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RCC STRUCTURE HEALTH MONITORING SYSTEM AND LOAD IMPACT ANALYSIS

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ABSTRACT

This paper describes the CSHM method for estimating civil structures using a combination of advanced tracking devices and probabilistic estimation. The number of structures such as bridges, tunnels, retaining walls, dams etc. increased in the last 30 years after the construction boom of the 50s and 60s. In recent decades, new strategies have been developed to maintain, inspect and evaluate our infrastructure so that buildings last longer than designed. The requirements for buildings are also different now than in the construction stage, for example the loads are higher, traffic disturbances are less accepted and traffic flows are greater. Therefore, new techniques are needed for inspection, evaluation, maintenance and validation. Structural health monitoring is a technique used to assess the performance and monitor the condition of civil structures. Without CSHM, old structures cannot be assessed effectively and reconstruction costs have a huge impact on society. Therefore, further use and development of CSHM methods is encouraged. The CSHM is also a very useful tool for evaluating the performance of structures built with new materials and reinforced with new reinforcement systems. This paper describes a new strategy to combine probabilistic assessment of structural performance with monitoring. The presented CSHM method also describes ideas for implementing strategic thinking based on inspections, research, monitoring and evaluation.

Keywords: RCC Structure; Stain Guage; Load; Impact Analysis; Civil Structures; Stress; Bridge; Impulse.

I. INTRODUCTION

As new materials and technologies are discovered, buildings become taller, bridges span longer, and the design of structures becomes more ambitious but more complex. Due to this development, there was a growing demand to provide both maintenance cost savings and a safer environment by avoiding structural defects. Although India is a developing country, it has embraced structural development including new technologies. India has a rich cultural and historical background which is reflected very well in the diverse array of historical structures. These structures are very well-built and have stood the test of time. However, due to their historical importance, it is very important to assess the health of these structures so that appropriate action can be taken before it is too late. Apart from the old buildings in India, there are steel and concrete tall buildings that have started to stray and since they require extensive modelling, design details and analysis before and during construction, it is important and good to know what has been done. done and its behaviour in the future. Critical buildings (or Lifeline Structures as they are also called), such as hospitals, schools, power plants, etc., and buildings that host large gatherings of people such as sports fields, stadiums, and commercial buildings that can be damaged by a large. number of people at the same time and require regular maintenance when they can be damaged by a natural or man-made accident. The safety of dams in our country is a primary concern of government agencies involved in their research, design, engineering, construction, operation and maintenance. Although most of the dams worked well, there were some failures. These deficiencies, whether partial or complete, underline the need to review the procedures and criteria adopted by the various states to provide the best assurance of dam safety within the limits of current technology. Structural Health Monitoring (SHM) is a process that proactively aims to provide accurate and timely information about structural conditions and performance. It consists of (i) continuous, (ii) intermittent or (iii) intermittent continuous recording of typical parameters over short or long periods of time. Information obtained from monitoring is typically used to plan maintenance, increase safety, test hypotheses, reduce uncertainty, and expand knowledge about the monitored structure. Despite its importance, the culture of structural monitoring is not yet widespread in India.

II. CONCEPT OF HEALTH MONITORING SYSTEM

Structural performance testing and inspection of structures such as bridges, dams, etc. have been made since mankind began to build larger structures. Structural health monitoring (SHM) originates from the aerospace industry. The idea is to continuously monitor the behaviour of critical parts and receive early warnings that can be dealt with immediately or during regular maintenance, depending on the severity of the problem. SHM in civil engineering is a relatively new phenomenon. However, recent developments and reductions in sensor and data technologies have made SHM systems more attractive for civil engineering applications. To distinguish the use of SHM in civil engineering applications from other industrial applications, we use the term civil structural health monitoring (CSHM). One of the challenges of the CSHM community is to develop methods and models that are suitable for the needs of civil engineering applications. Strengthen knowledge of CSHM methods for those working in structure management, e.g. in bridge assessment, repair, strengthening and maintenance, several guidelines have been written to increase information, as well as to enable the use of CSHM in maintenance programs. Any effective structural management program must develop life extension, improvement and replacement strategies. Here, the CSHM system can be an essential part of assessing the structural "health" of structures still in use. CSHM's long-term vision is to continuously monitor and evaluate the structure's performance to cost-effectively optimize maintenance, repair and upgrade initiatives. Since the evaluation of the paper is closely related to the strategies chosen in the SHM operation, I defined the CSHM operation as a method for on-site monitoring and performance evaluation of civil structures. disadvantages; it also includes performance evaluation of reinforced structures.

A. Significance of test

The structural phenomena to be studied such as cracking, settlements, etc.

- The time strategy, such as continuous, periodic or triggered monitoring.
- The condition of the phenomenon to be studied e.g. is it a global or local phenomenon that is to be observed?
- The load effect, such as where and how is the load applied, can be controlled, etc.
- The evaluation method. The model used to evaluate the cause-effect on a structure
- Requires knowledge of geometrical, material, load data, etc.

III. CHARACTERISATION OF STRUCTURAL PHENOMENON

One of the main purposes of a CSHM operation is to monitor the development of specific structural phenomena in a structure. Different phenomena can occur depending on which type of loads are acting on the structure during the monitoring. Typical phenomena are shown in the probable cause, such as internal and external loads, for these phenomena need to be identified to be able to determine which parameters should be measured. Examples of parameters are forces, stresses, displacements, rotations, vibrations, and strains. Also, environmental parameters can influence phenomena such as temperature, humidity, precipitation, wind, traffic, etc.

A. Time Strategies

The time strategy describes the duration and frequency of the measurements. Here, the time-dependent strategies are characterized as short-term, long-term, periodic, continuous, and triggered monitoring. The selected strategy depends on the phenomena to be observed. For example, if the crack width of an existing crack is going to be observed a periodic, long-term monitoring program can be recommended. If we want to measure the damping of a structure a short-term manually triggered program can be selected.

B. Short-time monitoring

Short-term monitoring can be used if the condition of the structure is examined at a certain time. This is a typical procedure when an inspection reveals defects or damage to a structure and questions its safety. Short-term monitoring provides more information than visual inspection because the safety of the structure can be monitored. Also, most of the sensors used in the CSHM application are not robust enough to be used for extended periods of time. Most CSHM operations are short-term "on-off" operations, where the CSHM system is used for a specific purpose, despite the instrumentation and installation costs being a large part of the total cost. This type of monitoring is often used to evaluate change. Examples are traffic load changes, structural

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system changes, structural strengthening etc. If several short-term monitoring measures are repeated frequently over a longer period of time, this is defined as periodic long-term monitoring.

C. Long-term monitoring

The SHM definition of long-term monitoring states that continuous monitoring of a structure is considered "long-term" if monitoring is carried out for years or decades. Rather, long-term monitoring should be conducted throughout the life cycle of the structure. Recent advances in sensor technology, data collection, computing power, communication systems, data and technologies now allow these types of systems to be built. Long-term monitoring should be considered only when load changes are slow, such as gradual changes in temperature, or when loads are unpredictable, such as natural hazards such as floods, hurricanes or earthquakes. In addition, if the structure is affected by slow decay processes, the methods to avoid it are limited or should be delayed as long as possible. It concerns the monitoring of ancient buildings and monuments, the aesthetics of which cannot be changed For historic structures, the only way to determine health is through non-destructive testing, as the material cannot be removed and tested to assess material properties.

D. Periodic, Continous and Triggered Monitoring

In For long-term monitoring activities, data collection can be continuous or intermittent, Regular monitoring is when data is collected at regular intervals. Triggered periodic monitoring is when data collection begins or is triggered by a specific event, e.g. when a measured parameter exceeds a threshold. The sample range of each data set depends on the dynamics of the studied phenomena, see also load dependence. A typical purpose of use for repeated periodic monitoring is when the loads are static and the observed phenomenon changes little by little, for example when it is necessary to monitor the annual temperature effect of the dam. A typical application of travel monitoring is the measurement of trains passing a bridge. Interesting specimens are here only when the train is on the bridge. Continuous monitoring is used when rapid changes due to stochastic events are expected. Most often, these types of data streams are processed to reduce the amount of data collected.

E. Sensor Used in Analysis

The sensor system must be chosen for the structural phenomena to be observed and the selected monitoring strategy. The quality of the result from the CSHM operation depends on the characteristics of the used sensors and sensor system. A limited budget is always present and this might influence the quality of the sensor system. For each sensor system planned the characteristics of each part must be investigated. Parameters that influence the selection of the sensors are the sample rate, resolution of the input and output signal, possibility to repeat the monitoring, temperature influence, sensor drift, etc.

SHM technique purely depends on the sensors to monitor the structure, so different sensors can be used. (ere are many types of sensors used by the industry for structural health monitoring. the following:

(1) Piezoelectric sensors (PZT)

(2) Fiber optic sensors (FOS)

(3) Micro-electromechanical systems (MEMS)

(4) Acceleration sensors

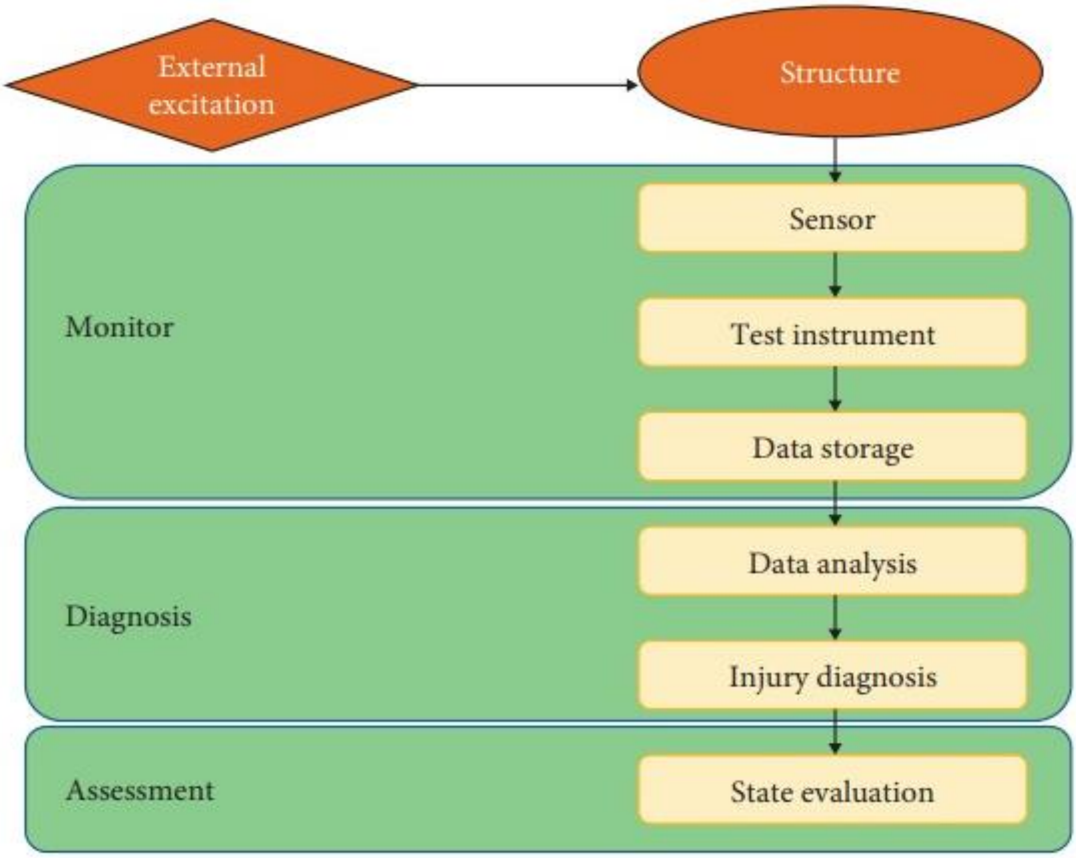
(5) Displacement sensors

(6) Strain sensors

(7) Temperature sensors

F. Working of SHM model

The information collected from the process can beupdated periodically to monitor the structure and based onthe data collected through monitoring a structure, and the structure can be strengthened and repaired, and rehabilitation and maintenance can be completed.



IV. CONCLUSION

In the paper, many aspects of Structural Health Monitoring were considered.

1. The need for SHM gives us some strong reasons for it to become an integral part of a structure.

2. India as a developing country needs to be more aware and cautious about its Infrastructure. A major event can cause irreversible losses and hence should be well-informed in time.

3. There are many important structures where instrumentation is already being used in India like the dams, whose various parameters have to be looked upon, but these are not being done effectively and can be better with new technologies.

4. Lifeline structures like hospitals and important bridges and tunnels should be mandated with monitoring as their failure causes more losses than any other.

5. Structural health monitoring economically is also light and is only 0.5% to 3% one-time cost of total structures and 2% to 5% for monitoring structures over 10 years.

6. It is done with some structures in India but has to be focused more on. Structural Health Monitoring is a relatively new concept worldwide and very recent in India. It has proved to be effective and fruitful in many countries, is now being practised often, and has great potential and usefulness for India for gaining confidence over the structures we are making so that development happens faster and with accurate results.

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