BETTER PLACES FOR PEOPLE

Kuala Lumpur Pilot Study

July 2018

In Collaboration With

lendlease

UPM UNIVERSITI PUTRA MALAYSIA

UNIVERSITI KEBANGSAAN MALAYSIA
The National University of Malaysia

CAREe
CENTRE FOR ADVANCED RESEARCH ON ENERGY
Universiti Teknikal Malaysia Melaka

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Executive summary

This project identifies design features that are known to have positive impacts on the health, wellbeing and productivity of office building occupants and relating those back to the physical features of buildings and employee perceptions.

This study looks at the performance of two office buildings one green and the other non green but both fitted out to a green interior specification. The findings indicate that the existing buildings shell and environmental performance, namely the cooling thermal performance and daylighting were the two main factors that effected the comfort levels for the employees day to day work in the workspace.

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Brief Acknowledgement

This report has been made possible by efforts of partner Green Building Councils, and in particular to the time dedicated by the malaysiaGBC project team. All of those involved are fully credited in the acknowledgements at the end of the report.

This study was sponsored by a grant funding by World Green Building Council(WGBC) and personal funding by malaysiaGBC.

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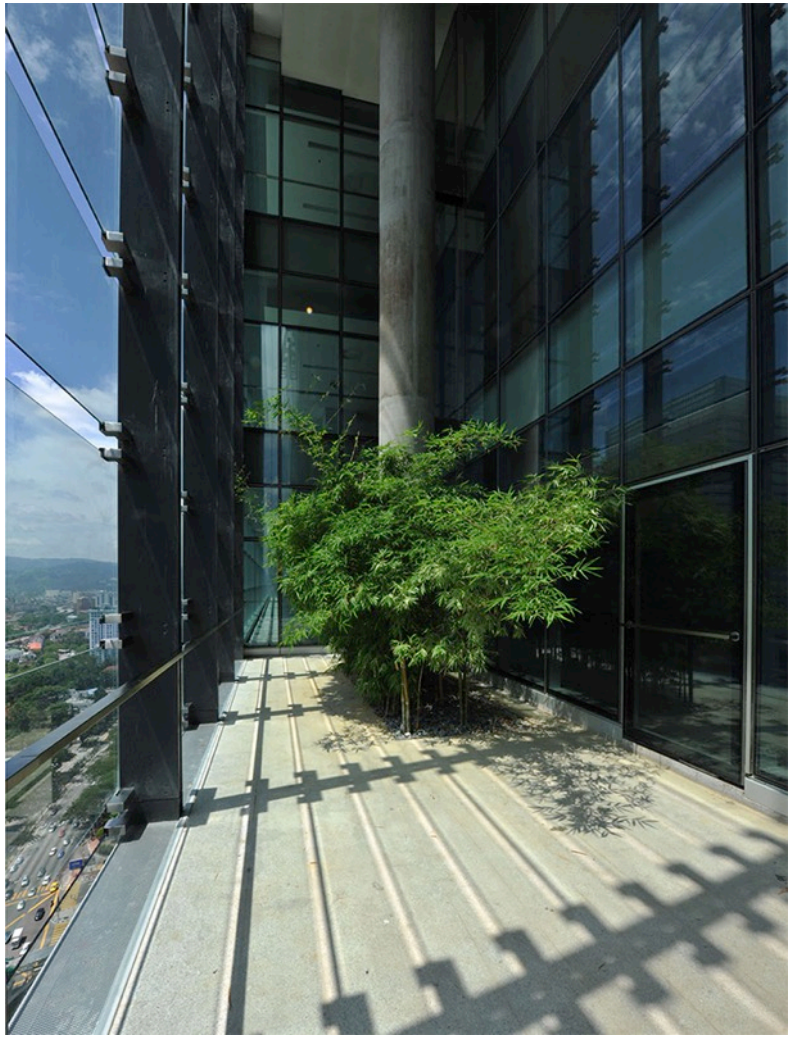
Aim of this report

This project is an attempt to build momentum on the topic of health, wellbeing and productivity in Kuala Lumpur.

The study intends to determine the Indoor Environmental Quality (IEQ) performance of Malaysia's green-rated commercial office buildings, in comparison to the conventionally constructed non-green rated commercial office buildings.

The study analyses the features of building design and the health, wellbeing and productivity of occupants through the occupant satisfaction survey.



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Process and scope

This study uses a post occupancy evaluation of two office buildings in Kuala Lumpur; one with GBI Building & Interiors Certification, and one without any green certification.

The post occupancy evaluation emphasises on perspective measurements of health, wellbeing and productivity of occupants in the workplace. These terms are used to encompass a whole range of broader feelings or perceptions of satisfaction and happiness.

Pilot Case Study: Lendlease Office in Kuala Lumpur;- Menara Binjai and Menara JCorp.

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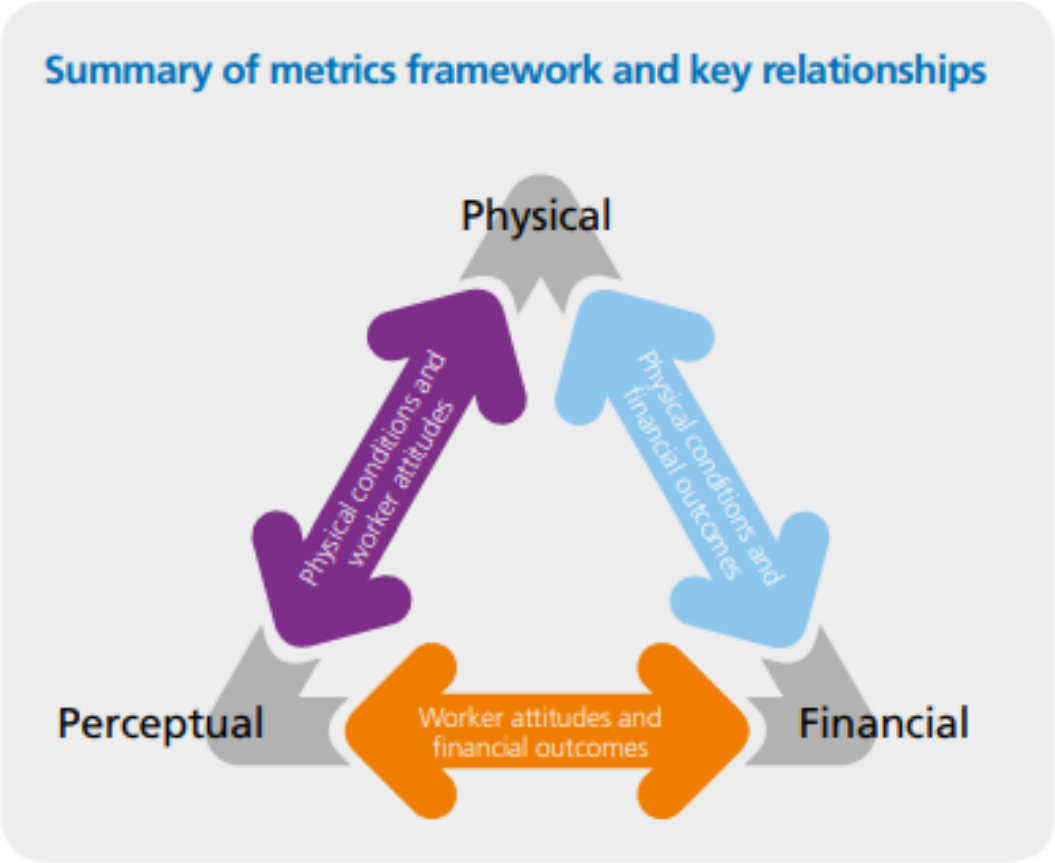
Methodology



Ref: Health, Wellbeing & Productivity in Offices;- The next chapter for green building report, World Green Building Council, Sep 2014

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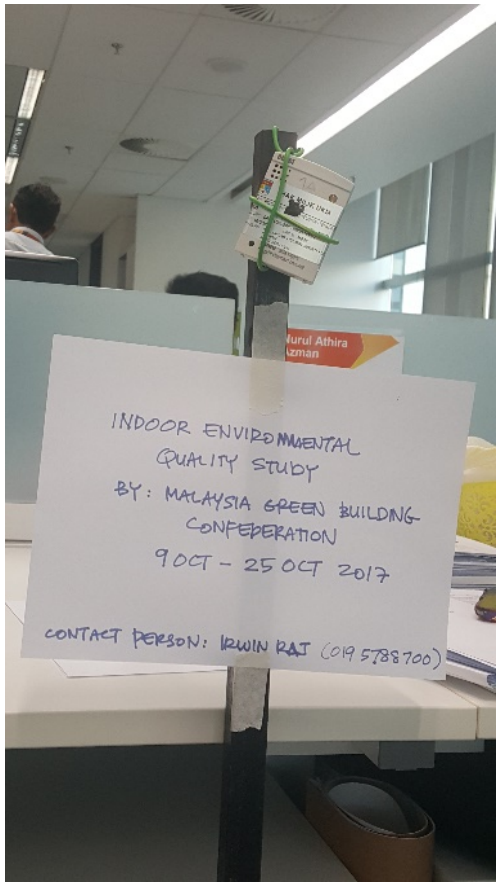
Methodology - Physical

To test the workspace that the physical design and operation affects the health, wellbeing and productivity of occupants.

This is studied using very direct measures as below;

- Monitoring of thermal and visual comfort by installing 3 Delta Ohm data loggers and 6 HOBO sensors for 2 weeks on different thermal zones of the office floor spaces

- Measuring PMV, & PPD, air temperature, mean radiant temperature, humidity, air velocity and illuminance.



Images: IEQ measuring devices setup at Lendlease Office in Menara Binjai

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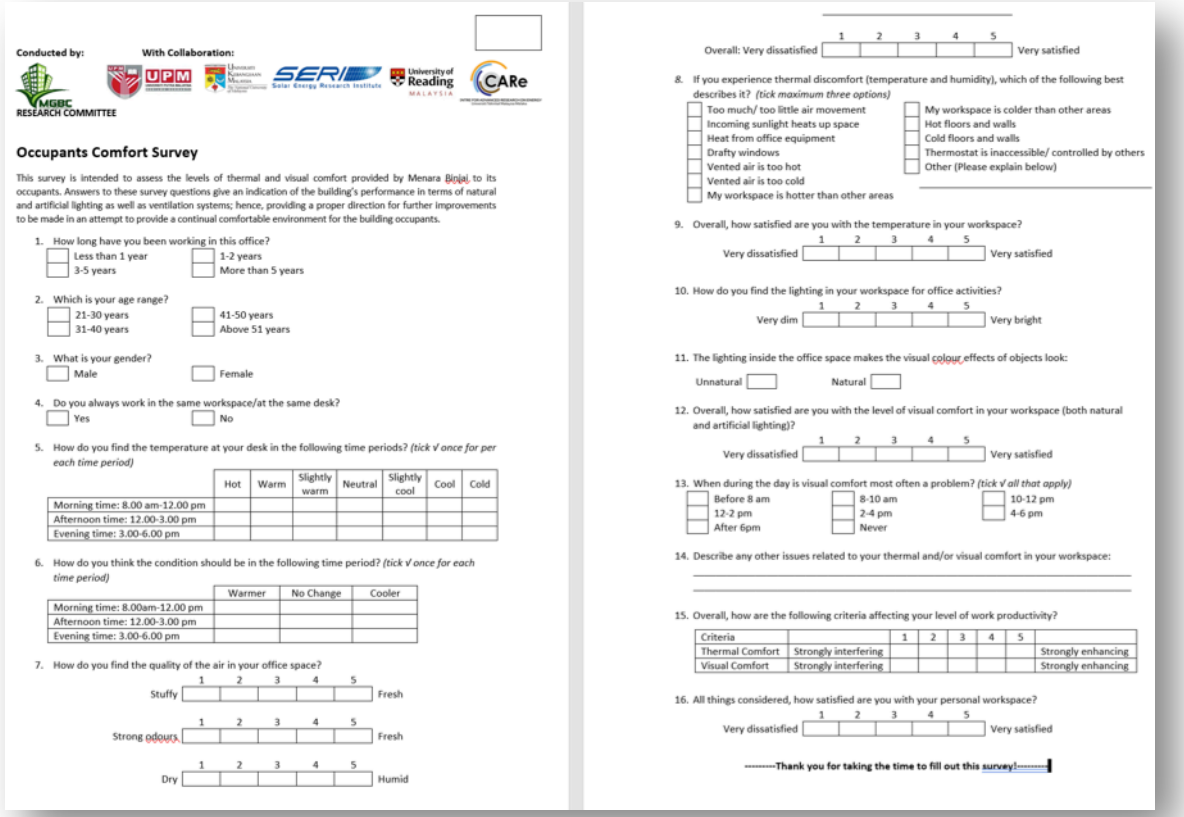
Methodology - Perceptual

The perception study tests a range of self-reported attitudes aiming to gain insight into health, wellbeing and productivity of occupants.

The completed occupancy comfort survey by occupants allows the study team to investigate the occupants' level of satisfaction in relation to thermal and visual comfort, and the corresponding impact on their workspace conditions.



Conducted by: MGBC RESEARCH COMMITTEE

With Collaboration: UPM, SERI Solar Energy Research Institute, University of Reading Malaysia, CARe

Occupants Comfort Survey

This survey is intended to assess the levels of thermal and visual comfort provided by Menara Binjai to its occupants. Answers to these survey questions give an indication of the building's performance in terms of natural and artificial lighting as well as ventilation systems; hence, providing a proper direction for further improvements to be made in an attempt to provide a continual comfortable environment for the building occupants.

1. How long have you been working in this office?
   ☐ Less than 1 year ☐ 1-2 years
   ☐ 3-5 years ☐ More than 5 years
2. Which is your age range?
   ☐ 21-30 years ☐ 41-50 years
   ☐ 31-40 years ☐ Above 51 years
3. What is your gender?
   ☐ Male ☐ Female
4. Do you always work in the same workspace/at the same desk?
   ☐ Yes ☐ No
5. How do you find the temperature at your desk in the following time periods? *(tick √ once for per each time period)*

	Hot	Warm	Slightly warm	Neutral	Slightly cool	Cool	Cold
Morning time: 8.00 am-12.00 pm							
Afternoon time: 12.00-3.00 pm							
Evening time: 3.00-6.00 pm							

6. How do you think the condition should be in the following time period? *(tick √ once for each time period)*

	Warmer	No Change	Cooler
Morning time: 8.00am-12.00 pm			
Afternoon time: 12.00-3.00 pm			
Evening time: 3.00-6.00 pm			

7. How do you find the quality of the air in your office space?
   Stuffy 1 2 3 4 5 Fresh
   Strong odours 1 2 3 4 5 Fresh
   Dry 1 2 3 4 5 Humid

Overall: Very dissatisfied 1 2 3 4 5 Very satisfied

8. If you experience thermal discomfort (temperature and humidity), which of the following best describes it? *(tick maximum three options)*
   ☐ Too much/ too little air movement
   ☐ Incoming sunlight heats up space
   ☐ Heat from office equipment
   ☐ Drafty windows
   ☐ Vented air is too hot
   ☐ Vented air is too cold
   ☐ My workspace is hotter than other areas
   ☐ My workspace is colder than other areas
   ☐ Hot floors and walls
   ☐ Cold floors and walls
   ☐ Thermostat is inaccessible/ controlled by others
   ☐ Other (Please explain below)
9. Overall, how satisfied are you with the temperature in your workspace?
   Very dissatisfied 1 2 3 4 5 Very satisfied
10. How do you find the lighting in your workspace for office activities?
    Very dim 1 2 3 4 5 Very bright
11. The lighting inside the office space makes the visual colour effects of objects look:
    Unnatural ☐ Natural ☐
12. Overall, how satisfied are you with the level of visual comfort in your workspace (both natural and artificial lighting)?
    Very dissatisfied 1 2 3 4 5 Very satisfied
13. When during the day is visual comfort most often a problem? *(tick √ all that apply)*
    ☐ Before 8 am ☐ 8-10 am ☐ 10-12 pm
    ☐ 12-2 pm ☐ 2-4 pm ☐ 4-6 pm
    ☐ After 6pm ☐ Never
14. Describe any other issues related to your thermal and/or visual comfort in your workspace:
15. Overall, how are the following criteria affecting your level of work productivity?

Criteria		1	2	3	4	5	
Thermal Comfort	Strongly interfering						Strongly enhancing
Visual Comfort	Strongly interfering						Strongly enhancing

16. All things considered, how satisfied are you with your personal workspace?
    Very dissatisfied 1 2 3 4 5 Very satisfied

---------Thank you for taking the time to fill out this survey!---------

Images: Occupants comfort survey provided to the occupants

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Case study

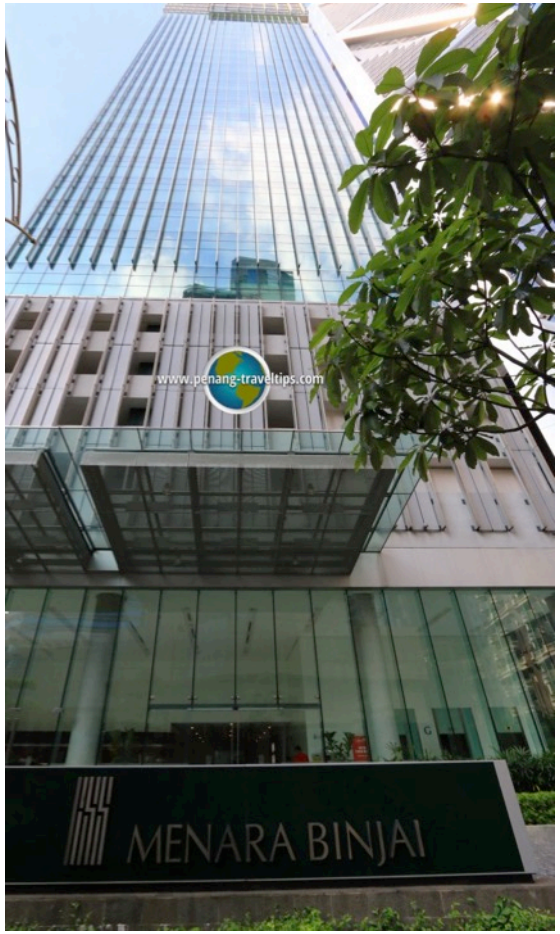
Lendlease is a leading international property and infrastructure group with operations in Australia, Asia, Europe and the Americas. Headquartered in Sydney, Australia, Lendlease has approximately 12,740 employees internationally.

This case study focuses on two of Lendlease's office in Kuala Lumpur, occupied by the same group of people over a period of time. The initial study was conducted on an office floor in Menara Binjai (a green rated building) occupied by Lendlease employees.

The same Lendlease employees, then relocated to another office floor in Menara Jcorp (non-green rated building).

The relocation of Lendlease employee provided our Project Team an opportunity to study the impacts of a green building design vs. a non-green building design on the same group of occupants.

Case study location



Images: Menara Binjai, Jalan Binjai Kuala Lumpur

Lendlease Office

MENARA BINJAI
GBI Silver-certified
Green Mark Gold-certified
Completed in 2012
LEVEL 20
Capacity: 112 pax
Area: 1200 sq.m.

MENARA JCORP
Non-green-certified building
Completed in 1995
LEVEL 8
Capacity: 160 pax
Area: 1020 sq.m.
MS1525 Interior

Images: Menara JCorp, Jalan Tun Razak, Kuala Lumpur

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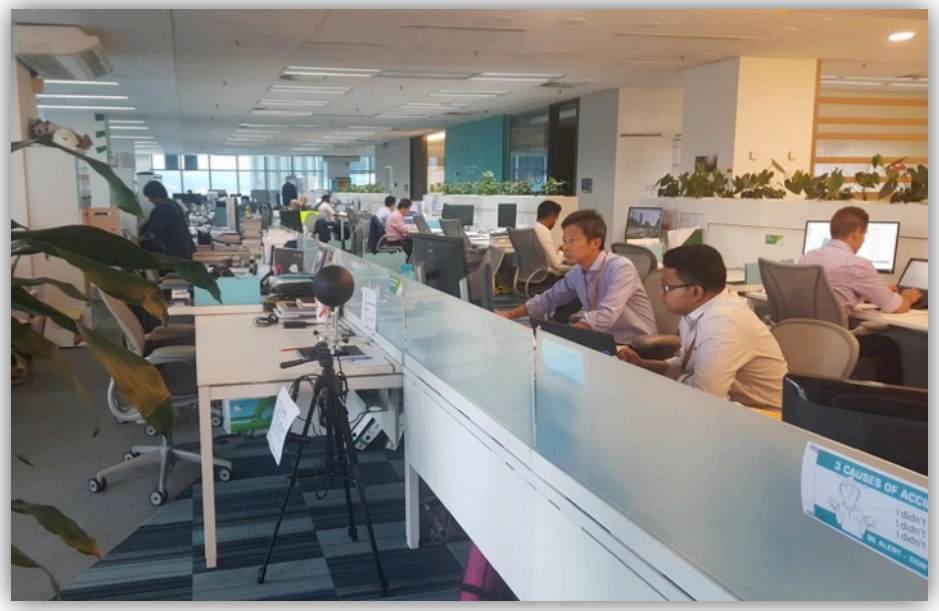
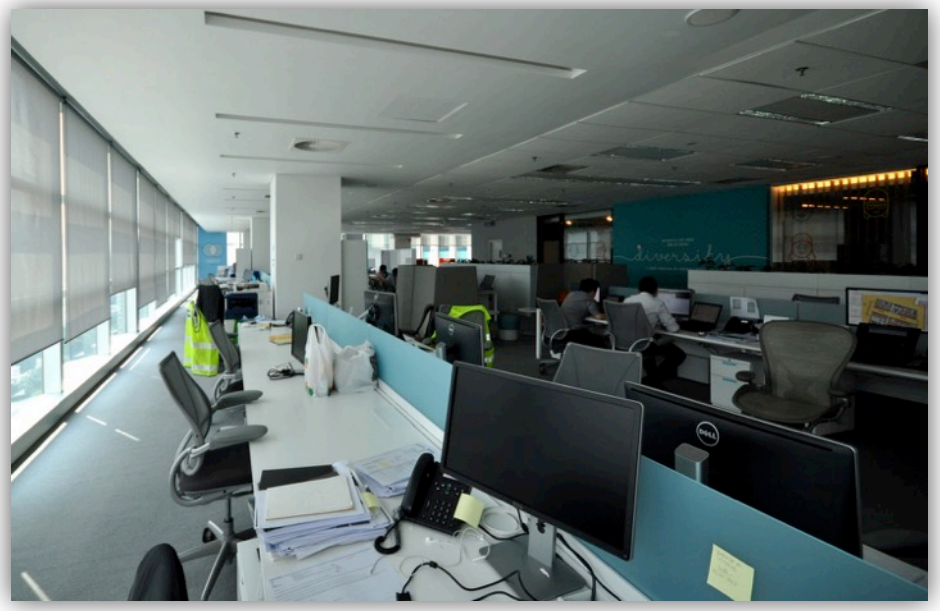
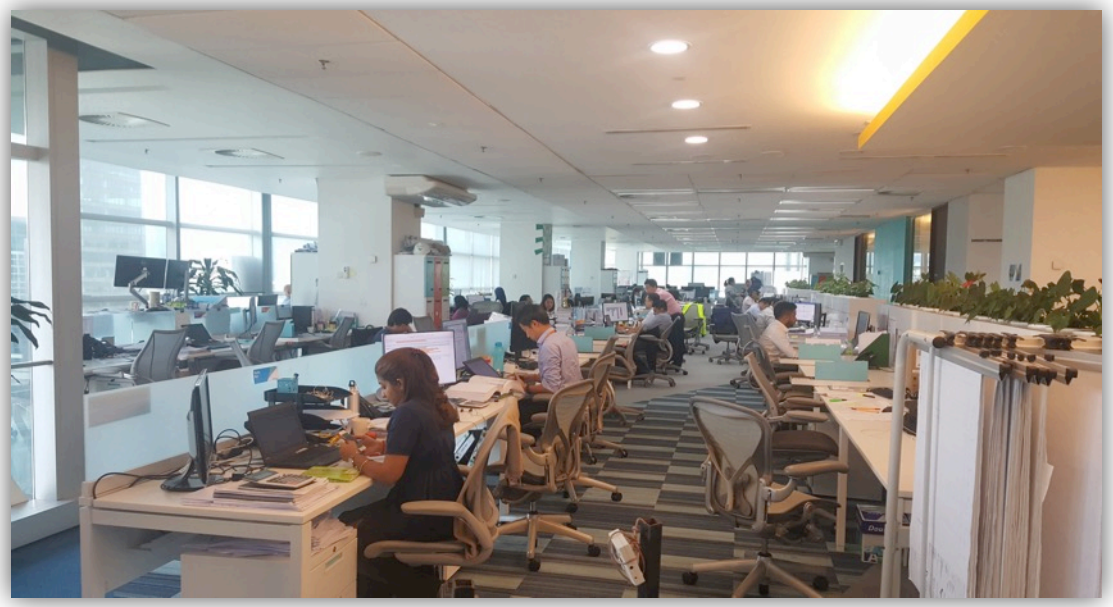
Lendlease Office, Level 20, Menara Binjai







Images (clockwise from bottom left: Lendlease employees at Level 20, Menara Binjai, Jalan Binjai Kuala Lumpur

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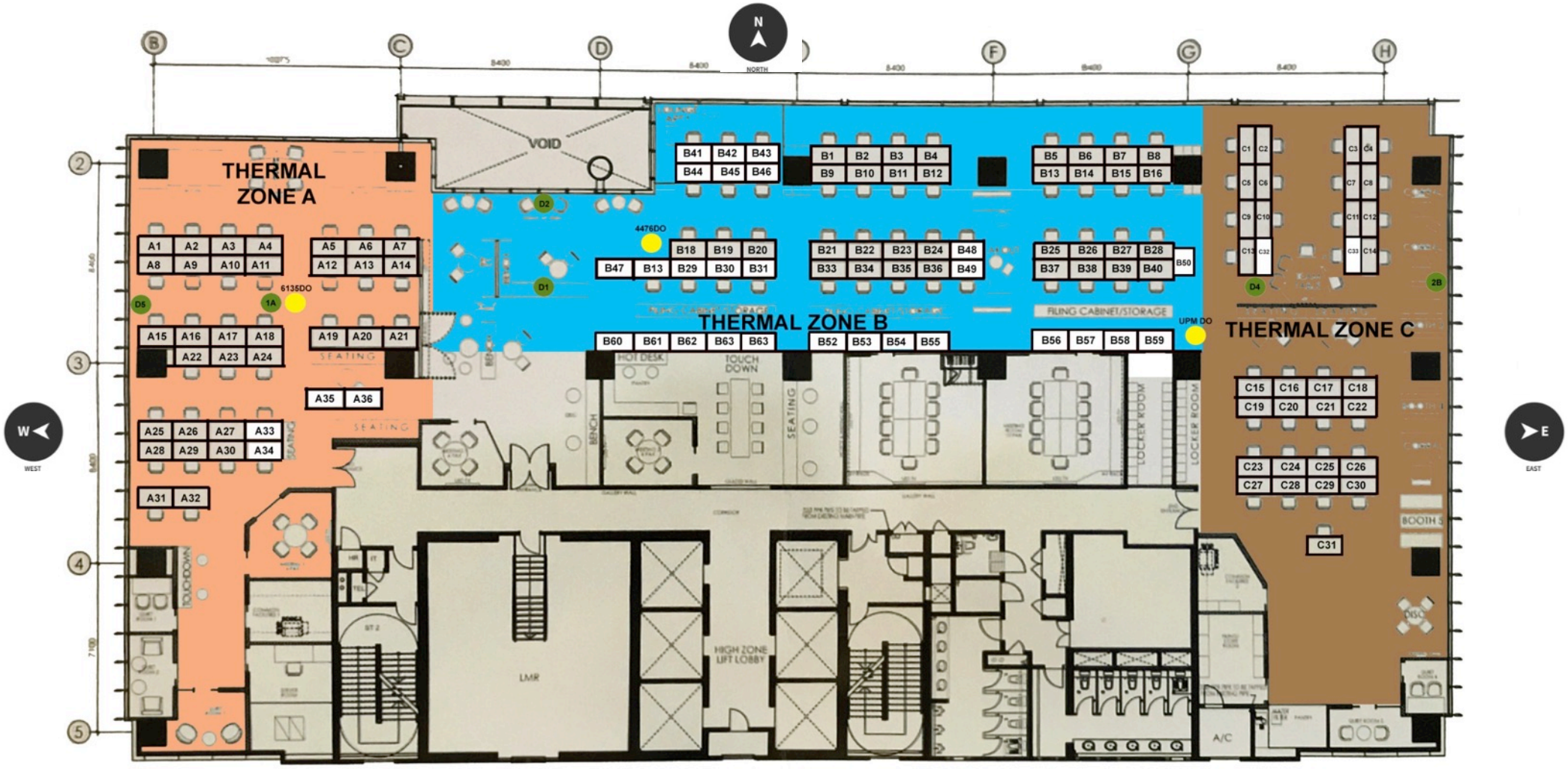
Lendlease Office, Level 20, Menara Binjai



Plan: Lendlease Project Office Level 20, Menara Binjai, Jalan Binjai Kuala Lumpur

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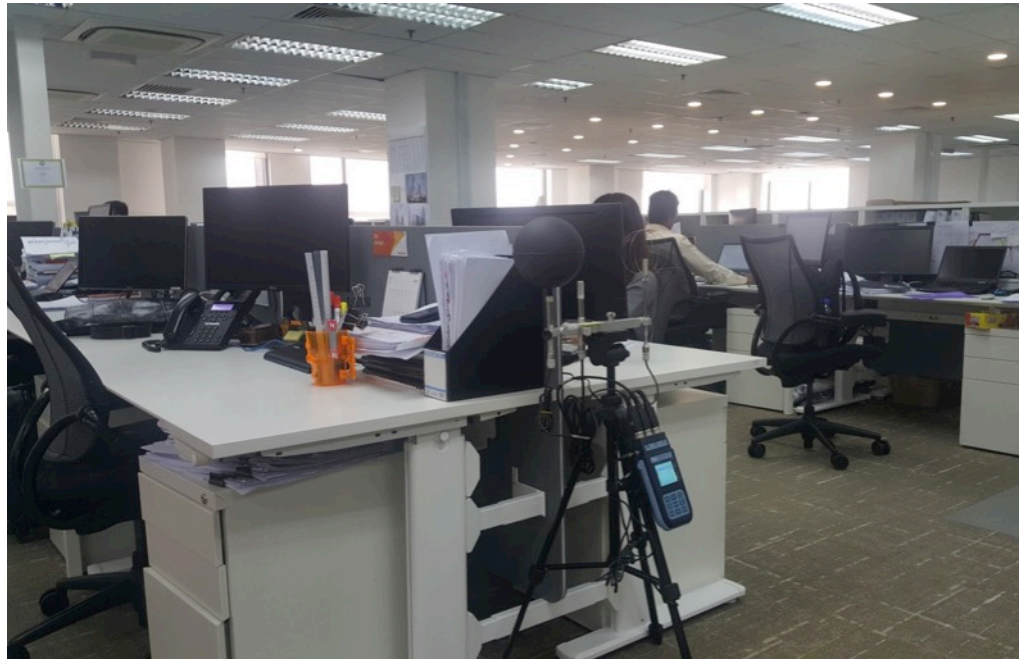
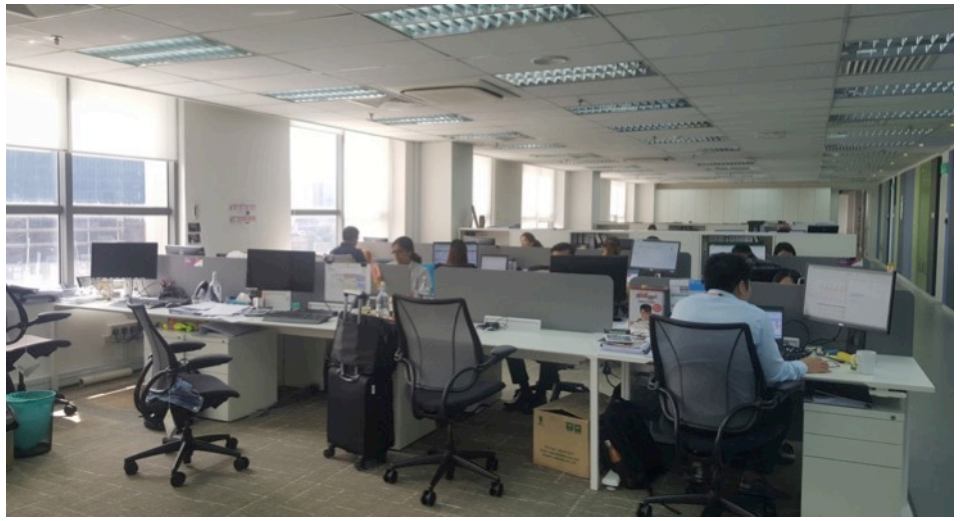
Lendlease Office, Level 8, Menara JCorp





Images (clockwise from bottom left: Lendlease employees at Level 8, Menara JCorp, Jalan Tun Razak Kuala Lumpur

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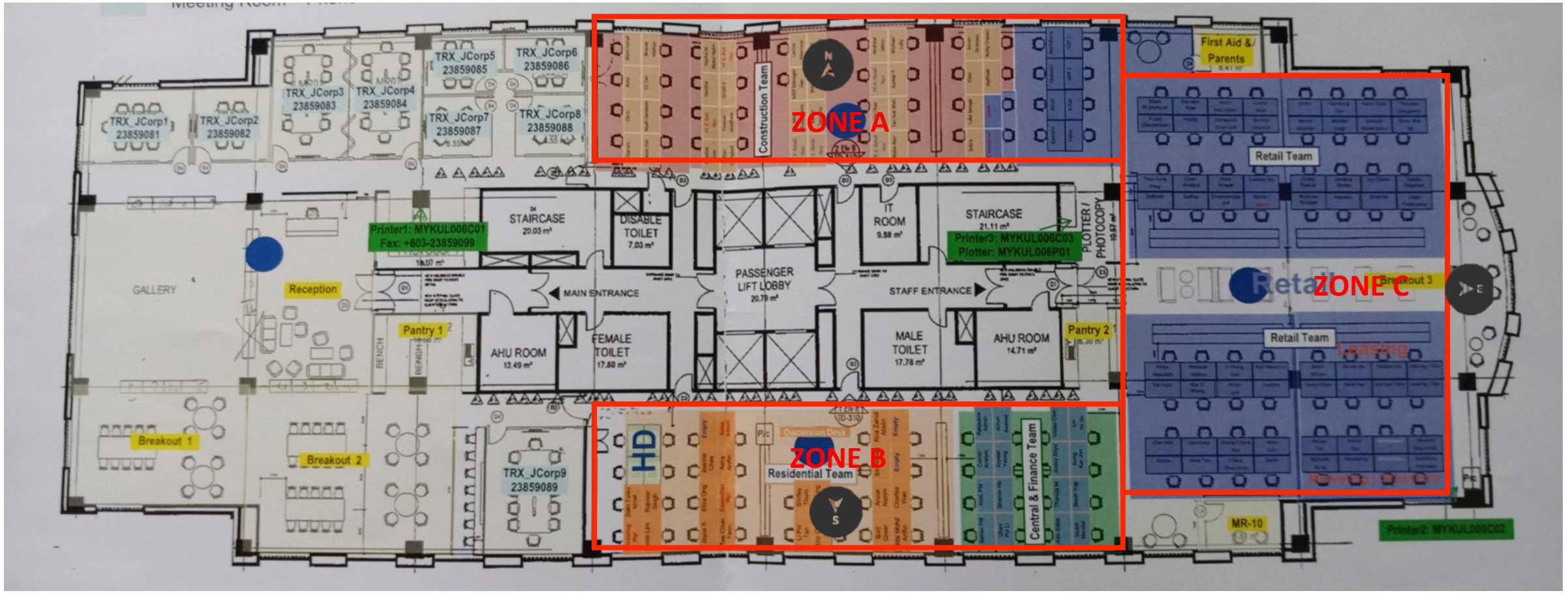
Lendlease Office, Level 8, Menara JCorp



Plan: Lendlease Project Office Level 8, Menara JCorp, Jalan Tun Razak Kuala Lumpur

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Lendlease offices specifications

Level 20 of Menara Binjai

Office	90% Open Plan 10% Cellular Office to external Side Core
Floor Area	1050 meter square
Capacity	112 Staff
Density	10.7 mpp
Floor to Ceiling	2.7 meters
Depth of Office	13-14 meters
Glazing Performance	Floor to Ceiling Double Glazed
Office Fit Out	White Walls, Ceiling- Floor Light Grey, Perimeter Blinds
Building Certification	GBI Certification

Level 8 of Menara JCorp

Office	100% Open Plan 0% Cellular Office to external Central Core
Floor Area	1296 meter square
Capacity	160 Staff
Density	6.375 mpp
Floor to Ceiling	
Depth of Office	
Glazing Performance	Floor to Ceiling Dark glazing
Office Fit Out	White Walls, Ceiling- Floor Light Grey, Perimeter Blinds
Building Certification	MS 1525

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Study work flow

PHYSICAL MEASUREMENTS 9/10/2017 - 25/10/2017

1st ROUND OF QUESTIONNAIRE SURVEY

DATA ANALYSIS

LEVEL 20 of MENARA BINJAI

Occupants on Level 20 Menara Binjai relocated to Level 8 Menara JCorp on 27/10/2017

COMPARISON OF RESULTS

Report writing & presentation to Lendlease

PHYSICAL MEASUREMENTS 17/1/2018 – 5/2/2018

2nd ROUND OF QUESTIONNAIRE SURVEY

DATA ANALYSIS

LEVEL 8 of MENARA JCORP

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INDOOR ENVIRONMENT HEALTH & WELLBEING

EIGHT FEATURES THAT MAKE HEALTHIER AND GREENER OFFICES

BETTER PLACES FOR PEOPLE | PUT WELLBEING AT THE HEART OF YOUR BUILDING

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1. INDOOR AIR QUALITY & VENTILATION

Healthy offices have low concentrations of CO_2, VOCs (volatile organic compounds) and other pollutants, as well as high ventilation rates.

101% **WHY?** increase in cognitive scores for workers in a green, well-ventilated office.[1]

2. THERMAL COMFORT

Healthy offices have a comfortable temperature range which staff can control.

6% **WHY?** fall in staff performance when offices are too hot and 4% if too cold.[2]

3. DAYLIGHTING & LIGHTING

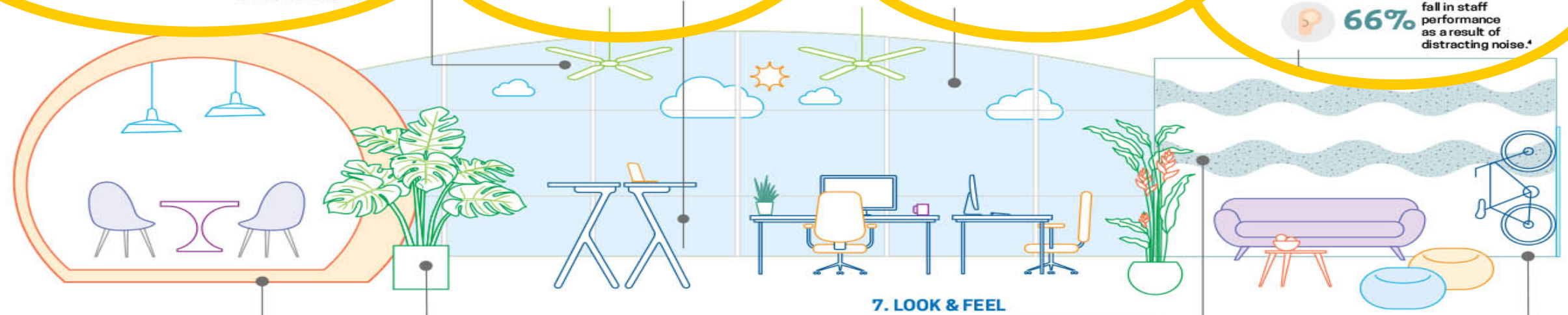
Healthy offices have generous access to daylight and self-controlled electrical lighting.

WHY? **46 minutes** more sleep for workers in offices near windows.[3]

4. NOISE & ACOUSTICS

Healthy offices use materials that reduce noise and provide quiet spaces to work.

66% **WHY?** fall in staff performance as a result of distracting noise.[4]



5. INTERIOR LAYOUT & ACTIVE DESIGN

Healthy offices have a diverse array of workspaces, with ample meeting rooms, quiet zones, and stand-sit desks, promoting active movement within offices.

WHY? Flexible working helps staff feel more in control of their workload and engenders loyalty.[5]

6. BIOPHILIA & VIEWS

Healthy offices have a wide variety of plant species inside and out as well as views of nature from workspaces.

7-12% **WHY?** improvement in processing time at one call centre when staff have a view of nature.[6]

7. LOOK & FEEL

Healthy offices have colours, textures, and materials that are welcoming, calming and evoke nature.

WHY? Visual appeal is a major factor in workplace satisfaction.[7]

EMPLOYEE ENGAGEMENT

Healthy offices have employees that are regularly consulted and that feedback is used to drive continuous improvement.[7]

8. LOCATION & ACCESS TO AMENITIES

Healthy offices have access to public transport, safe bike routes, parking and showers, and a range of health food choices.

€27m **WHY?** savings through cutting absenteeism as a result of Dutch cycle-to-work scheme.[8]

Part 1: Presenting the Evidence

Respondent Statistics

Level 20, Menara Binjai

- Total no. of staff: 110
- Total no. of respondents: **76**
- Response rate: 69%

Level 8, Menara JCorp

- Total no. of staff: 160
- Total no. of respondents: **85**
- Response rate: 53%

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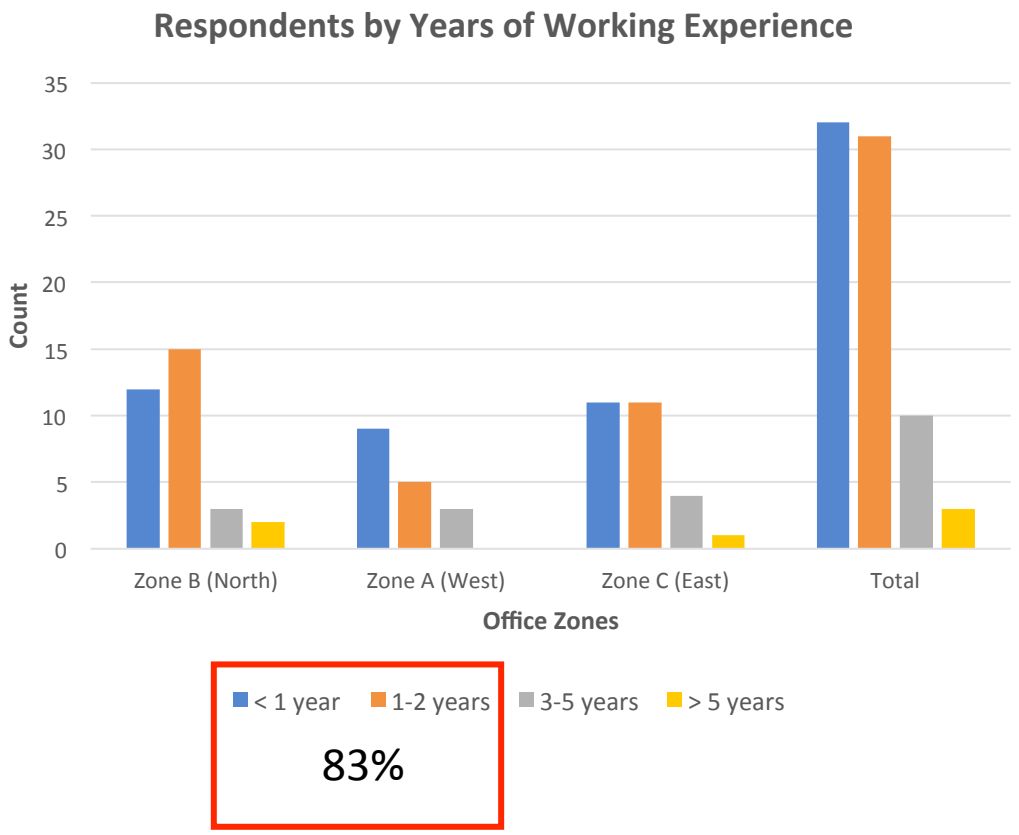
How long have you been working in this office?

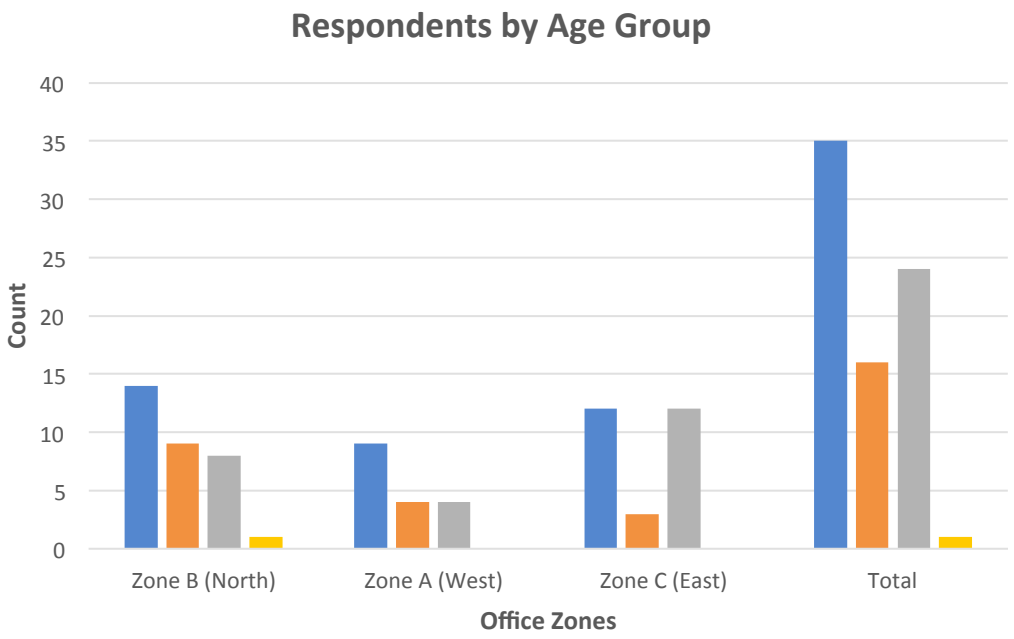
Menara Binjai (N=76)



Menara Jcorp (N=85)

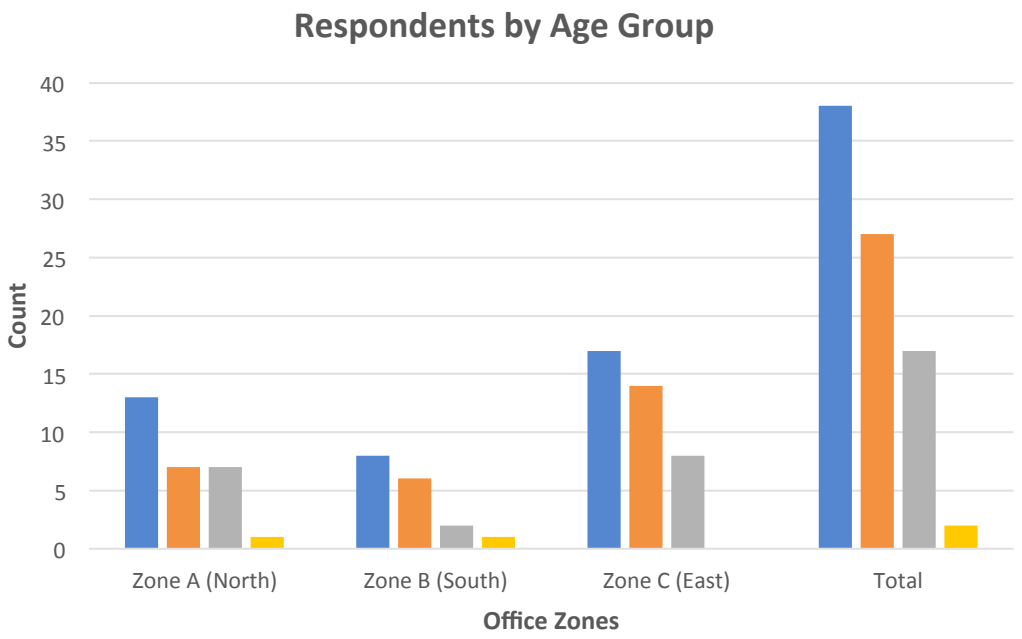
Which is your age range?

Menara Binjai (N=76)



21-30 years	31-40 years	41-50 years	>51 years
46%	21%	32%	1%

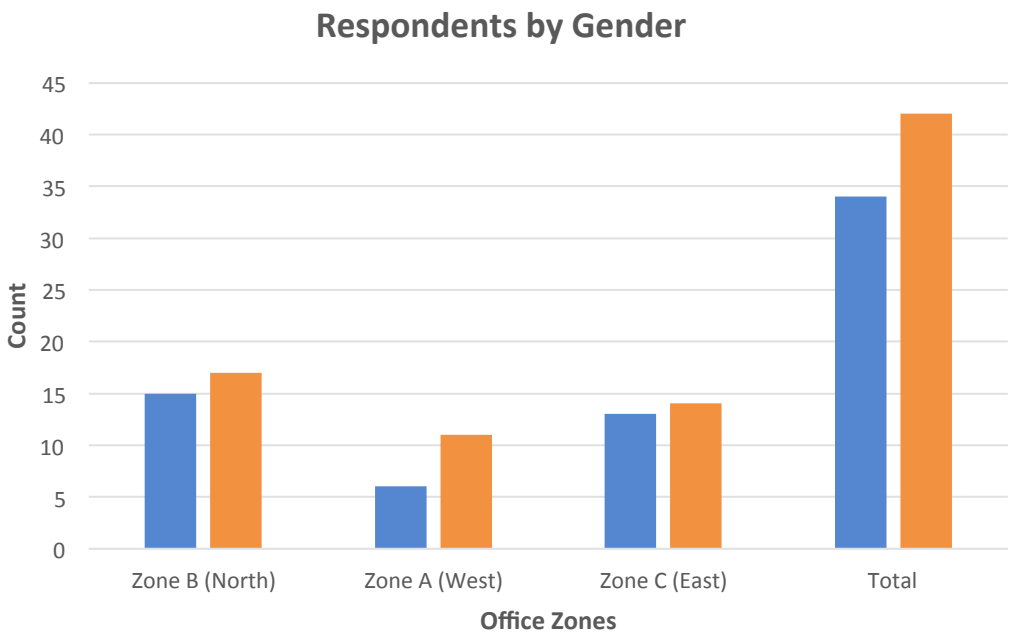
Menara Jcorp (N=85)



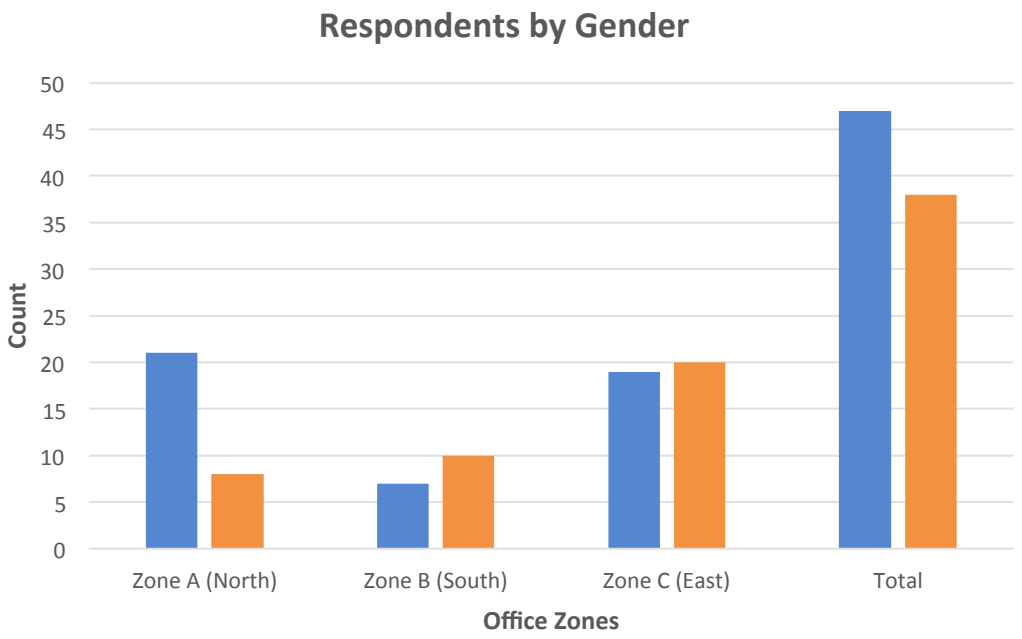
21-30 years	31-40 years	41-50 years	>51 years
45%	32%	20%	2%

What is your gender?

Menara Binjai (N=76)

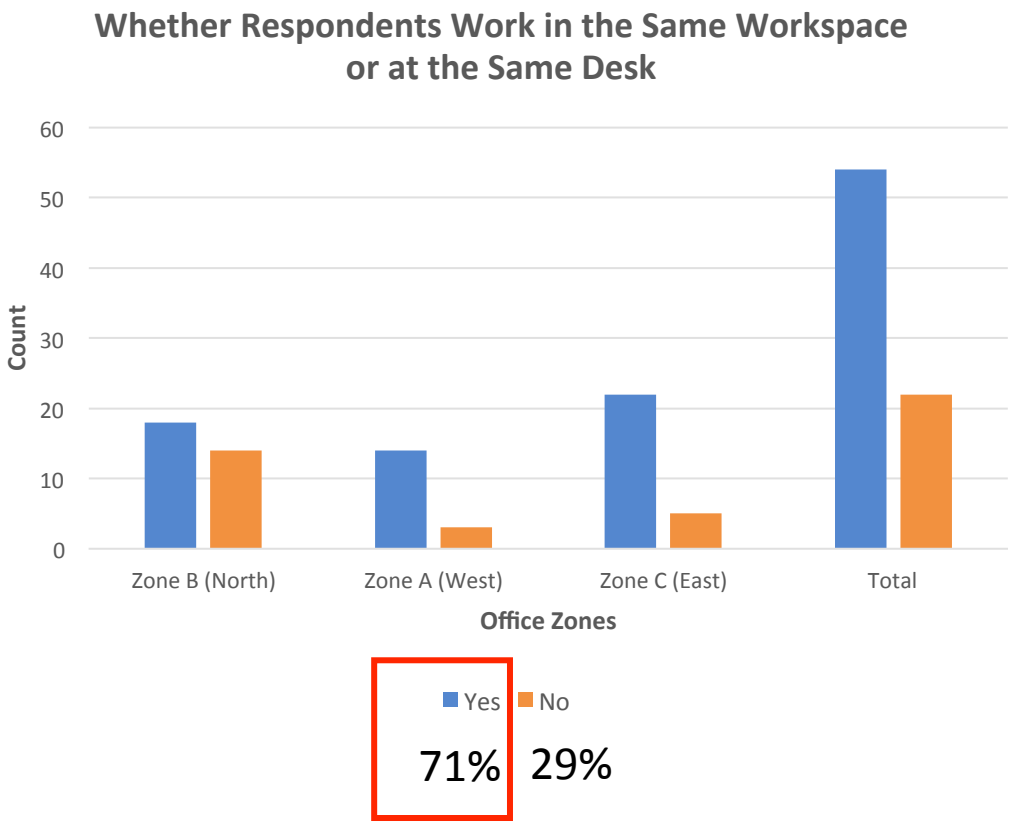


Menara Jcorp (N=85)

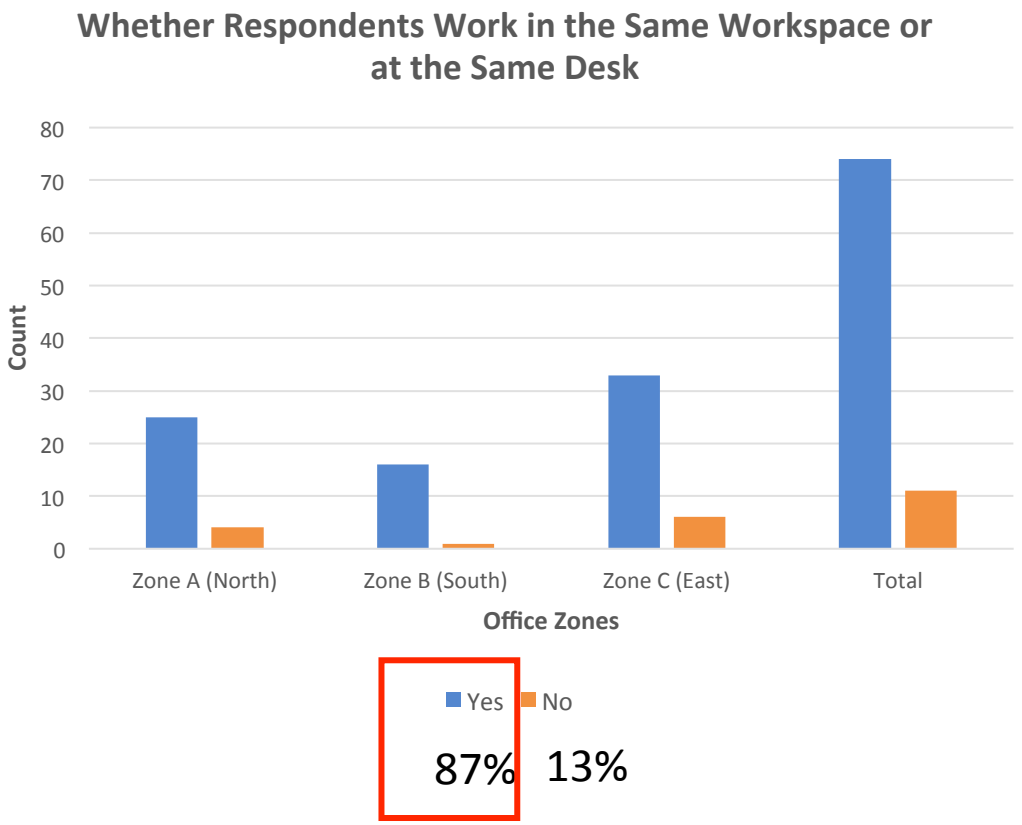


Do you always work in the same workspace or at the same desk?

Menara Binjai (N=76)

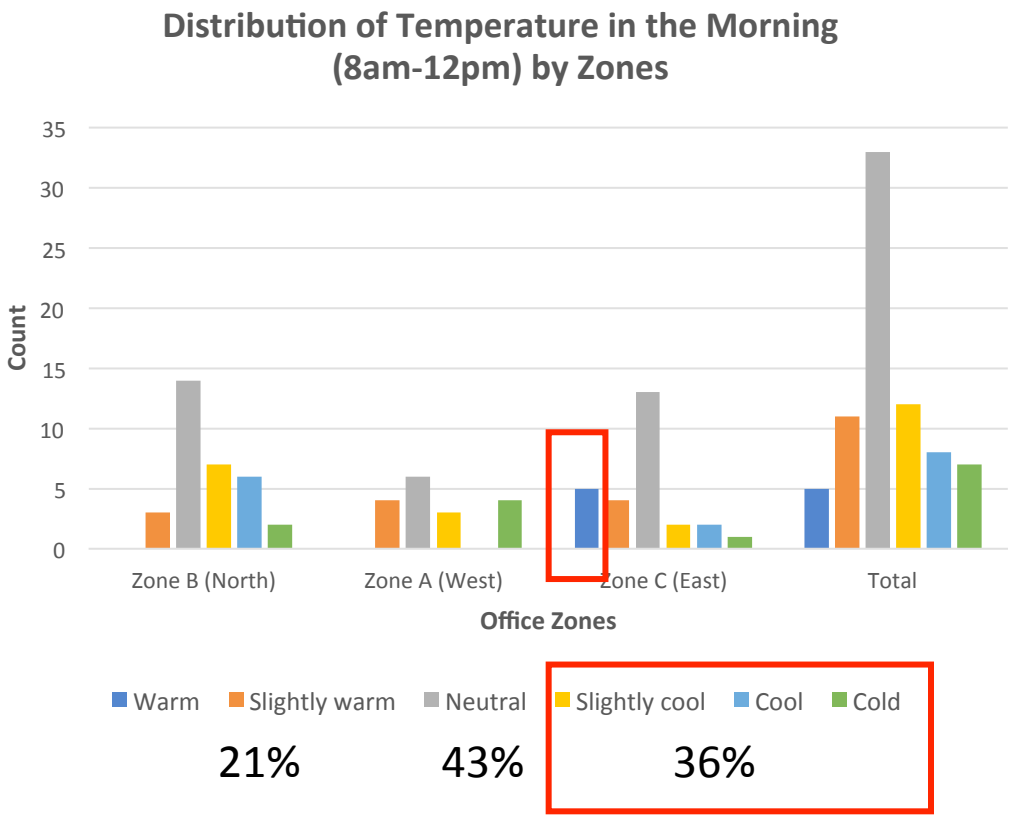


Menara Jcorp (N=85)

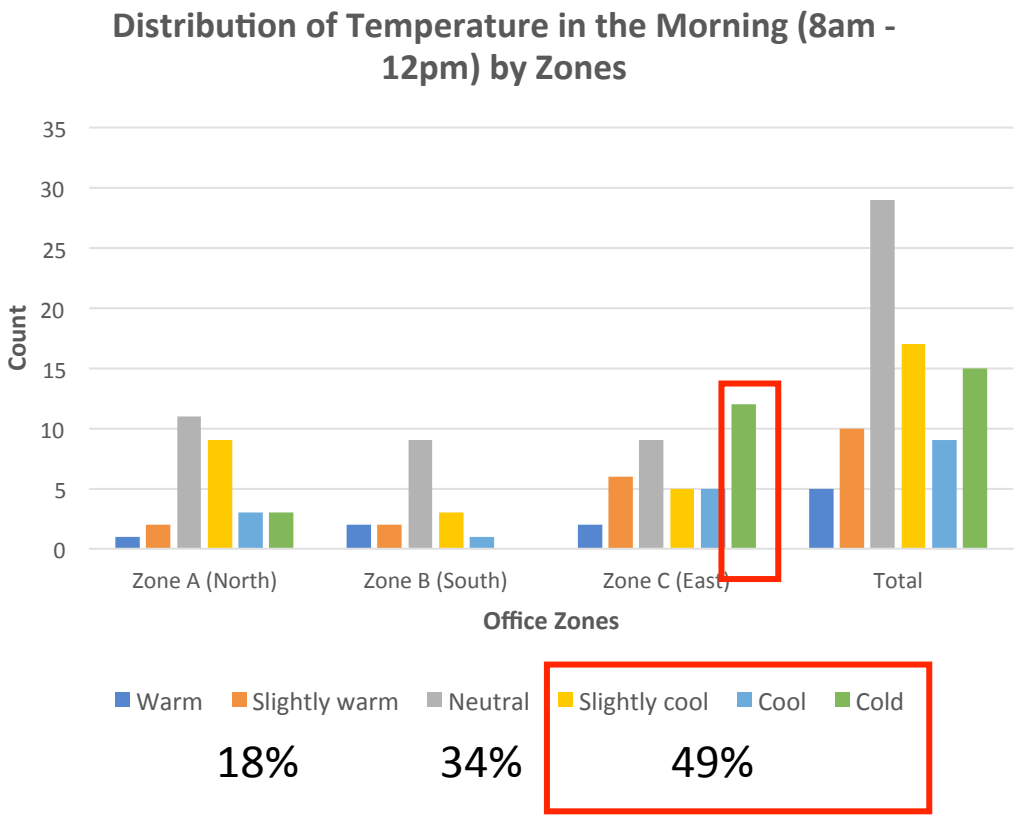


How do you find the temperature at your desk in the morning from 8:00 am to 12:00 pm?

Menara Binjai (N=76)

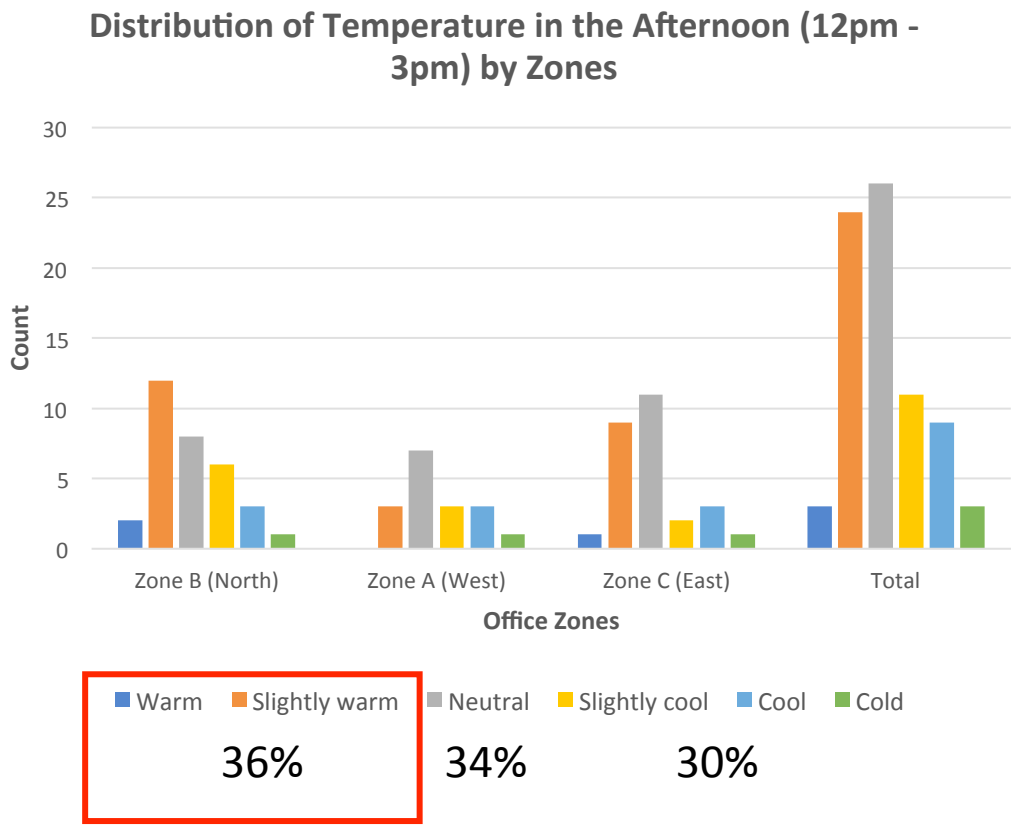


Menara Jcorp (N=85)

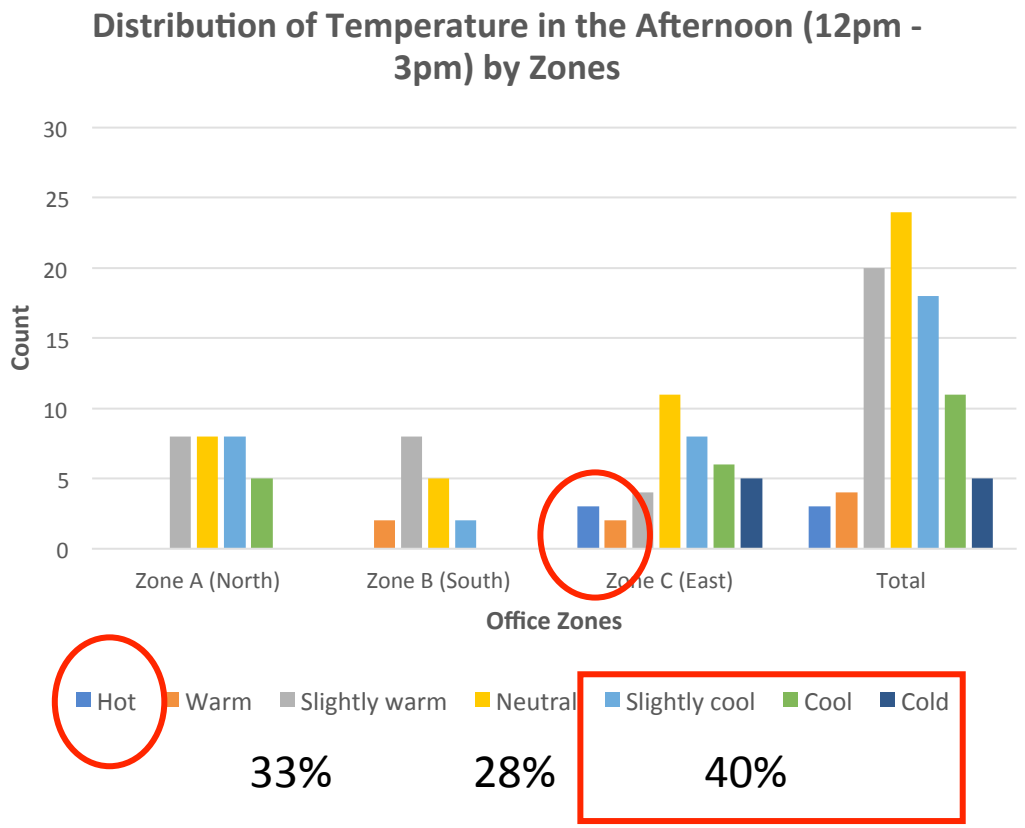


How do you find the temperature at your desk in the afternoon from 12:00 pm to 3:00 pm?

Menara Binjai (N=76)

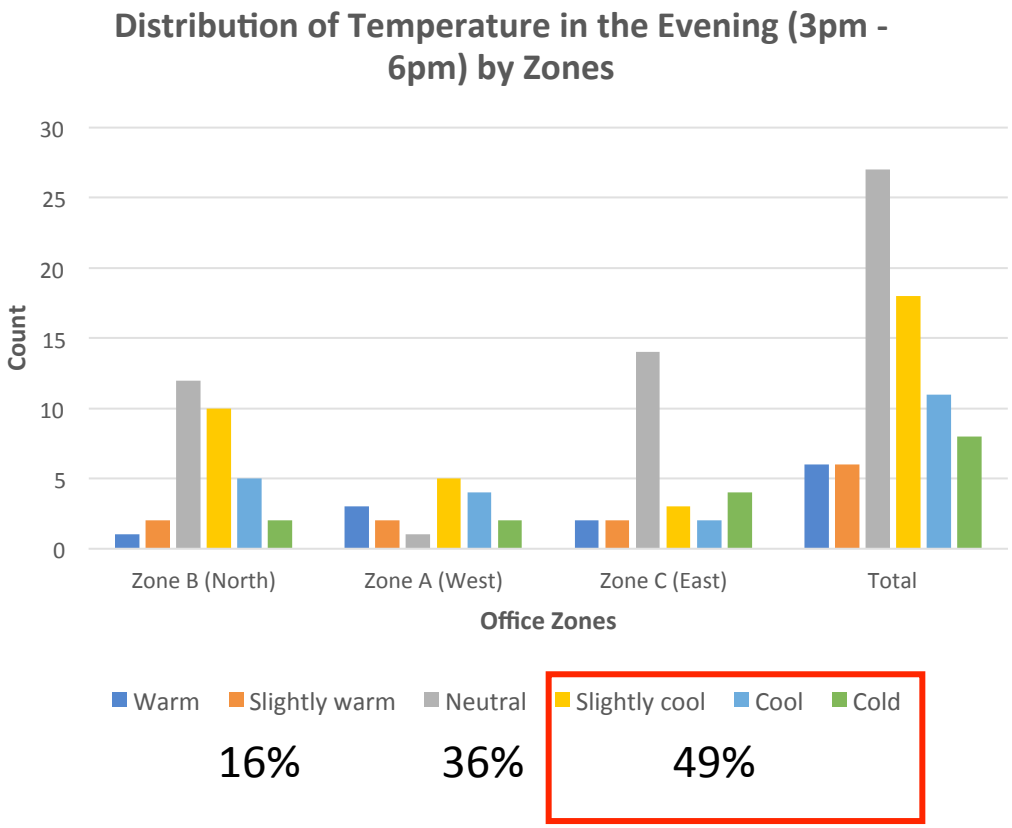


Menara Jcorp (N=85)

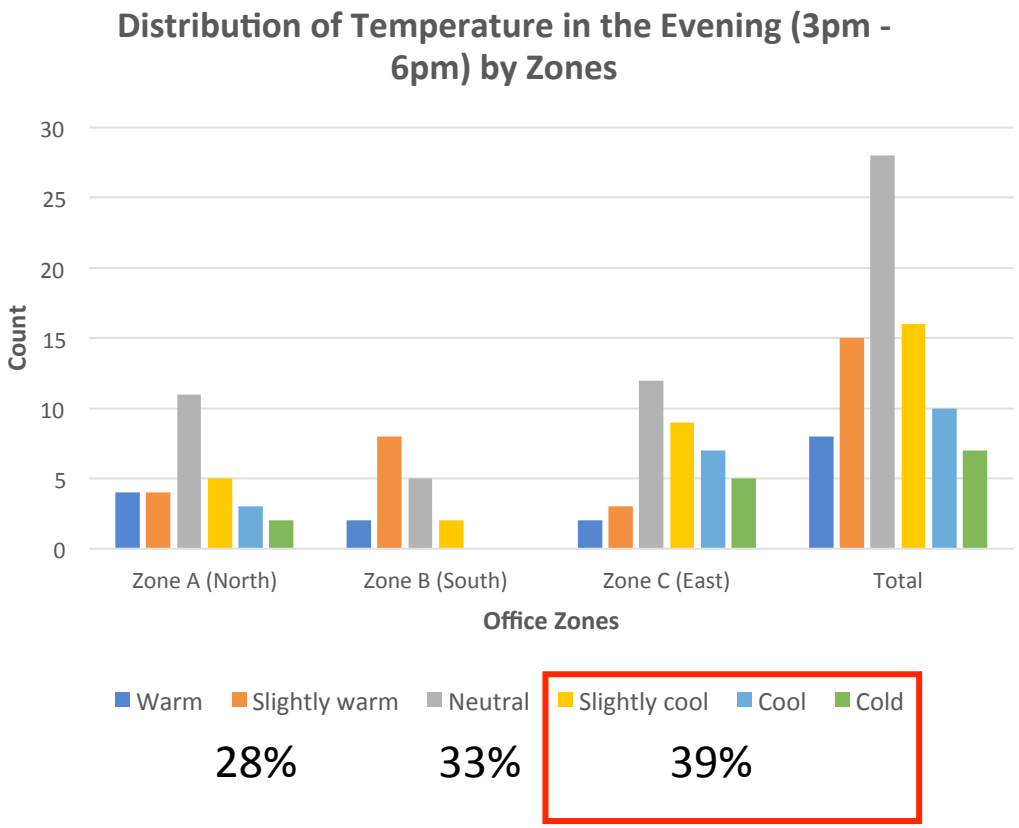


How do you find the temperature at your desk in the evening from 3:00 pm to 6:00 pm?

Menara Binjai (N=76)

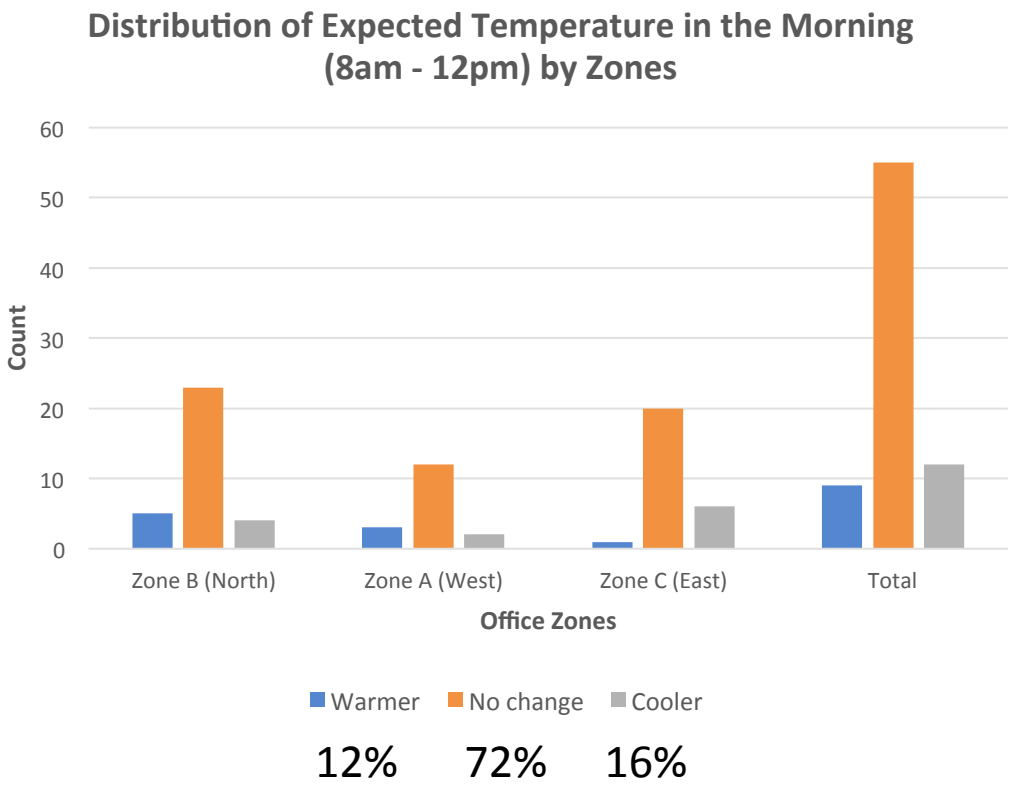


Menara Jcorp (N=84)



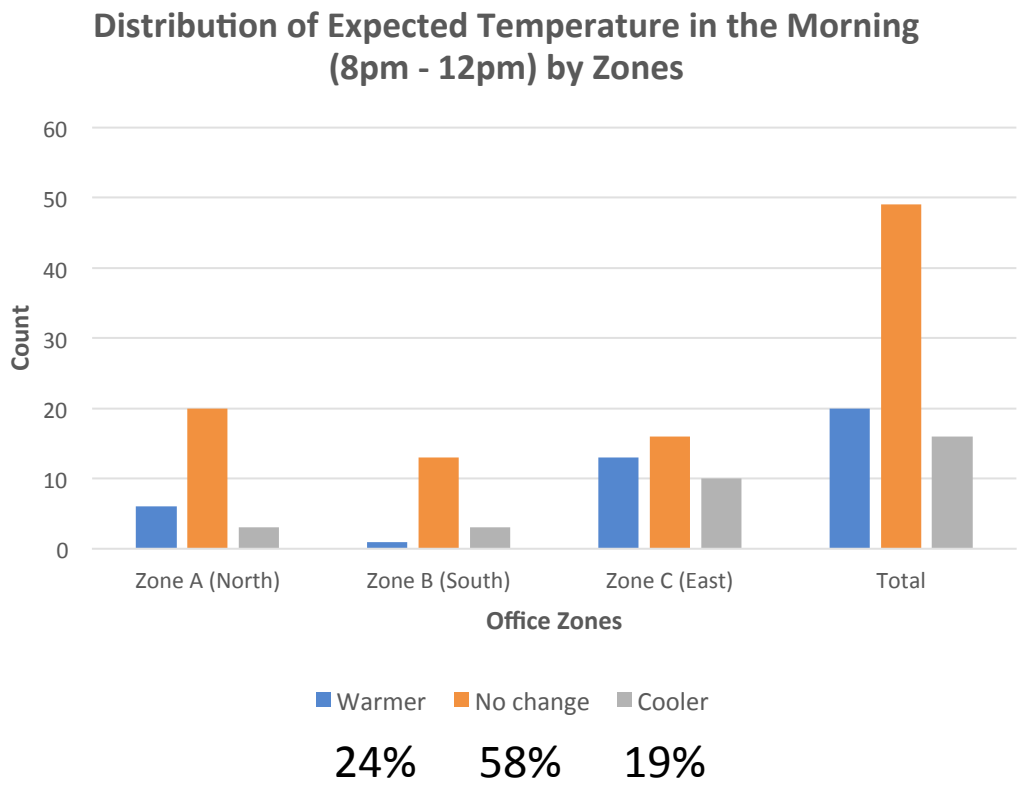
How do you think the condition should be in the morning from 8:00 am to 12:00 pm?

Menara Binjai (N=76)



12% 72% 16%

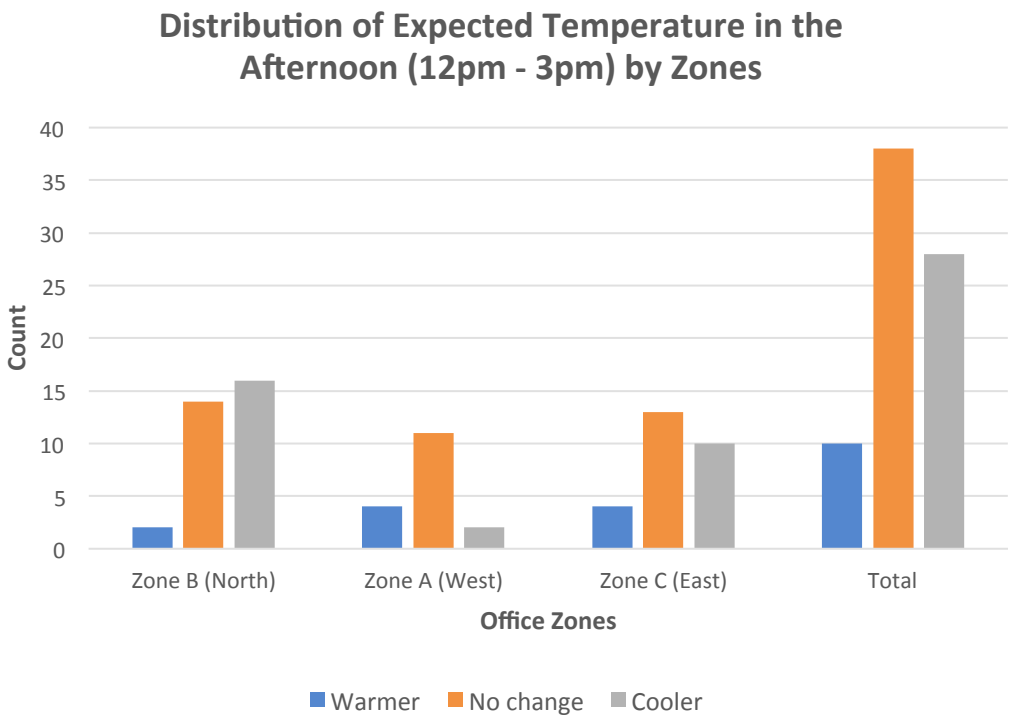
Menara Jcorp (N=85)



24% 58% 19%

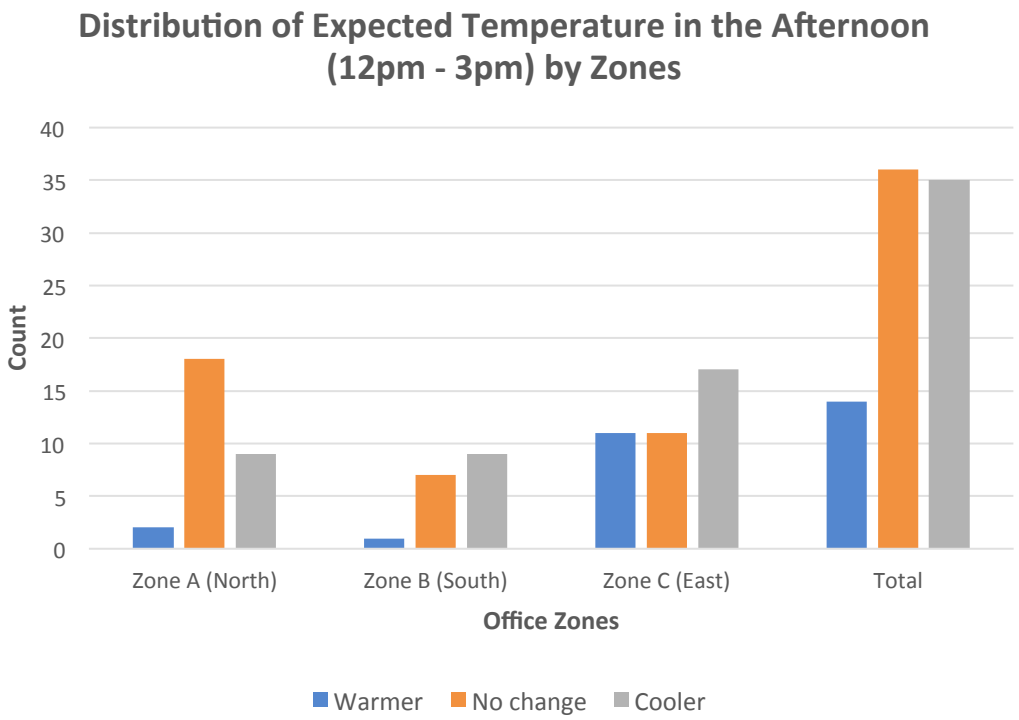
How do you think the condition should be in the afternoon from 12:00 pm to 3:00 pm?

Menara Binjai (N=76)



13% 50% 37%

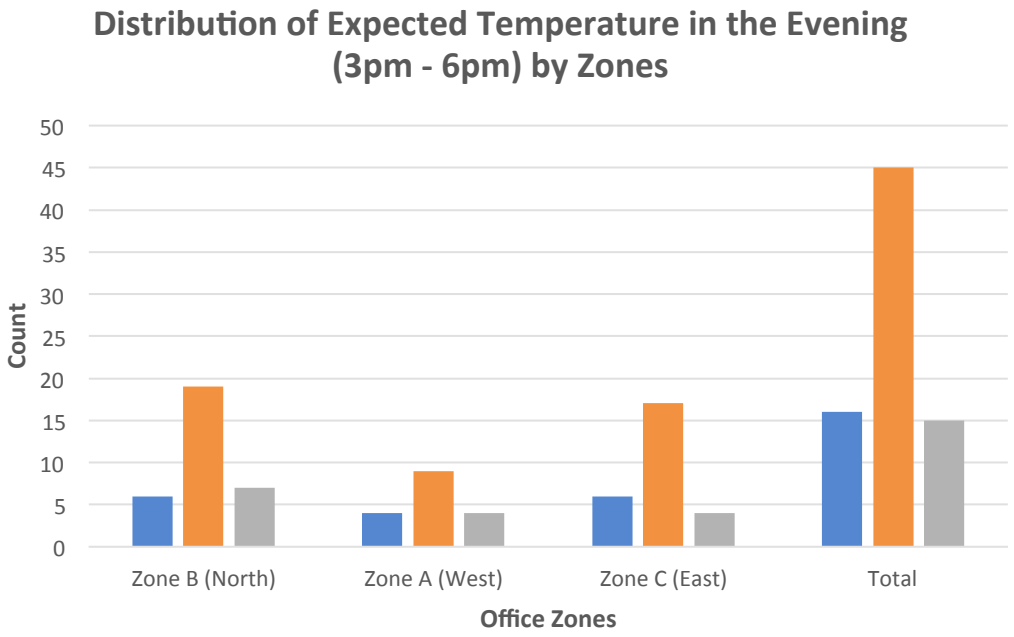
Menara Jcorp (N=85)



16% 42% 41%

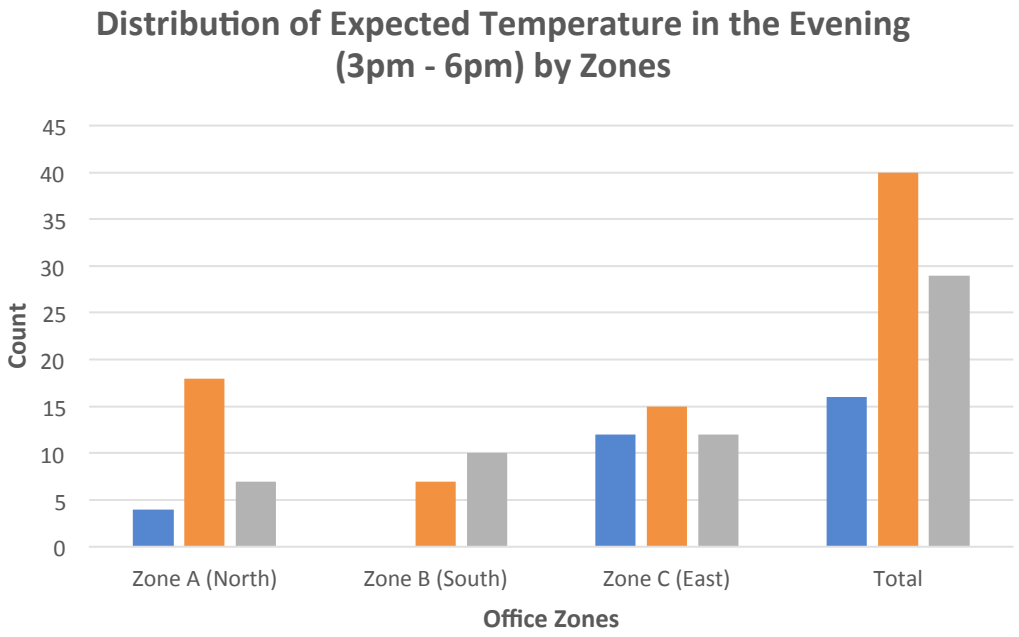
How do you think the condition should be in the evening from 3:00 pm to 6:00 pm?

Menara Binjai (N=76)



21% 59% 20%

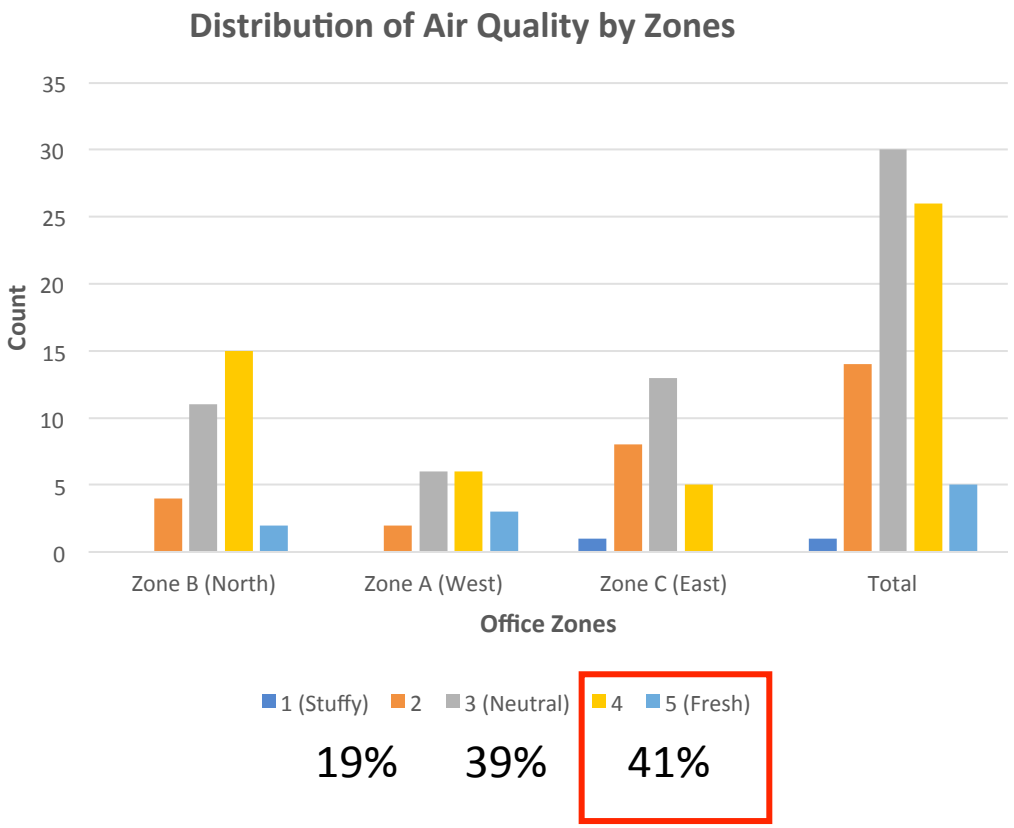
Menara Jcorp (N=85)



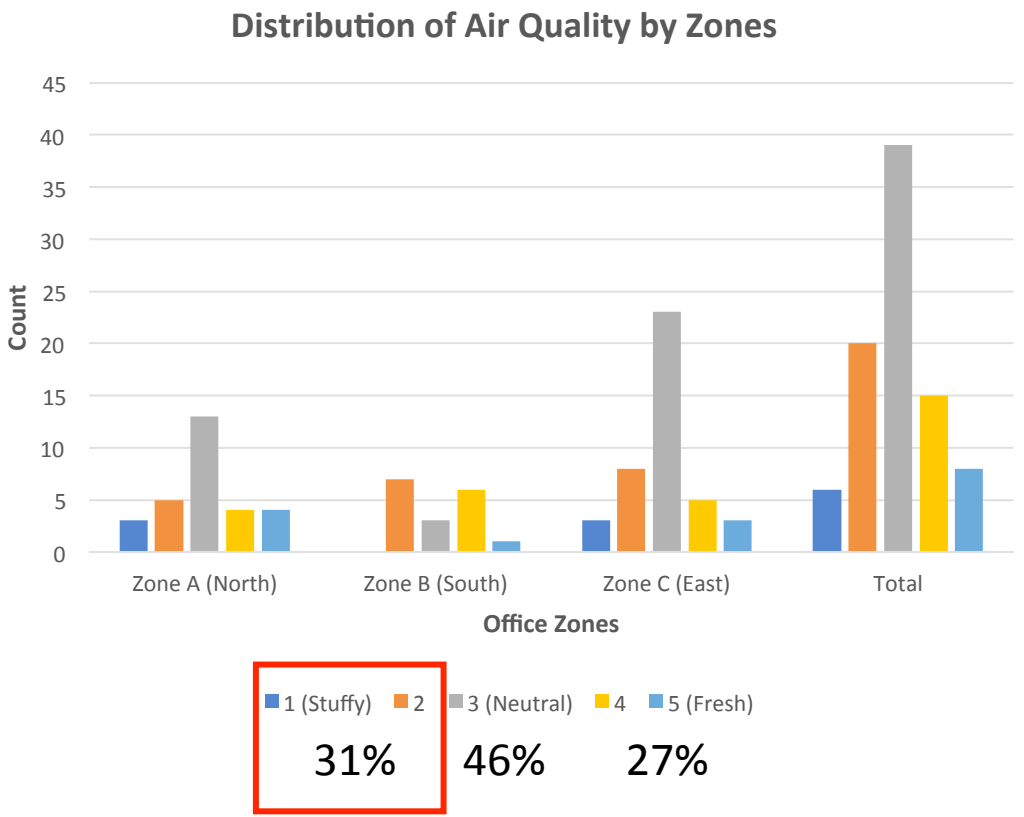
19% 47% 34%

How do you find the quality of the air in your office space? 1: Stuffy – 5: Fresh

Menara Binjai (N=76)

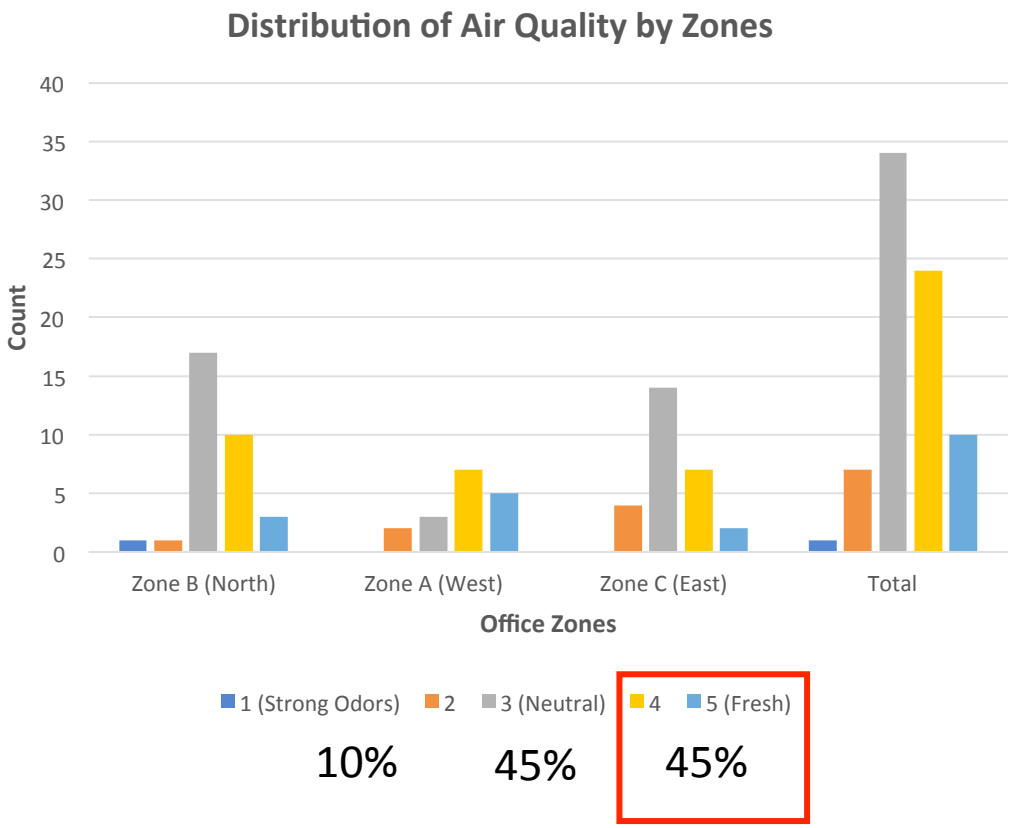


Menara Jcorp (N=85)

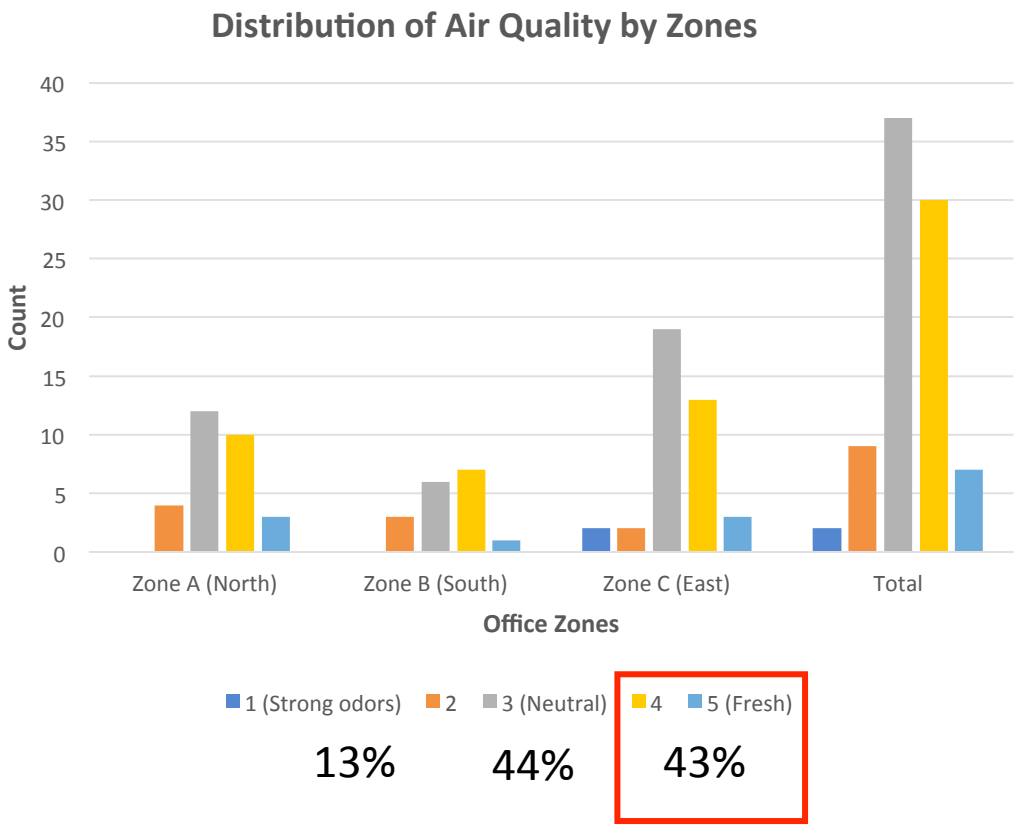


How do you find the quality of the air in your office space?
1: Strong Odors – 5: Fresh

Menara Binjai (N=76)

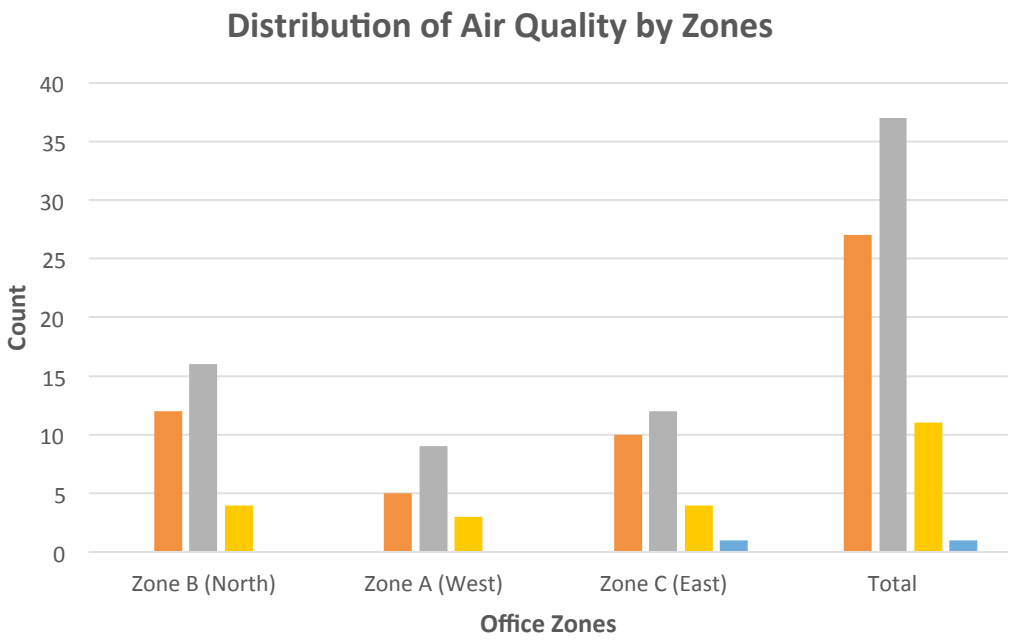


Menara Jcorp (N=85)



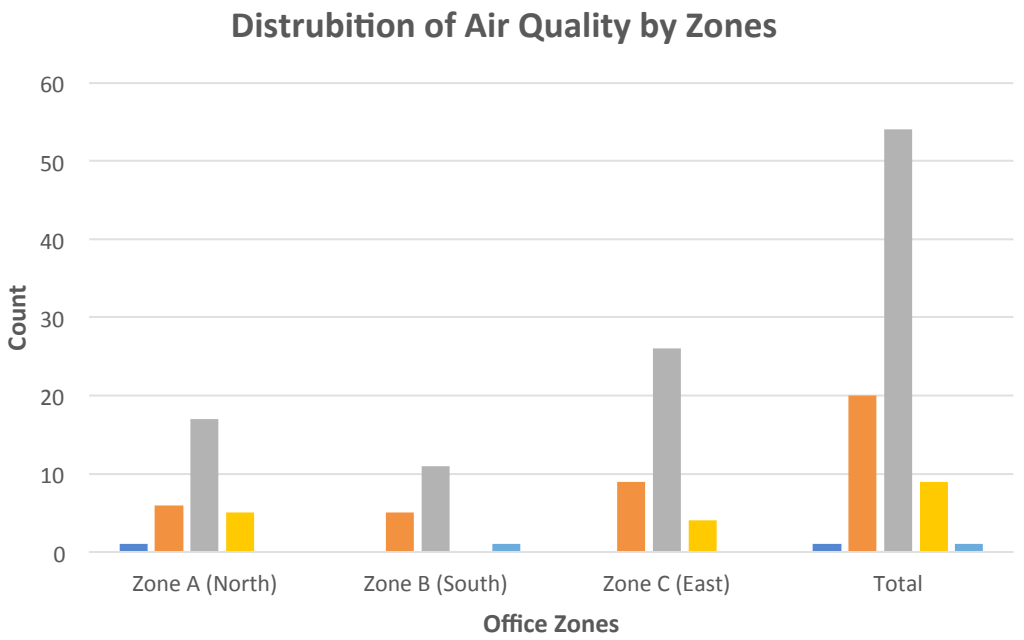
How do you find the quality of the air in your office space? 1: Dry – 5: Humid

Menara Binjai (N=76)



36% 49% 15%

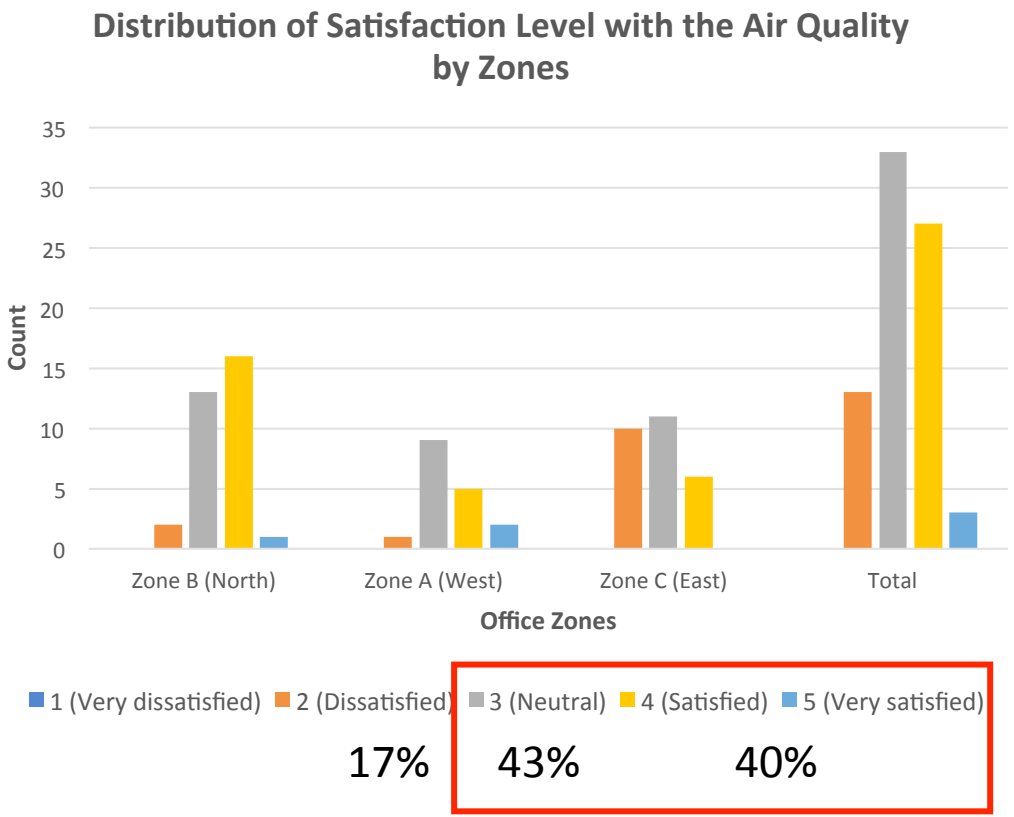
Menara Jcorp (N=85)



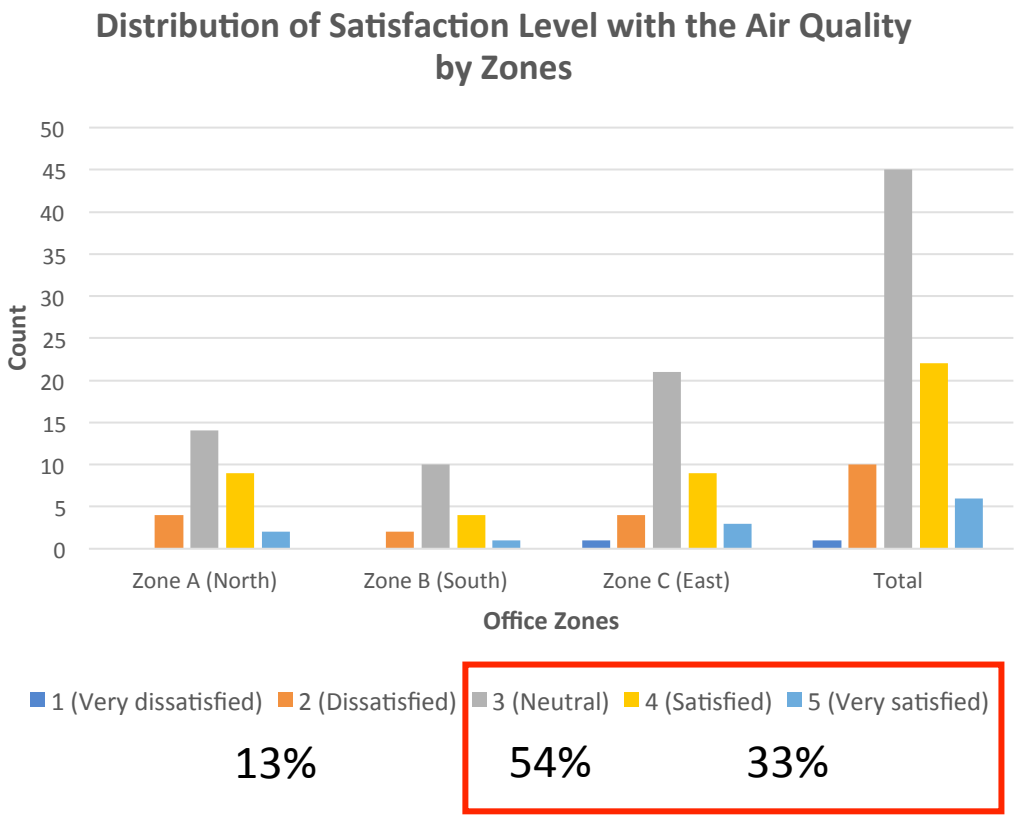
25% 64% 12%

How do you find the overall quality of the air in your office space?

Menara Binjai (N=76)

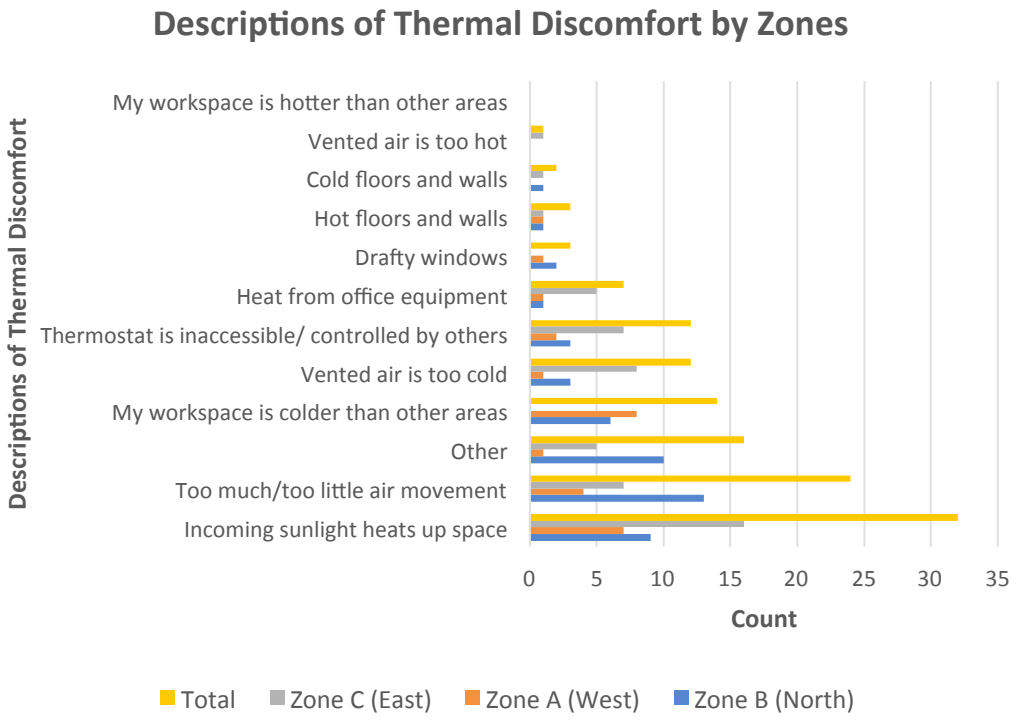


Menara Jcorp (N=84)

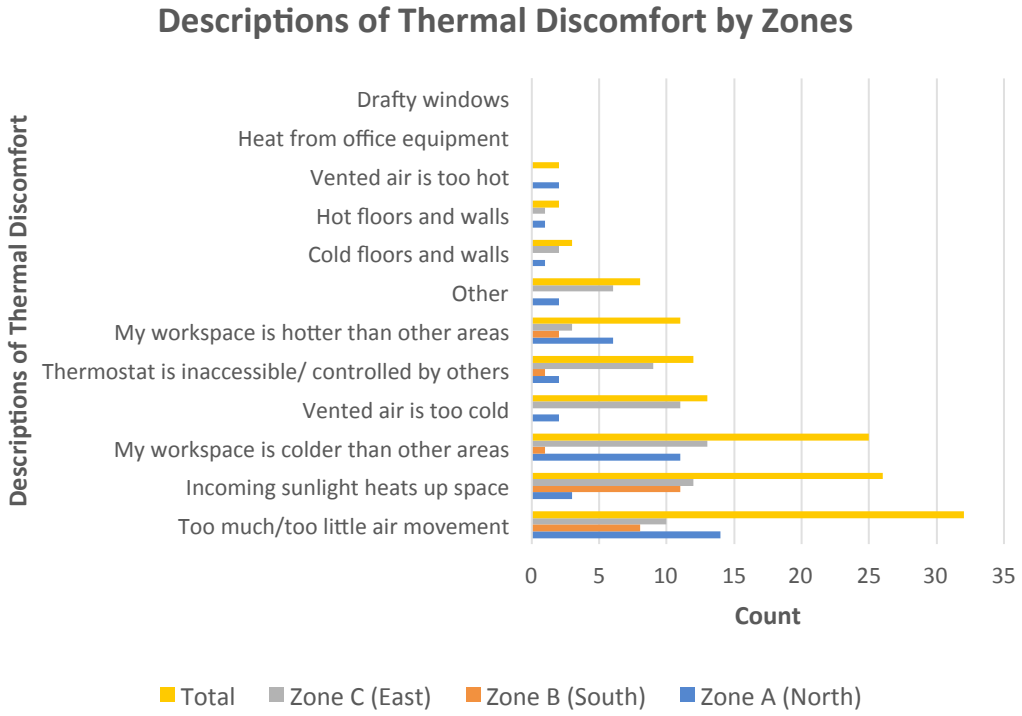


If you experience thermal discomfort (temperature & humidity), which of the following best describes it? Choose 3 options

Menara Binjai (N=76)

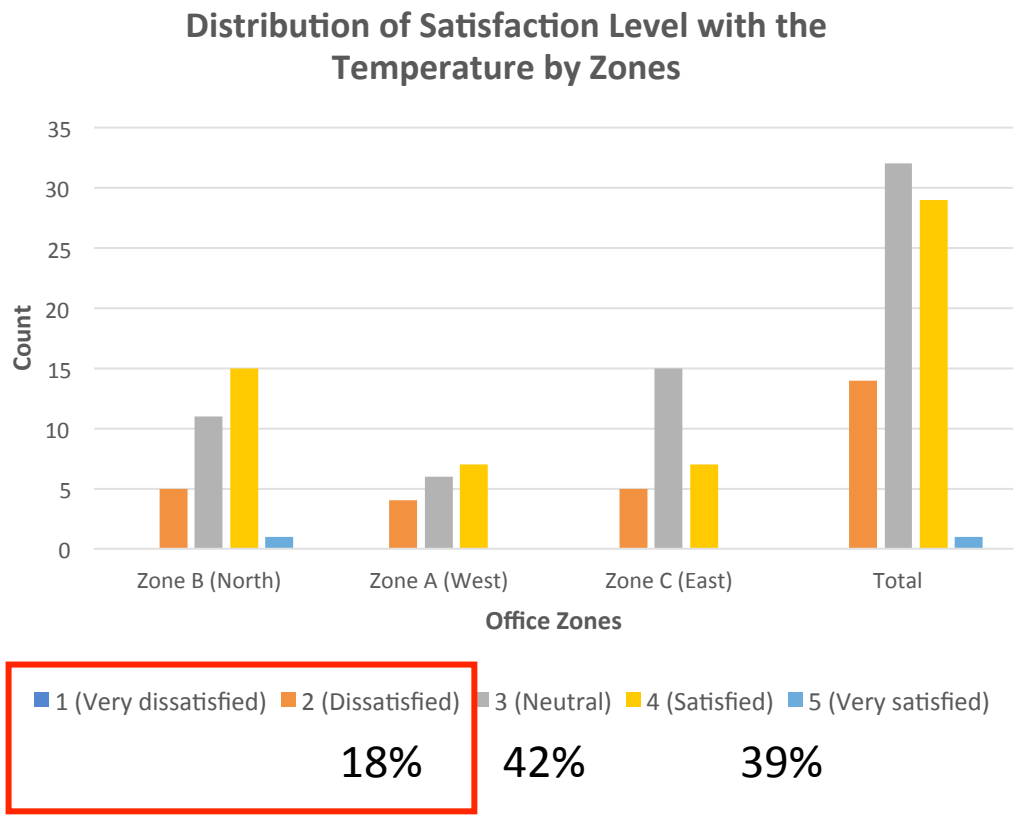


Menara Jcorp

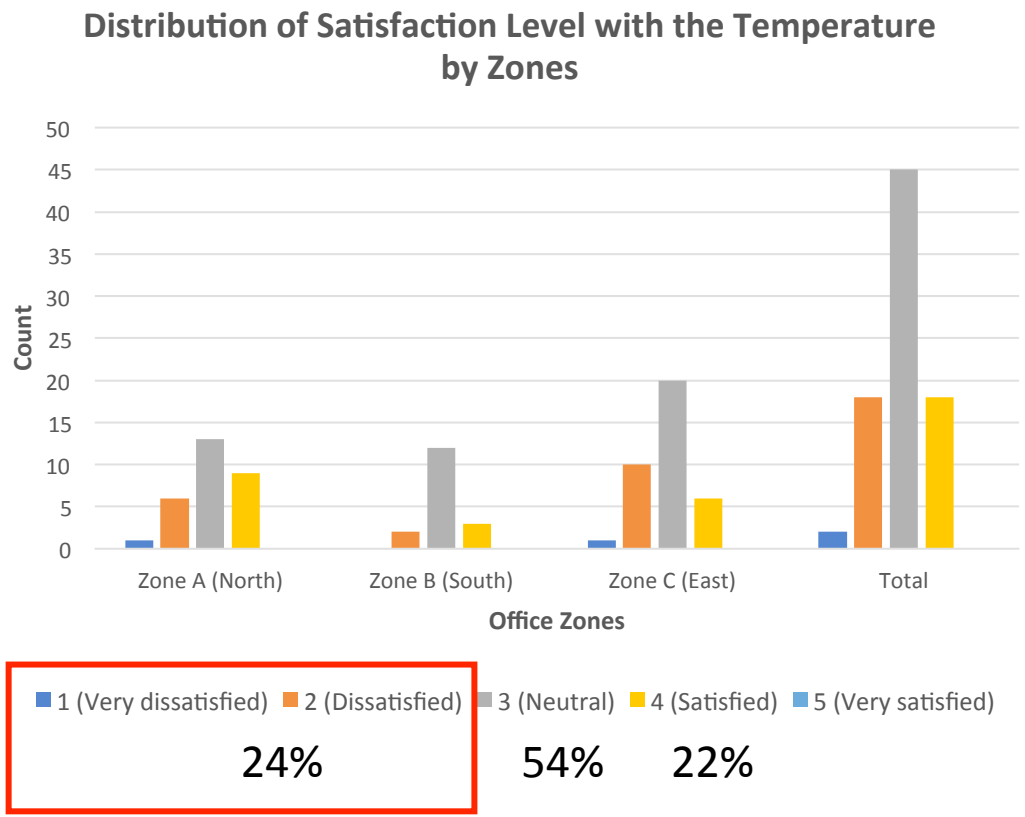


Overall, how satisfied are you with the temperature in your workspace?

Menara Binjai (N=76)

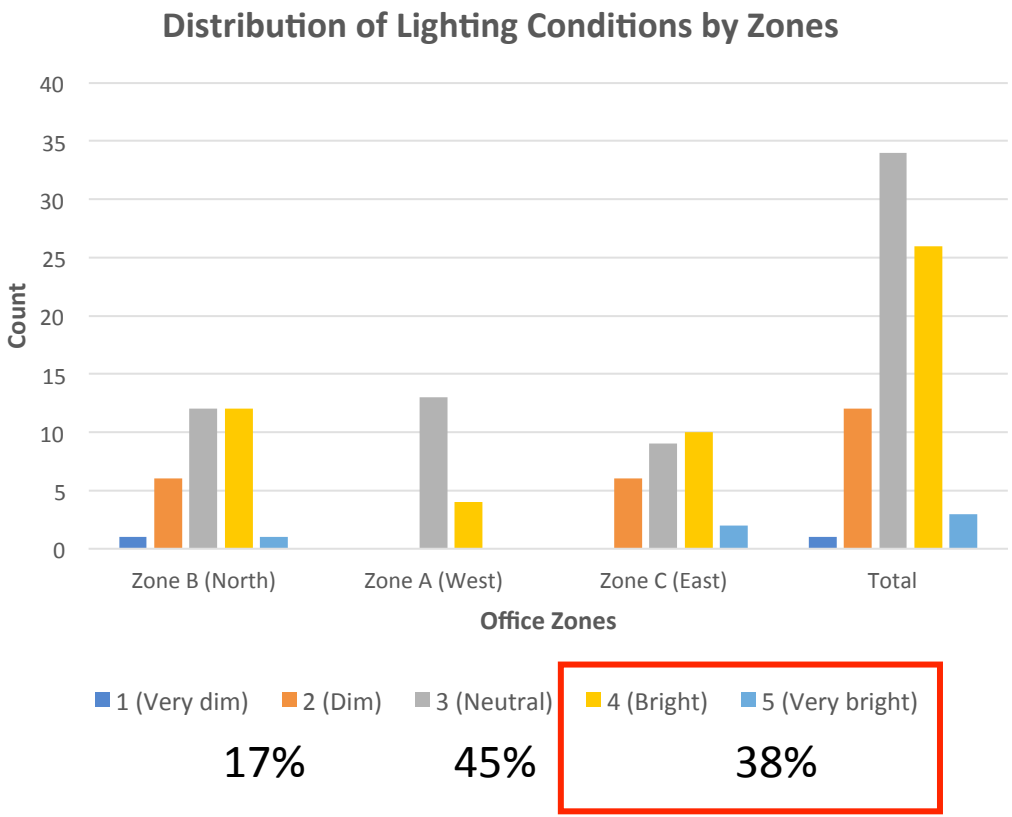


Menara Jcorp (N=83)

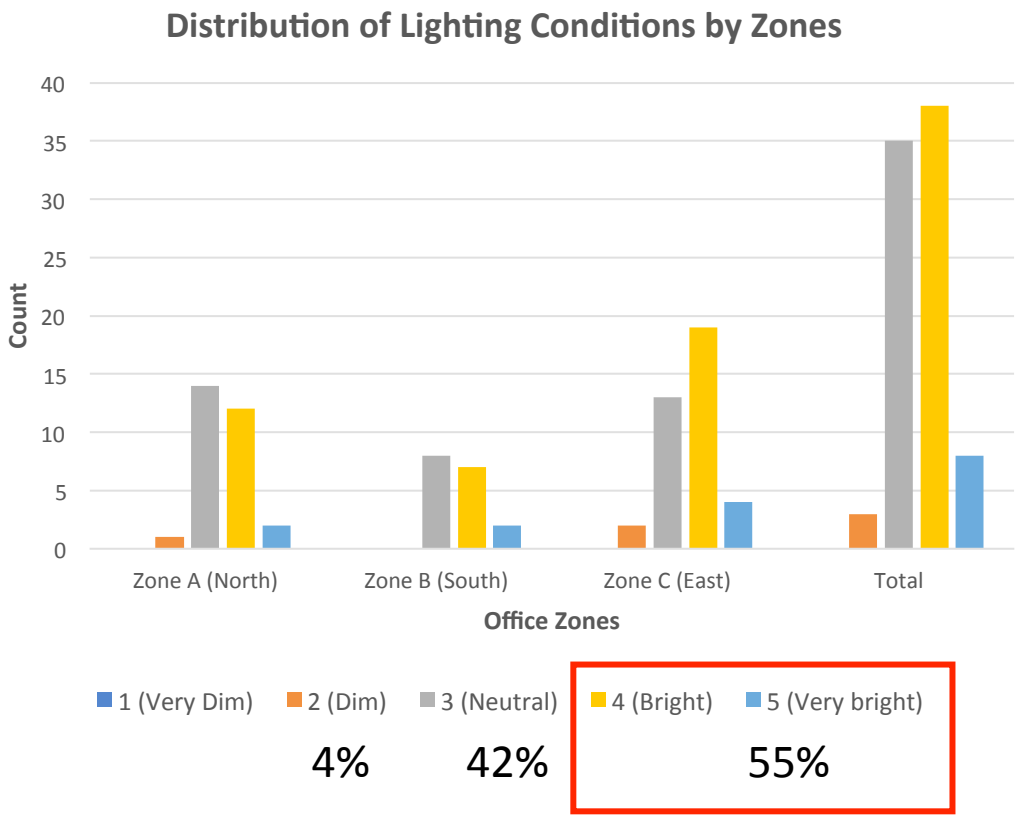


How do you find the lighting in your workspace for office activities?

Menara Binjai (N=76)

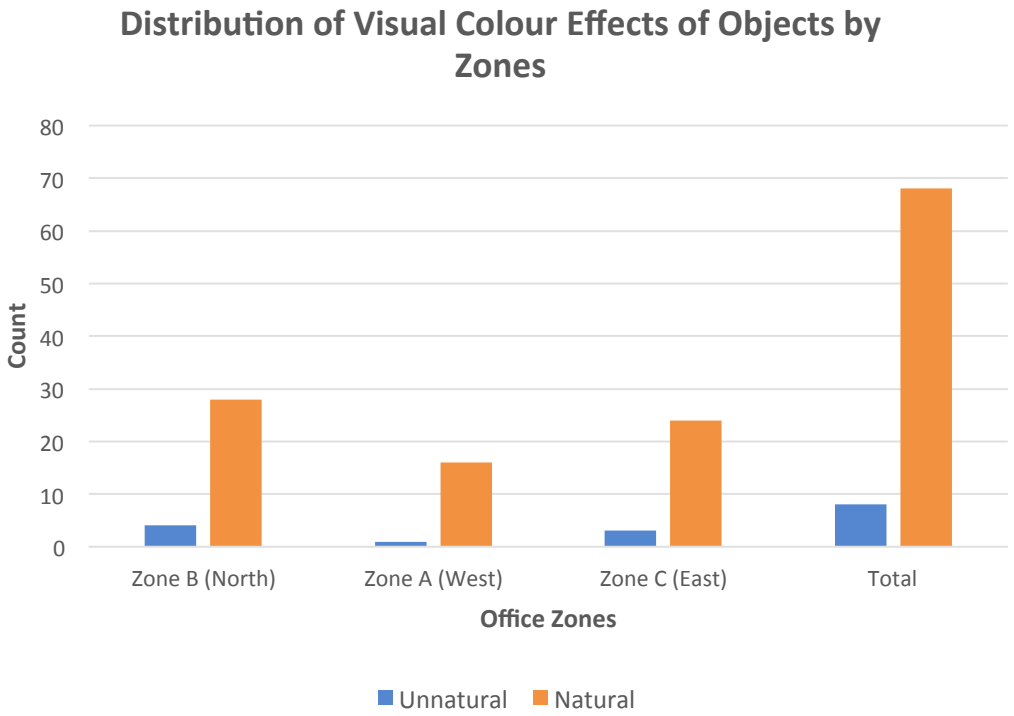


Menara Jcorp (N=84)



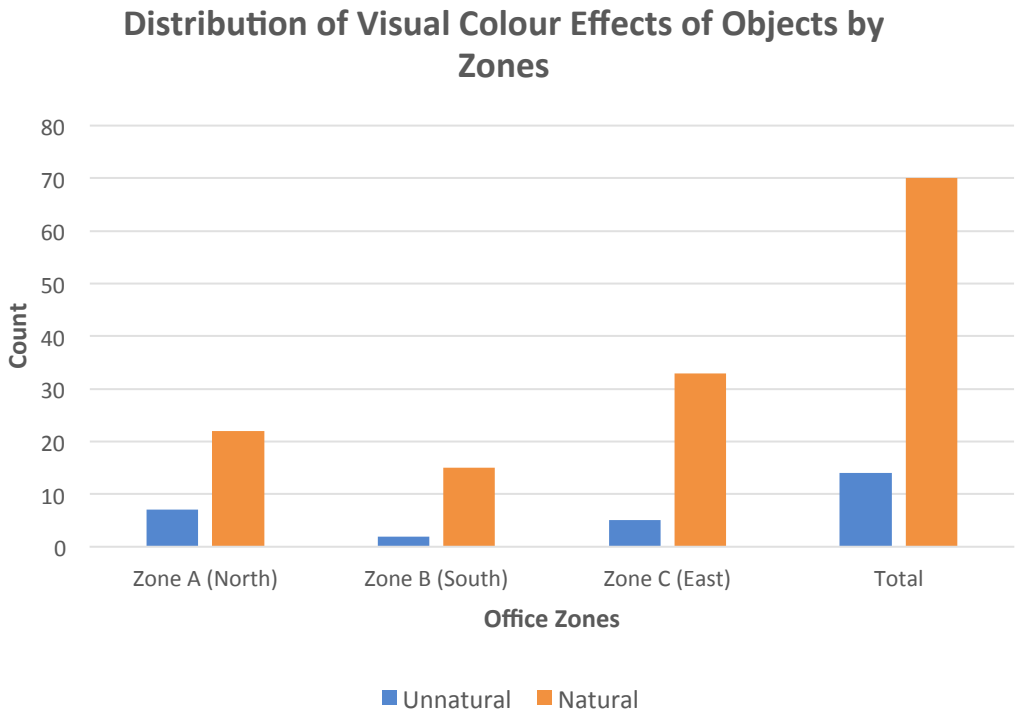
The lighting inside the office space makes the visual colour effects of objects look: Unnatural or Natural

Menara Binjai (N=76)



11% 89%

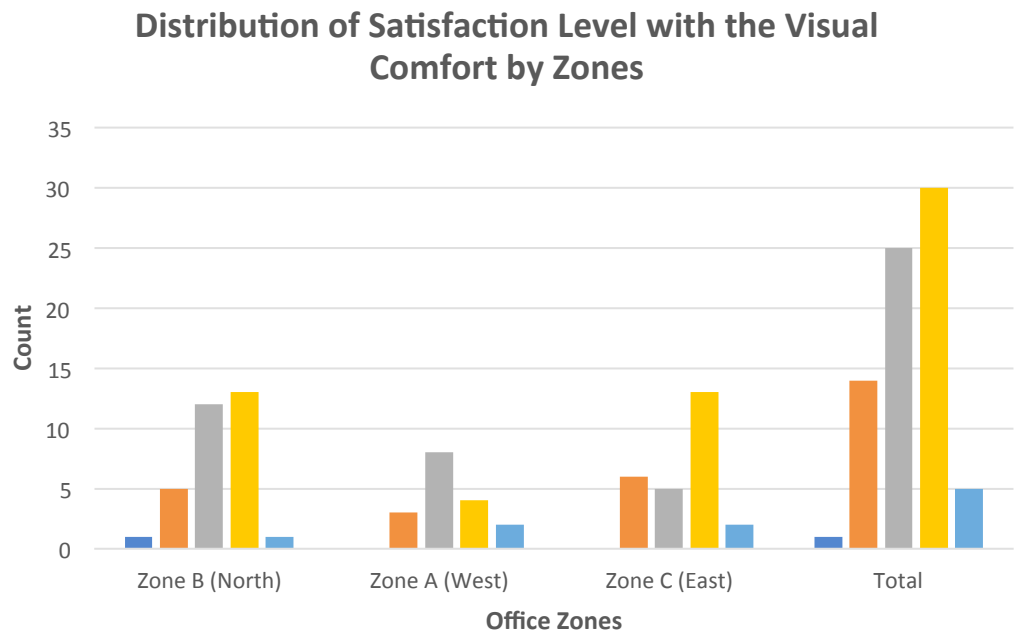
Menara Jcorp (N=84)



17% 83%

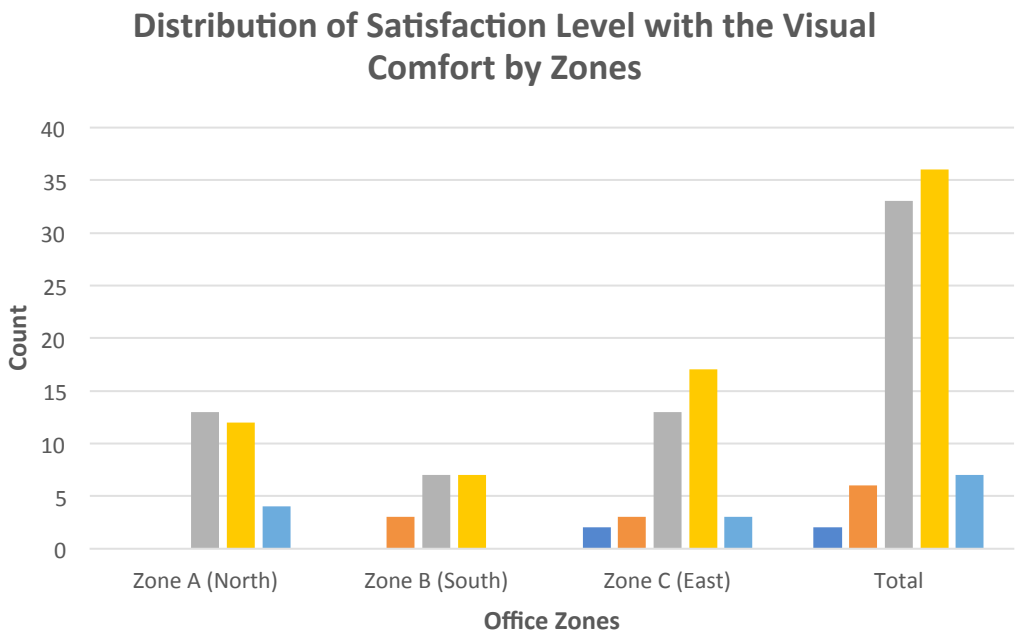
Overall, how satisfied are you with the level of visual comfort in your workspace (both natural & artificial lighting)?

Menara Binjai (N=75)



20% 33% 47%

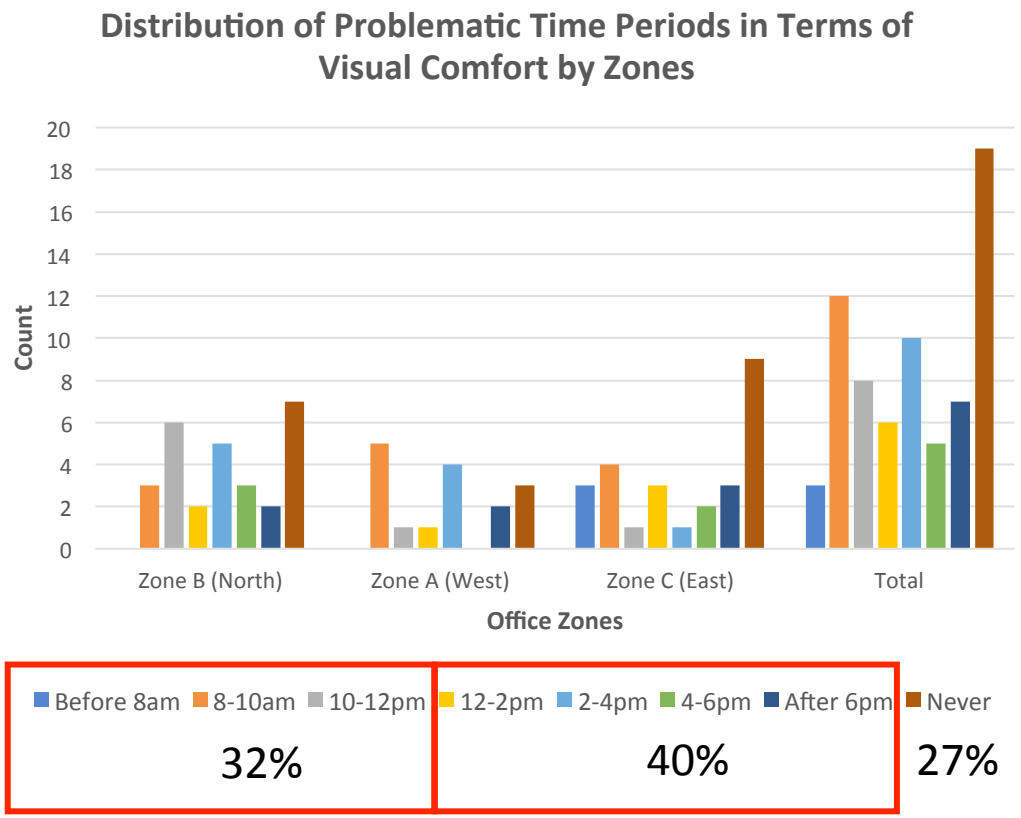
Menara Jcorp (N=84)



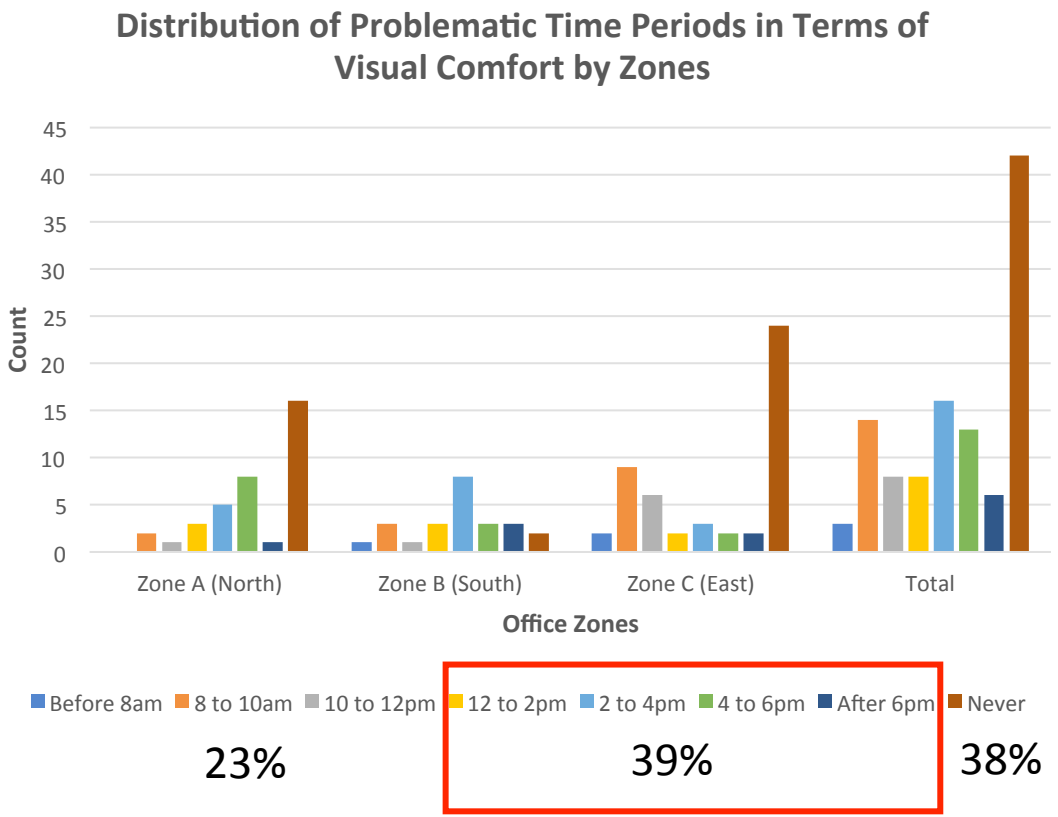
9% 39% 51%

When during the day is visual comfort most often a problem? Tick all that apply

Menara Binjai



Menara Jcorp



Describe any other issues related to your thermal and/or visual comfort in your workspace

Menara Binjai (N=76)

NO ISSUE - 61

LIGHT SENSOR ISSUES:

- Artificial lighting is automated based on light level which at times makes it difficult to adjust / read.
- Lights turn themselves on and off a lot in the afternoon. Very distracting.
- Automatic light sensors don’t always work as expected.
- Sensitivity at the light sensor inaccurate sensing where after it turn off than it is too dim to work.

Menara Jcorp (N=85)

GLARE ISSUES

- Glare issues.
- Too glaring on the laptop screen. My visual getting worse in just 1 year plus working in this office.
- The window is behind my workstation and the glare from the windows does hurt my eyes.
- Work area against the glass window has bad lighting and the glare from the window doesn’t help our eyesight. Eyesight condition has deteriorated.

Describe any other issues related to your thermal and/or visual comfort in your workspace

Menara Binjai (N=76)

LIGHTING ISSUES

- Light is a bit dim. On raining days, they are a bit dark.
- Natural day light is good but after dark the overhead lighting is very poor. The perimeter plaster board ceiling means that the standard lighting cannot be installed closed enough to the desk along windows.

ACOUSTIC ISSUE

- I experience a lot of sound discomfort especially after lunch.

Menara Jcorp (N=85)

THERMAL COMFORT ISSUES

- There's no specific time range, sometimes it feels warm because of the A/C performance around the sitting place.
- Too cold and sometimes too warm. Presence of split unit sometimes worsened it as I sit at the end of the A/C making it too cold.
- Warm in the morning to 8 am, required manual turn on and off.
- When you are sweating in the office it will take sometime for the body to cool off.

Describe any other issues related to your thermal and/or visual comfort in your workspace

Menara Binjai (N=76)

NO ISSUE - 69

GLARE ISSUES

- Glare from windows are hurting the eyes.
- More blinds are required.
- The window blinds are too thin.
- Too much glare from windows is causing migraine and even after shifting.

GENERAL

- Unsatisfactory environment in the meeting rooms.

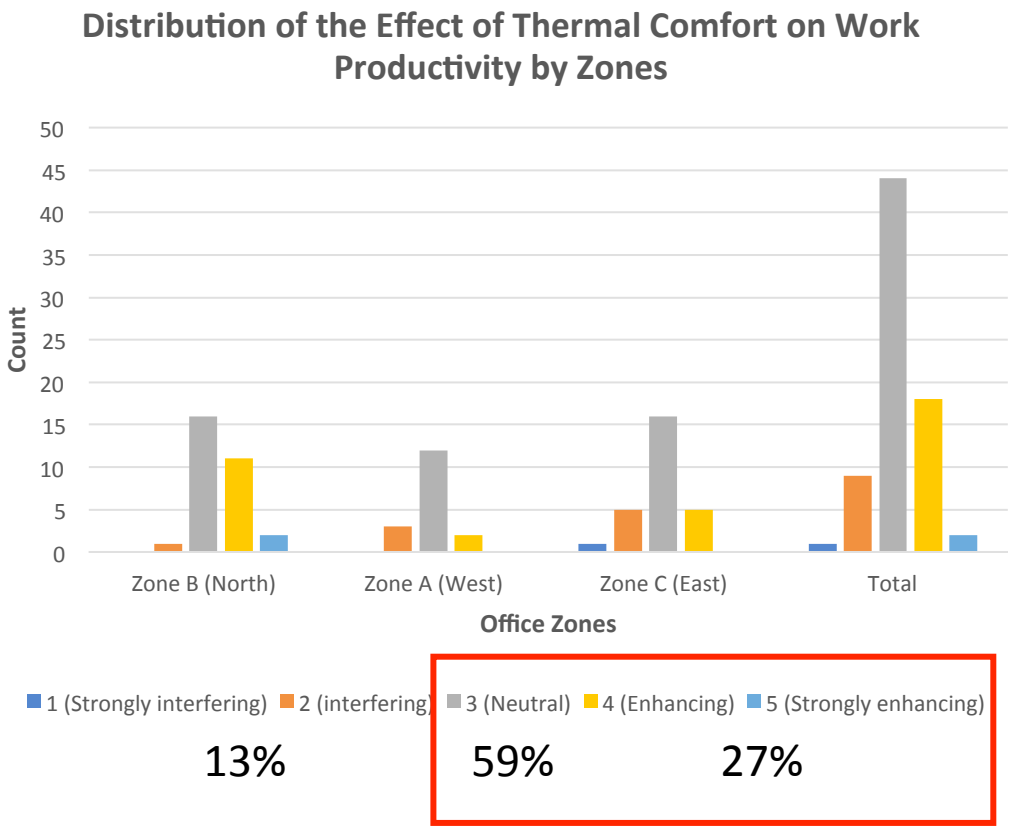
Menara Jcorp (N=85)

THERMAL COMFORT ISSUES

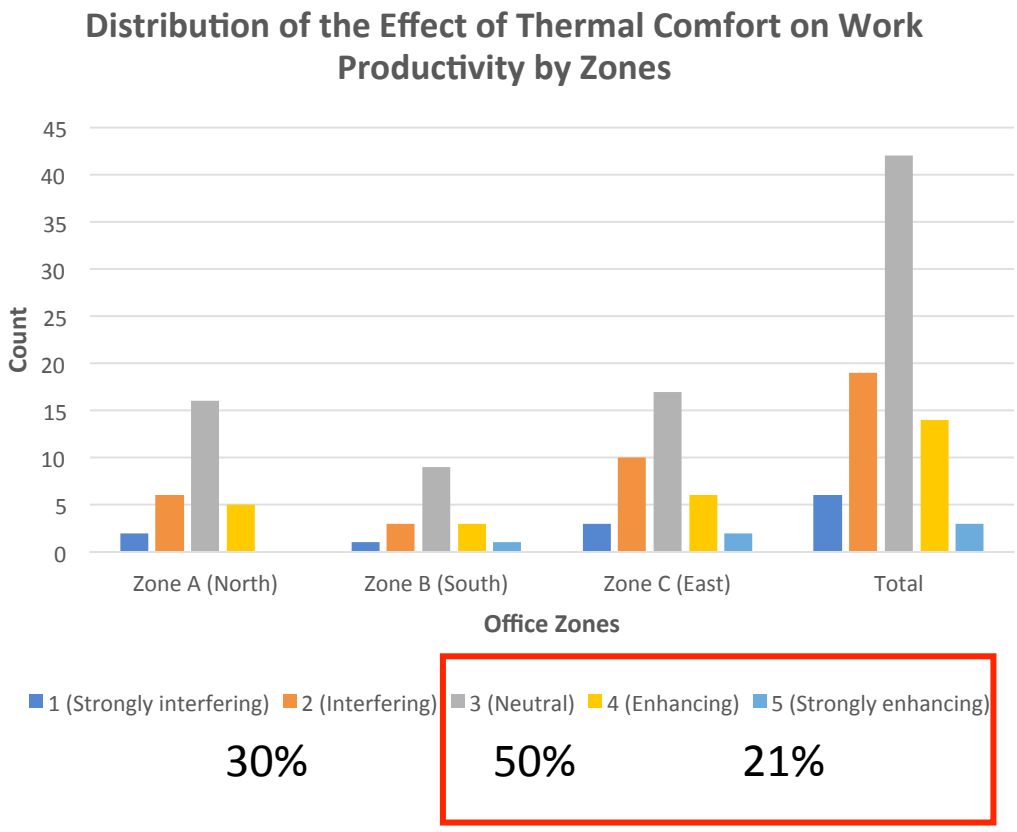
- Problems with thermal comfort.
- Extremely cold temperature hampering the health condition.
- Seating position below air condition makes it cold all the time.
- Sometimes it gets pretty cold.
- Temperature fluctuate a lot.
- The place is too cold.
- Too cold.

Overall, how does thermal comfort affect your level of work productivity?

Menara Binjai (N=74)

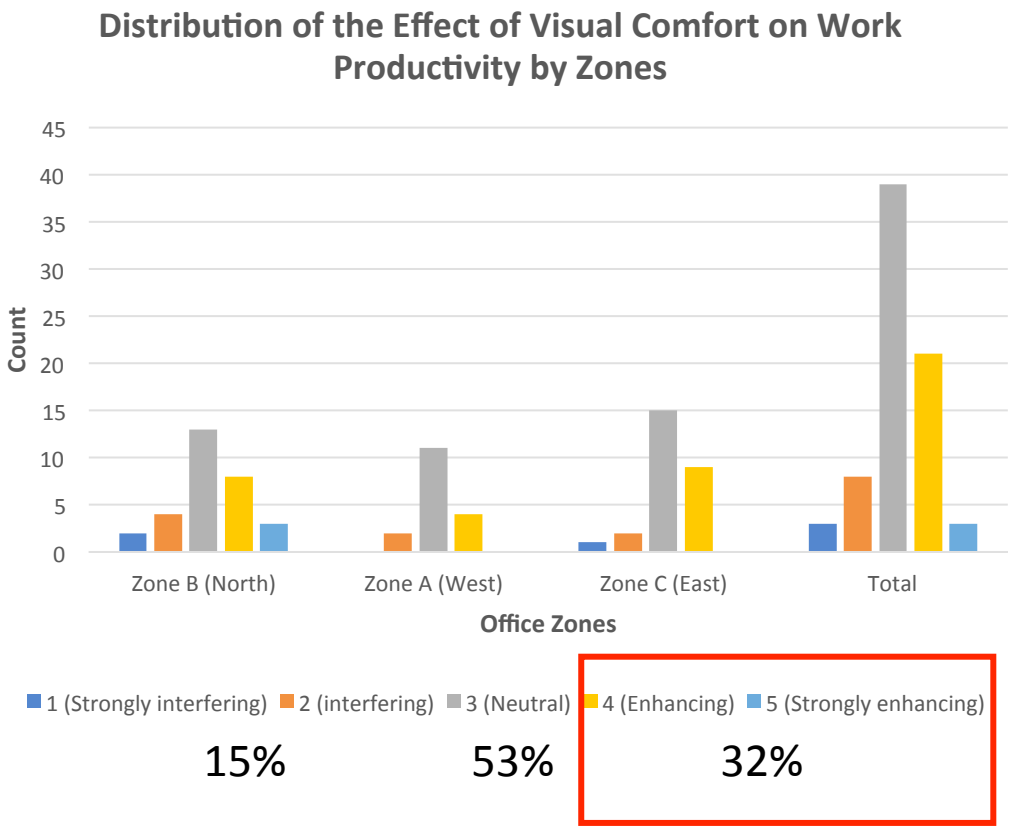


Menara Jcorp (N=84)

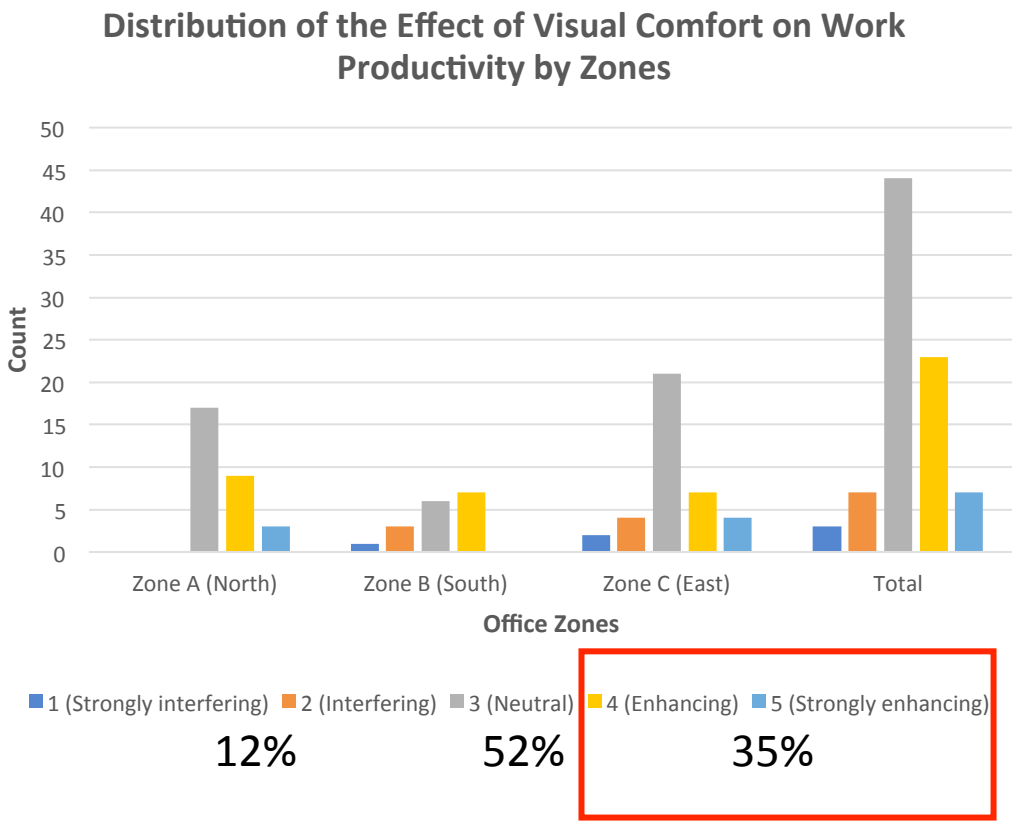


Overall, how does visual comfort affect your level of work productivity?

Menara Binjai (N=74)

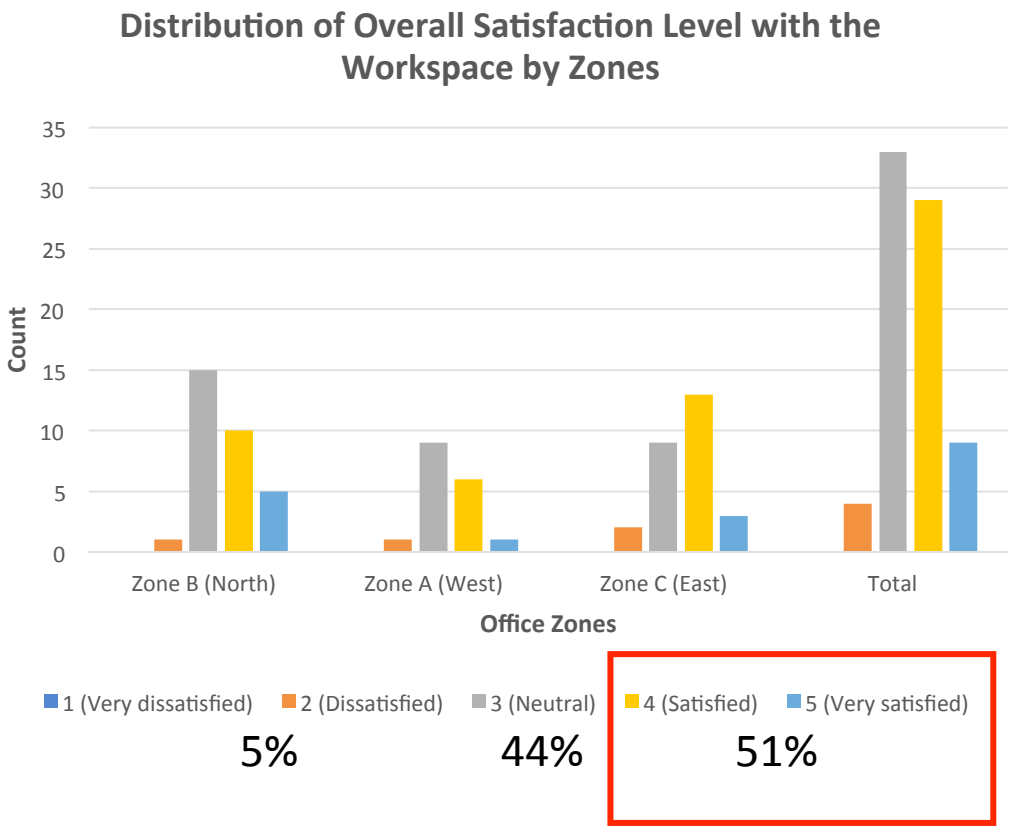


Menara Jcorp (N=84)

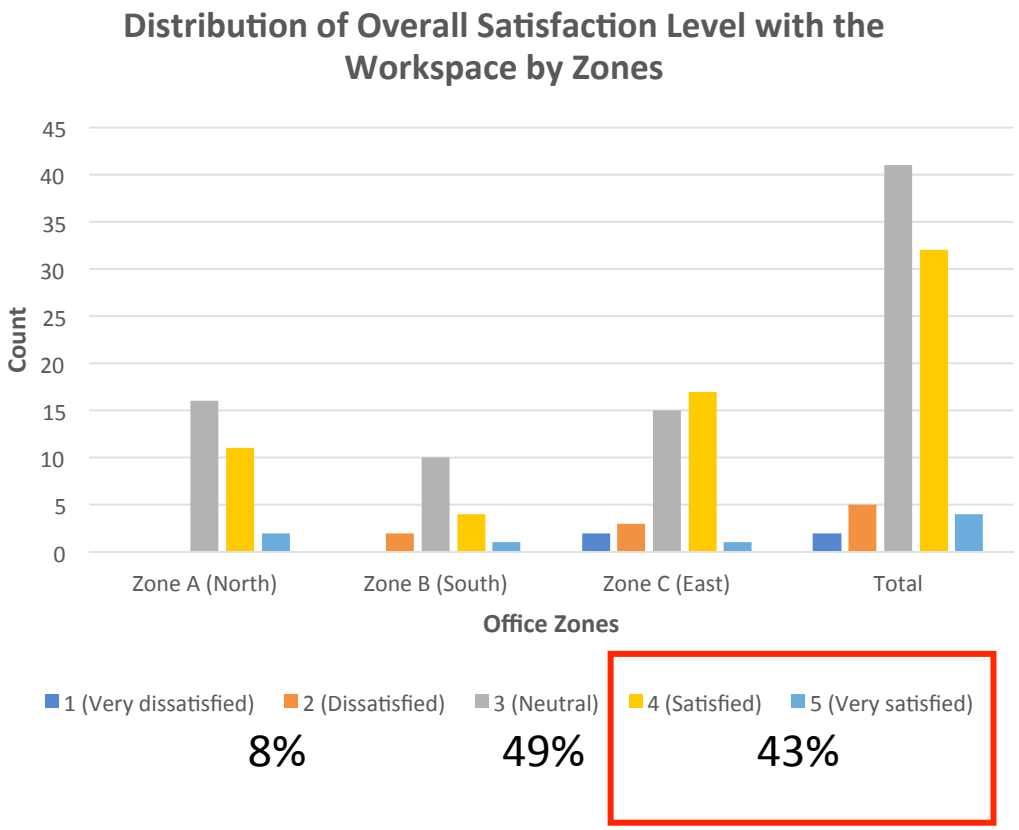


All things considered, how satisfied are you with your personal workspace?

Menara Binjai (N=75)



Menara Jcorp (N=84)



Part 2: Measuring Outcome

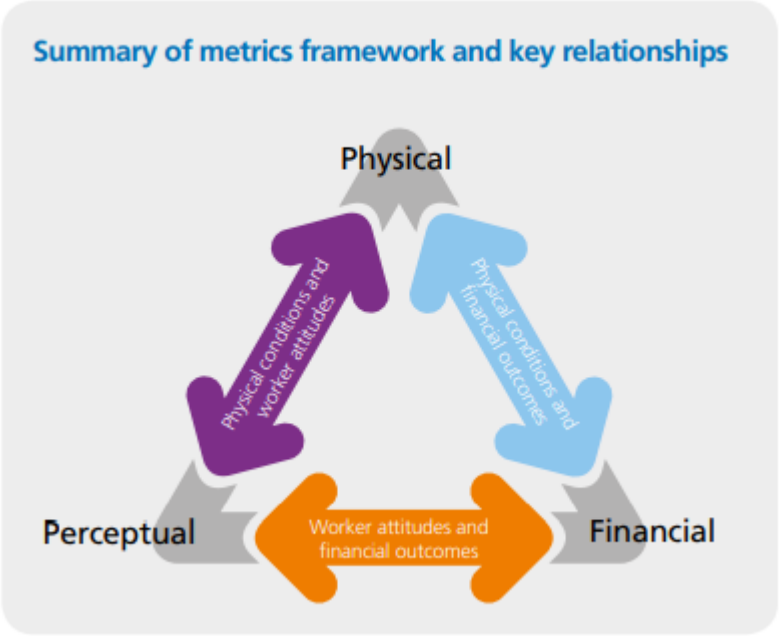
Binjai

This relatively new building main orientation with high performance glass receives heat gain from the east, west and north. The glare and acoustics were by far the biggest issues for Menara Binjai. Due to the larger northern façade facing the main street thoroughfare, the acoustics level and discomfort was felt more in this building. In general, most employees found their workspace in Binjai better than JCORP.

JCORP

Thermally, this workspace endured colder spots in comparison to Binjai with the balancing of thermal comfort not optimised to the 24 degree C target temperature creating discomfort for the employees. The general consensus is the air quality is stuffy and this may be due to an older mechanical & ventilation system.

Lighting luminance performance in the reading showed lower levels then the Malaysian standards of 300-400 lux.



WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE

Concluding Remarks

Over the course of months before the move of Lendlease site office staff from a GBI-Platinum green building (Menara Binjai) and interiors to a non-green building (Menara JCorp, retro fitted with new interior), we had the chance to monitor the indoor environmental performance of their green building.

Lendlease knew it was imperative for the new non-green office to have the same indoor environmental quality as the previous green office in terms of open plan, open pantry & touch down lounge, flexible work space, flexible meeting spaces and maximized daylight, views, optimum air performance, low VOC materials and introduction of indoor planting.

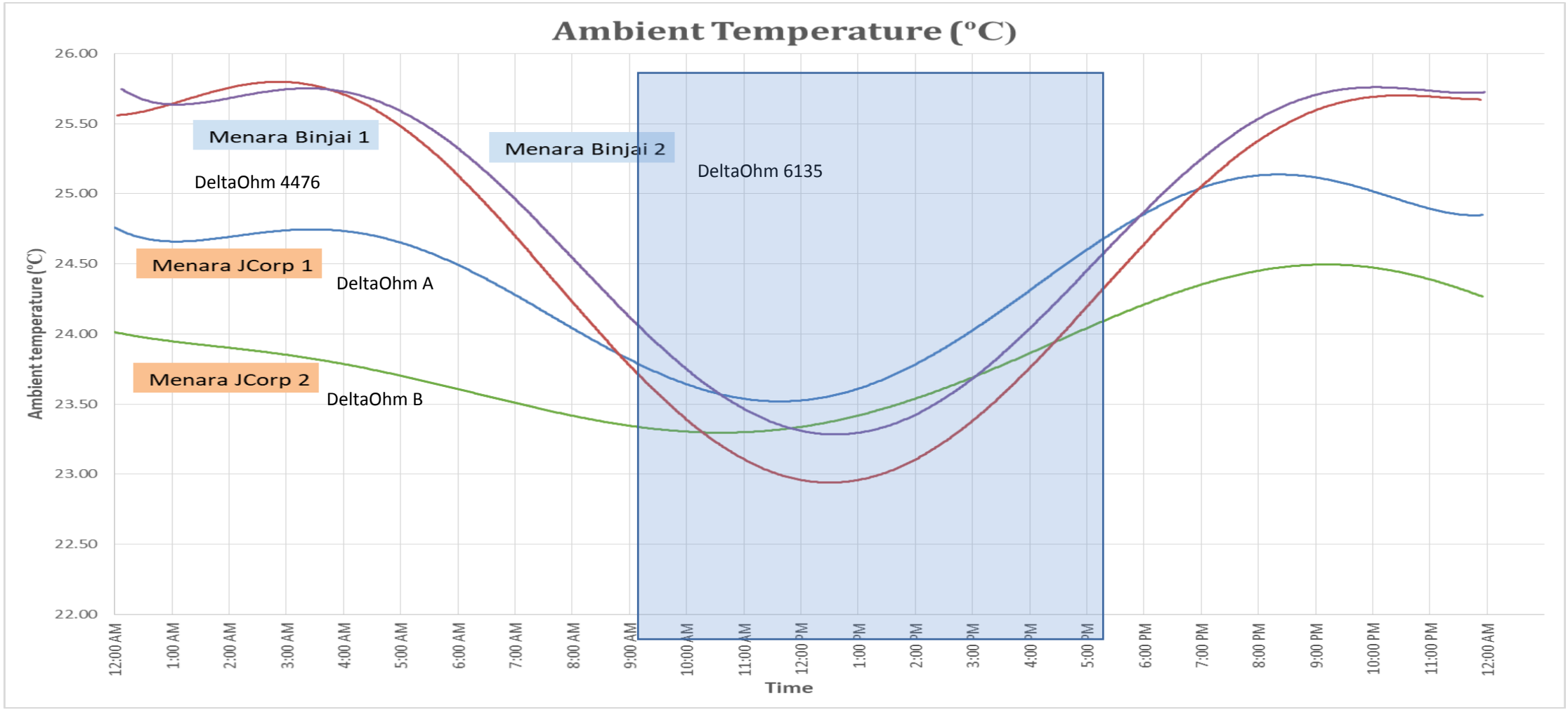
The impact of building orientation, façade material (building shell) mechanical & ventilation systems were the significant issues that impacted the overall thermal and comfort levels in both buildings.

Although not all IEQ aspects in Menara Binjai are excellent, employees are generally more satisfied working in Menara Binjai (green building) than in Menara JCorp (non-green building).

Appendix I – Data from Delta OHM

WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE



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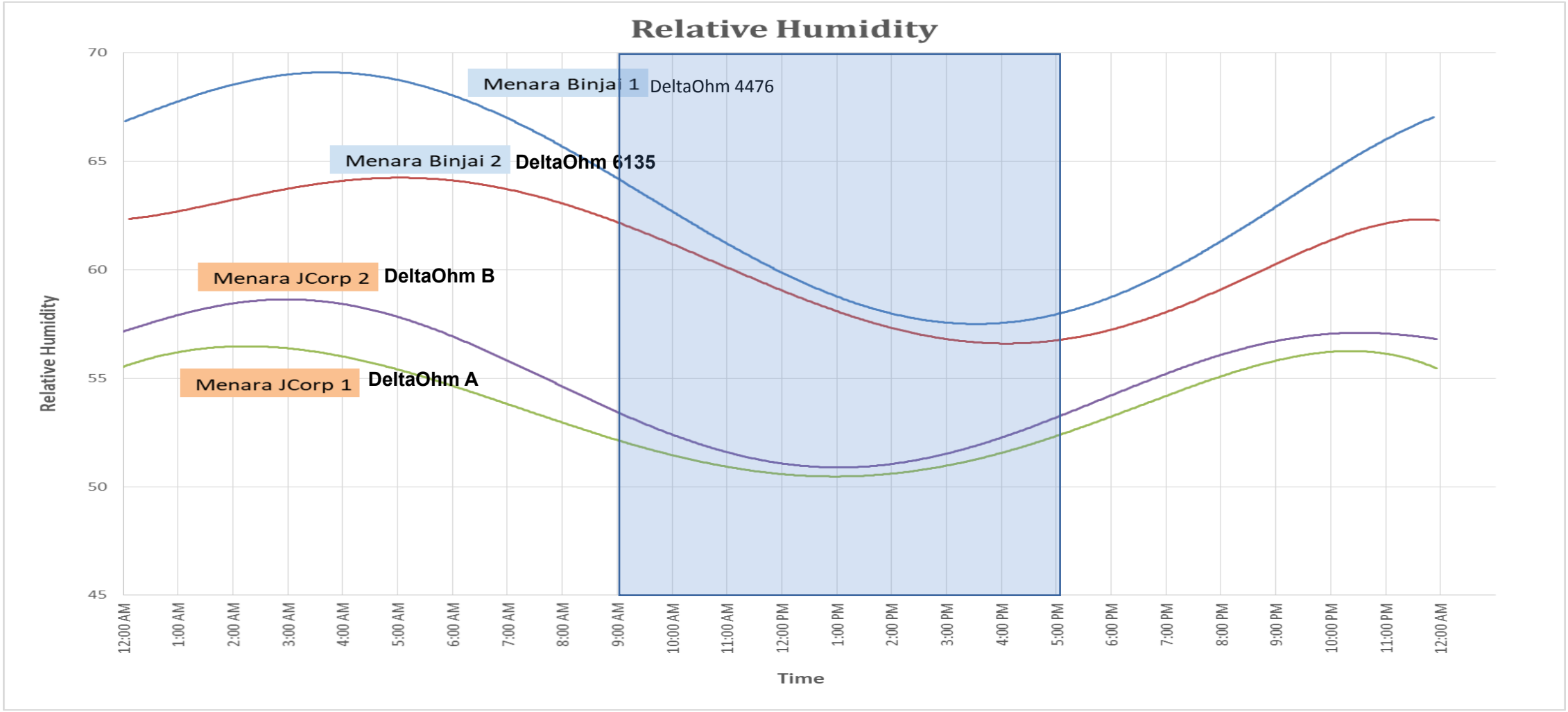
WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE



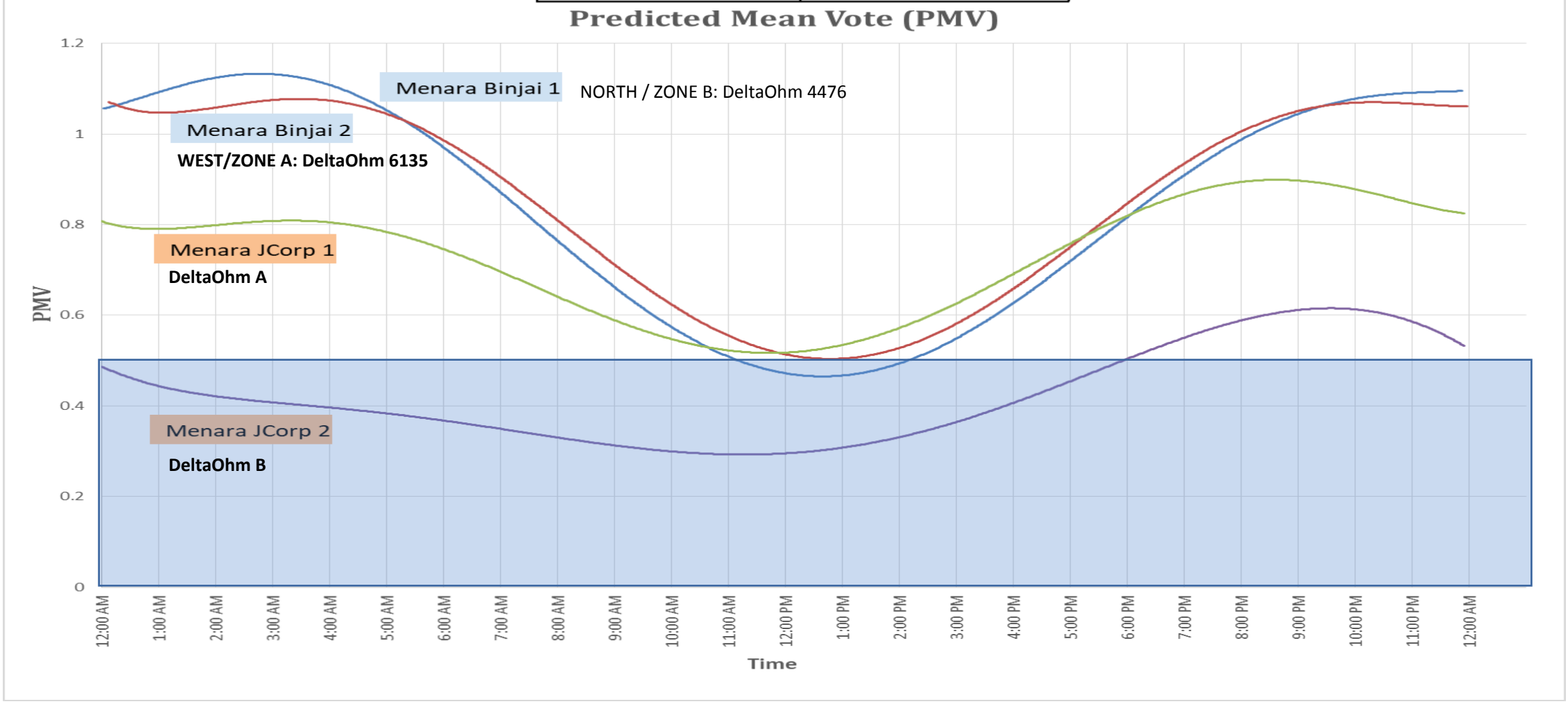
Appendix I – Data from Delta OHM

WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE

TABLE 5.2.1.2
Acceptable Thermal Environment for General Comfort

PPD	PMV Range
< 10	-0.5 < PMV < + 0.5



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BETTER PLACES FOR PEOPLE

TABLE 5.2.1.2
Acceptable Thermal Environment for General Comfort

PPD	PMV Range
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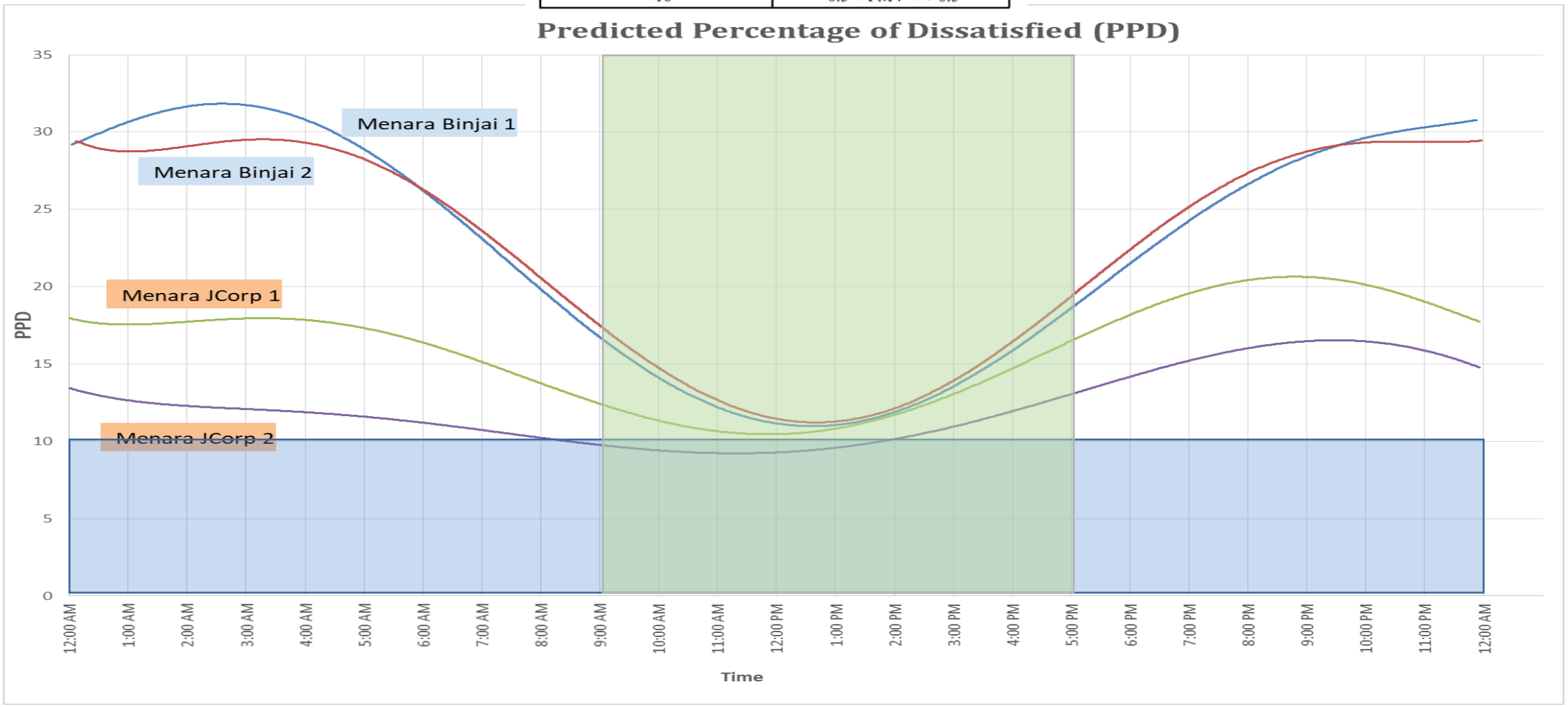
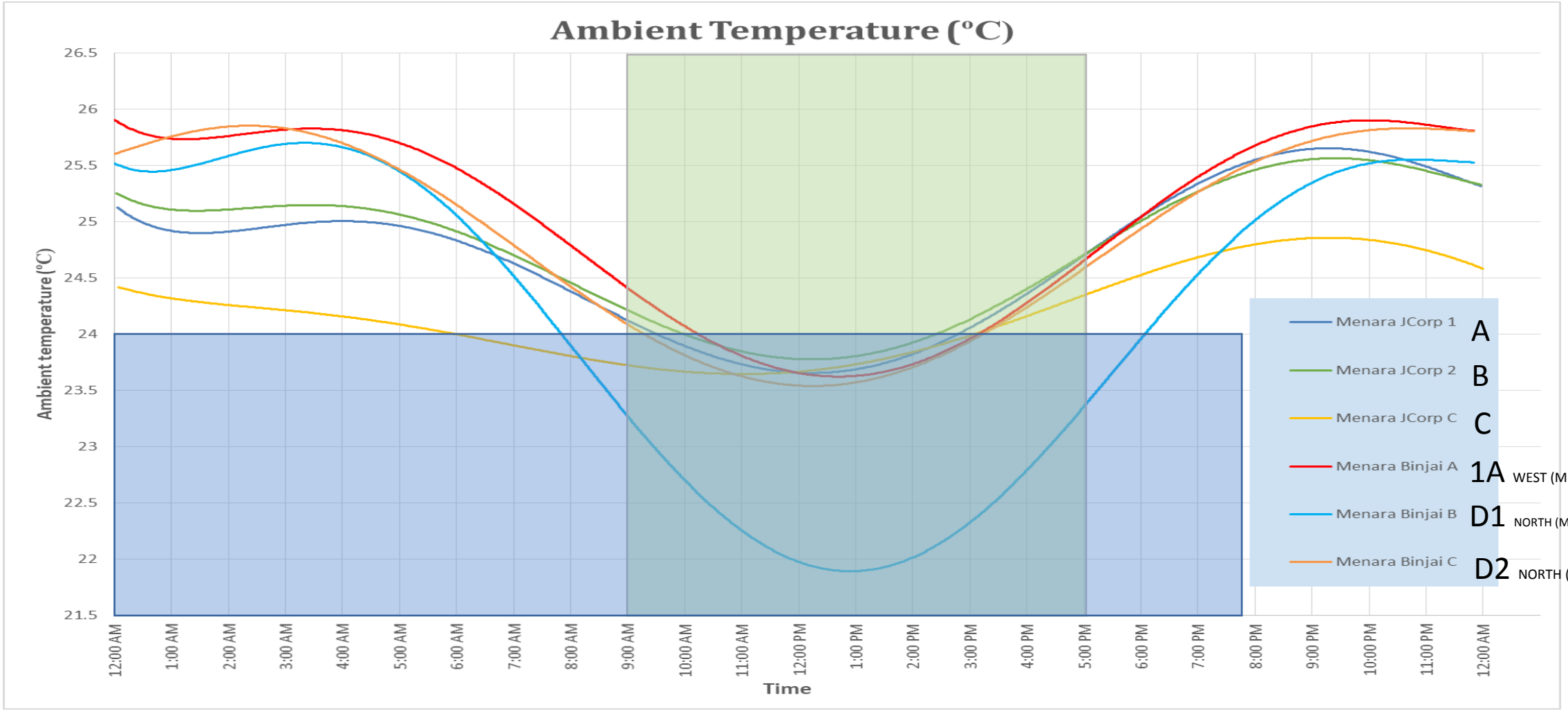


Appendix II – Data from Delta HOBO

WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE



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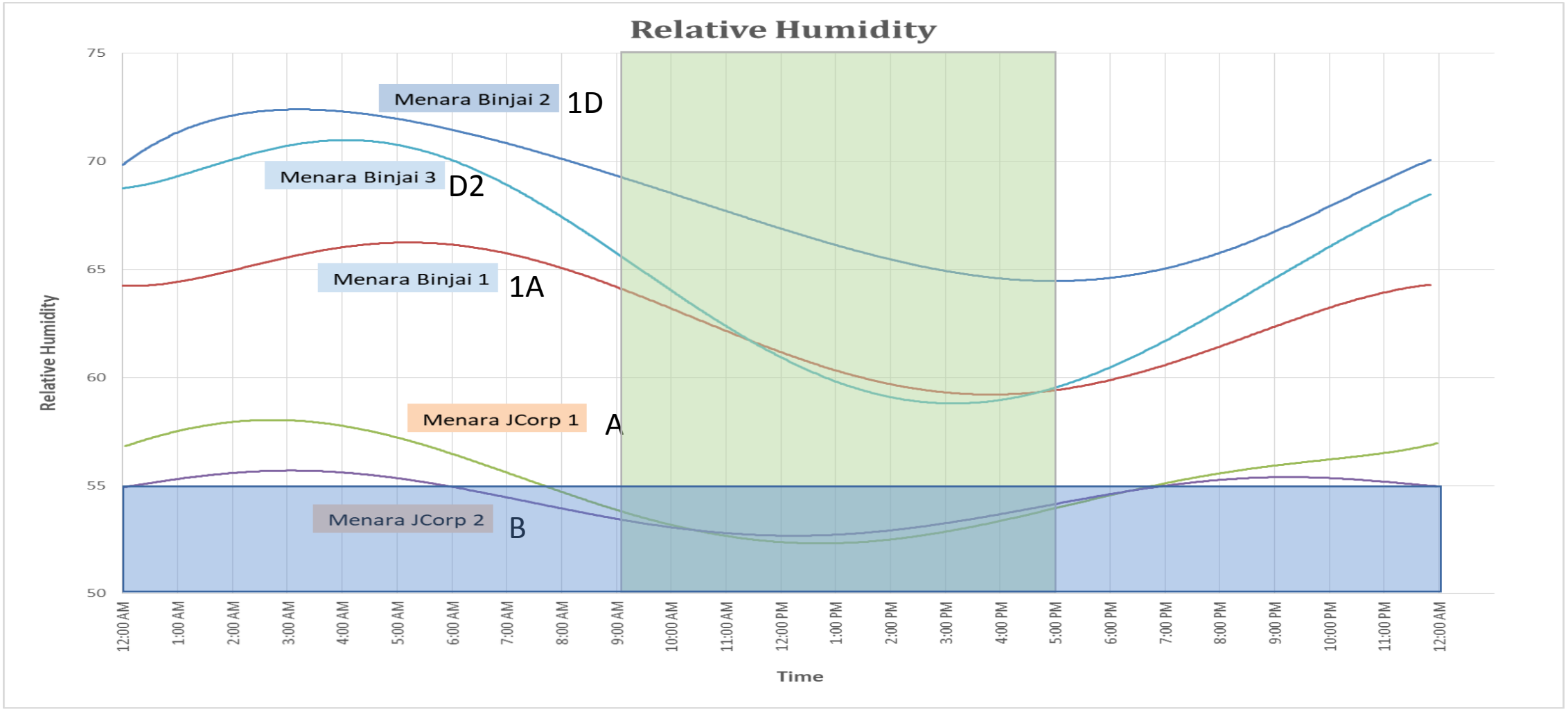
WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE



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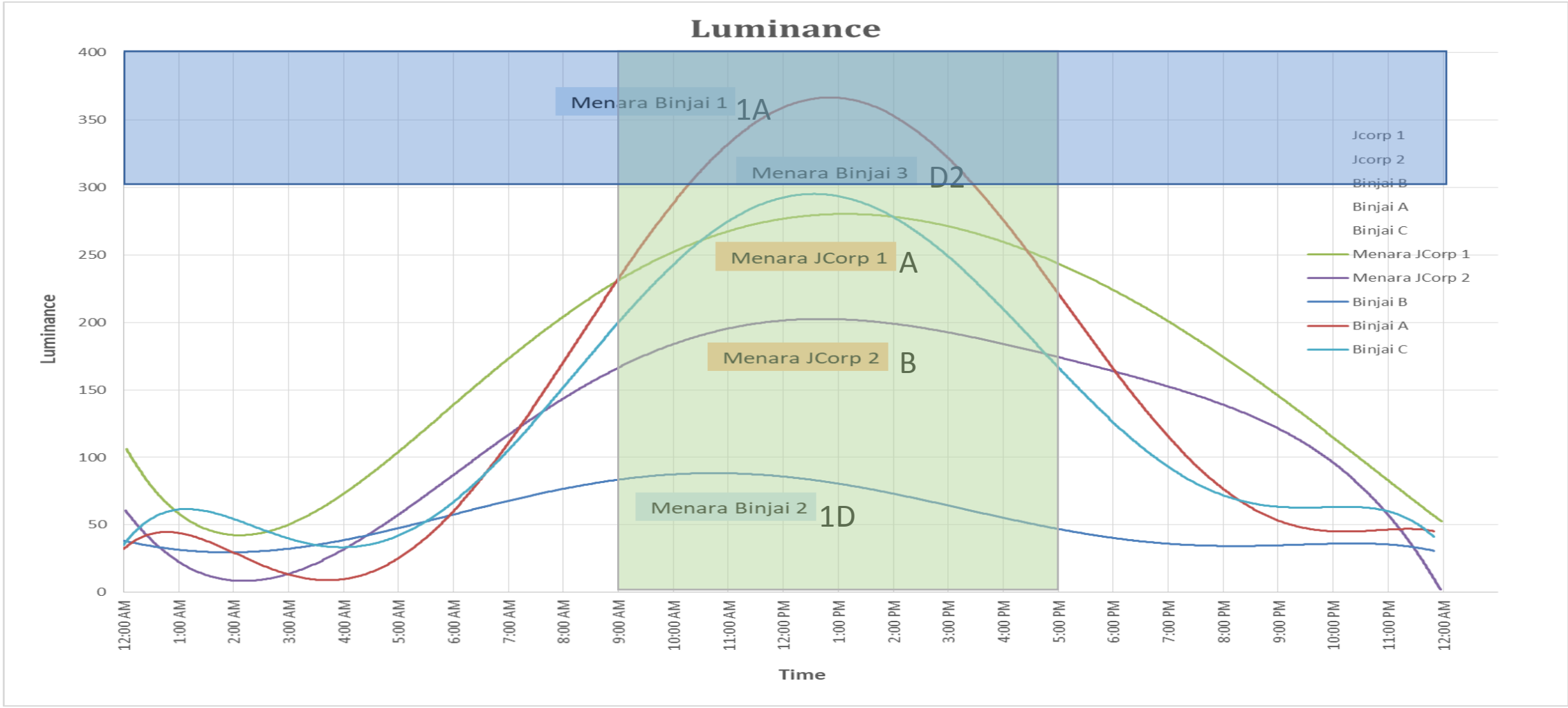
WORLD GREEN BUILDING COUNCIL

BETTER PLACES FOR PEOPLE



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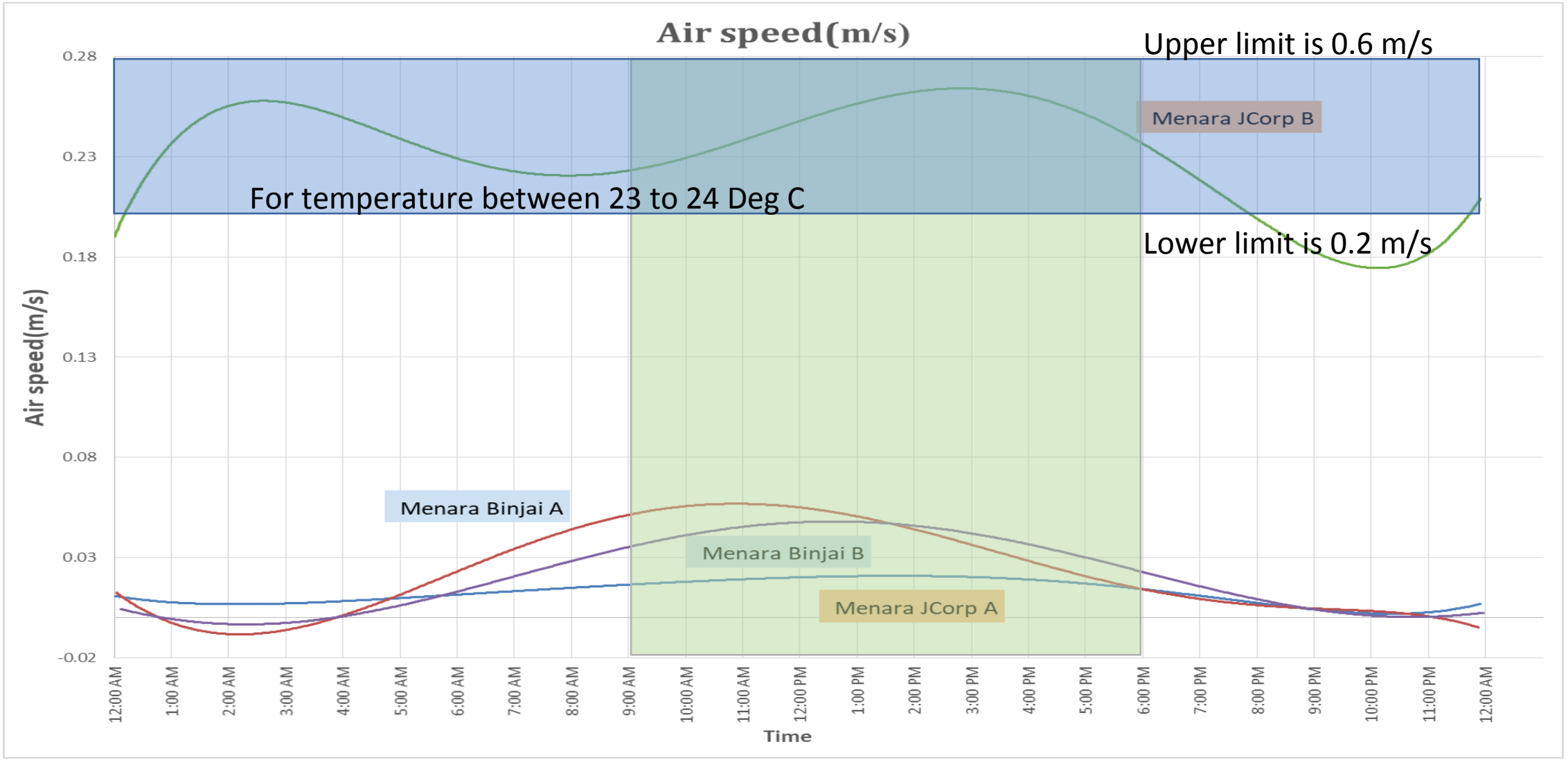
BETTER PLACES FOR PEOPLE



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