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INTERNATIONAL CONFERENCE

ENGINEERING & TECHNOLOGY DEVELOPMENT
UBL ICETD
2013

The Second International Conference on Engineering and Technology Development

2nd ICETD 2013

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

PROCEEDINGS

In Cooperations With :

APTIKOM

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Hosted by :
Faculty of Engineering and Faculty of Computer Science,
Bandar Lampung University (UBL), Indonesia

2nd ICETD 2013

The Second International Conference On Engineering And Technology Development

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

PROCEEDINGS

Organized by:

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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

Bandar Lampung, 29 August 2013-08-26

Mustofa Usman, Ph.D
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Infrastructure Health Monitoring System (SHM) Development, a Necessity for Maintance 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 natire 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 deteration 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 itselft but it have a deteration 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 strengh 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 deteration 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 deteration 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 nowdays, 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.

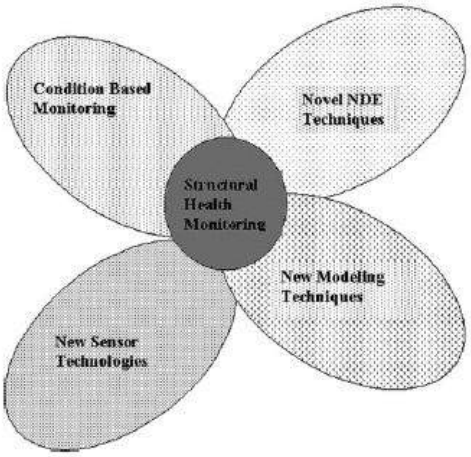

Figure 1 : Part of SHM Research (Srinivasan,2011).

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

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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.

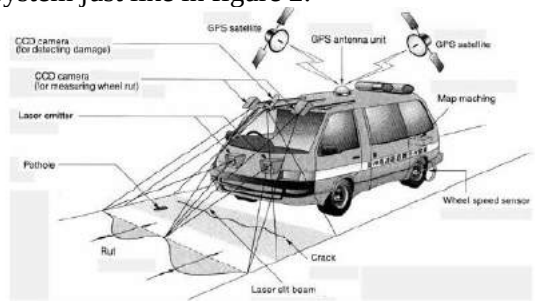

Figure 2 : Vehicle Robot Sensor (Yukio, 2005)

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.

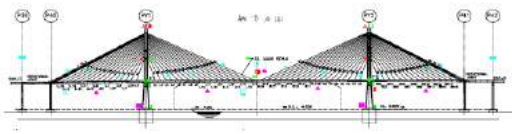

Figure 3 : Sensor in Sohae bridge

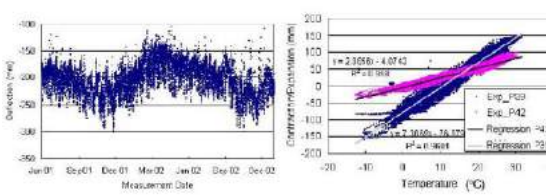

Figure 4 : Sohae bridge harvest data

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

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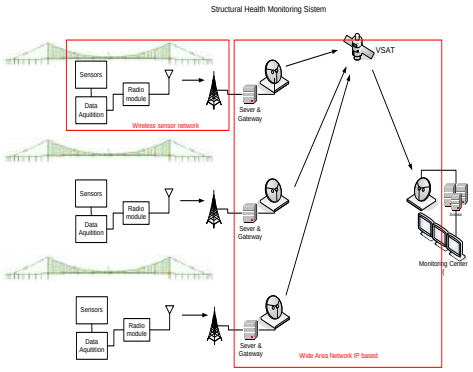

Figure 5 : Indonesia SHM Model System

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 .

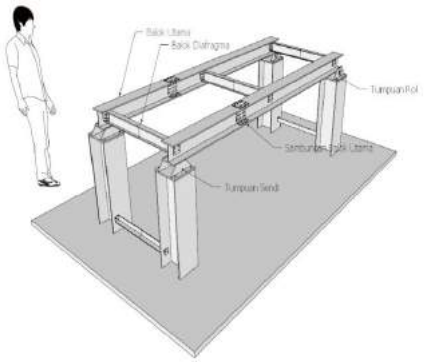

Figure 6 : Laboratory scale bridge test

And test trust of bridge already started, as define in figure 5.

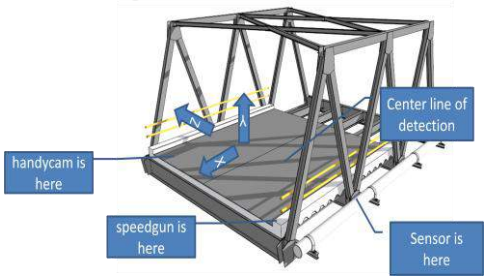

Figure 7 : Truss scale test

Test in field harvest vibration data around 48 hours. This data are sort to create a type of define data to use. Filtering and whitenning 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

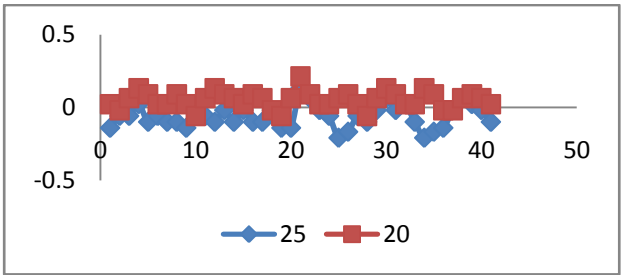

Figure 8. Case 1 in raw vibration data

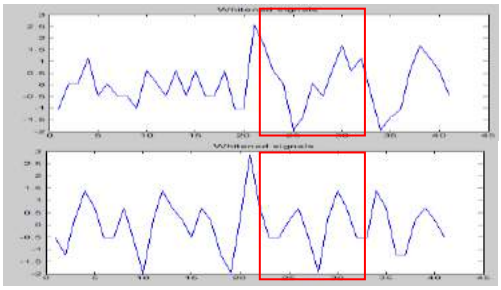

Figure 9. Data Result FastICA no 1b, 1b

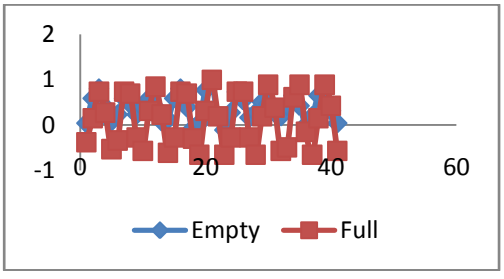

Figure 10. Case 2 in raw vibration data

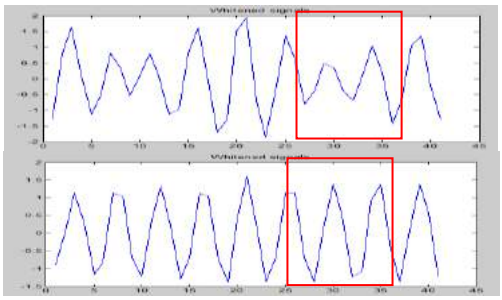

Figure 11. Data Result FastICA no 2b

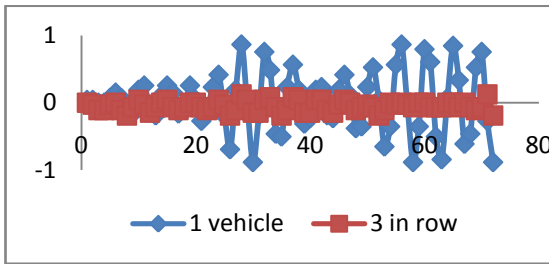

Figure 12. Case 2 in Raw Vibration Data

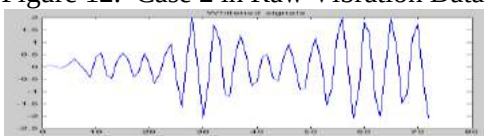

Figure 13a Data Result FastICA no 3a

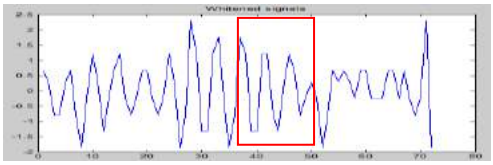

Figure 13b Data Result FastICA no 3b

This comparisson 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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