Indoor Air Quality Assessment Report

Of

Proposed Project – "Acme - Ozone"

At

Gut No. 61/1/1, 61/1/2, 3, 4 & 61/2/1,2,3

Village Chitalsar –Manpada,

Taluka & District - Thane

Proposed by

M/s. Acme Housing India Pvt Ltd

Prepared by

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(An ISO 9001:2015 Certified Company)

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Indoor Air Quality Assessment

1.0 About the Project:

The proposed project is a development of residential project at Gut. No. 61/1/1, Gut. No. 61/1/2, 3, 4, 61/2/1, 2, 3 village Chitalsar -Manpada, Taluka& District Thane. The detail location is shown in **Figure 1.1.**

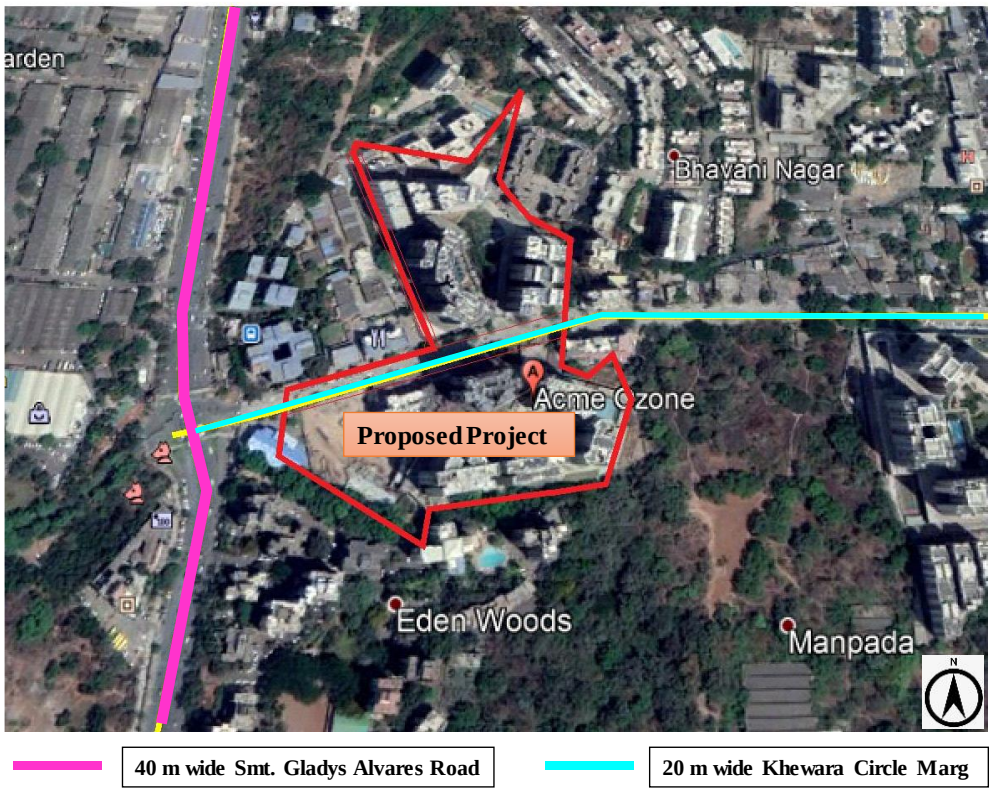


Figure 1.1: Location of the proposed project

Project layout shown in **Figure 1.2**

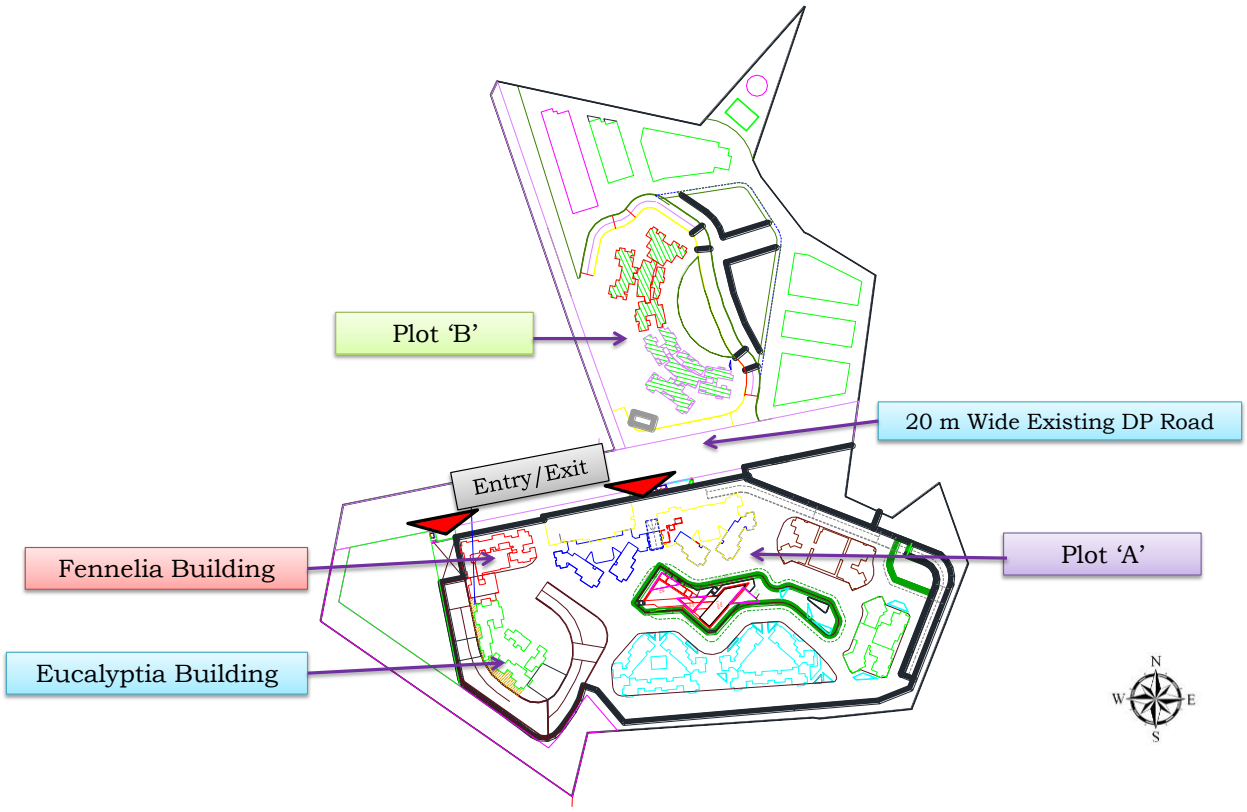


Figure 1.2: Layout plan of the proposed project

The project buildings details are given in **Table 1.1**.

Table 1.1 Project buildings

Name of Building	Previous Status		Current Status		Remarks
	Configuration	Height (m)	Configuration	Height (m)	
Eucalyptia	Gr. + 2P + ST + 27 Floor	91.8	2 level Basement + 3 level Podium (Gr.+2P) +Stilt +1st to 19th floor + Fire Check floor + 20th to 35th	118.87	Basement is added and also increase in floor from 27th to 35th floor. Height increased from 91. 8 m to 118.87 m

Name of Building	Previous Status		Current Status		Remarks
	Configuration	Height (m)	Configuration	Height (m)	
			(Pt) floors		
Fenelia	Gr. + 2P + ST + 27 Floor	91.8	2 level Basement+ Gr (Pt.)/ 1st level Podium + 1st floor (pt)/2nd level Podium + 2nd Floor (pt)/3rd Podium +Stilt + 1st to 19th floor +fire Check floor +20th - 35th (Pt) floor	118.87	Basement is added and also increase in floor from 27th to 35th floor. Height increased from 91. 8 m to 118.87 m

2.0 Methodology:

- Ventilation and Indoor Air Quality assessment carried out by Ecotect software.
- Windows sizes and area calculated by using AutoCAD software.
- Percentage of Open area for windows calculated by following formula

% of Open area to carpet area = Window area / Carpet area of room X 100

The Air Change Rate (ACH) calculated as per the following formula,

$$ACH = \frac{0.65\ x\ air\ speed\ (m/s) x\ window\ open\ area\ (m2) x\ 3600}{Volume\ of\ Room\ (m3)}$$

3.0 Standards:

The standards for different rooms given in **Table 1.2**

Table 1.2: Design criteria for Open windows and doors

Space type	Open area as percentage of total carpet area			
	Up to 5th Floor		Higher than 5th Floor	
	Min	Max	Min	Max
Living spaces	10%	12%	8%	10%
Kitchen	8%	10%	6%	8%
Bedroom	4%	5%	4%	4%
Toilet	4%	4%	4%	4%

4.0 Floor Plans:

Eucalyptia Building

The First floor plan of the Eucalyptia building is shown in **Figure 1.3.** The Typical floor plan of the Eucalyptia building is shown in **Figure 1.4** & the Refuge floor plan of the Eucalyptia building is shown in **Figure 1.5**

Eucalyptia Building



Figure 1.3: First floor plan of Eucalyptia building



Figure 1.4: Typical floor plan of Eucalyptia building

(2nd to 4th floor; 6th to 9th and 11th to 14th and 16th to 19th and 21st to 24th and 26th to 29th and 31st to 34th floor)

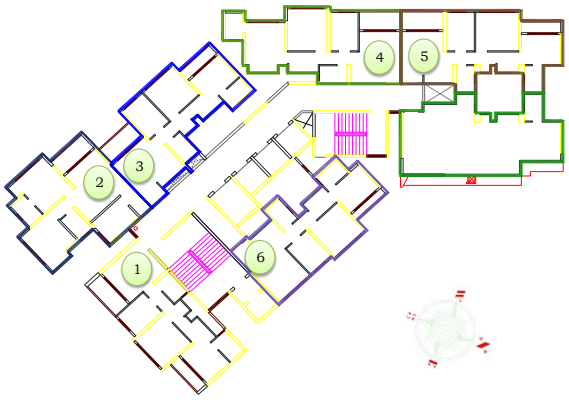


Figure 1.5: Refuge floor plan of Eucalyptia building

(5th; 10th; 15th; 25th; 30th & 35th floor)

Fenelia Building

The First floor plan of the Fenelia Building is shown in **Figure 1.6.** The Typical floor plan of the Fenelia building is shown in **Figure 1.7** & the Refuge floor plan of the Fenelia building is shown in **Figure 1.8**

Fenelia Building



Figure 1.6: First floor plan of Fenelia building

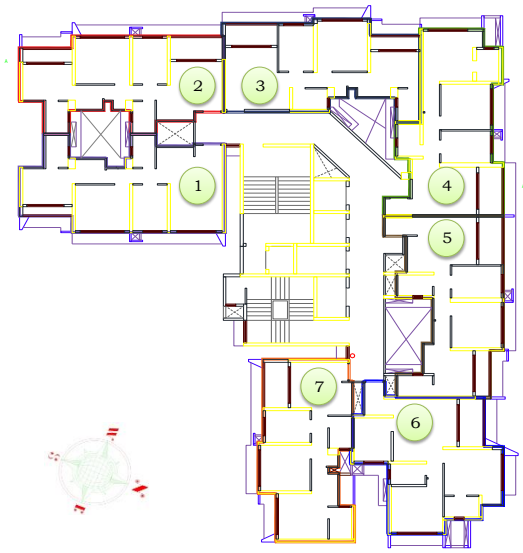


Figure 1.7: Typical floor plan of Fenelia building

(2nd to 4th floor; 6th to 9th and 11th to 14th and 16th to 19th and 21st to 24th and 26th to 29th and 31st to 34th floor)

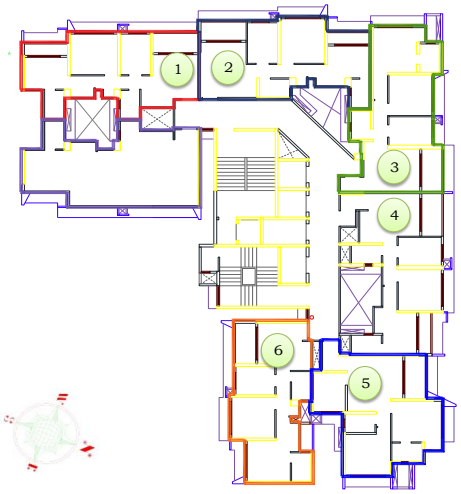


Figure 1.8: Refuge floor plan of Fenelia building

(5th; 10th; 15th; 25th; 30th & 35th floor)

5.0 Findings:

A. Indoor ventilation assessment – Perspective method

In order to achieve level, the door and window should have capacities or areas. Actual window Open area given in **Table 1.3**

Table 1.3: Actual window open area

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
Eucalyptia Building														
First Floor (Refer **Figure 1.3**)	2 BHK	1	Living	3.23	5.36	17.31	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.3
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	8 - 10	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	5.48	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.07	9.33	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	3	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			B 1	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	3.23	4.57	14.76	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	15.6
			Kitchen	2.13	2.74	5.84	Casement	1	2.2	Open	2.2	1.10	8 - 10	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Typical Floor – 2nd to 4th Floor (Refer **Figure 1.4**)	2 BHK	1	Living	5.36	3.23	17.31	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.3
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	8 - 10	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
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			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.07	9.33	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
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								Length (m)	Width (m)					
	2 BHK	3	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
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			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	3.23	5.05	16.31	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.2
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	6	Living	3.23	4.96	16.02	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.4
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8

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Refuge Floor – 5th Floor (Refer **Figure 1.5**)	2 BHK	1	Living	5.36	3.23	17.31	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.3
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			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
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			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
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			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
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	2 BHK	4	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			B 1	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	3.23	5.06	16.34	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.1
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Typical Floor 6th to 9th and 11th to 14th and 16th to 19th and 21st to 24th and 26th to 29th	2 BHK	1	Living	5.36	3.23	17.31	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.3
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	6 - 8	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	5.48	17.70	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.07	9.33	Slider	2	2.2	3 W	4.4	2.20	4	23.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
and 31st to 34th floor (Refer **Figure 1.4**)	2 BHK	3	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	3.23	5.05	16.31	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.2
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	6	Living	3.23	4.96	16.02	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.4
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Refuge Floor 10th ,15th ,20th ,25th ,30th , 35th floor (Refer **Figure 1.5**)	2 BHK	1	Living	5.36	3.23	17.31	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.3
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	6 - 8	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	5.48	17.70	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.07	9.33	Slider	2	2.2	3 W	4.4	2.20	4	23.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	3	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			B 1	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	3.23	5.06	16.34	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.1
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Fenelia Building														
First Floor (Refer **Figure 1.6**)	2 BHK	1	Living	2.8	5.63	15.76	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.1	3.35	10.39	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.2
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	3	Living	5.18	3.23	16.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.8
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.16	9.61	Slider	2	2.2	3 W	4.4	2.20	4 - 5	22.9
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	2.31	2.92	6.75	Casement	1	2.2	Open	2.2	1.10	8 - 10	16.3
			B 1	3.53	3.04	10.73	Slider	2	2.2	3 W	4.4	2.20	4 - 5	20.5
			B 2	3.2	3.04	9.73	Slider	2	2.2	3 W	4.4	2.20	4 - 5	22.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.25	1.4	3.15	Casement	0.6	1.7	Open	1.02	0.51	4	16.2
	2 BHK	5	Living	4.75	3.04	14.44	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	16.0
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	8 - 10	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Typical Floor – 2nd	2 BHK	1	Living	3.23	4.96	16.02	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.4
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
to 4th floor (Refer **Figure 1.7**)			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	3	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.1	3.35	10.39	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.2
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
		5	Living	5.18	3.23	16.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.8

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
	2 BHK		Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.16	9.61	Slider	2	2.2	3 W	4.4	2.20	4 - 5	22.9
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	6	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	2.31	2.92	6.75	Casement	1	2.2	Open	2.2	1.10	8 - 10	16.3
			B 1	3.53	3.04	10.73	Slider	2	2.2	3 W	4.4	2.20	4 - 5	20.5
			B 2	3.2	3.04	9.73	Slider	2	2.2	3 W	4.4	2.20	4 - 5	22.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.25	1.4	3.15	Casement	0.6	1.7	Open	1.02	0.51	4	16.2
	2 BHK	7	Living	4.75	3.04	14.44	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	16.0
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	8 - 10	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Refuge Floor – 5th Floor (Refer	2 BHK	1	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
Figure 1.8)			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.1	3.35	10.39	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.2
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	3	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	5.18	3.23	16.73	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.8
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	8 - 10	17.0
			B 1	3.04	3.16	9.61	Slider	2	2.2	3 W	4.4	2.20	4 - 5	22.9
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4 - 5	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	13.1
			Kitchen	2.31	2.92	6.75	Casement	1	2.2	Open	2.2	1.10	8 - 10	16.3
			B 1	3.53	3.04	10.73	Slider	2	2.2	3 W	4.4	2.20	4 - 5	20.5

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			B 2	3.2	3.04	9.73	Slider	2	2.2	3 W	4.4	2.20	4 - 5	22.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.25	1.4	3.15	Casement	0.6	1.7	Open	1.02	0.51	4	16.2
	2 BHK	6	Living	4.75	3.04	14.44	Slider	2.2	2.1	2 W	4.62	2.31	10 - 12	16.0
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	8 - 10	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4 - 5	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Typical Floor 6th to 9th and 11th to 14th and 16th to 19th and 21st to 24th and 26th to	2 BHK	1	Living	3.23	4.96	16.02	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.4
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
		3	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	12.7

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
29th and 31st to 34th floor (Refer **Figure 1.7**)	2 BHK		Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.1	3.35	10.39	Slider	2	2.2	3 W	4.4	2.20	4	21.2
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	5.18	3.23	16.73	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.8
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.16	9.61	Slider	2	2.2	3 W	4.4	2.20	4	22.9
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	6	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.1
			Kitchen	2.31	2.92	6.75	Casement	1	2.2	Open	2.2	1.10	6 - 8	16.3
			B 1	3.53	3.04	10.73	Slider	2	2.2	3 W	4.4	2.20	4	20.5
			B 2	3.2	3.04	9.73	Slider	2	2.2	3 W	4.4	2.20	4	22.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			Toilet 2	2.25	1.4	3.15	Casement	0.6	1.7	Open	1.02	0.51	4	16.2
	2 BHK	7	Living	4.75	3.04	14.44	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	16.0
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	6 - 8	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
Refuge Floor 10th ,15th ,20th ,25th ,30th , 35th floor (Refer **Figure 1.8**)	2 BHK	1	Living	3.23	4.87	15.73	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	14.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	2	Living	3.23	5.63	18.18	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	12.7
			Kitchen	2.13	3.04	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.1	3.35	10.39	Slider	2	2.2	3 W	4.4	2.20	4	21.2
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	3	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.1
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8

Floor	Flat Type	Flat No.	Type of Room	Length (m)	Width (m)	Carpet Area (Sq. m)	Window Type	Window Dimension		Open Type	Window area (Sq. m)	Open Window Area (Sq. m)	% of Open area to carpet area required	% of Open area to carpet area achieved
								Length (m)	Width (m)					
			B 2	3.04	3.35	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	4	Living	5.18	3.23	16.73	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.8
			Kitchen	3.04	2.13	6.48	Casement	1	2.2	Open	2.2	1.10	6 - 8	17.0
			B 1	3.04	3.16	9.61	Slider	2	2.2	3 W	4.4	2.20	4	22.9
			B 2	3.35	3.04	10.18	Slider	2	2.2	3 W	4.4	2.20	4	21.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
	2 BHK	5	Living	5.48	3.23	17.70	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	13.1
			Kitchen	2.31	2.92	6.75	Casement	1	2.2	Open	2.2	1.10	6 - 8	16.3
			B 1	3.53	3.04	10.73	Slider	2	2.2	3 W	4.4	2.20	4	20.5
			B 2	3.2	3.04	9.73	Slider	2	2.2	3 W	4.4	2.20	4	22.6
			Toilet 1	2.13	1.4	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	2.25	1.4	3.15	Casement	0.6	1.7	Open	1.02	0.51	4	16.2
	2 BHK	6	Living	4.75	3.04	14.44	Slider	2.2	2.1	2 W	4.62	2.31	8 - 10	16.0
			Kitchen	2.74	2.13	5.84	Casement	1	2.2	Open	2.2	1.10	6 - 8	18.8
			B 1	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			B 2	3.04	3.04	9.24	Slider	2	2.2	3 W	4.4	2.20	4	23.8
			Toilet 1	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1
			Toilet 2	1.4	2.13	2.98	Casement	0.6	1.7	Open	1.02	0.51	4	17.1

***Note:-**

2 W – sliding 2 nos.;

3 W – sliding 3 nos.;

Open – Full open able;

Casement – window that is attached to its frames by one or more hinges at the sides;

Slider – slide window

In order to achieve level, the door and window should have capacities or areas. Air Change Rate given in **Table 1.4**

Table 1.4: Air change rate

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
Eucalyptia Building						
First Floor (Refer **Figure 1.3**)	2 BHK	1	Living	4.62	17.31	6.82
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 1					**9.86**
	2 BHK	2	Living	4.62	17.70	6.67
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.33	12.05
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 2					**9.66**
	2 BHK	3	Living	4.62	15.73	7.50
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 3					**9.81**
	2 BHK	4	Living	4.62	18.18	6.49
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 4					**9.46**
	2 BHK	5	Living	4.62	14.76	8.00
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	9.24	12.17
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 5					**10.24**
	Average of First Floor					**9.81**
Typical Floor 2nd to 4th,6th to 9th,11th to 14th,16th to 19th, 21st to 24th, 26th to 29th, 31st to 34th Floor (Refer **Figure 1.4**)	2 BHK	1	Living	4.62	17.31	6.82
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 1					**9.86**
	2 BHK	2	Living	4.62	17.70	6.67
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.33	12.05
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 2					**9.66**
	2 BHK	3	Living	4.62	15.73	7.50
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 3					**9.81**
	2 BHK	4	Living	4.62	18.18	6.49
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
			Toilet 2	1.02	2.98	9.75
	Average of Flat 4					**9.46**
	2 BHK	5	Living	4.62	16.31	7.24
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 5					**9.58**
	2 BHK	6	Living	4.62	16.02	7.37
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	9.24	12.17
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 6					**9.79**
	Average of Typical Floor					**9.69**
Refuge Floor 5th ,10th ,15th ,20th ,25th,30th, 35th Floor (Refer **Figure 1.5**)	2 BHK	1	Living	4.62	17.31	6.82
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 1					**9.86**
	2 BHK	2	Living	4.62	17.70	6.67
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.33	12.05
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 2					**9.66**
	2 BHK	3	Living	4.62	15.73	7.50
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 3					**9.81**

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
	2 BHK	4	Living	4.62	18.18	6.49
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 4					**9.46**
	2 BHK	5	Living	4.62	16.34	7.22
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 5					**9.58**
	Average of Refuge Floor					**9.67**
Fenelia Building						
First Floor (Refer **Figure 1.6**)	2 BHK	1	Living	4.62	15.76	7.49
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.39	10.83
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 1					**9.59**
	2 BHK	2	Living	4.62	17.70	6.67
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 2					**9.68**
	2 BHK	3	Living	4.62	16.73	7.06
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.61	11.70
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 3					**9.66**

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
	2 BHK	4	Living	4.62	17.70	6.67
			Kitchen	2.20	6.75	8.33
			B 1	4.40	10.73	10.48
			B 2	4.40	9.73	11.56
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	3.15	9.23
	Average of Flat 4					**9.34**
	2 BHK	5	Living	4.62	14.44	8.18
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	9.24	12.17
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 5					**10.27**
	Average of First Floor					**9.71**
Typical Floor 2^{nd} to 4^{th},6^{th} to 9^{th},11^{th} to 14^{th},16^{th} to 19^{th}, 21^{st} to 24^{th}, 26^{th} to 29^{th}, 31^{st} to 34^{th} Floor (Refer **Figure 1.7**)	2 BHK	1	Living	4.62	16.02	7.37
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	9.24	12.17
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 1					**9.79**
	2 BHK	2	Living	4.62	15.73	7.50
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 2					**9.63**
	2 BHK	3	Living	4.62	18.18	6.49
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.39	10.83
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 3					**9.42**
	2 BHK	4	Living	4.62	17.70	6.67
			Kitchen	2.20	6.48	8.68

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 4					**9.68**
	2 BHK	5	Living	4.62	16.73	7.06
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.61	11.70
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 5					**9.66**
	2 BHK	6	Living	4.62	17.70	6.67
			Kitchen	2.20	6.75	8.33
			B 1	4.40	10.73	10.48
			B 2	4.40	9.73	11.56
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	3.15	9.23
	Average of Flat 6					**9.34**
	2 BHK	7	Living	4.62	14.44	8.18
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	9.24	12.17
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 7					**10.27**
	Average of Typical Floor					**9.68**
Refuge Floor 5^{th} ,10^{th} ,15^{th} ,20^{th} ,25^{th},30^{th}, 35^{th} Floor (Refer **Figure 1.8**)	2 BHK	1	Living	4.62	15.73	7.50
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.18	11.04
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 1					**9.63**
	2 BHK	2	Living	4.62	18.18	6.49
			Kitchen	2.20	6.48	8.68
			B 1	4.40	10.39	10.83
			B 2	4.40	10.18	11.04

Floor	Flat Type	Flat No.	Spaces	Window Area (m2)	Area of Room (m2)	ACH
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 2					**9.42**
	2 BHK	3	Living	4.62	17.70	6.67
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.24	12.17
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 3					**9.68**
	2 BHK	4	Living	4.62	16.73	7.06
			Kitchen	2.20	6.48	8.68
			B 1	4.40	9.61	11.70
			B 2	4.40	10.18	11.04
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 4					**9.66**
	2 BHK	5	Living	4.62	17.70	6.67
			Kitchen	2.20	6.75	8.33
			B 1	4.40	10.73	10.48
			B 2	4.40	9.73	11.56
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	3.15	9.23
	Average of Flat 5					**9.34**
	2 BHK	6	Living	4.62	14.44	8.18
			Kitchen	2.20	5.84	9.63
			B 1	4.40	9.24	12.17
			B 2	4.40	9.24	12.17
			Toilet 1	1.02	2.98	9.75
			Toilet 2	1.02	2.98	9.75
	Average of Flat 6					**10.27**
	Average of Refuge Floor					**9.67**

B. Indoor ventilation assessment – Simulation method

Indoor Ventilation Assessment – Eucalyptia Building

The Typical floor plan of the Eucalyptia building indoor ventilation assessment is shown in **Figure 1.9**

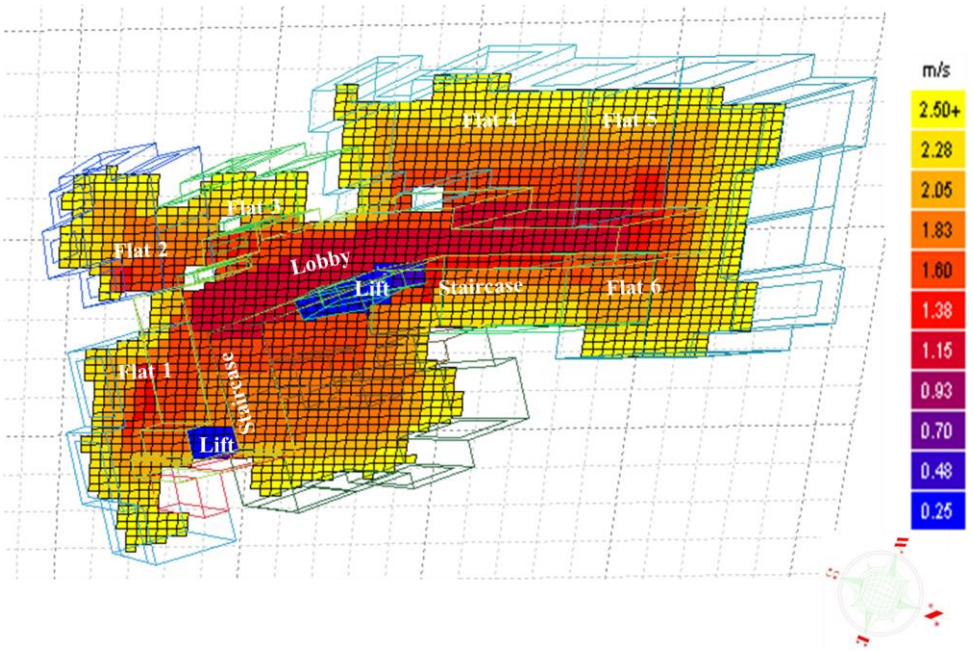


Figure 1.9: Indoor ventilation assessment (m/s) of typical floor plan of Eucalyptia building

0.25 m/s to 2.50 m/s wind speed can be observed for typical floor plan of Eucalyptia building

ACH (Observed): 9.69 CFM ACH (Required As per IGBC): 6.5 CFM per person

Indoor Ventilation Assessment – Fenelia Building

The Typical floor plan of the Fenelia building indoor ventilation assessment is shown in **Figure 1.10**

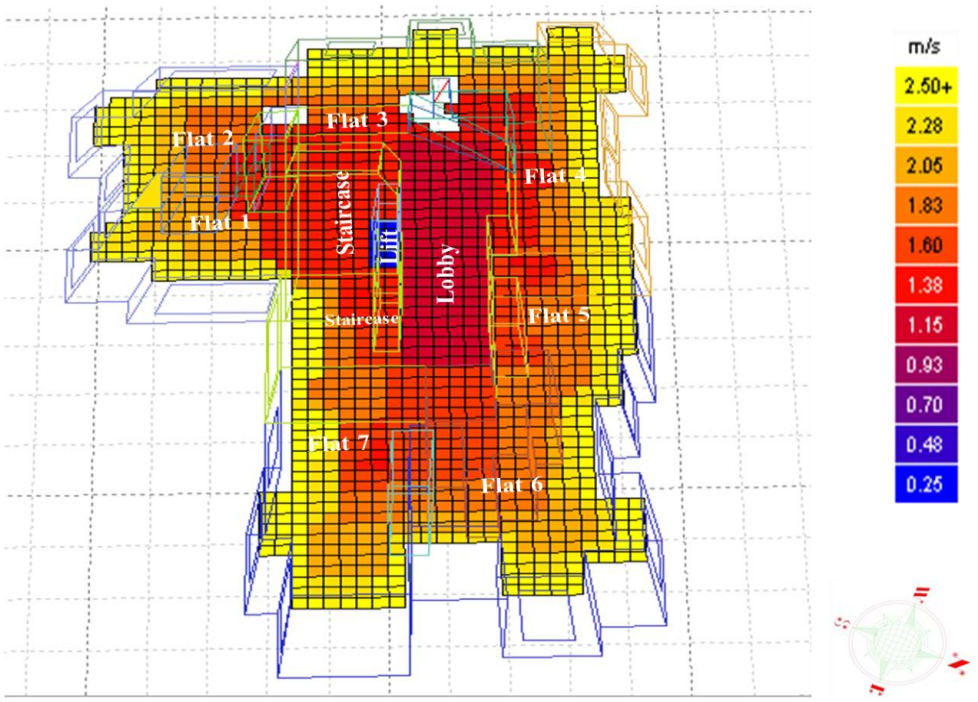


Figure 1.10: Indoor ventilation assessment (m/s) of typical floor plan of Fenelia building

0.25 m/s to 2.50 m/s wind speed can be observed for typical floor plan of Fenelia building

ACH (Observed): 9.68 CFM ACH (Required As per IGBC): 6.5 CFM per person

6.0 Mitigating Indoor Air Quality Problem:-

In order to mitigate the problem of IAQ, efforts must be taken to identify and control the pollution sources. Source control is generally the most cost effective approach to mitigating IAQ problems in which point sources of contaminants can be identified. In the case of a strong source, source control may be the only solution that will work. The following are categories and examples of source control:

a. Modify the environment

Cleaning and disinfecting area which are contaminated by fungal or bacterial growth, control humidity to make conditions in hospitable for re-growth. In some cases, modification of the environment is necessary for effective mitigation. If the indoor air problem arises from microbiological contaminants, for example, disinfection of the affected area may not eliminate the problem. Re-growth of micro-biological could occur unless humidity control or other steps, such as adding insulation to prevent surface condensation, are taken to make the environment inhospitable to microbiological.

b. Ventilation

Ventilation modification is often used to correct or prevent indoor air quality problems. This approach can be effective either where buildings are under-ventilated or where a specific contaminant source. There would be six buildings in the proposed site. They would have different types of flats along with different area. All these structures have been designed to provide appropriate sizes of windows which would meet the indoor air quality as per ASHRAE standards.

The main urban climatic factors in high density cities that affect thermal comfort are lower urban wind speed, higher temperatures and restricted access to solar energy compared with climatic conditions in low density cities placed in a similar natural climate. Mumbai is high density city having average annual wind speed about 3.2 m/s (as procured from MPCB). Lower outdoor wind speed reduces ventilation rate and indoor air speed of naturally ventilated buildings. The higher outdoor temperature elevates the indoor temperature of buildings, thus likelihood and severity of thermal discomfort. Indoor air quality is depends on temperature, humidity and wind speed. As per standards given in NBC, 2016 the acceptable wind speed will

be between around 0.23 m/s to 2.10 m/s as per considering maximum relative humidity and temperature around 31 -33^{0}C.

c. Air Change Rate (ACH)

As per NBC 2016, Air Exchange Rate (ACH) should be 4 to 6 ACH. This would dissipate most of the indoor pollutants. This would lead to better standard of living for residents of proposed buildings. Proposed site would have 2 buildings for amendment having different types of flats. ACH would depend on the volume of the room as well as door and window opening. It would also depend on wind movement, its speed and direction. The average annual wind speed of Mumbai was procured from MPCB. It is about 3.2 m/s. Ventilation rate is also important in order to maintain the IAQ of a building. Both ACH and ventilation rate were calculated as per ASHRAE standard.

7.0 Conclusion and Recommendations:-

- Proposed project would be developed with following standards and codes:
  - National Building Code of India (NBC) 2016
  - ASHRAE Hand Books
  - Relevant BIS Codes & SMACNA standards
  - Air filters as per ASHRAE 52.1-1992 and 52.2-2007
  - Indoor Air Quality as per ASHRAE 62.1-2007
  - National Fire Codes (NFPA) - 2018
- The design aspects of the proposed buildings have incorporated required wind speed between 0.25 – 2.5 m/s as per NBC, 2016 (Standard: 0.23 m/s to 2.10 m/s).
- Since the project is of residential in nature, enclosed and centralized air conditioning is not envisaged. Residents are likely to keep their windows and doors open on a regular basis
- The building maintenance services shall be asked to also include indoor air causing agents clean up/ maintenance, such as carpets, curtains, rugs, etc on regular basis.
- Indoor plants can improve the aesthetic value as well as IAQ. Some of them are peace lily, devil's ivy, acacia palm, money plant, goose foot plant, dwarf bamboo plant, etc.
- The developer would be using low VOC or VOC free and lead free paints. During renovation or any changes, residents would be advised to use similar or better type

(ecofriendly) paints. Developer would provide a list of eco-friendly paints to society manager.

- The types of window that can be proposed is given in **Table 1.5**

Table 1.5: Types of windows can be proposed for flats

Floor	Flats	Type of room	Window Glazing VLT of Glass	Type of windows		
				3W	2W	Casement
Eucalyptia building						
1st Floor	2 BHK	Living	0.41	✓	✓	✓
		Kitchen	0.53	✓	✓	✓
		Bed room 1	0.27	✓	✓	✓
		Bed room 2	0.27	✓	✓	✓
		Toilet 1	-	✓	✓	✓
		Toilet 2	-	✓	✓	✓
Typical Floor (2nd to 4th and 6th to 9th and 11th to 14th and 16th to 19th and 21st to 24th and 26th to 29th and 31st to 34th floor)	2 BHK	Living	0.41	✓	✓	✓
		Kitchen	0.53	✓	✓	✓
		Bed room 1	0.27	✓	✓	✓
		Bed room 2	0.27	✓	✓	✓
		Toilet 1	-	✓	✓	✓
		Toilet 2	-	✓	✓	✓
Refuge Floor (5th; 10th; 15th; 25th; 30th , 35th floor)	2 BHK	Living	0.41	✓	✓	✓
		Kitchen	0.53	✓	✓	✓
		Bed room 1	0.27	✓	✓	✓
		Bed room 2	0.27	✓	✓	✓
		Toilet 1	-	✓	✓	✓
		Toilet 2	-	✓	✓	✓
Fenelia building						
1st Floor	2 BHK	Living	0.41	✓	✓	✓
		Kitchen	0.53	✓	✓	✓
		Bed room 1	0.27	✓	✓	✓
		Bed room 2	0.27	✓	✓	✓
		Toilet 1	-	✓	✓	✓
		Toilet 2	-	✓	✓	✓
Typical Floor (2nd to 4th and 6th to 9th and 11th to 14th and 16th to 19th and 21st to 24th and 26th to	2 BHK	Living	0.41	✓	✓	✓
		Kitchen	0.53	✓	✓	✓
		Bed room 1	0.27	✓	✓	✓
		Bed room 2	0.27	✓	✓	✓
		Toilet 1	-	✓	✓	✓

Floor	Flats	Type of room	Window Glazing VLT of Glass	Type of windows		
				3W	2W	Casement
29th and 31st to 34th floor)		Toilet 2	-	✓	✓	✓
Refuge Floor (5th; 10th; 15th; 25th; 30th , 35th floor)	2 BHK	Living	0.41	✓	✓	✓
		Kitchen	0.53	✓	✓	✓
		Bed room 1	0.27	✓	✓	✓
		Bed room 2	0.27	✓	✓	✓
		Toilet 1	-	✓	✓	✓
		Toilet 2	-	✓	✓	✓