CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents physical and mechanical properties of test material, and selection and preparation of test specimens. The requirements and procedures for experimental study and investigation of concrete strength under stress using infrared camera. The objective of this research is to determine the concrete strength under stress using image provided by Infrared thermography (IRT) and to produce and come out set of data by using Colour Detector and IRT analysis system.

In order to obtain the desired data for analysis purpose, two sources which is primary sources and secondary sources is needed to perform the analysis. A primary source is the source that is gained from experimental program that is done in structural laboratory. This source is the data that are used in analysis and it will be visualized in the form of graph, chart and etc. in order to make comparison. Secondary sources are obtained from text books, journals, revision books, articles and previous researches. Research methodology for this research start with the problem statement, aim and objective, data collection, data analysis, conclusion and recommendation (refer to Appendix A1)
3.2 EXPERIMENTAL PROCEDURE

In the study, experimental programs are conducted to determine the characteristic and properties of different concrete's grade using infrared cameras. The flow of the experimental study conducted is shown in Figure 3.2

Figure 3.1: Flow Chart of experimental study
3.3 RESEARCH EQUIPMENT

3.3.1 Infrared Thermography

Infrared thermography is equipment or a technology to detect and visualize infrared energy radiating from an object for displaying images of temperature measurement or temperature distribution. Sometimes it is called infrared camera or thermo camera and it can forms an image using infrared radiation, similar to a common camera that forms an image using visible light. Instead of the 450–750 nanometer range of the visible light camera, infrared cameras operate in wavelengths as long as 14,000 nm (14 μm). Infrared energy is just one part of the electromagnetic spectrum, which encompasses radiation from gamma rays, x-rays, ultra violet, a thin region of visible light, infrared, terahertz waves, microwaves, and radio waves. These are all related and differentiated in the length of their wave (wavelength). All objects emit a certain amount of black body radiation as a function of their temperatures (Maldague, 2002).

Generally speaking, the higher an object's temperature is the more infrared radiation is emitted as black-body radiation. A special camera can detect this radiation in a way similar to the way an ordinary camera detects visible light. It works even in total darkness because ambient light level does not matter. This makes it useful for rescue operations in smoke-filled buildings and underground. Images from infrared cameras tend to have a single color channel because the cameras generally use a sensor that does not distinguish different wavelengths of infrared radiation. Color cameras require a more complex construction to differentiate wavelength and color has less meaning outside of the normal visible spectrum because the differing wavelengths do not map uniformly into the system of color vision used by humans (Wild, 2007).

Sometimes these monochromatic images are displayed in pseudo-color, where changes in color are used rather than changes in intensity to display changes in the signal. This is useful because although humans have much greater dynamic range in intensity detection than color overall, the ability to see fine intensity differences in bright areas is