

# **A Study of Formal-Spatial-Morphology and Pattern Recognition; Computed on Evidence from Ecological Healing Environment fit for Hospital Architecture in Melbourne - Focused on Topological - Solid applying for Climate Consultant Program: Human Thermal Comfort Model (HTCM)**

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**Abstract.** Extensive evidence suggests that sunlight and fresh air are essential for healing and cure in healthcare settings. Daylight and environmental breeze are exceptionally beneficial and satisfactory UV rays along with adequate oxygen are fundamental for Healing Environment. This is an Evidence-Based design crafted accordingly as a subtractive solid where the complex matrix is achieved by applying pattern recognition of sun and wind movement hour by hour, then a building section is provided on 3D Max, to maximize the surface towards the sun in Melbourne. St Vincent's Hospital planning is analyzed on Climate Consultant Software by application of sunrays to sculpt the solid to incorporate a sunny plaza shaped according to sun movement and prevailing wind current every hour of each month. In this research hospital building massing and form is sculpted according to the sun and wind movement, and is validated by capable Artificial Intelligent software forecasting technique to achieve hypothesis of design ecological architectural and environmental envelope prediction model. The finding maximizes the healing rate according to evidence up to 99% to 100% according to the sun and wind direction.

**Keywords:** Climate Consultant Software; Human Thermal Comfort Model (HTCM); Climate Responsive Design; Architectural Orientation; Natural Ventilation; Envelope Design Melbourne.

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## **1. Introduction**

This paper computes evidence to support the hypothesis that sun exposure is directly proportionate to healing (Beauchemin & Hays, 1996; Ulrich, 1984; Beauchemin & Hays, 1998). Thus 98% sun is achieved to facilitate healing (Selzer, 2005; Tennessen & Cimprich, 1995; Heerwagen & Orians, 1986; Orr, 2002) for all hours of the day and month for Melbourne where the temperate in the coastal zone is typically warm, dry summers and cool, wet winters, with a wider diurnal temperature range in summer than in winter.

Climate Consultant 2) proposes different design strategies suitable for this particular climate using a characteristic analysis. The variety of analyzing climatic parameters for the Melbourne location is

facilitated with the help of available human thermal comfort models (HTCMs). Each model sets particular criteria based on the descriptive study of a particular code and standard. A simplified explanation of each HTCM is prescribed before the selection.

### ***1.1. Research Backgrounds and Objectives***

The quest for healthy hospital building (Vittori, 2002; Critical, 1993; Green Guide; Ausubel, 2004; Corvalan, Hales and McMichael, 2010; Environmental Science). The temperate temperature of Melbourne permits for a sun exposure-based exercise as compared to Pakistan where design caters to lessening sun effect rather than enhancing it. Thus,

this is research-based experimentation where healthcare design could be simulated based on the response to sun and environmental design (Wickersheimer, 2013; Schettler, 2001; Hampton, 2007; Rossi, & Lent, 2006; H2E, 2005). The ongoing research for the evidence (Frumkin, 2003; De Vries, 2001; Frumkin, 2001) of healing environment (suggested by Ulrich) (Morris, 2003; Ulrich, 1983; 1991; 1999; 2001; 2002), and ecological architecture fit for healthcare settings (Stichler, 2008; Forman, 1996; Hannen, 2009).

On 21 June the winter solstice has a total sum of nine hours which is the least amount of daylight of the year. In Melbourne, the sun ascends from a location on the horizon about 30° north of due east, moves low across the sky, and sets about 30° north of due west. Its maximum altitude angle at solar noon is about 29° 1). On 21 December the summer solstice has a total sum of around 14.5 hours of the most daylight of the year. In Melbourne, the sun rises from a position on the horizon about 30° south of due east, moves high in the sky, and sets about 30° south of due west. Its maximum altitude angle at solar noon is around 75° 1).

Weather is often changeable, with rapid drops in temperature due to the effects of coastal winds. The performance and design of climate-responsive buildings require a detailed study of different attributes of climate. The analysis of local Melbourne climate 3) helps to determine the design strategies suitable for that climate. To track the macro climatic behavior, a considerable analysis of the psychometrics chart for this area of Melbourne was helpful. In Melbourne temperature suggested by Climate Consultant is in summer 26°C–15°C winter 13°C–6 °C.

In psychometrics charts table 3 and 4, the sun shading, thermal mass, and ventilation requirements are important passive cooling strategies for the temperate climate of Melbourne.

## 1.2. Background

Melbourne enjoys a pleasant climate; the city is seldom intolerably cold or unbearably hot as shown in Fig.1. Melbourne is the largest and densely populated coastal city of Victoria, Australia. Its geographical location is 38°S. Melbourne is situated at 38 latitudes therefore she has a need of 2.5 hours of sun rays per week for the production of adequate Vitamin E.

## 1.3. Research Backgrounds: A proposed approach

To validate data mining methods for predicting form which is fit for healing acceleration concerning light and air an approach shown as follow was proposed:

- a. Define the problem in terms of Climate Consultancy and categorize measures with the aid of a team of specialists for example medical practitioners and nurses (shown in Fig. 1).
- b. Data post checking processing: is availed to develop the quality of the data collected on the CC software and the mining results (Table. 2).
- c. Building the classifier model on 3D max software according to the UV light chart (Fig.1).
- d. Assessment of the performance of the model on Climate Consultant, based on defined measures of 3D max software and then comparing with the UV light required (Table 3).
- e. Apply the chosen model comprehensively to acquire and analyze results. Proposing the solution for future upcoming research (Table 4).

Descriptive ↔ Analytical ↔ Data Quality

*Diagram.1. Showing research flow as a funnel from macro analysis to microanalysis on climate consultant to data-mine the best solution for sun orientation.*

In this prospective investigation of healing patterns at a macro level on-site plan application of climate consultant program is proposed as shown in Fig.1. Here the wired cylindrical form is simulated to showcase the angle of the sun in Melbourne. The Climate consultant shading is designed such that the obstructions are removed according to the suggestion of the software. This way the healing environment is enhanced to the utmost (Malkin, 1992; Schweitzer et al., 2004; Kohn, Corrigan, & Donaldson, 2000; Fottler et al., 2000; Douglas & Douglas, 2005).

**1.4. Research Objective**

The objectives of this research are;

- i. To examine climate responsive design strategies for Melbourne based on the prior studies.
- ii. To evaluate the increased percentage of the healing environment and its impact of various proposed designs 3) strategies of HTCMTs in climate consultant.4)-8).

An extensive experiment was conducted to quantify the performance of our multidimensional pattern recognition scheme on the healing chart Table. 3, testing the effectiveness on the prototype of various forms and healing patterns (Table.4) and simulation of UV light via depth map analysis.

**1.5. Research Methods**

A tripartite organization has been designed to test the external environment at the macro level. Thus, a three-prong strategy is designed here where the external environment of the site is simulated on the Climate Comfort program in terms of airflow, sun shading, and psychrometric chart.

Table 1. The three-software used to calculate evidence for healing from Macro level external features are calculated on Climate Consultant and Micro-level analysis on Syntax.

Ecological healing Evidence Melbourne	Climate Consultant Software
Simple cylinder form	Tilt Surface Radiation
Cube form	Sun Shading Chart
Hospital site	Human Thermal Comfort Model

A methodology of a set of three forms of design to calculate the HTCMT according to the UV light on Psychrometric Chart to simulate the rate of healing in terms of architectural features in a healthcare facility.

**2. Literature review**

Recent Literature Review involves the perspective of hospital environment: nature which has given the output while gathering the information for nature, minimization of mental pressure, further there is a growing expectation of happiness and maximization of the psychological relief for healthcare (Van Lerberghe, 2008; Guidelines, 2006; Brannen, 2006; Rossi & Lent, 2006; Benedetti et al., 2001). A growing number of evidences suggest that the sun is directly proportionate to the sun and open towards nature. Currently, the green hospital is the top priority in the research direction throughout the globe.

The cylinder visuals are used with the permission of Marcus White from his Ph.D. Thesis while author travels to Australia for research data collection. CC data is produced by the author.

**2.1. Subtracted according to Sun – solid negative shadow subtraction tool**

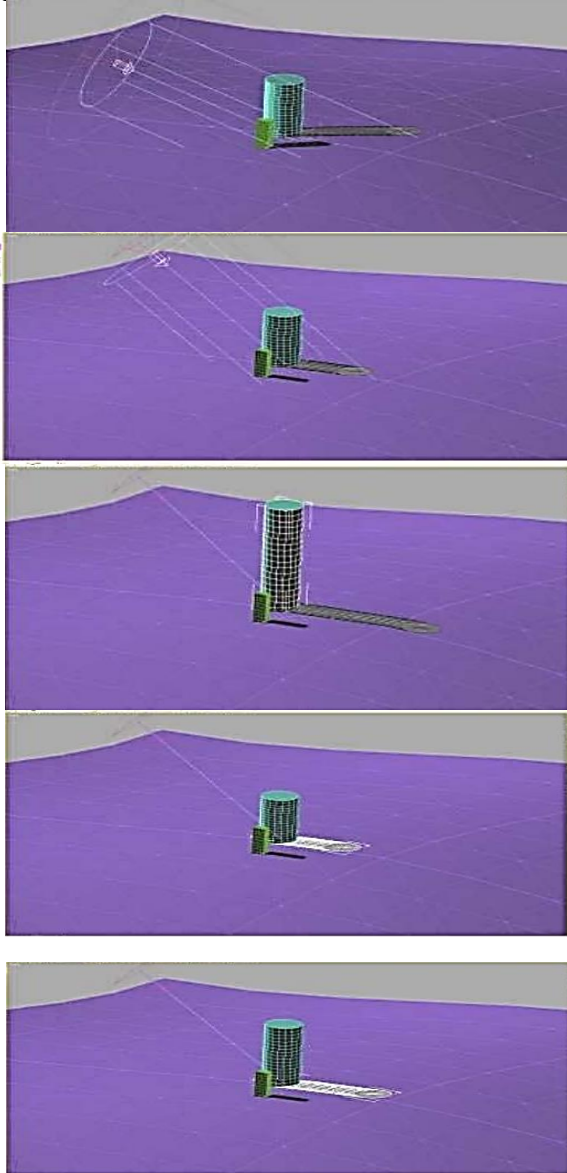
Here when subtracting according to the sun's movement, the message goes far beyond buildings. The aim of the subtracted tool according to the sun is to reduce the harm caused by a building by expanding its systems boundaries from building outward, accounting for other natural and man-made life cycles that border and interact with it.

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The development of a technique called Subtracted according to-Sun, can go beyond reducing the harm caused by the built environment and make buildings an active force for the common good. This tool used solar systems parametric Boolean Wired command determinants.

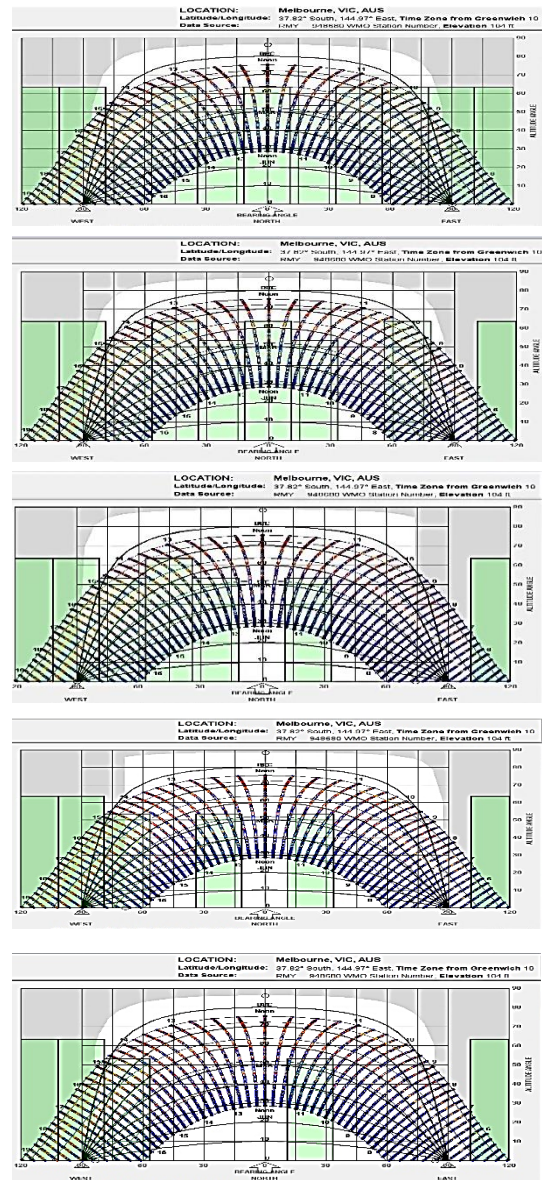
The tool mold envelope is permissible to the building

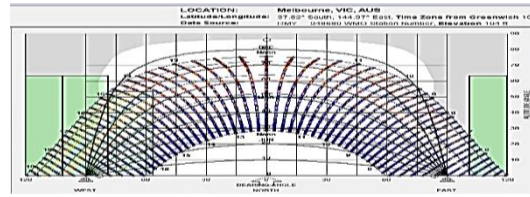
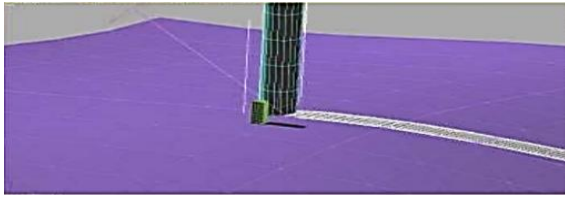
Sun angle along with a wired solid cylinder on 3D max ray-light



by sculpting a solid truncation according to the 'shadow' of mass, and rays of light directional angles of the sun for the entire day in the winter and summer period. Thus, recognizing the resource flow on which this building depends, and identifying them and their multiple boundaries, from the building scale through to neighborhood, city, regional and global scale.

Climate Consultant software with everyday sun effect on 3D chart radiation



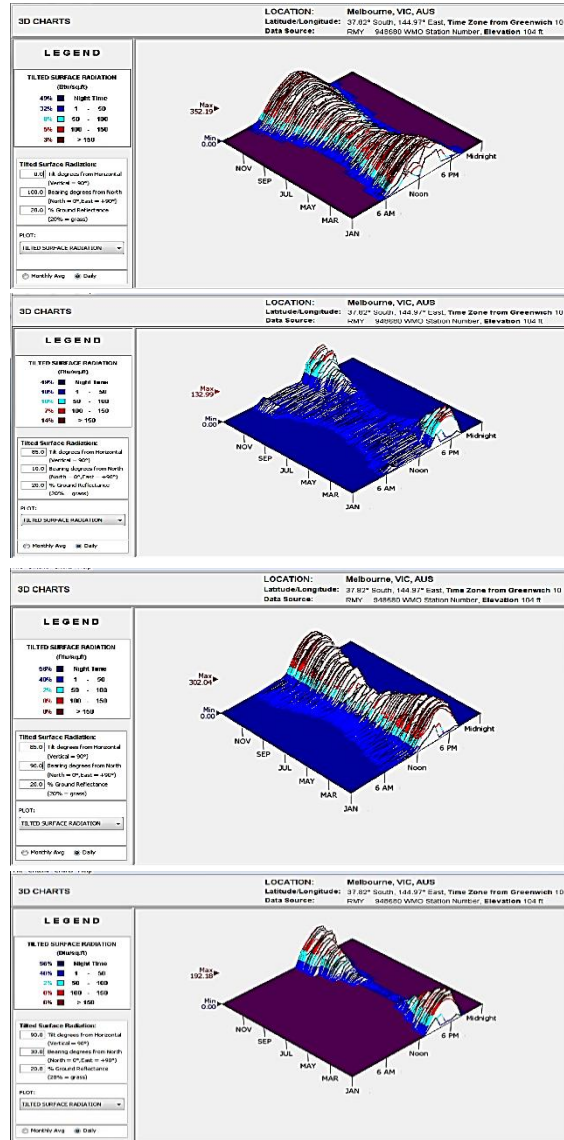
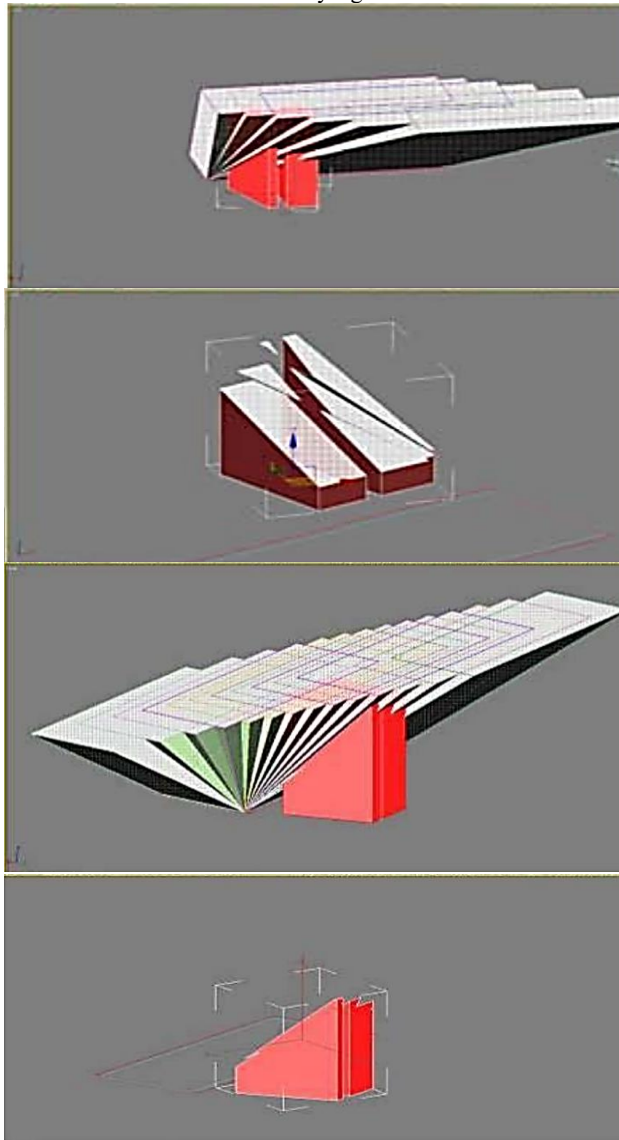


**Fig. 1. The wired mesh of a cylinder to understand sun effect compared to the Seung Climate Consultant wired mesh for radiation for the same angle**

**Table 2. Rating Scale of Pairwise Comparison**

Form sculpted according to the Sun angle along with a red solid cube on 3D Max ray-light and ECOTECT

Climate Consultant software with the wired mesh of every day sun effect on 3D chart radiation



### 3. Results


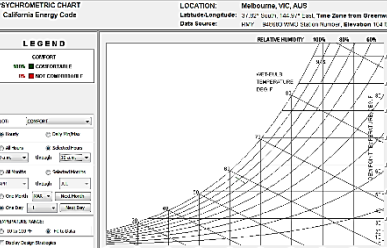
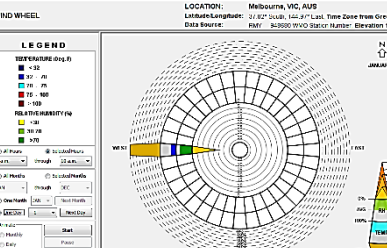

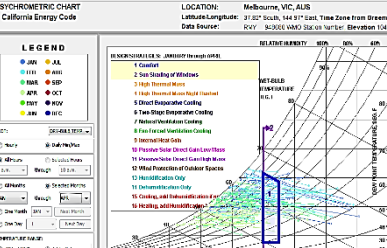
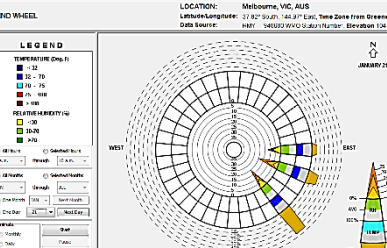

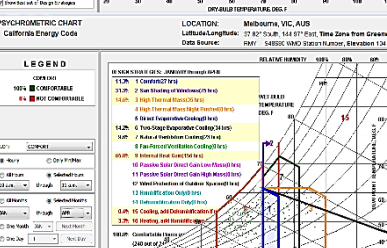
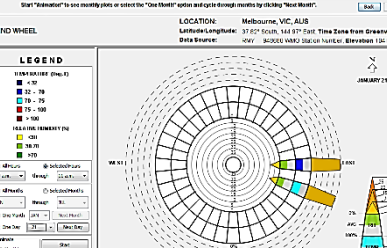
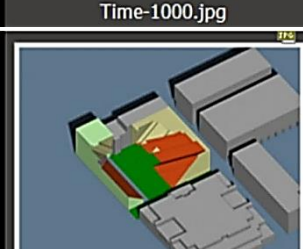
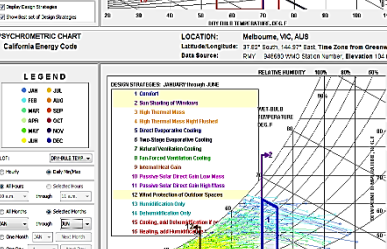
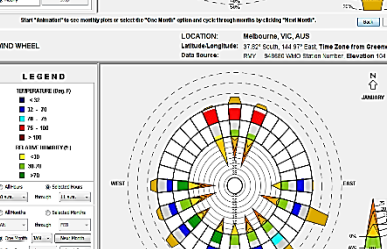
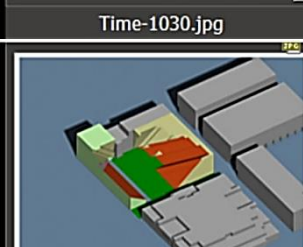
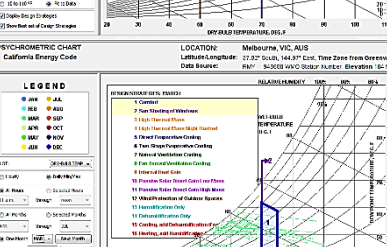
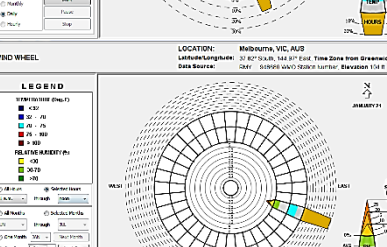
Medicine and public health institution will explicitly commit to promoting the health restoration of the natural, social, and built environments. These commitments will extend to the social determinants of health and disease. This project defined a series of

goals to create a building and landscape that will integrate building purpose, program, and academics.

A setting that provides a healthy interior environment daylit, free of toxic material, and connecting its occupants to nature. It improves workplace

productivity, reduces stress, increases job satisfaction, and improves comfort. Uses an integrated building approach and life-cycle assessment.

Table 3. Comparison Matrix from 9:00 am to 11:30 am

Site plan: subtracted to sun	Psychrometric plan: for the selected time	Wind movement on-site for the same time
 <p>Time-0900.jpg</p>		
 <p>Time-0930.jpg</p>		
 <p>Time-1000.jpg</p>		
 <p>Time-1030.jpg</p>		
 <p>Time-1100.jpg</p>		

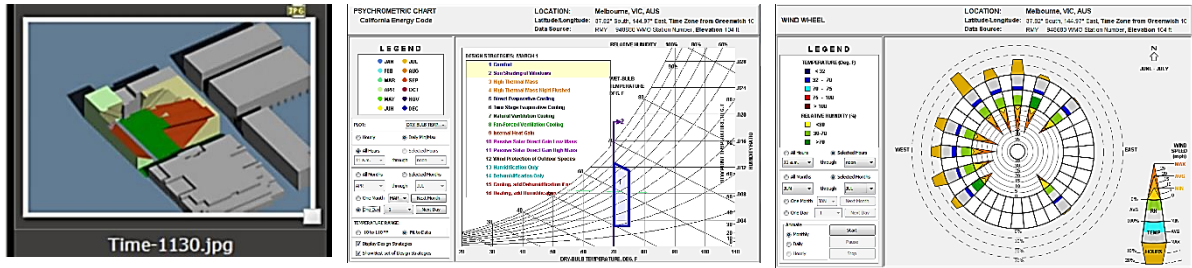
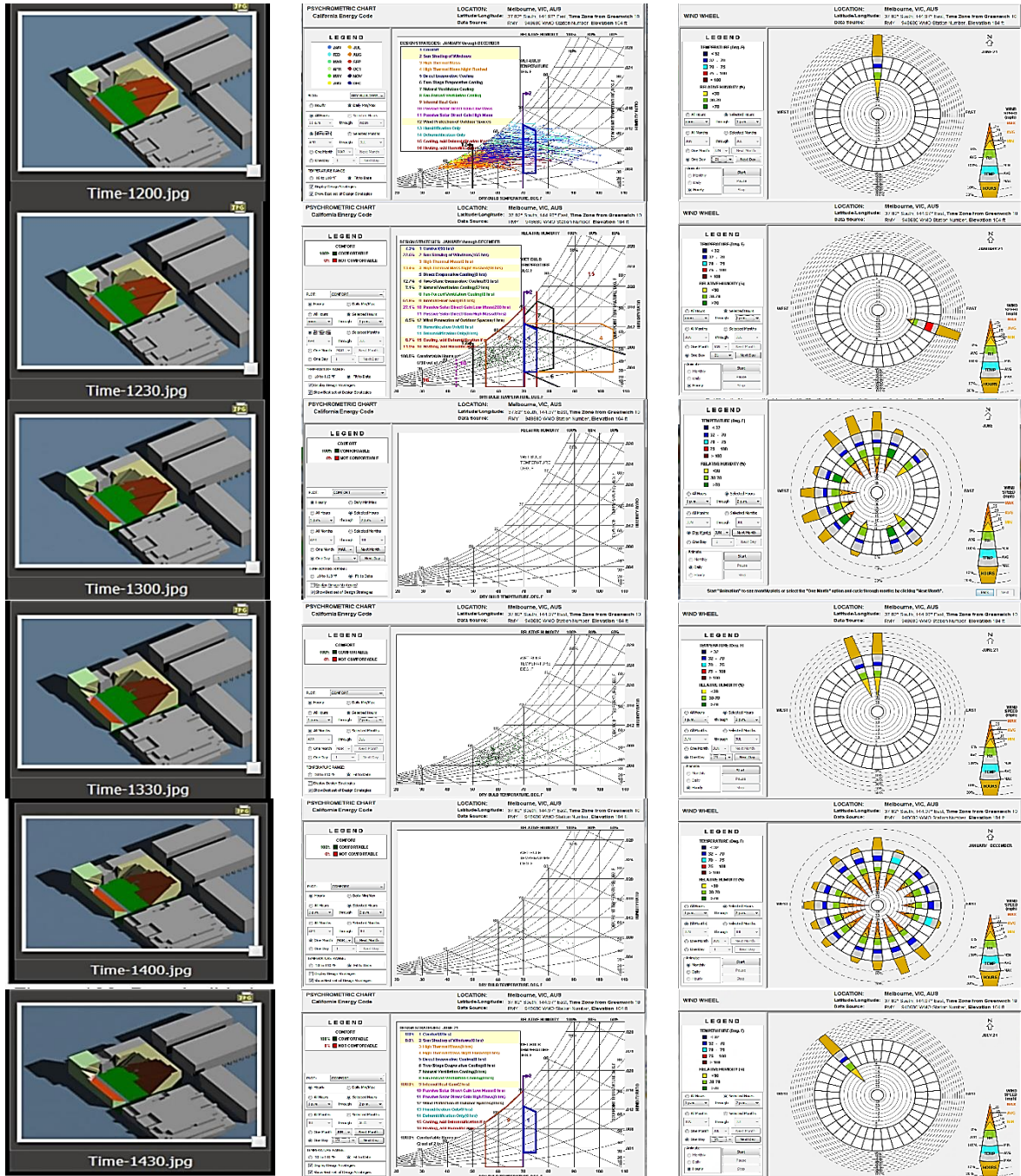


Table 4. Ranking of form hourly basis simulated on the psychrometric chart and wind wheel on Climate Consultant



## 4. Discussion

Far-reaching evidence reveals that daylight and fresh air are vital for cure in hospital architecture. Sunlight and breeze are highly therapeutic and an ample amount of UV rays coupled with fresh breath are objectives of this paper. The Evidence-Based Design suggested form design according to natural determinants can heal better. A thorough study both all day round and all year round are conducted on a purposely designed model on 3D Max to simulate. Conclusively we proved that if 95-98% of the form is designed on ECOTECT software to allow 98%-daylight and breeze in, it results in the same amount of healthy design i.e., 95%-100% achievement of the healing environment. The site is in Melbourne. Hospital planning is analyzed on Climate Consultant Software.

### 4.1. Hypothesis

The hypothesis is based on an understanding of how humans engage with their environments through life cycle events. The Hypothesis which we want to test here is “The level of appropriateness of sunlight in healthcare applicability for healing environment”. Thus, the hypothesis which we have tested is known as the null hypothesis, and  $H_0$  denotes it, while the hypothesis opposite the null hypothesis is the alternative hypothesis and is represented by  $H_1$  or  $H_a$ . i.e.,  $H_0: \mu = 2$

The alternative hypothesis may be stated as

$$H_1: \mu < 2 \quad \mu > 2 \text{ or } \mu \neq 2$$

Thus, the null hypothesis is a “claim” to be verified. The alternative hypothesis is exactly the reverse of the null hypothesis. Therefore, the claim is to check the probability and appropriateness of healing with the sun in the healthcare setting for Melbourne.

## 5. Conclusions

The project began by defining a series of correlations of sun, wind, and their implementation in hospital

settings.

- The St Vincent’s Hospital of project’s central organizing principles evolved use of software 3D max ‘Subtracted Sun’ – solid truncated according to shadow negatives analysis according to plaza every half an hour on 3D max.
- A setting designed according to use natural capital- sun, wind, and water to reduce operating costs and maintenance; uses renewable resources. Therefore, above is a setting that harms the environment as little as possible; one that pollutes less consumes less, and uses fewer non-renewable resources. To foster a healthy environment and protects natural ecosystems.
- The project focused on energy performance and indoor environment quality (through abundant daylighting). Given the orientation of the restricted sit by use of state-of-the-art software.
- Conclusively a form was evolved which could incorporate round the close sun exposure for healing purposes. Therefore attaining 98% of healing through sun, thus this study is designed so that the methodology could be applicable to test the fitness of the form for the other research.

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