

Radiant Times Series (RTS) For Equatorial Climates

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Abstract

Air conditioning units are the most significant energy user in a building. Therefore, an accurate cooling load calculation is important to optimize the design of these air conditioning units for a better system for the building energy load. American Society of Heating, Refrigerating and Air Conditioning (ASHRAE) has developed a method called Radiant Times Series (RTS) to improve the accuracy of cooling load calculation. There are several traditional cooling load calculation methods commonly practiced by designers in Malaysia especially Rules of Thumbs, CLTD (Cooling Load Temperature Difference) and TFM (Transfer Function Method). Designer may considered higher safety factor for conventional method because of constraint in initial parameter consideration, thus this will promote higher loading and over designed air conditioning system. This study will discuss the various types of cooling load methods in equatorial climates (hot and humid), where buildings in Malaysia is used as a subject in this paper. The results would be useful for Mechanical, Ventilation and Air Conditioning (MVAC) designer to consider and design a better and optimum system for the building. The finding shows that the huge convocation hall with estimated occupant of 5000 tenants shall be design between the ranges of Cooling Load per Square Feet, of 70 Btu/Hr.ft² to 125 Btu/Hr.ft² based on RTS method and CLTD method respectively. Meanwhile, for office building the design shall be between the ranges of Cooling Load per Square Feet, of 33.81 Btu/Hr.ft² to 46.79 Btu/Hr.ft² based on RTS method and CLTD method respectively. These values are to be achieved comfort cooling for the respective building. The results also showed that the accuracy of cooling load will be determined by the considered parameter of the cooling load methods. It's important to use this method in Malaysian perspectives because of the accuracy and recommended for other hot and humid countries.

Keywords: Radiant Times Series, Cooling Load, Equatorial

1. Introduction

Malaysia is located in an equatorial climates which the weather is hot and humid. Ambient conditions are temperature of 33.3°C with a humidity of around 75%-85% [1]. With these extreme conditions, serious design challenges in designing suitable air conditioning system is a must as it is combination of various climatic conditions with room sensible and latent heat conditions[2]. These problems are also faced by designer in temperature climates, usually at non-peak humid weather conditions when the room sensible heat load is low and the room latent heat is high[2]. To maintain the desired design condition, maximum sensible and latent heat load are determined and a supply of air, often partly re-circulated and partly fresh is passed over a relatively cold heat exchanger surface of a dehumidifier, where it is cooled and moisture is condensed in order to offset the sensible and latent heat loads.[3] This paper will

describe the cooling load for the hall of Dewan Tunku Abdul Rahman Putra (DeTAR PUTRA) UNIMAS and the building of Wisma Bapa Malaysia (WBM). DeTAR PUTRA is the main hall for University Malaysia Sarawak. The DeTAR PUTRA is the venue for University's convocation, conference, undergraduate student registration and for many other functions.[4] DeTAR PUTRA is a unique building where the convocation hall is in cylindrical shape, floor area 53,455 ft², designed to accommodate 5000 people and one of its kind. Figure 1 shows the image of the building from front view. While, banquet hall having a flat roof shape, thus the tall convocation hall cylindrical shape is very obvious to be seen from far. [4] Figure 2: Shows The Convocation Level 2 Air Conditioning Floor Plan system in which there are nozzle type diffuser and typical type diffuser proposed in the tender drawing design.