

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 BACKGROUND**

Infrared first discovered in 1800 by William Herschel, an astronomer while searching for new optical filter materials to reduce the brightness of sun image in telescope during solar observation. Thermoelectric discovered by Thomas Johanna Seeback lead the scientist to research long wave radiation. Knowledge development in 20<sup>th</sup> century leads to production of camera that can measure radiation and temperature measurement. Nowadays, this new technology of infrared camera are widely used in engineering world. Application can be varies at any condition where surface temperature of objects depends on process inside. Infrared camera can only sense temperature received from the surface of object and not from the visible light reflected to the object's surface. (Rao 2008)

Infrared thermography (IRT) can be defined as the investigation of obtaining and examination of data from non-contact thermal imaging devices. IRT camera consist of an infrared permeable lens, a transmission line and a sensitive detector. The detector convert radiation of infrared into electrical signal. This signal transformed into graphical pixel and appears on the screen. IRT camera are sensitive and need to be handled extremely care. Lens of this camera should be protected from any scratches and should never be wiped or touched by hand to protect its sensitivity. The camera contains a focal plane array of semiconductor detectors and is able to detect radiation from the surface. (Palaskar 2009)

IRT has been an effective tools to investigate and evaluating the condition of building structure in civil engineering. The benefit is it's easy to be handled and gives

faster result and information. IRT application in non-destructive test method (NDT) by using temperature as measurement to produce image and the visual are not limited to passive investigations of the quality of thermal insulation of building envelopers. IRT measurement are taken without any necessary contact to test subject. IRT measures the radiated infrared electromagnetic spectrum between 8 to 14  $\mu\text{m}$  and produces 2D-images that represent heat wave contour. IRT is used for detecting subsurface characteristic such as thermal properties, presence of subsurface anomalies or defects. Infrared camera is generally used for creating fully analysable images from the thermal radiation given off by the object surface. A defect in subsurface of the object can be revealed by thermal anomaly in distribution of the temperature. IRT can be applied through active or passive approaches, depending on whether the inspected part is in thermal equilibrium or not. The use of IRT in inspection procedures is well generous thermal pattern as the surface temperature over the wet material is higher. (Barreira et al. 2016)

IRT are very useful in all engineering field such as civil, mechanical, electrical and also chemical field. IRT also can be useful to locating sources of fire in case of fire ravaged building, fire potential of stored materials as well as surveillance. They are used in the food processing industry, wild life studies and diagnostics such as cancer detection. Several types of infrared cameras suitable for various applications are available commercially.

## **1.2 PROBLEM STATEMENT**

Existing methods of measuring structure in composite materials are often categorized into two broad groups, destructive and non-destructive. Destructive test method implies damaging or removing a section of material resulting the specimen may no longer be useful meanwhile non-destructive test method relatively simple and quick to perform besides giving advantage of using the same samples again and again. One of the method in NDT is using Infrared Thermography (IRT) that can provides an invaluable service to civil engineering and concrete technology. This tools can produce thermal imaging to check the characteristic of concrete such as concrete ages and strength based on set of data that gathered from image processing without damaging the structure. Age and strength of concrete can be determine in situ to be compared with the require strength designed.

## **1.3 OBJECTIVE**

Based on research problem statement, this research aims to achieve two (2) objective.

- i. To study correlation of RGB value from IRT of concrete age and strength development.
- ii. To come out with correlation equation between IRT RGB value with concrete age and strength.