and C.W. Park	908
Dynamic Characteristics Research of Magneto-Rheological Fluid Engine Mount	
G.Y. Pan, Q.Q. Wang and X. Yang	913

Twin Shaft Rotor System Vibration Damping Experimental Investigation M.S. Nikhamkin, S.V. Semenov, G.V. Mekhonoshin, I.V. Semenova and N.A. Sazhenkov.....	918
Numerical Analysis of Swirl Chamber Combustion System in DI Diesel Engines with the Conical-Spray S.L. Wei, K.P. Ji, X.Y. Leng and X. Liu.....	922
Air-Fuel Ozonation System for a Combustion Engine Addressing an Environmental Target N.K. Poluyanovich, D.V. Burkov, D.P. Rassoja and M.N. Dubyago	928
Structural Modification Strategies to Improve Piezoelectric Energy Harvester Performance H. Salleh, M.H. Lam, L. Muhamad and M.F. bin Jaafar	934
Improving the Efficiency of Power Generation Plants Based on Internal Combustion Engines A.Y. Budko, M.Y. Medvedev and V.V. Matsiborko	941

Chapter 6: Automation, Robotics and Control

Verification of External Gas-Assisted Mold Temperature Control for Injection Molding Process P.S. Minh and T.T. Do	949
Ensuring Maximum Stability Degree in the Systems with Interval Parameters T.A. Ezangina and S.A. Gayvoronskiy	955
Embedded Wireless Automatically Watering Plants Using UAV P. Subpratatsavee, P. Kuha and P. Pudtuan	961
Path Control for a Manipulator while Tracking a Given Trajectory Y.A. Lezhnina, G.N. Ternovaya and I.Y. Petrova	967
Kinematic Optimization of Parallel Manipulators with a Desired Workspace Z.G. Yang, M.L. Shao and D.I. Shin.....	973
Diagnostics of Resistance Coefficients and Cavitation of Flow Control Valve J. Jablonská and M. Kozubková.....	980
The Extension of Battery Lives Used in a Solar Irrigation System with Regards to Charge-Discharge Numbers F.A. Kazan, C. Sungur and H. Terzioğlu	988
Enhancement the Maneuverability of Tele-Hydraulic System Using Fuzzy Friction Compensator W. Po-Ngaen and J. Maka.....	995
The Design of Pneumatic Visual Servo Positioning System L.K. Zhu, D. Zhao, W. Ji and Y. Chen	1000
Automated Car Parking Authentication System Using NFC and Public Key Cryptography Based on Android Phone P. Subpratatsavee, W. Sriboon and W. Issavasopon.....	1006
Low Cost Mobile Robot Kits Design as a Teaching Tool for Education and Research C. Chomyim, S. Chaisanit and A. Trangsansri.....	1010
Development of Foot Modules of an Exoskeleton Equipped with Multiple Sensors for Detecting Walking Phase and Intent B.J. Son, Y.S. Baek and J.H. Kim.....	1016
Development of Exoskeleton 4-Bar Linkage Gripper for Front End Module (FEM) Assembly Process M.H. Shim and J.H. Kim.....	1022

Chapter 7: Measurement, Monitoring and Detection, Identification and Advanced Systems

A Study on Structural System Identification and Damage Detection for Free Vibration Response Using the Wavelet Transform	
A. Sahekhaini, P. Muhamad, M. Kohiyama, A. Abu, L. Kee Quen and H. Abdullah	1029
Analysis of Ground Massif Temperatures with Slinky Horizontal Heat Exchanger	
M. Šedřová, P. Neuberger and R. Adamovský	1035
Reliability of Identification Based on Fingerprints in Dual Biometric Identification Systems	
V. Nidlová and J. Hart.....	1040
Weld Detect Identification Using Texture Features and Dynamic Time Warping	
H. Yazid, H. Arof, H. Yazid and N. Abd Razak	1045
A Co-Simulation Analysis of Hydraulic Pitch Control System in Large Wind Turbine	
M.H. Chiang, C.S. Wang, C.C. Huang, W.N. Su and T.C. Tung	1051
A Design and Implementation of Attendance System Using Smallest Wireless Fingerprint with Arduino Yún Embedded Board	
P. Subpratatsavee and N. Pubpruankun	1057
Home Patient Sensor and Monitor System Using iPhone	
P. Subpratatsavee and T. Promjun	1062
Employee Attendance Checker in Manufacturing Using Barcode and Mobile with Embedded Camera	
P. Subpratatsavee and T. Kongtrakul	1066
HC2D Barcode for Handwritings Verification Using Embedded Camera on Tablet	
P. Subpratatsavee and W. Sakulsaknimit	1069
Design and Analysis of the Oxygen Regulator in the Aircraft	
Y.J. Zhao and H.X. Wu.....	1073

Chapter 8: Communication, Graphic and Image Processing, Information Technologies Applications

3D Mosaic from Images	
J.H. Park.....	1081
Object Movement Computation from Two Images	
J.H. Park and S.H. Park.....	1085
The Pattern Based Visual Property Specification Language and Supporting System for Software Verifications	
S.S. Chun.....	1090
Effective Extraction of State Invariant for Software Verification	
S.S. Chun.....	1097
Management of Eastern Farmers Association Community Radio and Ban Huakrok Community Radio, Chon Buri Province	
P. Prompitak.....	1105
Hybrid Distributed Correlation Noise Model and Parameter Estimation	
R. Cai and D.Y. Zhang.....	1110

Raising Energy Awareness through 3D Computer Animation	
C. Prayoonrat.....	1116
Prediction of Indoor Millimeter Wave Propagation Characteristics Based on BP Neural Network	
Z.Y. Sun and H.H. Li	1121

Chapter 9: Energy Control and Power Systems, Electrical and Electronic Engineering

An Outage of Overhead and Underground Distribution Network Evaluation Assessment	
P.U. Okorie	1127
The Measurement of the Voltage Distribution along High Voltage Suspension Porcelain (5-6-7 Insulator)/String in Case of Clean Condition	
N. Tonmitr, E. Kaneko, K. Tonmitr, A. Kaewrawang and A. Suksri	1133
Research and Establishment of UHV AC Transmission Model	
H. Yang and F. Tang	1139
Reliability Evaluation of Optical Fiber Protection Channels Based on Practical Coding and Logical Calculation	
B.W. Fang, D.C. Liu, B. Wang, X.L. Ye, J. Jia and C.Z. Bian.....	1146
Thermodynamic Approach for Identifying Oxidative Processes Insulation Breakdown	
M.N. Dubyago, I.A. Poluyanovich and N.K. Poluyanovich	1153
Performance Verification of Power Quality Signals Classification System	
A.R. Abdullah, N.A. Abidullah, N.H. Shamsudin, N.H.H. Ahmad and M.H. Jopri.....	1158
Comparison of Open and Short-Circuit Switches Faults Voltage Source Inverter (VSI) Analysis Using Time-Frequency Distributions	
M. Manap, N.S. Ahmad, A. Rahim Abdullah and N. Bahari.....	1164
Transient Instantaneous Voltage Sag of Distributed Generation Bus in Muangxay Substation, Oudomxay Province, Laos	
K. Phothilath, K. Tonmitr and P. Artrit.....	1170
Experimental Comparison between CAV Control and CO₂ Ventilation Control Approaches with Respect to Energy Saving of Air Conditioner	
S. Panyavee, J. Khedari, S. Wisitsak and J. Hirunlabh	1175
Long Term Accumulation Storages and their Structure	
V. Sipkova, J. Labudek and S. Korbelova	1183
Experimental Measurement of the CO₂ Content in a Passive Home during a Simulated Air-Conditioning Power Outage	
Z. Galda, J. Labudek and V. Sipkova.....	1187
The Designing of Data Acquisition Card through PIC18F4550 and an Interface Study	
H. Terzioğlu, S. Herdem and G. Bal	1191

Chapter 10: Disaster Prevention and Mitigation Technology, Environmental Protection and Safety Management

Analyse of Agricultural Soil Heavy Metals Pollution	
R. Králiková and M. Andrejiová.....	1201

Investigation and Analysis of International Roughness Index at National Freeway in Taiwan	
J.D. Lin, P.H. Sung, M.C. Ho and C.J. Shen	1206
CO₂-Brine Displacement in Geological CO₂ Sequestration: Microfluidic Flow Model Study	
S.C. Cao, J.W. Jung and J.W. Hu.....	1210
Project Acquaponia - Designing Sustainable Equipment for Treating Gray School Waters for Irrigation and Food Growing	
R.V. Uribe, R.V. León, A.S. Ortega and M.Á. Rubio Toledo	1214
Revisiting the Reliability Assessment of Frame Constructions of Industrial Building	
T. Zolina and P. Sadchikov	1218
Analysis on Current State on Safety Education of Korean Construction Sites in Overseas	
Y.S. Shin and G.H. Kim.....	1224
Study on Spending for Safety Management Cost in Korean Construction Sites	
Y.S. Shin and G.H. Kim.....	1228
A Comparative Study on the Noise between Floors of Apartment and Multiplex Housing	
J.H. Kim and Y.S. Shin	1232
The Experimental Research on Horizontal Underground Tank Magnetic Flux Leakage Testing	
M.L. Zheng, Z.W. Ling, M. Wang, S. Kong and W.C. Guo.....	1236
A Safety Management Method Based on Job Stress Analysis for Foreign Construction Laborers in Korea	
Y.S. Shin	1240
A Method of Section Replacement for Pile-Bent Pier Rehabilitation	
A. Srikongsri and A. Sopapun.....	1244
RFID Tag Anti-Collision Security Study and Evaluation	
L. Wang.....	1250
Influence of Connection Lane on the Left of Running Lane on Intersection in Ostrava-Petrkovice	
J. Petru, I. Mahdalova, V. Krivda and M. Kludka.....	1257
Analysis of Baffle Effect for Measuring Transmission Loss	
H. Abdullah, A. Abu, P. Muhamad, A. Sahekhaini and L.K. Quen.....	1263
Simulation of Tsunami Wave Generated by Submarine Slide: Generation, Propagation, Run-Up and Impact	
V.N.P. Huan and I.S.H. Harahap	1269
Simulating Migration Properties of Aquifer Disposal of CO₂ in Western Taiwan Basin	
C.H. Tseng, W.C. Su, C.C. Kuo and C.L. Lai	1275

Chapter 11: Industrial Engineering, Production Quality and Management

Product Knowledge and Lifecycle Management in Project-Based Manufacturing	
S. Laitinen, M. Huhtala, M. Lohtander, T. Kässi and J. Varis.....	1283
How to Save Energy in Thailand Industrial Manufacturing	
P. Subpratsavee and C. Supsanung	1288
The Problem of Organization and Industry after Using ERP	
P. Subpratsavee and C. Tiensai	1292
A Security of Circular Email in Manufacturing	
P. Subpratsavee, C. Chintho and S. Tanaiadehawoot.....	1296

Modeling Design and Rapid Prototyping Manufacture of Cream Bottle Based on Handheld Laser Scanning	
X.X. Wang, J.D. Wei, Y. Pei, Y. Zhu and H.J. Ni.....	1301
Modeling Design of Plastic Bottles Based on Laser Scanner and Rapid Prototyping Technology	
H.J. Ni, Q.Q. Chen, L. Chen, M.Y. Huang and X.X. Wang	1307
Keys for Redesign Industrial Facilities in a Current Productive Environment	
I.P. Carrizosa, M.O. Rubio, O.J. Mora and G.Á. Guarín	1312
Study for Development Directions and Real Application Cases of Korea Production System (KPS)	
C.M. Kim, J.C. Lee and S.W. Choi.....	1320
Hybrid Knowledge-Based System for Collaborative Green Automotive Manufacturing Management	
M.K. Mohd Nawawi, N.M.Z. Nik Mohamed and A.S. Adli Aminuddin	1333
Quality Assurance of CIPP Liners According EN ISO 11296-4	
O. Cigler, K. Kubečka and P. Waldstein.....	1339
Performance Evaluation of Real Power Quality Disturbances Analysis Using S-Transform	
A. Rahim Abdullah, N.H.T.H. Ahmad, N.A. Abidullah, N.H. Shamsudin and M.H. Jopri	1343
Modular Service-Oriented Cyber-Physical Systems for the European Tool Making Industry	
G. Schuh, S. Rudolf, M. Pitsch, M. Sommer and W. Karmann	1349
Data Preprocessor for Order Preserving Encryption	
S.Y. Jo, S.S. Lee and D.H. Choi	1356
Development of a Knowledge Management System for the Basic Hand Tools and Machinery Using Ontology Technology	
U.T. Sriprasert, A.T. Sriprasert, P. Kalnaowakun and T. Yingsamcharoen.....	1360
Mobile Factory Network (MFN) – Network of Flexible and Agile Manufacturing Systems in the Construction Industry	
E. Rauch, D.T. Matt and P. Dallasega.....	1368
The Combination Method for the Service Parameters of Product-Service Systems	
F. Zhang and Y. Xu.....	1374
Characterization of Multiple Functional Solid Line of Graphite Ink Surface Printed by Micro-Flexographic	
M.I. Maksud, M.S. Yusof and Z. Embong.....	1379
Research on Strategic Supplier Selection and Evaluation Method of Manufacturing Enterprise Based on AHP-GCA Method	
B.L. Wu, X.J. Chen, J. Yu and Q. Sun.....	1384
Research on Strategic Supplier Selection and Evaluation Standard System of Manufacturing Enterprise	
B.L. Wu, J. Yu and Q. Sun.....	1393
Design and Rapid Prototyping of S-Shape Push-Ups Frame Based on Laser Scanning	
H.J. Ni, Q.Q. Chen, Y. Pei, Y. Lv and X.X. Wang.....	1401
Three Dimensional Detection of the via in the PCB CT Image Using Morphology Operation	
L. Zeng, J. Chen, H.N. Li, B. Yan, Y.F. Xu, T. Jia and Z.G. Li	1406
An Energy Aware Routing Algorithm for WSNs Based on Semi-Static Clustering	
T. Du, Q.B. Guo, K. Zhang and K. Wang.....	1413
Traffic Simulation at Intersections with Cranked Priority	
V. Krivda, J. Petru, I. Mahdalova and V. Skvain	1419
Application of Neural Networks in Perishable Inventories Management	
W. Assawawongmethee and W. Laosiritaworn	1424

Analysis of Research Trends in Water Resource Management Using Network Analysis D.H. Jeong and Y.D. Koo	1430
Drinking Water Production Using Passive Solar Stills with Different Absorbing Materials K.W. Yusof, A. Riahi, B.S.M. Singh, E. Olisa, N. binti Mohd Azezs, A.R. bin Mohamad Khir and M. Marzuki	1441
Keyword Index	1447
Author Index	1457

bridge structures these characteristics are relatively well known and strictly monitored. However, in the case of temporary structures the scientific studies have not been performed.

Characteristics of Monitored Structure

For the closer research there was elected a specific bridge over the river Becva which is situated near the village Hustopece nad Becvou. This construction serves in this place for 17 years and it is a part of the third class road number 3/43911.

This is a temporary steel bridge construction of the "Mabey Universal" concept. From the static point of view, the bridge represents a single span beam, where its range is 62.15 m and the road width is 4.2 m. The supporting structure is made by double truss girder MABEY, where the length of main truss girder section is 4.50 m, height of complete truss structure is 2.741 m and axial distance of the main beams is 6.43 m. The bridge deck is made of thin-walled steel panels which are attached onto the top flanges of the bridge crossbars, where the axial distance of these crossbars is 2.25 m. Whole the construction rests on the reinforced concrete foundations where it is attached used the steel bearings. The bridge ordinary load capacity in this case is set as 22 t and exceptional load capacity is 40 t. Constructional arrangement of this bridge is evident from Fig. 1 and Fig. 2.



Fig. 1 Monitored bridge construction
MABEY UNIVERSAL



Fig. 2 Supporting of the structure on
the reinforced concrete foundations

Performed in-Situ Measurements

The aim of the experimental measurements there was the analysis of dynamic and acoustic characteristics of the original structure and evaluation of the proposed measures. The measures consisted in the adaptation of the bridge structure where the deck was covered with anti-vibration mats (Fig. 3, 4). Adjustment of the deck was designed based on primary research where the original surface of the steel deck was detected as the dominant source of noise. Designed surface treatment is the primary solution not only in terms of noise reduction of structure itself, but also with regard to the elimination of vibrations which are spread into the environment.

To excite the characteristic load there was used a personal delivery van Renault Master, which alternately passed over the bridge in both directions. Behavior of the structure was observed also depending on different vehicle speed (20 km/h, 30 km/h, 40 km/h and 50 km/h). Provisional technology of placing the anti-vibration mats on the bridge deck did not allow to verify the results of monitored variables demonstrably at a speed higher than 20 km/h. Therefore, the following results are presented only for this speed.



Fig. 3 Monitored bridge construction MABEY UNIVERSAL during the test

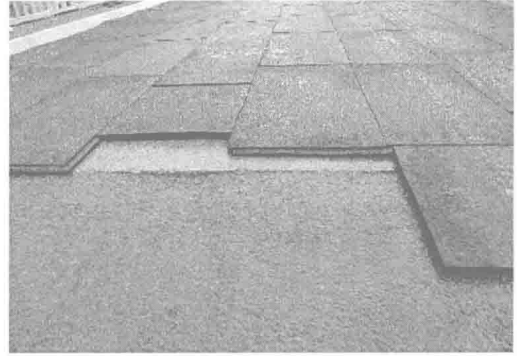


Fig. 4 Detail of anti-vibration mats on the surface of the bridge deck

Dynamic Characteristics of the Monitored Structure

The main monitored variable in this case was the eigenfrequency of oscillation of the bridge structure, which was detected by accelerometers (KB12VD) - Fig. 5. These accelerometers were located approximately at one-third of the structure. This location of sensors made it possible to monitor a potential second eigenfrequency of vibration, [2, 3].

From the Graph 1 which is shown below the difference between the oscillation of structure in the vertical direction in the original condition and after placing the mats is noticeable. The red curve characterizing the structure in its original condition refers to the non-stationary oscillation with variable mean value and relatively small amplitude of oscillation. After the placing of anti-vibration mats, the oscillation characteristic has changed significantly and it is approaching to the stationary oscillation with bigger amplitude range, [4, 5].

The first eigenfrequency decreased due to the installation of anti-vibration mats by 0.0251 Hz, the second one by 0.0835 Hz, and the third one by 0.1287 Hz, compared to the original state – Graph 2. Decrease of eigenfrequency is an expected phenomenon, because with increasing of weight there is preserved the structure stiffness.

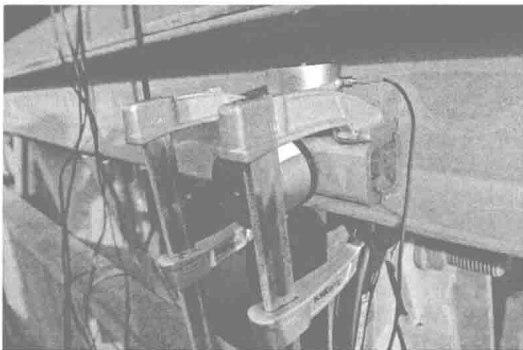


Fig. 5 Location of accelerometer KB12VD