Profile: Unitized Curtain wall Alum Mullion Profile

Analysis Type: Thermal Analysis

Boundary Condition:

Delhi: Exterior: 46^{O}C Interior: 24^{O}C

Mumbai: Exterior: 33^{O}C Interior: 24^{O}C

Glass Performance Sheet (without framing effect)

Following mentioned Properties of Glass are Considered for Thermal Analysis to find out Heat Transfer Coefficient of Without Frame Glazing and With Frame Glazing.

Glass No	Location Used	Type	Make-Up	Visual Light Performance	Light Reflectance		SC	SHGC	U Value (Max. Summer)
				%	Ext %- Max	Int % - Max	Max	Max	Watts/m^2 K
G1	Typical Floors: Vision Glazing	DGU	6 mm H.S. Coated + 12 Air Space + 6 mm H.S. Clear Inner Glass	45	14	14	0.30	0.27	1.56

Results

Following Table gives the Heat Transfer Coefficient Value for With Frame and Without Frame Glazing for Delhi and Mumbai Environmenal Conditions:

Location	Options	Glazing Type	Ucw Value (W/m^{2}K)
Delhi	Option 1	Without Framing Effect	1.56
	Option 2	With Framing Effect	2.463
Mumbai	Option 3	Without Framing Effect	1.56
	Option 4	With Framing Effect	2.374

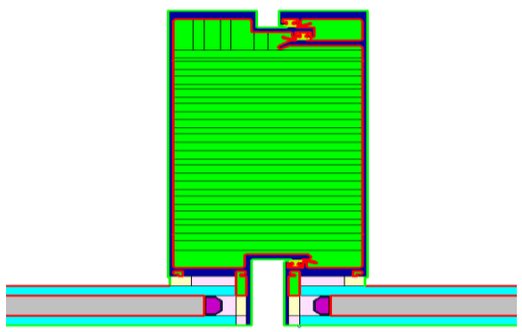
1.0 U- value Calculation

The purpose of this Thermal study is to Analyse Heat transfer Coefficient of Facade systems for change in the environmental Conditions.

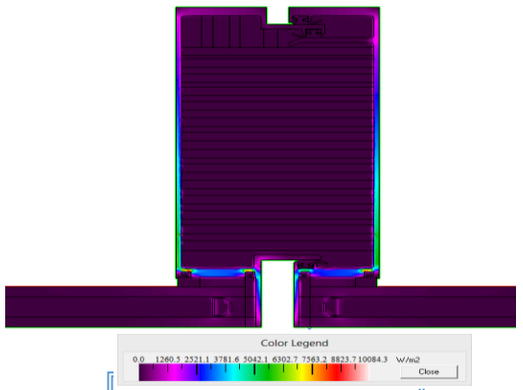
To Analyse the effect we have considered two different glazing i.e. Without Frame Glazing & With Frame Glazing. Glazing are Analysed in Environmental Condition of Delhi and Mumbai.

IGBC/LEED requires facade systems to consider overall thermal performances considering edge framing effect not jut glass alone. Unlike glass data which is available from the supplier, studying framing effect is little complex and time consulting process. Hence this study understand the impact of edge framing and advise

Image : Thermal flow of a typical curtain wall with Aluminium framing effect



Model of Framing



Heat Flux Distribution

Though the difference in U value is significant, the impact of overall energy is negligible as illustrated in following pages

Following are the General Assumptions and Key Design Inputs considered to Analyse the effect of change in Heat Transfer Coefficient Value of Glazing on Cooling Load.

General Assumption

Usage Type	Office
Air Condition Used	Yes
No of Floors Consider	2 (3rd & 4th Floor)
Floor Area Considered	36130 m^2

Key Design Input

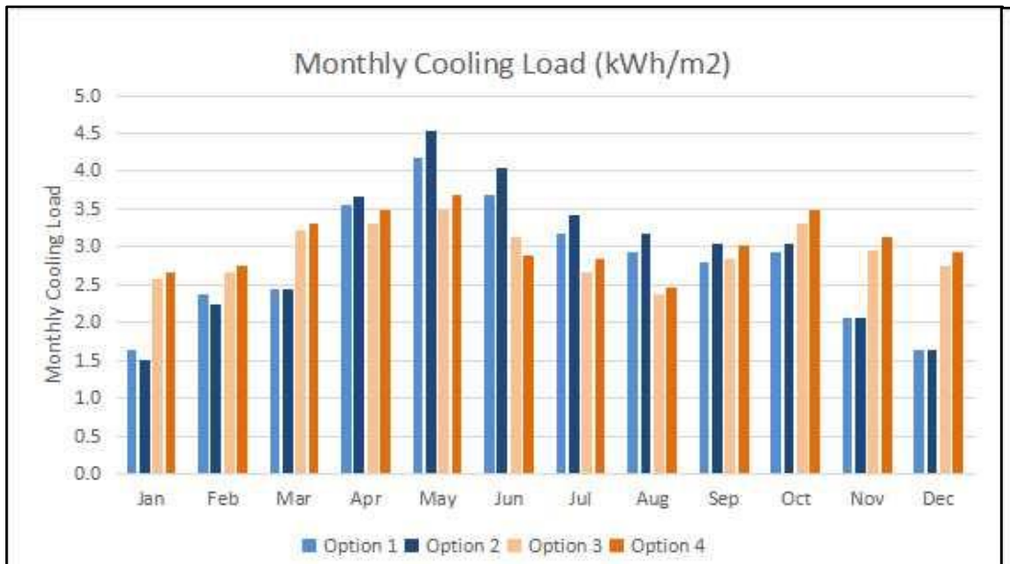
Aspects	Design 1	Design 2
Location	Delhi	Mumbai
Coordinates	28.61° N, 77.20° E	19.07° N, 72.87° E
Local Weather Station	New Delhi	Mumbai
Maximum Temperature	46° C	33° C
Minimum Temperature	3° C	20° C

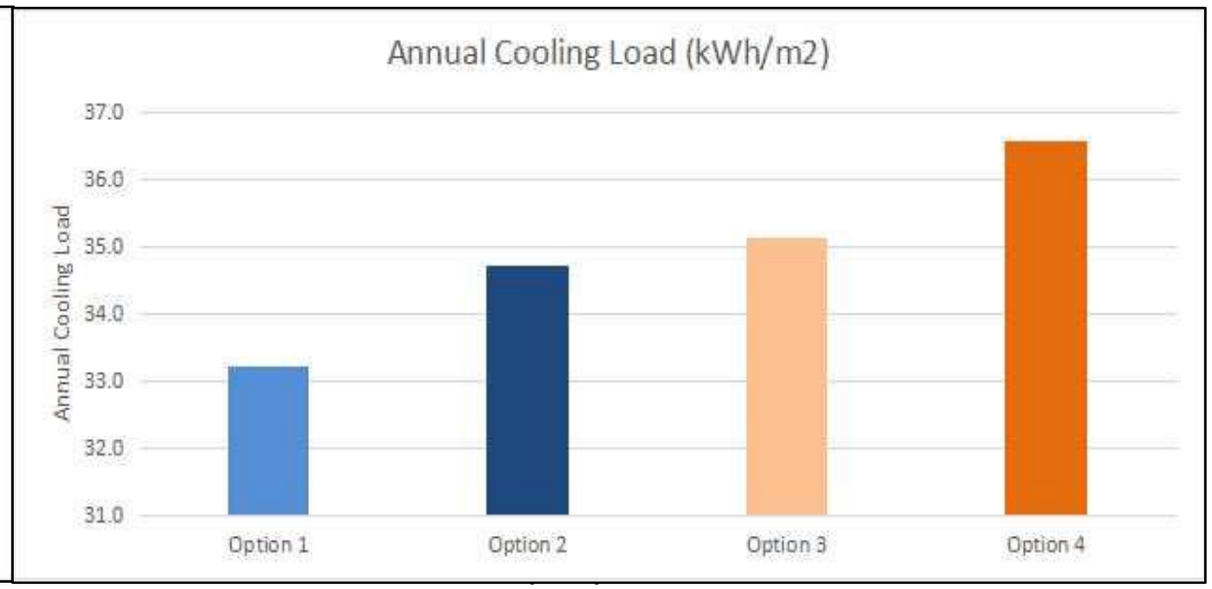
2.0 Energy Analysis:

The purpose of this Energy Analysis is to Analyse the effect of Heat Transfer Coefficient (U Value) on Annual Cooling Load for change in the environmental Conditions.

To Analyse the effect we have considered the U Value of Without Framing and With Framing Glazing and Simulated in Delhi and Mumbai Environmental Condition.

Following Images gives the Monthly and Annual Cooling Load for Without Frame Glazing & With Frame Glazing in Mumbai and Delhi Environmental Conditions





Legends:		
	Option 1	Delhi - Without Frame Effect
	Option 2	Delhi - With Frame Effect
	Option 3	Mumbai - Without Frame Effect
	Option 4	Mumbai - With Frame Effect

Results:

During the Winter Season October to February in Delhi Minimum Temperature is 3° C and in Mumbai 20° C. Because of this Monthly Cooling load in Delhi during Winter Season is Lower than Cooling Load of Mumbai.

During March to September Month in Delhi Maximum Temperature is 46° C and in Mumbai 33° C. Because of this Monthly Cooling load in Delhi during these Months is Higher than Cooling Load of Mumbai.

But only 6% Maximum Variation is found in Annual Cooling Load for Change in Environmental Condition.

Note: Energy values shown are not actual, They are for comparison purpose only.

Result Comparison Table

Following table gives the information about effect of Change in System and Environmental Conditions on Heat Transfer Coefficient and Annual Cooling Load.

Location	Options	Glazing	U Value (W/m^2K)	SHGC	Annual Cooling Load	
					kWh/m^2	% Increase
Delhi	Option 1	Without Framing Effect	1.56	0.27	33.207	Base Value
	Option 2	With Framing Effect	2.463	0.27	34.698	**4.49%**
Mumbai	Option 3	Without Framing Effect	1.56	0.27	35.122	5.77%
	Option 4	With Framing Effect	2.374	0.27	36.556	10.09%

Note: Energy valus shown are not actual, they are for comparison purpose only.

Findings :

From Above Thermal and Energy Analysis, We found that due to Change in Glazing Type from Without frame system to With Frame system there is about 36% rise in Heat Transfer Coefficient Value, But there is only 4.5% Variation in Annual Cooling Load for Environmental Condition of Mumbai and Delhi. Due to Change in Environmental Condition From Delhi to Mumbai, we found about 6% Variation in Annual Cooling Load for any type of Glazing. The Effect of change in Heat Transfer Coefficient have very less impact on the Annual Cooling Load. Hence we can Consider the Heat Transfer Coefficient of Without Frame Glazing for Calculation of Annual Cooling Load.

Code Based Vs Performance Approach

Code based is a generic approach, often not necessary yield optimum design approach. For Example U value for windows / fenestrations including framing effect less than 1.6 (W/m^2K) is highly challenge to achieve and results complex façade systems. For Hot climatic conditions energy impact of U value is negligible, rather SC / SHGC is very critical. Hence the performance approach shall have more flexibility in design and may result optimum and cost effective design solution for challenging design requirements.

3.0 Result Comparison

The adjacent table of Result Comparison Shows the Effect of Environment Condition on Heat Transfer through Without Frame Glazing and With Frame Glazing. Also the effect of Change in Heat Transfer Coefficient on Annual Cooling Load for Delhi and Mumbai Environmental Conditions.

Conclusion

The relative difference of overall energy impact (with and without framing effect) is not significant (**less than 5% only**).

Hence the designers and consultants do not have to go through extensive analysis and simulations during the design stage. There are several design options, comparisons of various facade systems and profiles will take significant time frame which will delay the design process.

Based on the study we conclude that framing effect for facade systems within hot climatic revisions shall be ignored at concept level which will help in quicker design finalisations in dealing complex design options. Furthermore a performance based approach shall verify the overall impact of energy rather than replying on a particular value.