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Applications Of Sensors For Prevention Of Failures In Structures

Mir Aijaz Ahmad[1], Tabish Gulzar[2]

[1] Assistant Professor, Department of Civil Engineering, SoET, BGSBU
[2] Student, Department of Civil Engineering, SoET, BGSBU

Abstract- *Structural Health Monitoring (SHM) aims to develop automated systems for the continuous monitoring, inspection, and damage detection of structures with minimum labour involvement. The first step to set up a SHM system is to incorporate a level of structural sensing capability that is reliable and possesses long term stability. Smart sensing technologies including the applications of fibre optic sensors, piezoelectric sensors, magnetostrictive sensors and self-diagnosing fibre reinforced composites, possess very important capabilities of monitoring various physical or chemical parameters related to the health and therefore, durable service life of structures]*

Keywords- *Sensors, Structures, civionics, SHM, Monitoring.*

I. INTRODUCTION

Civil engineering forms the core of modern day society by providing the raw material for its organized growth i.e., infrastructure. Infrastructure is one such element of modern society that can be used as an analogous term for development, and as such the safety of structures attains prime importance in pre-construction and post-construction phase. The designing and monitoring of various elements of modern day structures requires powerful devices to check various developments in them. To do such a mammoth task, the field of electronics comes to the rescue by introducing sensors that can be used at various points in structural elements to check the changes in them and also for data collection in pre-construction phase. Such a humble union of civil engineering and electronics is termed as civionics.

II. FAILURE OF STRUCTURES

Failure of concrete occurs due to two factors:

- Structural factors
- Non-structural factors

Structural failures occur due to miscalculations made in pre-construction phase. They occur due to faulty design, improper soil analysis, bad site selection and degraded quality of work.

Non-structural failures occur due to defects in old structures, dampening in structures, corrosion in RCC, temperature variation air pollution, solar radiation etc. Structural defects exhibit themselves in the form of cracks in foundations, walls, slabs, beams and floors and occur due to the reason that concrete is designed such that it is incapable of bearing the flexural and shearing stresses that are developed in it.

In this study, use of sensors at various points in structural elements has been studied so that failures can be reduced and/or eliminated by proper monitoring in pre-construction and post-construction phase

III. SENSORS IN PRE-CONSTRUCTION PHASE

Pre-construction phase is the most important phase of the construction process. It is the step wherein all the data regarding the construction project is collected, analysed and resultant design is optimised for best results. Main causes of failure of structures in pre-construction phase include underlying water table, seepage through ground, changing soil profile, wind loads, seismic loads etc. Most of these phenomena are observed and accounted for in calculations for a brief period of time, mostly for a season. But, these forces show a significant variation over the course of a year. Thus, efforts must be made to continuously monitor these phenomena for at least a year. In this direction electronic sensors can play a pivotal role. Water detection sensors can give an accurate set of data regarding the water table depth over the course of a full year. In excess to that, water flow below the ground can also be monitored to check the variations in it and design the structure accordingly. Soil-salts are also a common factor of deterioration of foundation. Adequate and continuous data must be collected before construction is started so that foundations are designed accordingly. Wind forces are most important in design of high-rise buildings. Suitable sensors must be used to assess the speed of wind over the course of a full year. The models of the buildings must be tested against those loads in a wind tunnel, which again demands the use of accurate sensors to study wind effects like vortex shedding. Since most of the buildings nowadays use materials like plastics, paints and bitumen based material, which are highly solar radiation absorbents, sensors must be used to collect solar radiation data and design