

INTERNATIONAL CONFERENCE



The Second International Conference on
Engineering and Technology Development

2nd ICETD 2013

27, 28, 29 August 2013, Bandar Lampung, Indonesia



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Faculty of Engineering and Faculty of Computer Science,
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2nd ICETD 2013

THE SECOND INTERNATIONAL CONFERENCE
ON ENGINEERING AND TECHNOLOGY DEVELOPMENT

28 -30 January 2013
Bandar Lampung University (UBL)
Lampung, Indonesia

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PREFACE

The Activities of the International Conference is in line and very appropriate with the vision and mission of Bandar Lampung University (UBL) to promote training and education as well as research in these areas.

On behalf of the Second International Conference on Engineering and Technology Development (2nd ICETD 2013) organizing committee, we are very pleased with the very good response especially from the keynote speaker and from the participans. It is noteworthy to point out that about 80 technical papers were received for this conference.

The participants of the conference come from many well known universities, among others : University Kebangsaan Malaysia – Malaysia, APTIKOM – Indonesia, Institut Teknologi sepuluh November – Indonesia, Surya Institute – Indonesia, International Islamic University – Malaysia, STMIK Mitra Lampung – lampung, Bandung Institut of Technology – Bandung, Lecture of The Malahayati University, B2TP – BPPT Researcher – lampung, Starch Technology Center – Lampung, Universitas Islam Indonesia – Indonesia, Politeknik Negeri Malang – Malang, University of Kitakyushu – Japan, Gadjah Mada University – Indonesia, Universitas Malahayati – Lampung, Lampung University – lampung, Starch Technology Center – Lampung, Universitas Riau – Riau, Hasanuddin University – Indonesia, Diponegoro University – Indonesia, King Abdulaziz University – Saudi Arabia, Parahyangan Catholic University – Indonesia , National Taiwan University–Taiwan, Surakarta Christian University – Indonesia, Sugijapranata Catholic University – Indonesia, Semarang University – Indonesia, University of Brawijaya – Indonesia, PPKIA Tarakanita Rahmawati – Indonesia, Kyushu University, Fukuoka – Japan, Science and Technology Beijing – China, Institut Teknologi Sepuluh Nopember – Surabaya, Researcher of Starch Technology Center, Universitas Muhammadiyah Metro – Metro, National University of Malaysia – Malaysia.

I would like to express my deepest gratitude to the International Advisory Board members, sponsor and also to all keynote speakers and all participants. I am also gratefull to all organizing committee and all of the reviewers who contribute to the high standard of the conference. Also I would like to express my deepest gratitude to the Rector of Bandar Lampung University (UBL) who give us endless support to these activities, so that the conference can be administrated on time

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Table Of Content

Organizing Committee	i
Table Of Content.....	v
Keynote Speaker	
1. Recent Advances in Biofuel Cell and Emerging Hybrid System Abdul Aziz Ahmad and Raihan Othman	1
2. Waste Utilization Study Tailing Gold Mine in Way Linggo-Lampung, as Fine Aggregate Materials for Producing Mortar Materials based on concept of Green Technology Lilies Widodojoko & Susilawati	8
3. Infrastructure Health Monitoring System (SHM) Development, a Necessity for Maintance and Investigation Prof. Dr. Priyo Suprobo, Faimun, Arie Febry	17
4. Four Phases Quality Function Deployment (Qfd) By Considering Kano Concept, Time And Manufacturing Cost Prof. Dr. Moses L Singgih, Dyah L. Trenggonowati, Putu D. Karningsih	22

Speaker

1. Comparative Analysis for The Multi Period Degree Minimum Spanning Tree Problem
Wamiliana, Amanto, and Mustofa Usman..... 39
2. Choosing The Right Software In Supporting The Successful of Enterprise ERP Implementation
Yodhie Yuniarthe, Idris Asmuni..... 44
3. Climate Adaptive Technology In Maintaining Vernacularism Of Urban Kampong Case study: Kampung Adat (Indiginous) Mahmud, Bandung District, West Java
Marcus Gartiwa..... 50
4. The Prospect Of Diesohol In Facing Fossil Fuel Crissis
M.C. Tri Atmodjo..... 63
5. The Potential Of Agriculture And Forestry Biomass Wastes As Source Of Bioenergy
Hardoyo..... 66
6. The Importance of Education Facility as Sustainable Urban Generation Tool
Fritz Akhmad Nuzir, Haris Murwadi and Bart Julien Dewancker 71
7. The implementation of Secton Method for Solving Systems of Non Linear Equations
Nur Rokhman 80
8. Quality Control Analysis Into Decrease The Level Defects On Coffee Product
Heri Wibowo, Sulastri and Emy Khikmawati 85
9. Public Transpotion Crisis In Bandar Lampung
Ida Bagus Ilham Malik 89
10. Geospatial Analysis of Land Use Change in Way Kuripan Watershed, Bandar Lampung City
Candra Hakim Van Rafi'1., Dyah Indriana Kusumastuti2., Dwi Jokowinarno..... 99
11. Material Utilization Technology Of Agriculture And Forestry Waste
Hardoyo..... 105
12. The Supply Chain System Of Cassava On The Tapioca Industry
Hardoyo..... 108
13. Glass Technology In Natural Light Glasses On Aperture Element In The Architecture World
Muhammad Rija & MT Pedia Aldy 113

14. An Eksperimental Permeable Asphalt Pavement Using Local Material Domato Stone On Quality Of Porous Asphalt
Firdaus Chairuddin, Wihardi Tjaronge, Muhammad Ramli, Johannes Patanduk 117
15. Coordination Of Architectural Concepts And Construction Systems
Eddy Hermanto. 129
16. Seismic Assessment of RC Building Using Pushover Analysis
Riza Ainul Hakim...... 136
17. Viscosity and Liquidity Index Relation for Elucidating Mudflow Behavior
Budijanto Widjaja and Shannon Hsien-Heng Lee...... 143
18. The Use of Pozzolanic Material for Improving Quality of Strontium Liquid Waste Cementation in Saline Environment during Nuclear Waste Immobilization Process
Muhammad Yusuf, HayuTyasUtami, Tri SulistiyoHariNugroho, SusetyoHarioPutero 148
19. Geospatial Analysis Of Land Use And Land Cover Changes For Discharge At Way Kualagaruntang Watershed In Bandar Lampung
Fieni Yuniarti, Dyah Indriana K, Dwi Joko Winarno...... 153
20. Wifi Network Design For High Performance
Heru Nurwarsito, KasyfulAmron,BektiWidyaningsih 161
21. Studi on The Efficiency Using Nature Materials in The Structural Elements of Reinforced Concrete Beam
Yasser, Herman Parung, M. Wihardi Tjaronge, Rudy Djamaluddin...... 167
22. The Research Of Slow Release Nitrogen Fertilizer Applied In Sugarcane (Saccharum Officinarum) For Green Energy Bioethanol
M.C. Tri Atmodjo, Agus Eko T. Nurul Rusdi, Sigit Setiadi, and Rina...... 179
23. Energy Utilization Technology Of Agriculture And Forestry Waste
Hardoyo...... 185
24. Implementation Of Fuzzy Inference System With Tsukamoto Method For Study Programme Selection
Fenty Ariani and Robby Yuli Endra. 189
25. The Analysis of Video Conference With ITU Standarization (International Telecommunication Union) That Joining in Inherent At Bandar Lampung University
Maria Shusanti F, Happy Reksa 201

26. The E-internal audit iso 9001:2008 based on accreditation form assessment matrix in study program for effectiveness of monitoring accreditation Marzuki, Maria Shusanti F.	207
27. The Developing Of e-Consultations For Effectiveness of Mentoring Academy Ahmad Cucus, Endang K	214
28. The Evaluation of information system performance in higher education case study with EUCS model at bandar lampung university Reni Nursyanti, Erlangga.	221
29. The Analysis Of History Collection System Based On AndroidSmartphone With Qr Code Using Qr CodeCase Study: Museum Lampung Usman Rizal, Wiwin Susanty, Sutrisno.	230
30. Application of Complaint Handling by Approach Model of ISO 10002 : 2004 to Increase Complaint Services Agus Sukoco and Yuthsi Aprilinda.	235
31. Towards Indonesian Cloud Campus Taqwan Thamrin, Iing Lukman, Dina Ika Wahyuningsih	252
32. Bridging Router to ADSL Modem for Stability Network Connection Arnes Yuli Vandika and Ruri Koesliandana.	257
33. The Effect of Use Styrofoam for Flexural Characteristics of Reinforced Concrete Beams Yasser , Herman Parung, M. Wihardi Tjaronge, Rudy Djamaluddin	261
34. The Estimation Of Bioethanol Yield From Some Cassava Variety M.C. Tri Atmodjo	273
35. Effect of Superficial Velocity of Pressure Difference on The Separation of Oil And Water by Using The T-Pipe Junctionl Kms. Ridhuan and Indarto.	277
36. The use of CRM for Customer Management at Cellular Telecommunications Industry Ayu Kartika Puspa.	293
37. Indonesian Puslit (Centre Of IT Solution) Website Analysis Using Webqual For Measuring Website Quality Maria Shusanti Febrianti and Nurhayati.	297
38. The E-internal audit iso 9001:2008 based on accreditation form assessment matrix in study program for effectiveness of monitoring accreditation Marzuki, Maria Shusanti F.	307

39. Enhancing Quality Software Through CMMI-ISO 9001:2008 and ISO 9126 Agus Sukoco	320
40. Value Analysis Of Passenger Car Equivalent Motorcycle (Case Study Kartini Road Bandar Lampung) Juniardi, Aflah Efendi	337
41. Alternative Analysis Of Flood Control Downstream Of Way Sekampung River Sugito, Maulana Febramsyah.	347
42. Analysis Of Fitness Facilities And Effective Use Of Crossing Road Juniardi, Edi Haryanto.	353
43. Study On Regional Development Work Environment Panjang Port Lands In Support Bandar Lampung City As A Service And Trade Ir. A. Karim Iksan, MT, Yohn Ferry.	359
44. Analytical And Experimental Study Bamboo Beam Concrete Hery Riyanto, Sugito, Juli	370
45. Comparative Analysis Of Load Factor Method Static And Dynamic Method (Case Study Akdp Bus Route Rajabasa - Bakauheni) A. Ikhsan Karim, MT., Ahmad Zulkily.	378
46. Optimization Utilization Of Water Resources dam Batutegei Using Method Of Linear Program Aprizal, Hery Fitriyansyah	386
47. Characteristics Generation Traffic Patterns And Movement In Residential Area (Case Study Way Kandis Residential Bandar Lampung) Fery Hendi Jaya, Juniardi,	392
48. Use Study On Slight Beam Reinforced Concrete Floor Plate in Lieu Of Secondary Beam Hery Riyanto, Sugito, Lilies Widodjoko, Sjamsu Iskandar	399
49. Observation Of The Effect Of Static Magnetic Field 0.1 Mt On A-Amylase Activity In Legume Germination Rochmah Agustrina, Tundjung T. Handayani, and Sumardi.	405
50. Effectiveness Analysis Of Applications Netsupport School 10 Based Iso / Iec 9126-4 Metrics Effectiveness Ahmad Cucus, Nelcy Novelia	413
51. Comparative Performance Analysis Of Banking For Implementing Internet Banking Reza Kurniawan	418

Infrastructure Health Monitoring System (SHM) Development, a Necessity for Maintenance and Investigation

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Abstract-*Failure of Kutai Bridge already give Indonesia civil engineer a blow in face. The failure which bring cause human accident make a new challenge to Indonesia civil engineer not to wait till failure but to safe before the construction failure. By the development in sensor and monitoring technology the idea become more realistic. Structure Healthy Monitoring (SHM) become new idea to detect, to monitor and to find out the reliability of structure. The development and research in Indonesia for SHM till now are presented and compared to other country. SHM research are need to predict behaviour of bridge by using data from monitoring to gain healthy condition.*

Keywords- *Monitoring, Bridge, Structural Healthy Monitoring (SHM)*

Preface

Engineer of civil engineering are risk takers, this means design and build any construction are related with human life. Any mistake to design and build will create a disaster. History already record an engineer fault in civil engineering that involve to human accident.

Civil engineering are different than another engineering. Other could create a prototype to see it behaviour and create a standard to avoid mistake. But in civil engineering every construction are different, have their own characteristic and have their own strenght. Many factor create this condition from paper to field problem when that construction build until mother nature involve.

Even in Melchers (1987) say that civil engineering failure that created a problem are smallest than other human activity (0.1 millions / years) depending to smoke activities risk which is 1000 millions / years. But still when a construction fail many people will watch and investigate more that dead by smoke. A civil construction failure happens in many ways. First a bad design by civil enginner consultant, a bad construction by civil contractor which create a bad composition of material strenght or detailing to building which is very poor.

And last a deterioration of construction to nature or envirotment.

If construction are human being, we can consider the condition of it life are related to all this above. This might be a health condition for it. The different to human being are it does not grow by itself but it have a deterioration which alway say as life time of construction.

Failure of construction before the life time will create a shock effect for all, specially for all civil engineer. lets just say our tragedy of Kutai Kartanegara Bridge. Failure of Kutai Bridge bring many things to Indonesia engineers. Investigation, history and strenght of bridge are learn and calculate. Cause of the failure are considered and take by note so there will be no other tragedy like it. This tragedy created a change in civil engineer to create and seek the more ways to convience the other or next bridge will be safe for no more tragedy.

Beside of making better design and build effort, this will also bring a consideration about how to see a healthy condition of structure. Question like how healthy actually this construction or actually how much old this construction (which mean to life time design) and how much strenght remain in construction are

ask. If question above are need to find out the reliability of construction.

Reliability of construction which mean to it healthy are new part of civil engineering know as Structural Healthy Monitoring (SHM). This part idea are monitoring construction behaviour from it build to deterioration of it. So by learning all data and condition related to construction, question above can be answer and can be use to predict maintance and deterioration to construction. By ideas to safe and not to wait till failure, the changes of civil engineer idea may be different in next period

From all construction, brigde might be a start for SHM, this consideration come because bridge have a unique condition compare to other construction. Bridge are use every day by human but inspection are not often because not like building, people use bridge but not related to fell it condition compare to building. Bridge are use every day by different load type, different composition of load and dynamic load occur in it. Other than that bridge are skeleton construction type, which mean SHM can be use directly to it main construction.

This idea to change from how to detect, to monitor and to safe the structure with SHM come with development of technology. Century ago or at least fifty year ago, this idea to monitor might be not accross in civil engineer mind. Technology of sensor and computer monitoring become a fast growing in electro engineering nowadays, by combining it to our basic concept structure behaviour, the idea from wait till to monitor might become a solution for life safety. This condition mean a challenge for all of civil engineer to be ready to this change specially for Indonesia engineer to use the monitoring system to the idea to safe before the construction fail.

This paper aim to detail Indonesia SHM application depending to other countries, progress of SHM in bridge and next research for SHM which can be

challenge to all of us to the next future of construction.

SHM Development in Other Country

Research for SHM are now main idea in several countries, because the patern of research are large and need integration of them. Figure 1 show main idea of SHM research.

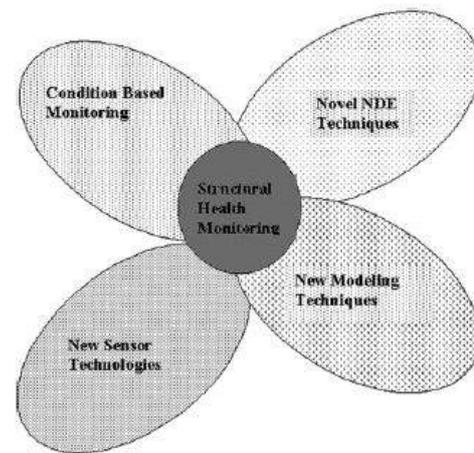


Figure 1 : Part of SHM Research (Srinivasan,2011).

According to data, research for SHM started from 1996 as define in table 1.

Table 1. SHM Research in other country

Country	Year Start
Hungaria	2003
Swiss	1998
Prancis	2000
Cina	1998
Jerman	1996
Austria	1999
Amerika	1998
Thailand	2001
Singapura	1997

Source : Helmut, 2009

Research for SHM from other country consist from laboratory and field test using many sensor and many method to define result of sensor. And there is

still no agreement reach about standard for SHM data read.

Oth (2012) from Luxenburg has propose a method for deflection of bridge from their field experiment using vibration data. Meanwhile Zhu (2012) from USA, propose a frequency to create a mode shape in FEM for the bridge. Another research come from Resnik (2012) in Jerman which propose to use natural frequency as base standard of healthy.

Other type research of monitoring might come from other type than vibration data, Yukio (2005) propose to use a robot detection method for monitoring and vehicle detection robot system just like in figure 2.

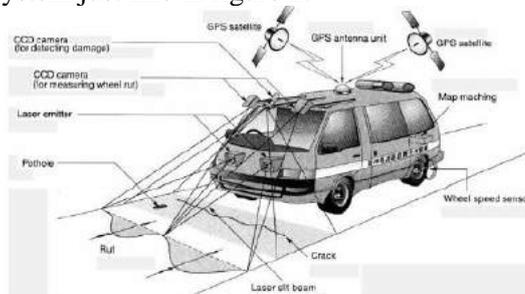


Figure 2 : Vehicle Robot Sensor (Yukio, 2005)

Meanwhile Korea system for monitoring are called with SBBMS propose for deflection and temperature sensor to determine condition of bridge (Koh,2005).

Research for SHM until 2012 are still trying to propose their method so it can be use as standard of healthy bridge. Korea research are now harvest data from their major bridge which is Sohae bridge using sensor as figure 3 and 4.

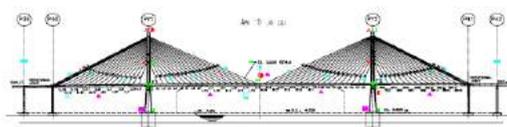


Figure 3 : Sensor in Sohae bridge

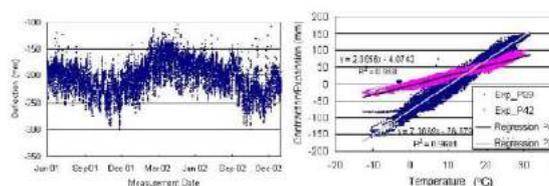


Figure 4 : Sohae bridge harvest data

Indonesia SHM Development

Indonesia started SHM development by integrated SHM system in Suramadu bridge. Around 514 sensors are attached consist of vibration, corrotion, global positioning system, temperature and wind sensor. Suramadu sensor are using cable to transfer data.

But the main idea getting a SHM attached not only to harvest data but also to read data from it. Which mean not only apparatus but human resource must be applied for SHM data. Research about SHM can be started when Suramadu Bridge SHM start their harvesting data, but with Kutai bridge failure need for human resource and cheap apparatus become more significant to do. Indonesia which is create by Island with a lot of river which mean there are a lot of small, medium and long bridge need to monitor.

A Research for Indonesia SHM

Need for Indonesia SHM research are cheap, can be transfer to control unit with long range, moveabel apparatus and can be define a bridge healthy in control monitor system. This need refer to envirotment condition and resource of indonesia.

Because of this need SHM study group referring a condition of wireless sensor using GSM packet data to sent. Meanwhile from civil engineer need a algorithm for analysis data sent from wireless in second to define bridge healthy

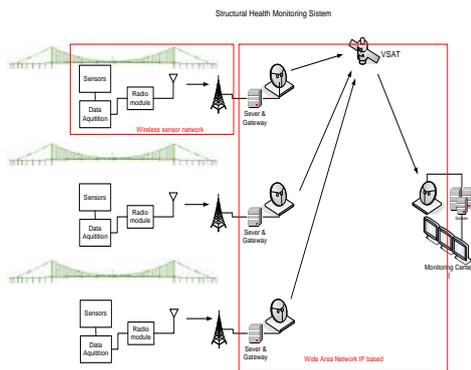


Figure 5 : Indonesia SHM Model System

SHM study group define a vibration data harvest from accelerometer can be a start for define bridge behaviour. Test will be do in laboratory scale using bridge model and full scale test in field using wireless sensor apparatus which is still in prototype .

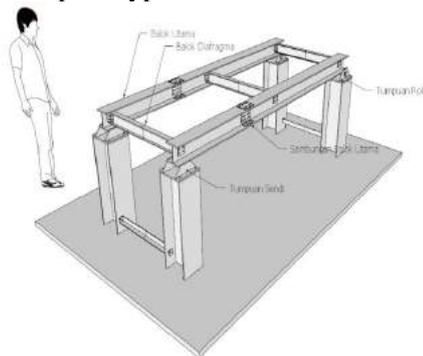


Figure 6 : Laboratory scale bridge test
And test trust of bridge already started, as define in figure 5.

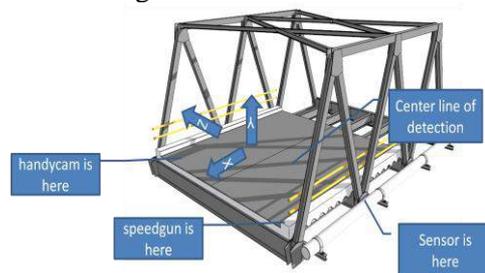


Figure 7 : Truss scale test

Test in field harvest vibration data around 48 hours. This data are sort to create a type of define data to use. Filtering and whitening data using Fast ICA method.

TABLE 2. VEHICLE DATA
COMPARRISON

No	Vehicle Type	Load	Speed km/ hours
1a	Truck With Wood As Load	Full	26
1b	Truck With Wood As Load	Full	20
2a	Concrete Mix Truck	Empty	24
2b	Concrete Mix Truck	Full	24
3a	Fuel Tank 10000	Full	29
3b	Fuel Tank 10000 litre 3 in row	Full	29

Comparison using raw data are show above

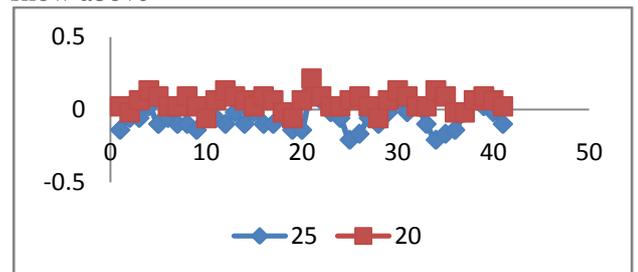


Figure 8. Case 1 in raw vibration data

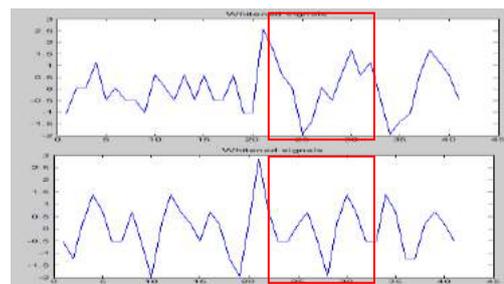


Figure 9. Data Result FastICA no 1b, 1b

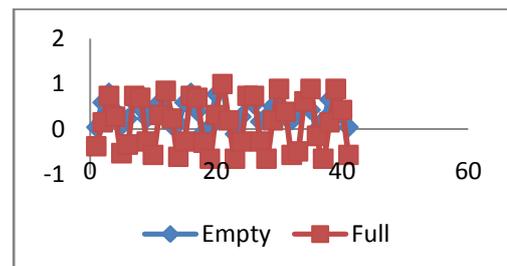


Figure 10. Case 2 in raw vibration data

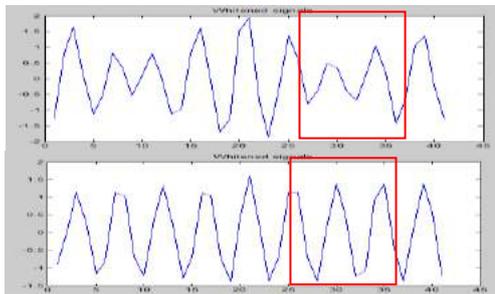


Figure 11. Data Result FastICA no 2b

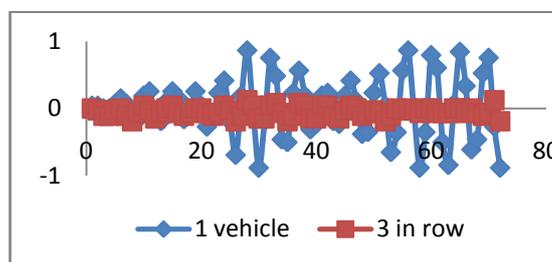


Figure 12. Case 2 in Raw Vibration Data

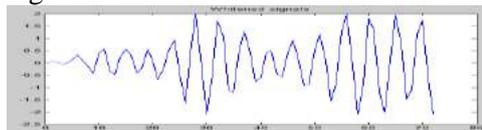


Figure 13a Data Result FastICA no 3a

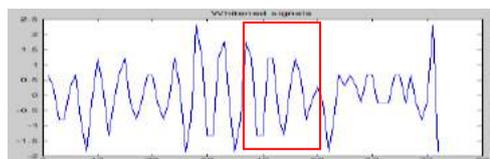


Figure 13b Data Result FastICA no 3b

This comparison above show that vibration in bridge monitoring system need a database of load to create a standard frequency for define condition of bridge healthy. And test must be do in real time to get a prediction for bridge healthy. Research of wireless sensor and wireless system to bridge monitoring system are need to gain more information about bridge behaviour.

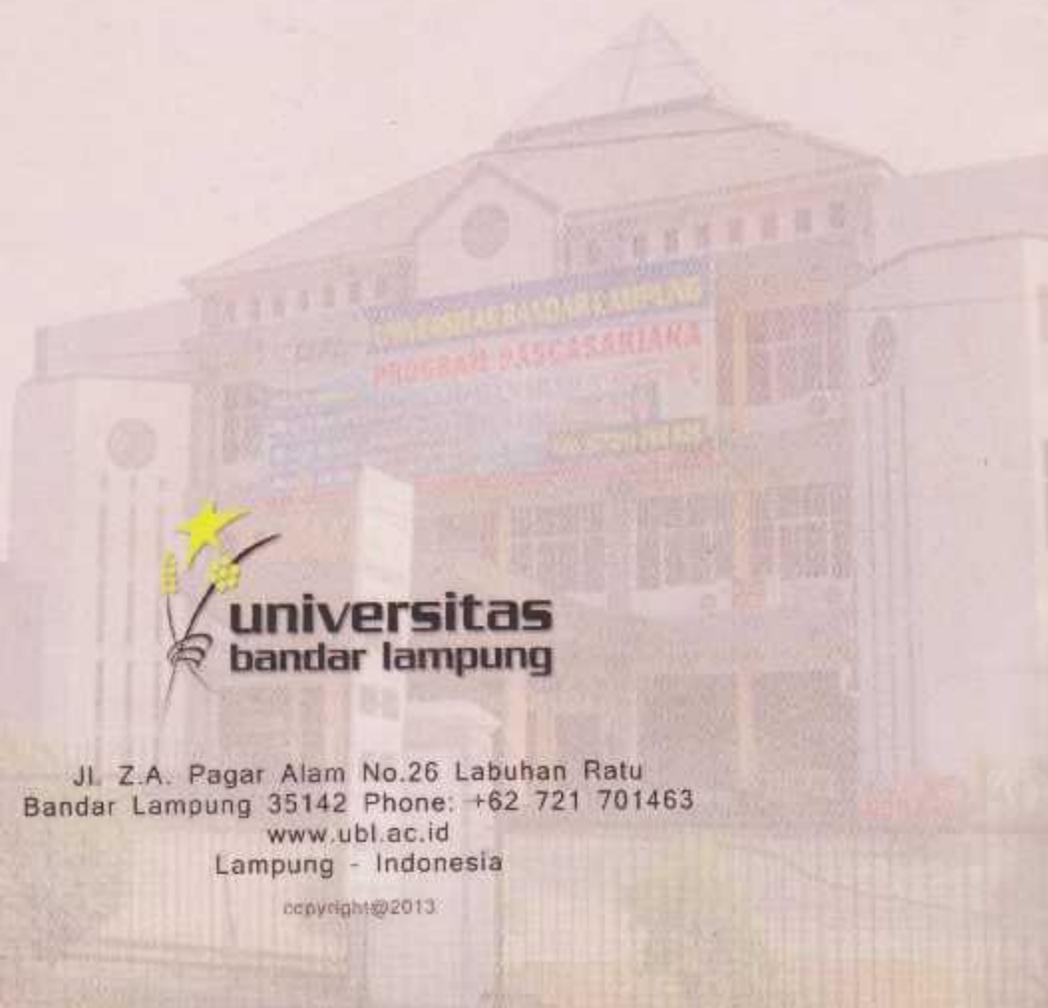
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