CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Monitoring and maintenance are necessarily in every civil infrastructures and superstructure that employs various techniques. Subsurface cracking, bending, honeycomb and some other defects infect bridges, highways, and buildings. In order to reduce these problems, engineers need to do an early detection and maintenance before structure fails.

Nowadays civil engineering field witness a major advancements in the building diagnostics technologies, it has been found that the non-destructive test (NDT) for the non-contact, accurate nature and fast method which facilitate the detection of many complex cases such as cracking, deflection, bending and etc. It's found that infrared thermography (IRT) is commonly used for structures diagnostics among the NDT methods. It's basically conducted by measuring the radiant thermal energy which is released from the targeted object and could get a noticeable difference in measured temperature in the non-homogeneities region compared to homogametic one. (Kylili, Fokaides, Christou, & Kalogirou, 2014). The detection of deterioration of structures components can be done through gathering high resolution visual images and thermal images which is collected by infrared camera either on ground or in mobile status. In 1970s Virginia Highway and

Transportation Research Council could explore by using IRT the corrosion –induced delamination in reinforced concrete (RC) in a bridge decks. This method is also used to analysis the delamination on the eleven mile Chicago expressway in the USA. In combination with radar imaging, IRT could inspects the defects in bridges and highways (Khan, Bolhassani, Kontsos, Hamid, & Bartoli, 2015).

Researches and experiments shows the relationships between infrared thermography and FRP as thermography method able to examine the quality of adhesion of FRP. It's also offer a simple technique to examine repaired structures in a qualitative way (detection of the bonding defects)(Taillade, Quiertant, Benzarti, & Aubagnac, 2011).

In other hands Scientists' and researchers' goals is to model temperature efficiently transfer in partially and fully grouted concrete masonry walls and enhance visualization associated with thermography that is active regarding the concrete masonry specimens with the aid of comparing two or more numerical methods by finite element and finite variance (Khan et al., 2015).

By comparing apparent density of the result of testing different zones on the same material with same circumstances researchers could get the apparent density of the various areas with the thermal response to identify the deterioration zone. By conclusion it's cleared that Areas with less apparent density (greater porosity) are shown in thermographic images to have lower temperatures (up to 15% lower). This technique allows us to spot areas which is why flakes tend to be about to fall loose since it's an easy task to observe in thermographic images the effects of the reduced thickness of the flakes when compared to undamaged rock.(Lerma, Mas, Gil, Vercher, & Peñalver, 2013)

This research could be done by using the infrared thermal camera to do a comparison of different defected samples of concrete with a control samples and use these comparison to get the dimension and position of the defected part in every concrete sample.

1.2 PROBLEM STATEMENT

As it's known there are two existing methods for concrete testing which is destructive and non-destructive test. Destructive test ends with deformation section of material, means the specimen may no longer be used while non-destructive test is simple and easy to preform and ends without effects to the specimen. Rebound Tests, ultrasonic pulse velocity (UPV) and infrared thermograph are familiar types of non-destructive test.

It has been found that the using of ultrasonic pulse velocity (UPV) required some additional concrete preparation to ensure good contact between the transducers and the concrete member, moreover its required to access two opposite sides of concrete which might be difficult in some cases(Lim & Cao, 2013). Additionally the calculation of ultrasonic is a highly specialized and such a complicated action that needs watchful data gathering and skilful analysis (Lorenzi, Tisbierek, Carlos, & Filho, 2007)

1.3 OBJECTIVE OF RESEARCH

I. To discover and locate the defected parts in concrete such as cracks and honeycombs using infrared thermography camera

II. To analyse the dimensions of the defected parts.

1.4 SCOPE OF WORK

The study focused on comparing different results of thermography test and analysis the defected region as the study will be conduct at concrete laboratory in University Malaysia Pahang by preparing concrete grade 30, these samples will be 150× 150×750 mm and 150×150×150 mm cured in water for 28 days. Then different cases will be performed on several concrete samples and keeping others as control, concrete samples will be heated to 120 ^{o} C for 3 hours and the infrared thermal camera will be installed on fixed distance