Advanced Engineering and Technology

Part 2

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

TTP TRANS TECH PUBLICATIONS

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

Trans Tech Publications Ltd
Churerstrasse 20
CH-8808 Pfaffikon
Switzerland
http://www.ttp.net

Volumes 752-753 of
Applied Mechanics and Materials *2-part-set*
ISSN print 1660-9336
ISSN cd 1660-9336
ISSN web 1662-7482

Full text available online at *http://www.scientific.net*

***Distributed** worldwide by*

Trans Tech Publications Ltd
Churerstrasse 20
CH-8808 Pfaffikon
Switzerland

Fax: +41 (44) 922 10 33
e-mail: sales@ttp.net

and in the Americas by

Trans Tech Publications Inc.
PO Box 699, May Street
Enfield, NH 03748
USA

Phone: +1 (603) 632-7377
Fax: +1 (603) 632-5611
e-mail: sales-usa@ttp.net

printed in Germany

Advanced Engineering and Technology

PART 2

Edited by
Dongkeon Kim
Jong Wan Hu
Jongwon Jung
Junwon Seo

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 there 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.

The Organizing Committee of ICAET 2014

Committee Chair Prof. D. Kim, Dong-A University
Prof. J.W. Hu, Incheon National University, South Korea
Prof. J.W. Jung, Louisiana State University, United States
Prof. J. Seo, South Dakota State University, United States

Committee

Core Committee

- Executive Committee

  Chief Patron: Prof. D. Kim, Dong-A University, Korea

  Prof. J. Hu, Incheon National University, Korea

- Organizing Committee

  Organization: Incheon National University, Korea

  Disaster Prevention Research Center, Korea

Organizing Chairs: Prof. D. Kim and Dr. M. Kaloop

Conference Secretary: President H.K. Son, IETP Association Inc, Korea

Technical Committee

Prof. Y. H. Jeong, Kangwon National University, Korea

Prof. H. S. Kim, Ehwa Womans University, Korea

Prof. J. W. Jung, Louisiana State University, USA

Prof. J. W. Seo, South-Dakota State University, USA

Prof. J. Lee, Purdue University, USA

Prof. R. T. Leon, Virginia Tech, USA

Prof. R. DesRoches, Georgia Tech, USA

Prof. S. H. Kim, Southern Georgia Polytech, USA

Prof. U. S. Kim, California State University, USA

Prof. S. Lim, Inha University, Korea

Prof. J. Y. Park, Inha University, Korea

Prof. K. H. Moon, Inha University, Korea

Prof. D. W. Kack, Incheon National University, Korea

Prof. H. K. Lee, Incheon National University, Korea

Prof. J. W. Kim, Korea Institute of S&T Evaluation and Planning (KISTEP), Korea

Prof. S. G. Jeong, Korea Institute of S&T Evaluation and Planning (KISTEP), Korea

Prof. S. H. Lee, Korea Institute of S&T Evaluation and Planning (KISTEP), Korea

Prof. D. G. Kim, Korea Hydro & Nuclear Power Co., LTD, Korea

Prof. J. H. Lee, Daegu University, Korea

Prof. M. W. Park, Myongji University, Korea

Prof. S. H. Yun, Hanyang University, Korea

Prof. M. H. Tak, Hanyang University, Korea

Prof. M. H. Noh, Research Institute of Industrial Science and Technology (RIST), Korea

Table of Contents

PART 2

Chapter 5: Mechanical Engineering and Design, Manufacturing Technologies

Chapter 6: Automation, Robotics and Control

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

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

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

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

Chapter 11: Industrial Engineering, Production Quality and Management

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.

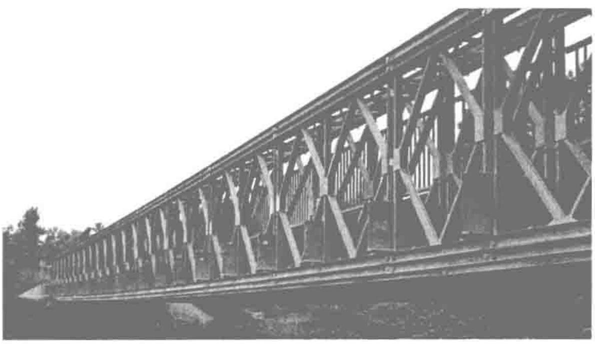

Fig. 1 Monitored bridge construction MABEY UNIVERSAL

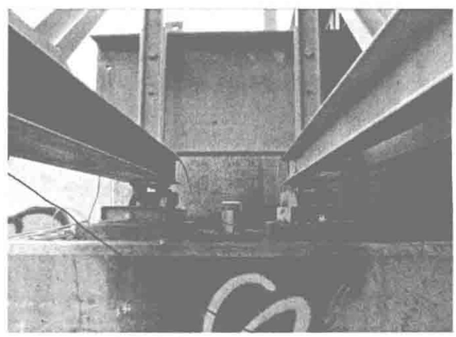

Fig. 2 Supporting of the structure on the reinforced concrete foundations

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

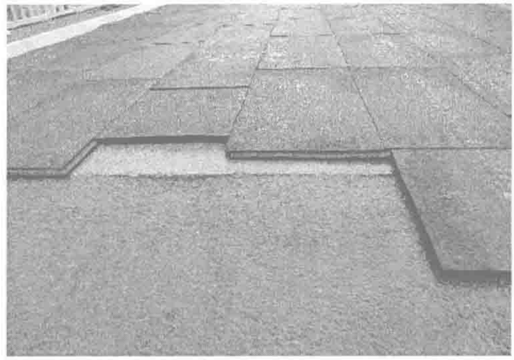

Fig. 4 Detail of anti-vibration mats on the surface of the bridge deck

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.

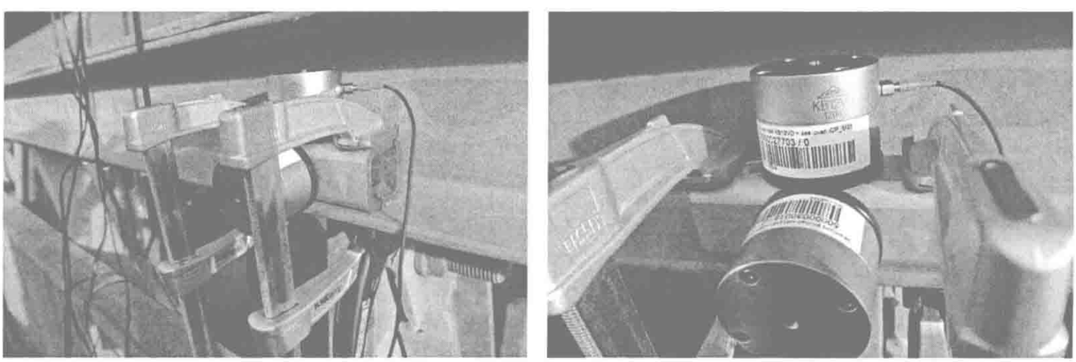

Fig. 5 Location of accelerometer KB12VD