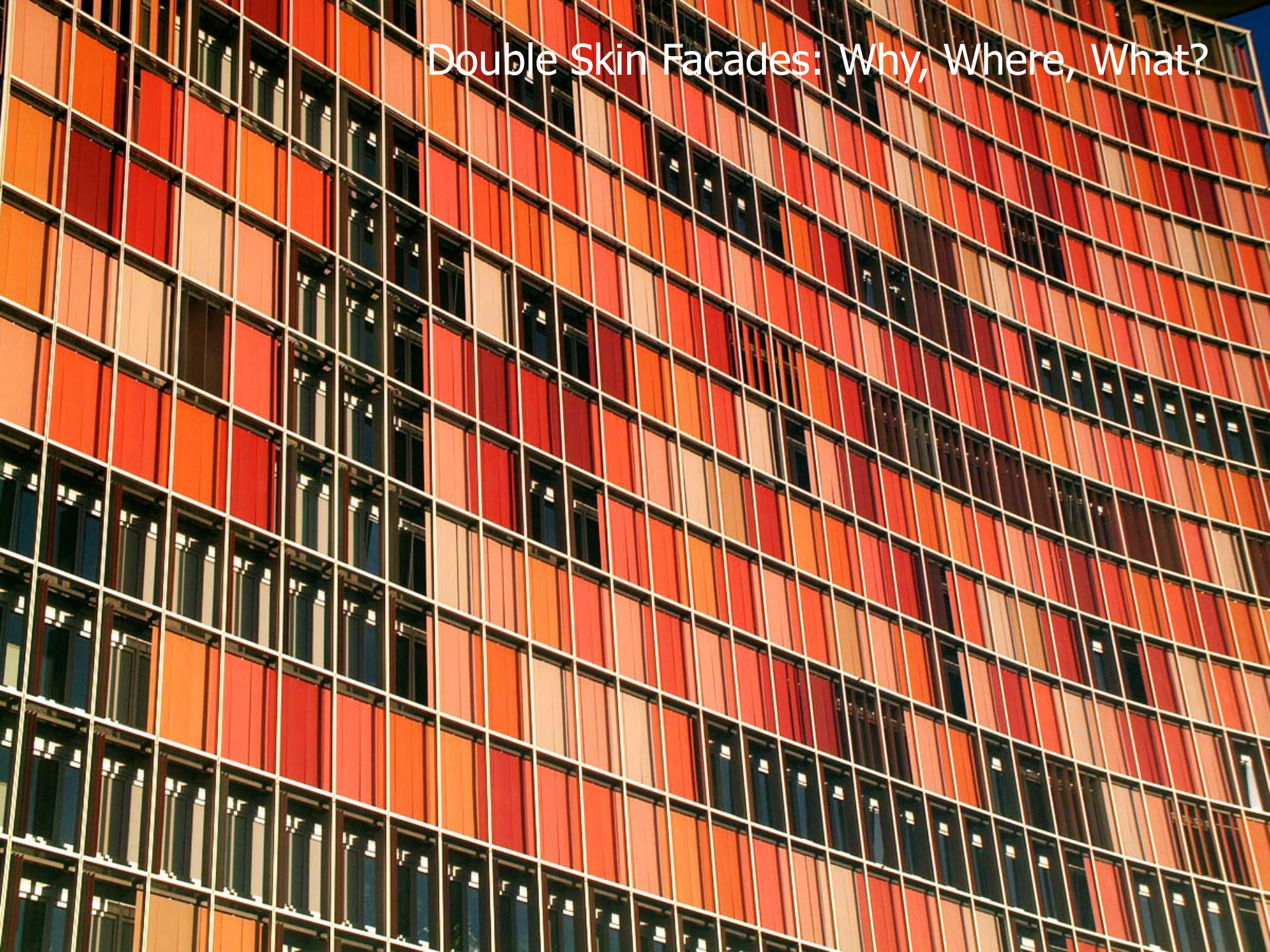
Double Skin Facades: Why, Where, What?



Classifying Double Skin Walls

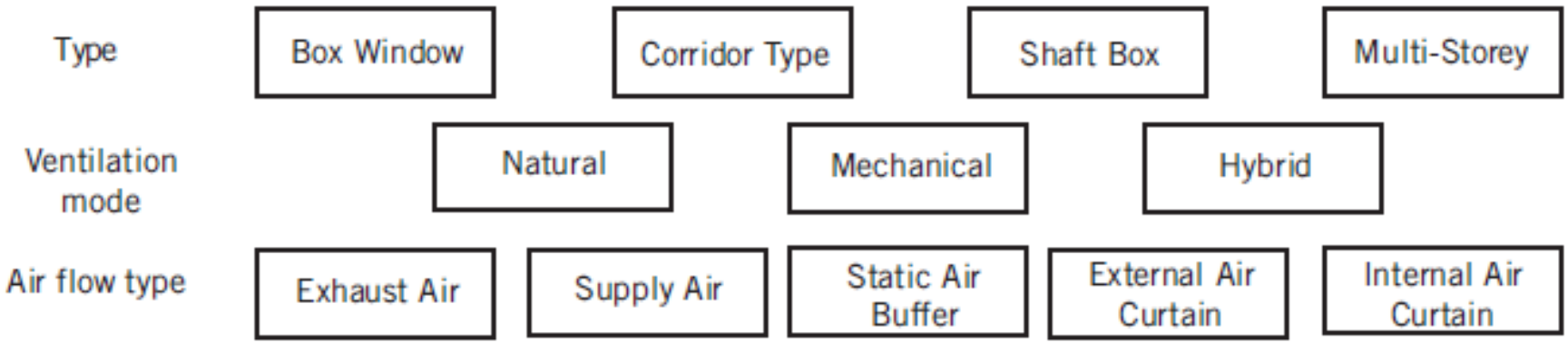
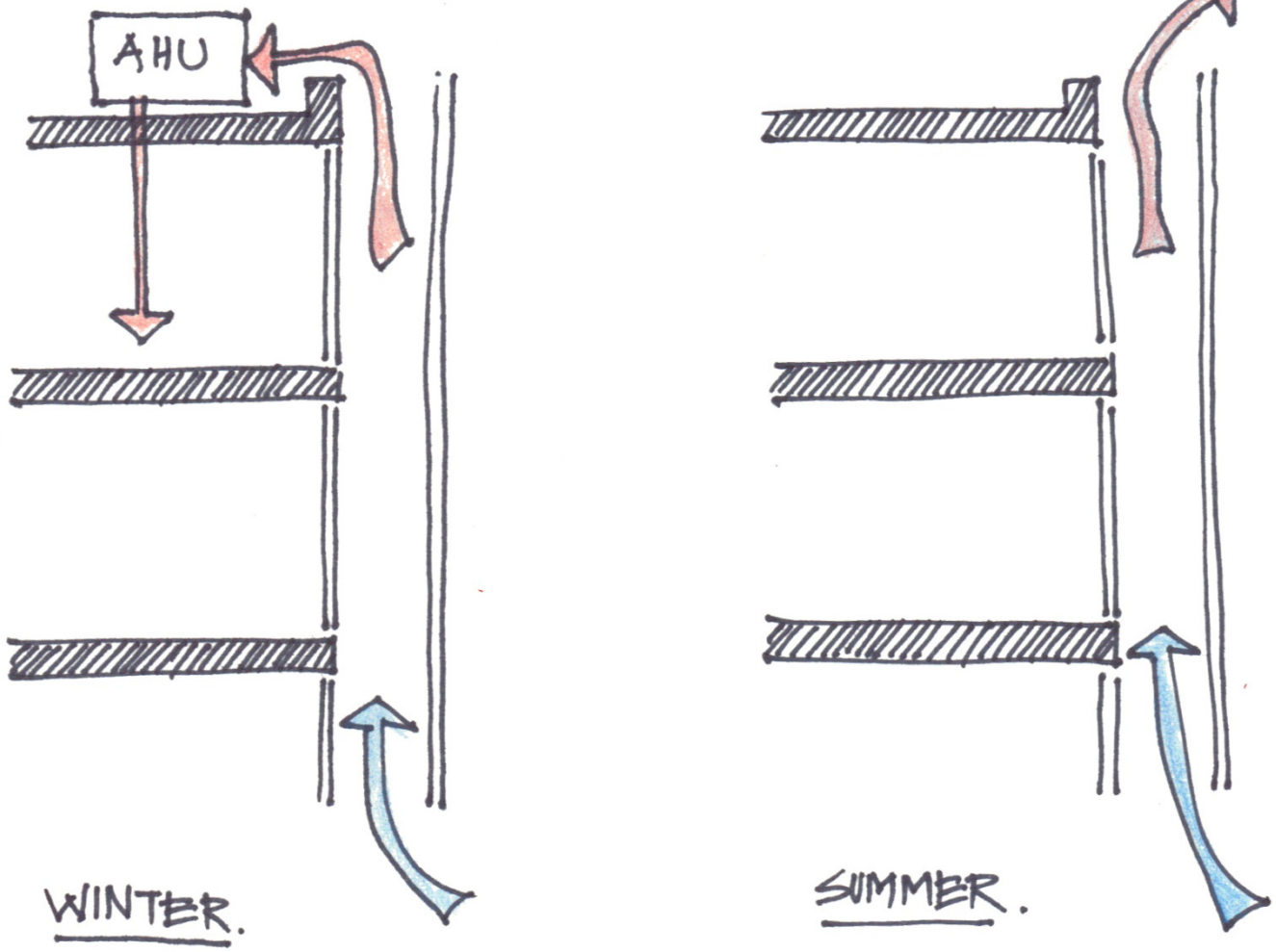


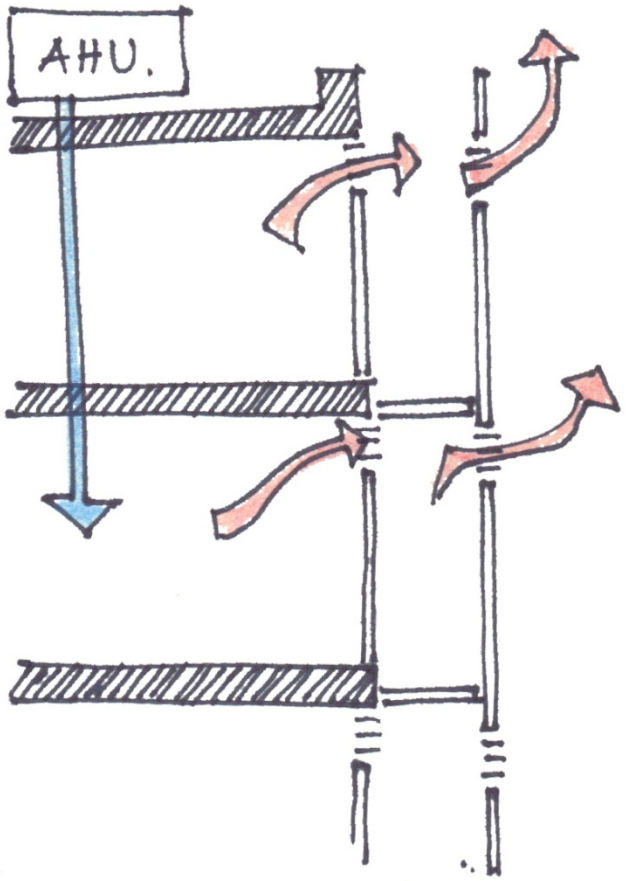
Figure 1: Classification of double skin walls.

Source: Perkins+Will Research Journal

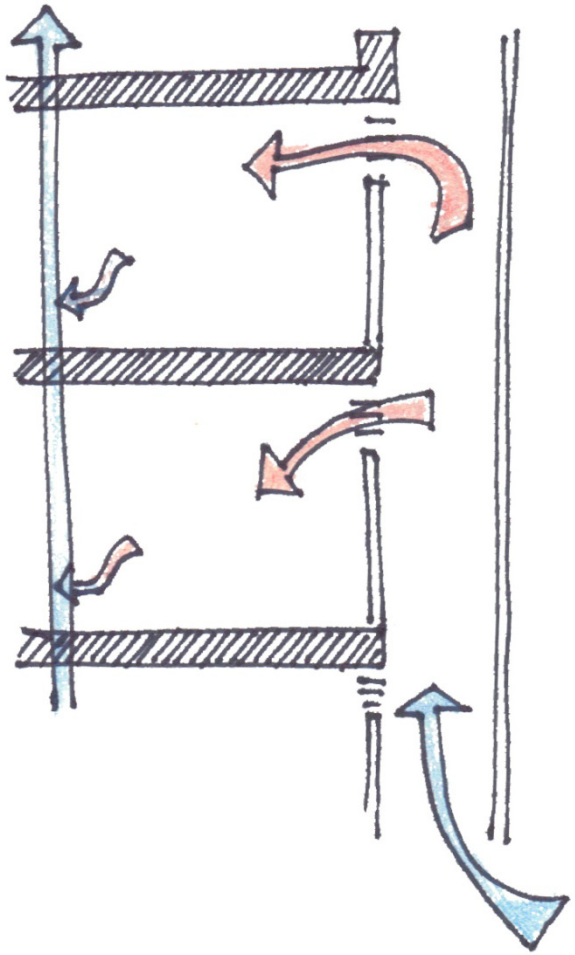
Double Skin Façade as a central direct pre-heater of the supply air

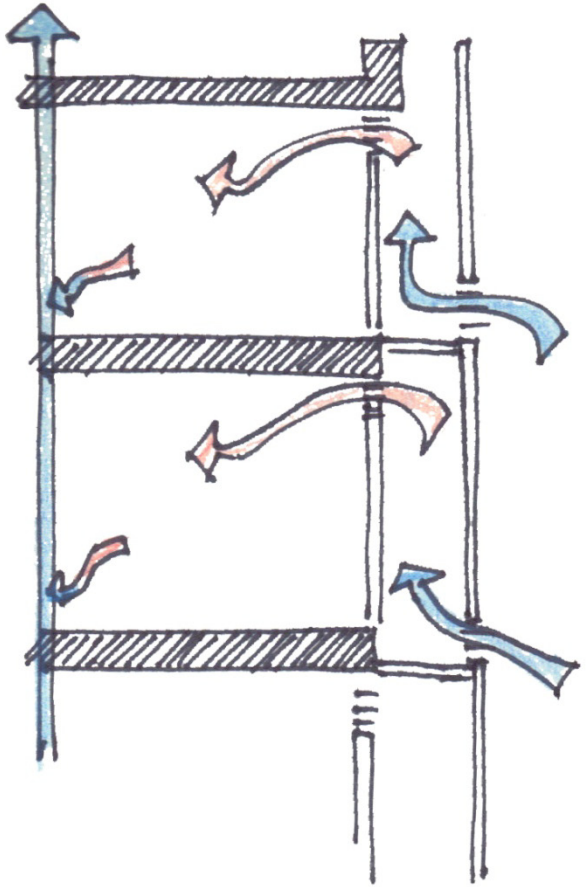


Double Skin Façade as an exhaust duct

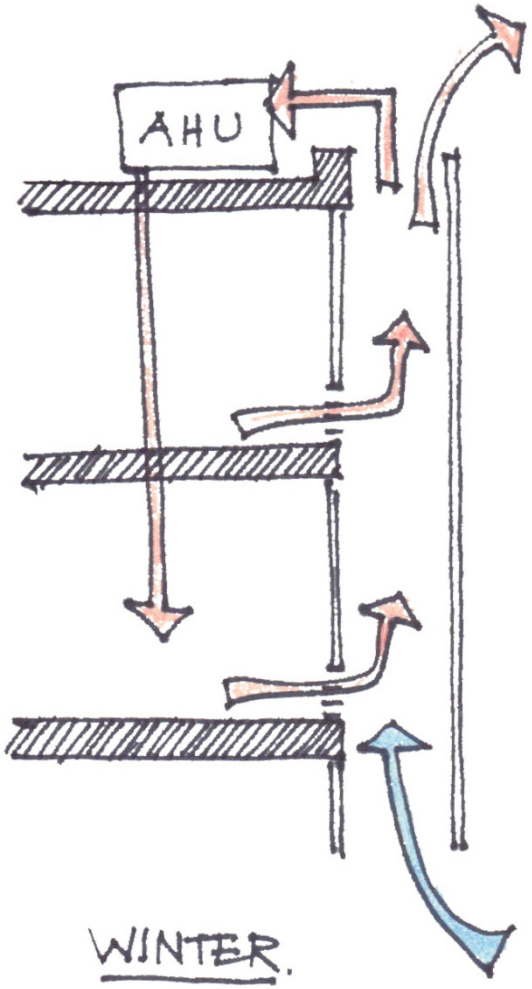


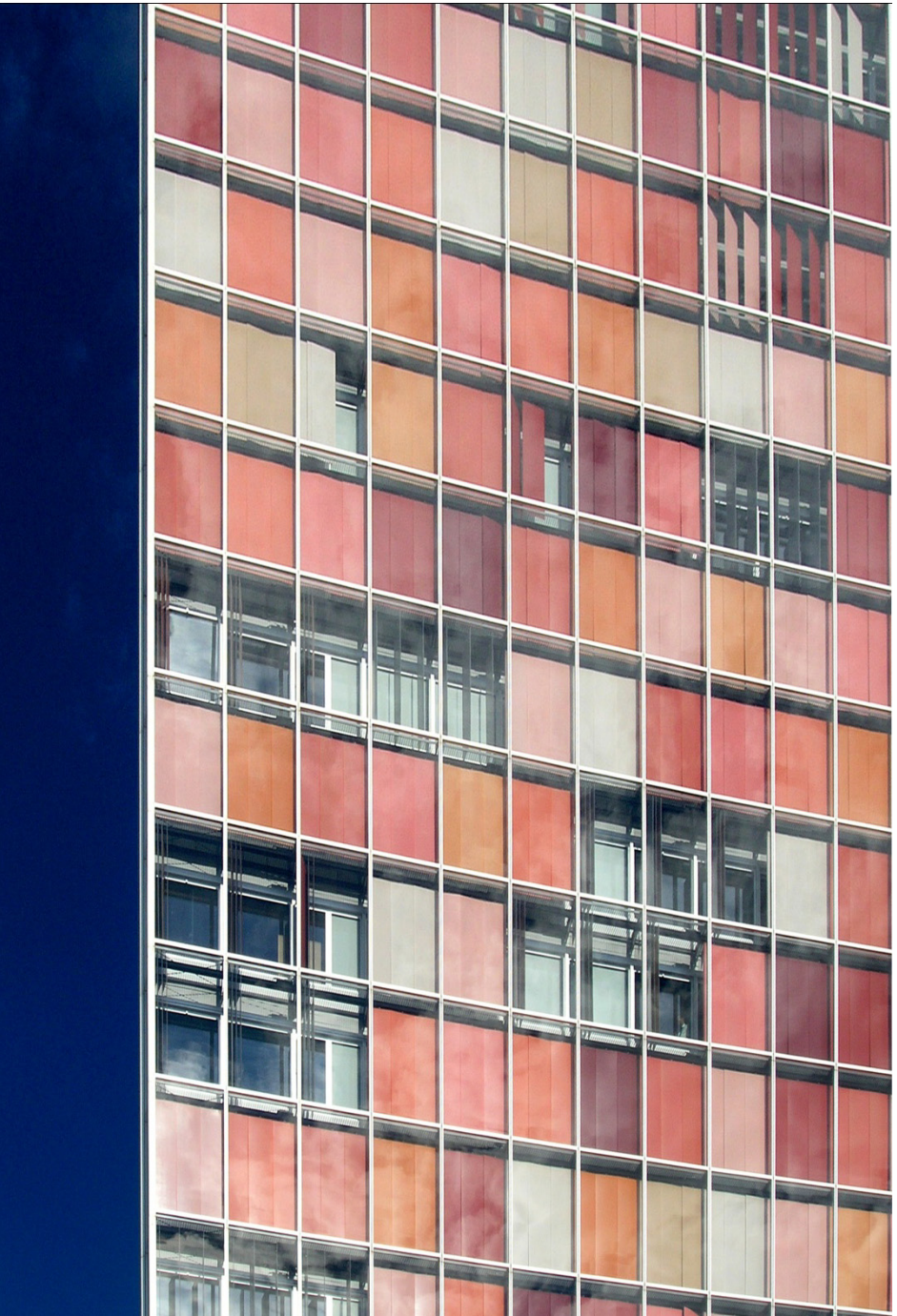
Double Skin Façade as an individual supply of the preheated air

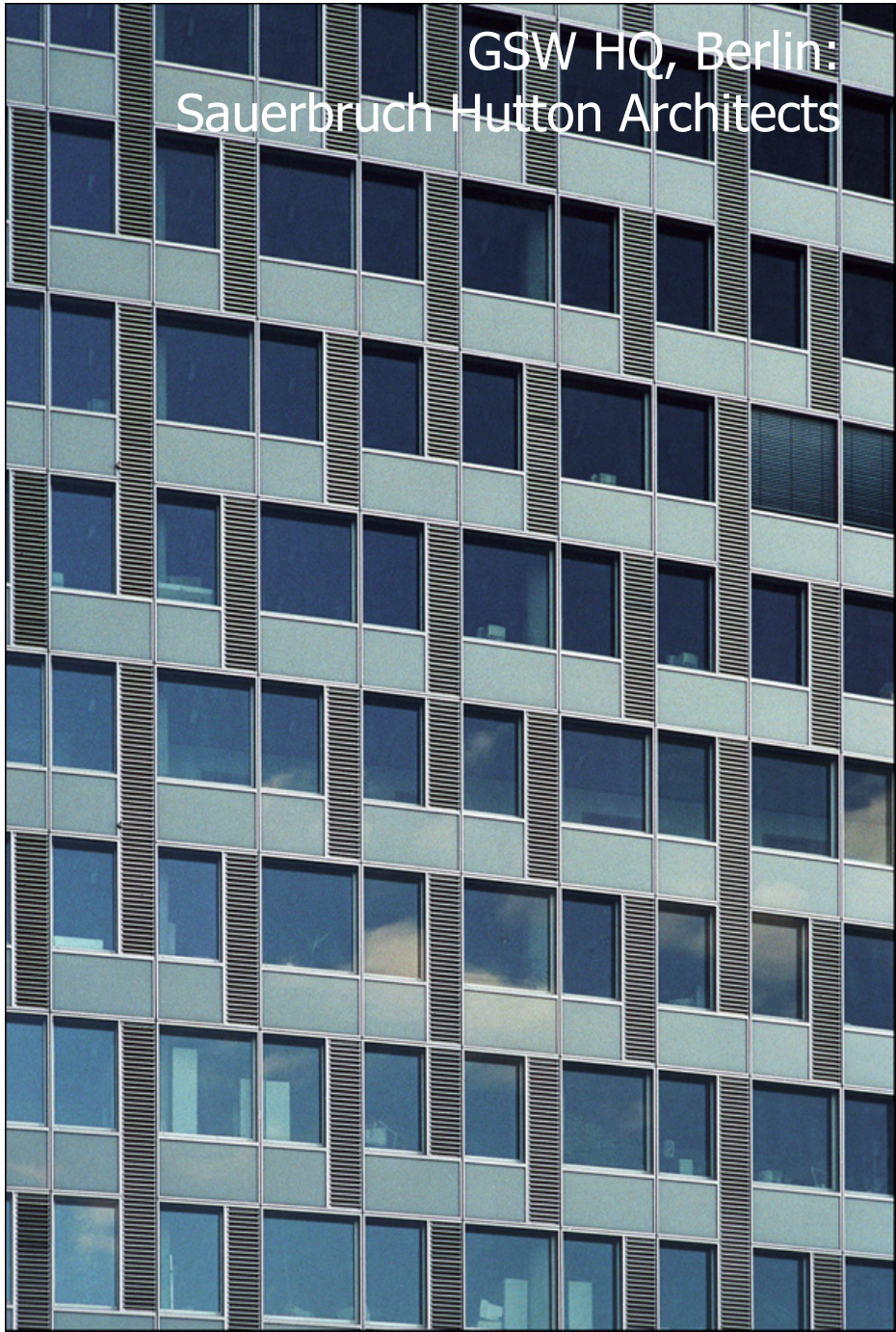




Double Skin Façade as a central exhaust duct for the ventilation system

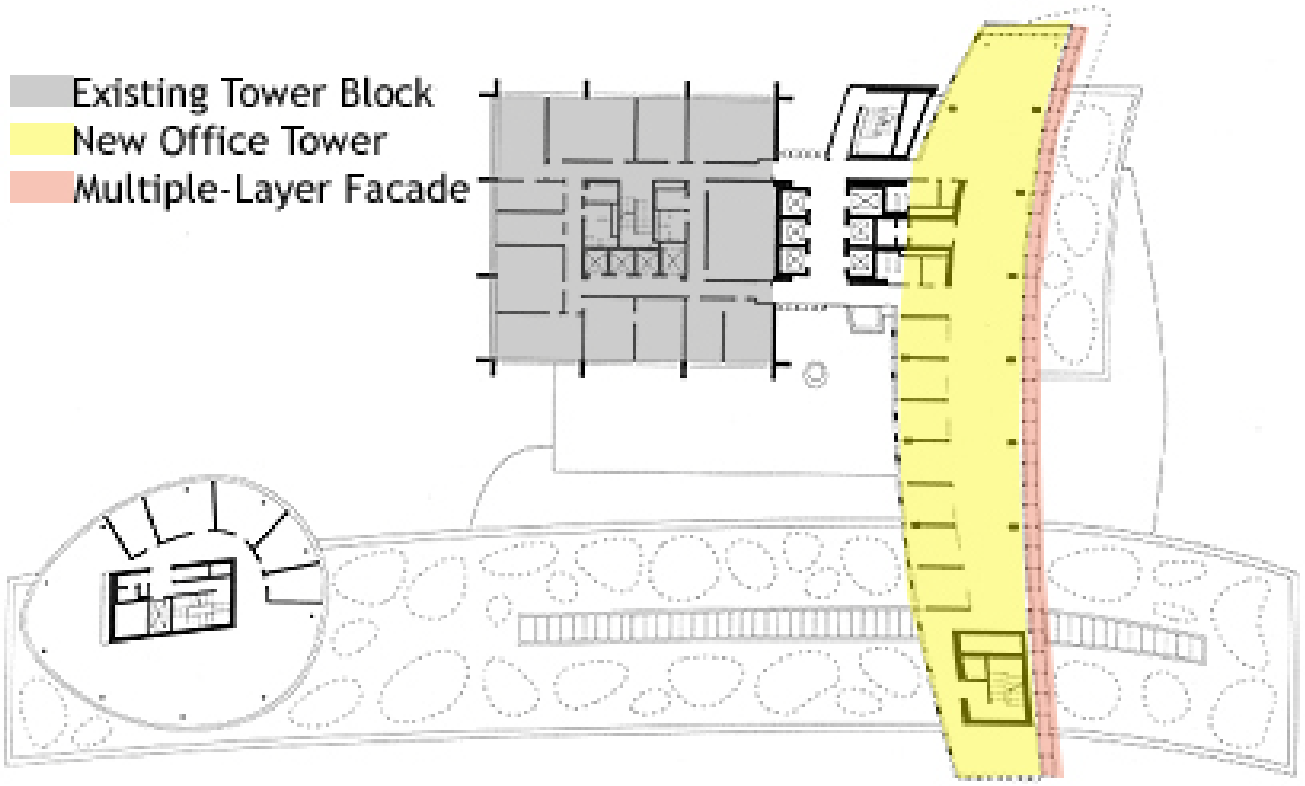






GSW HQ, Berlin:
Sauerbruch Hutton Architects

Double Skin Facades



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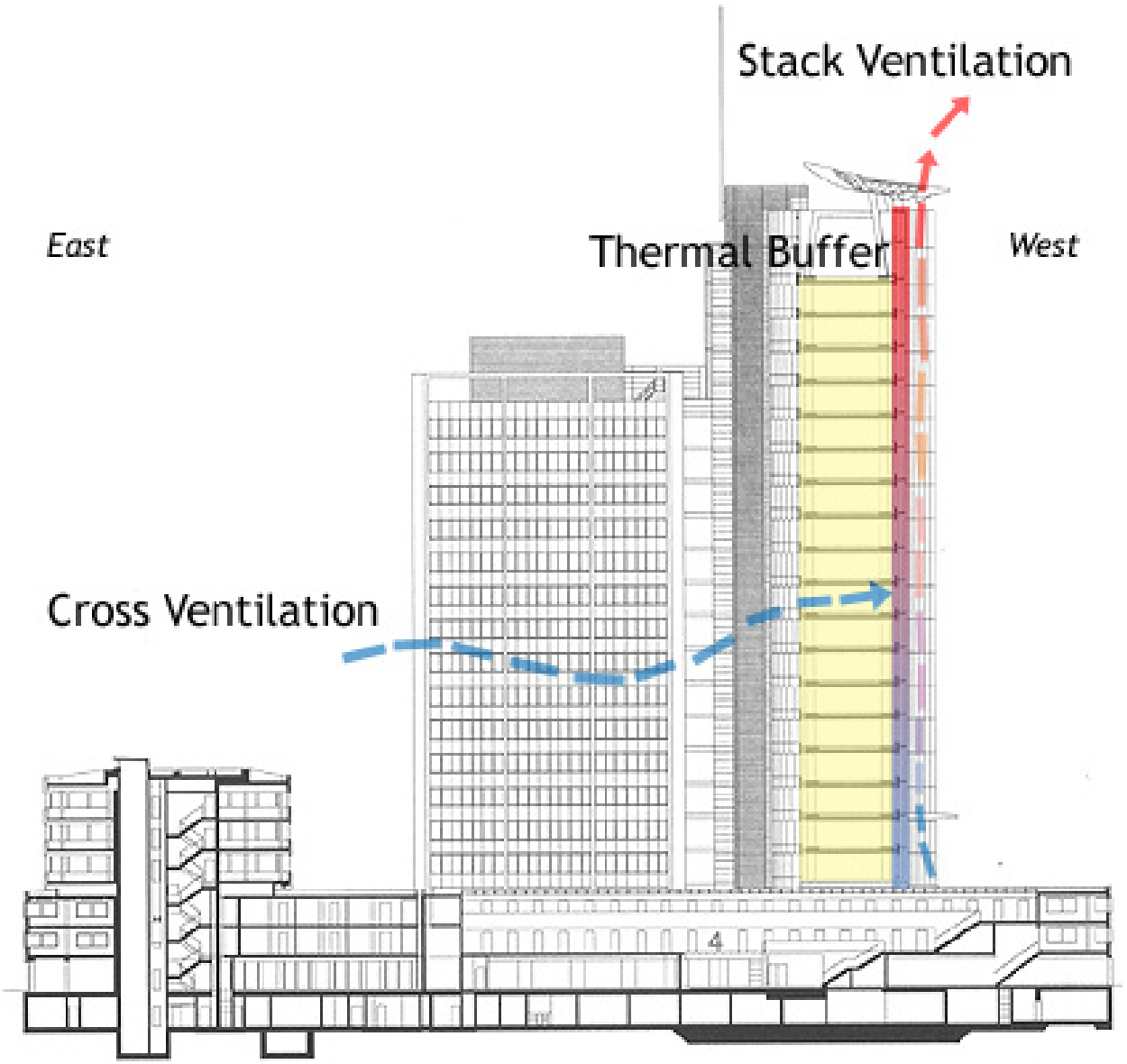

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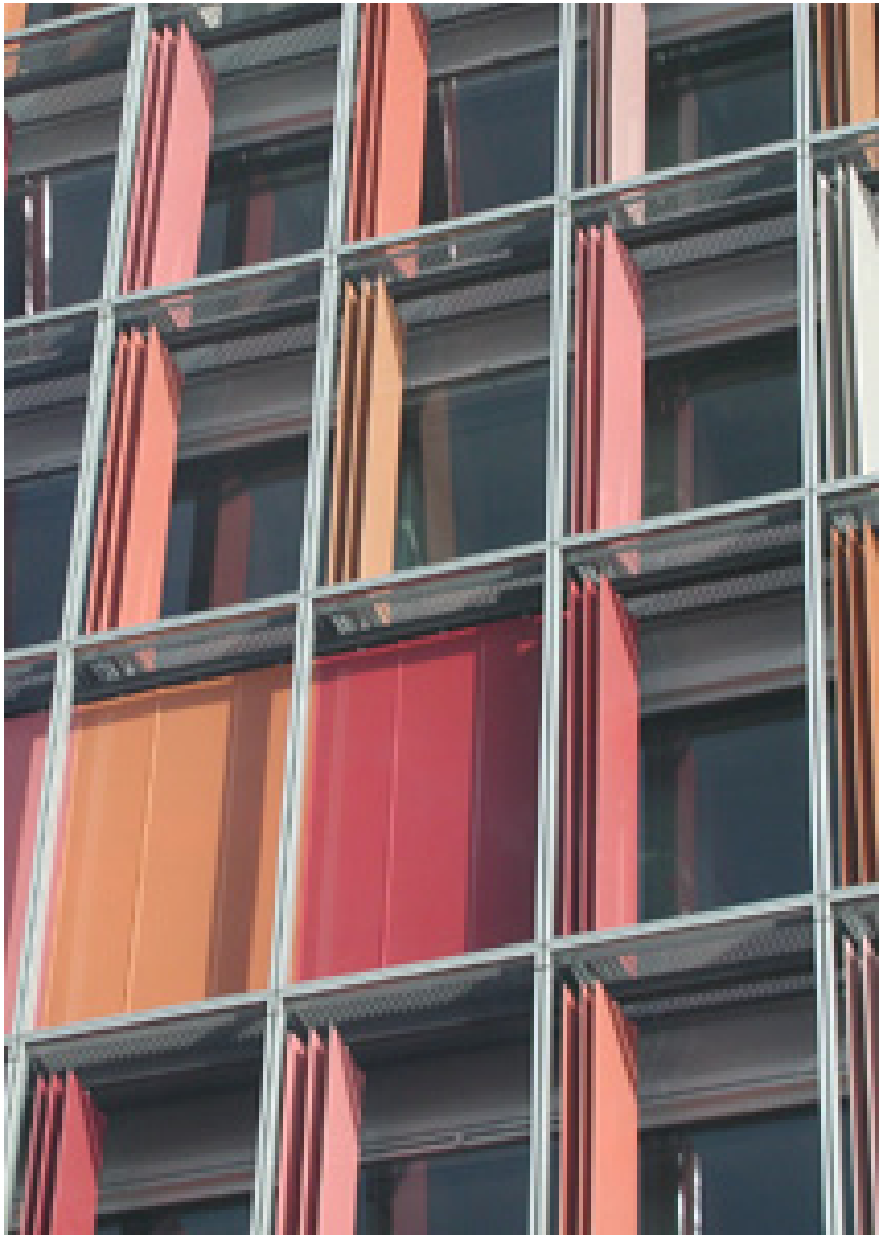
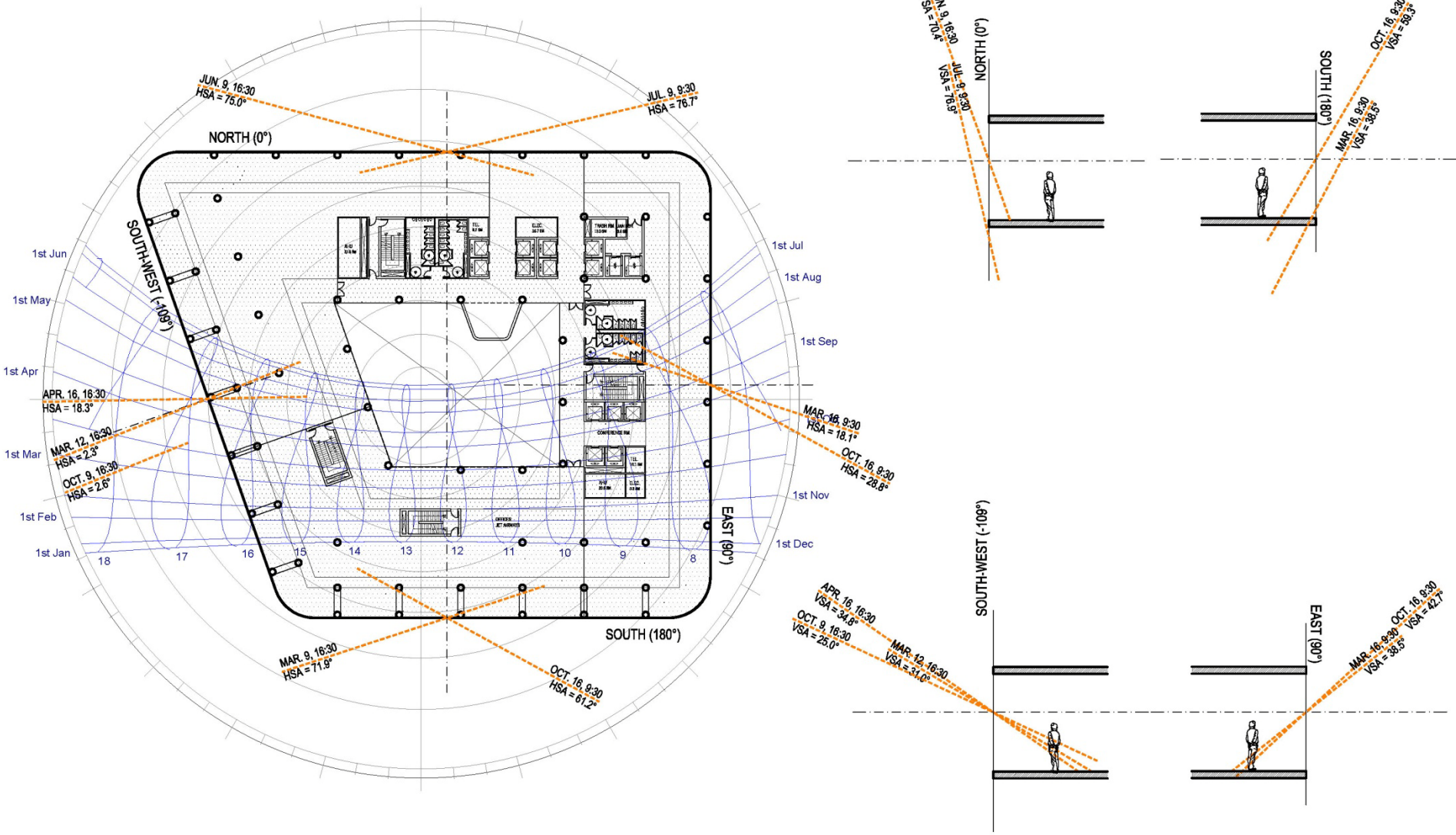
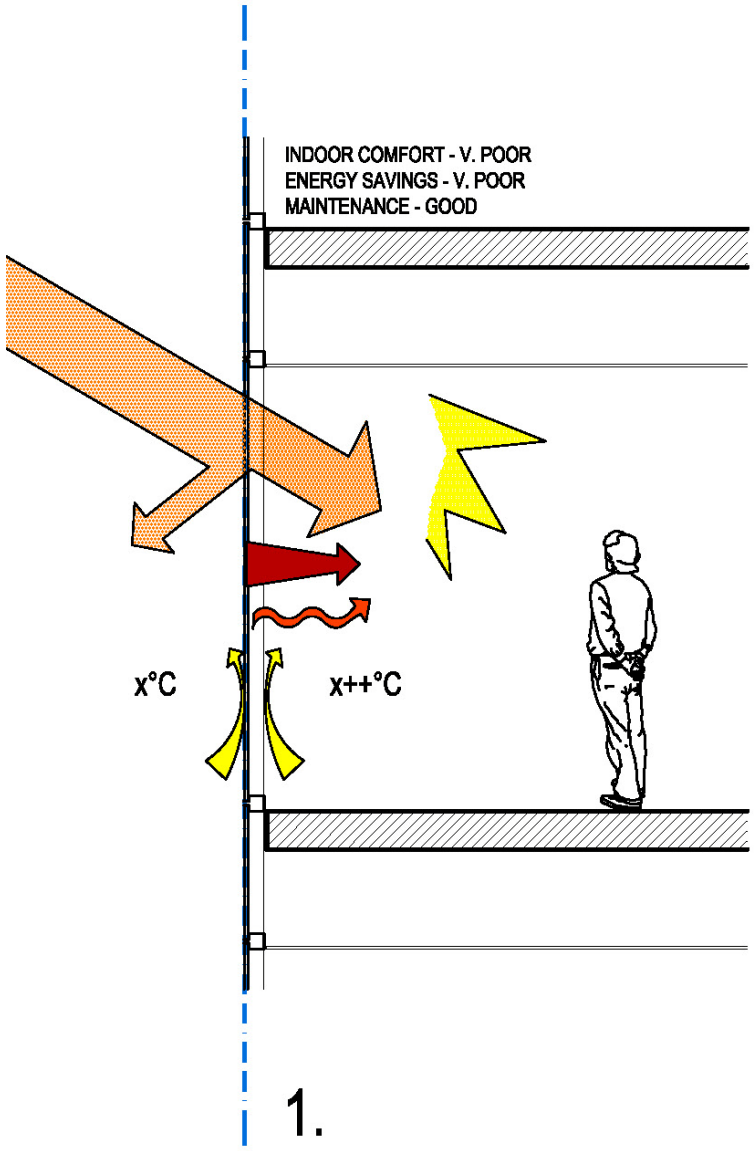


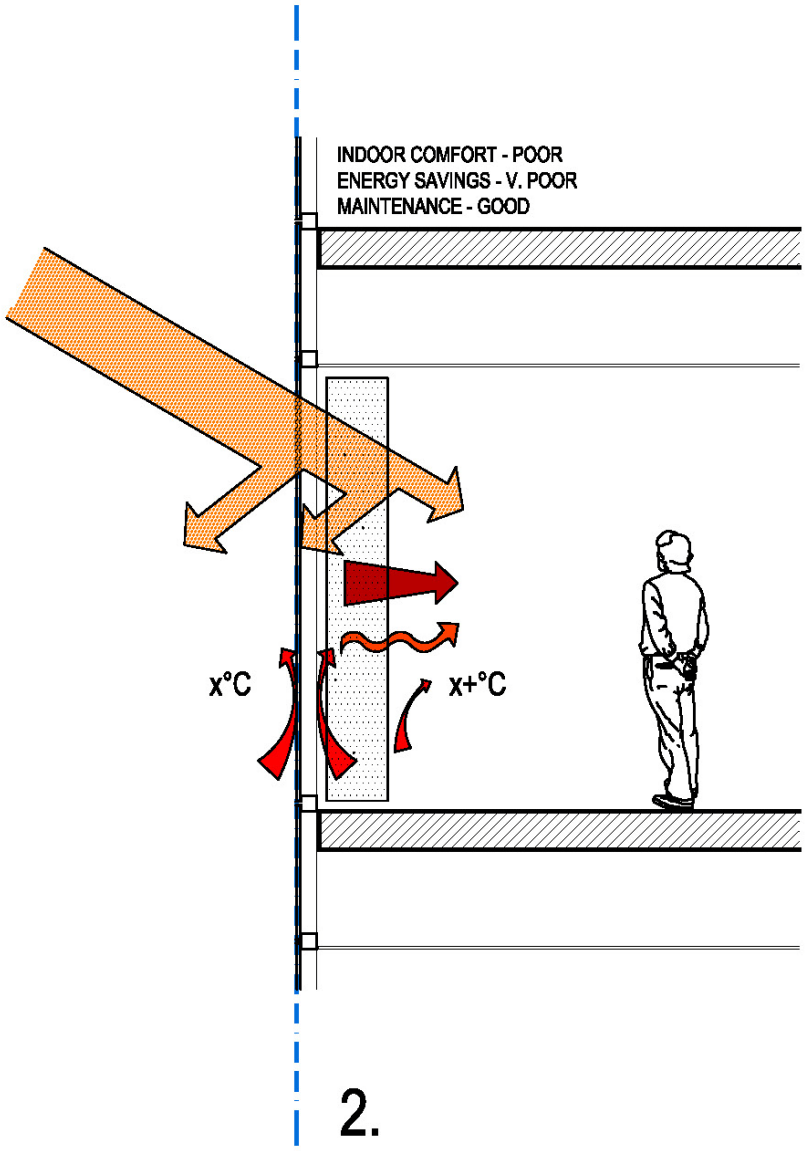
Jet Airways HQ, Mumbai - SOM

Double Skin Facades

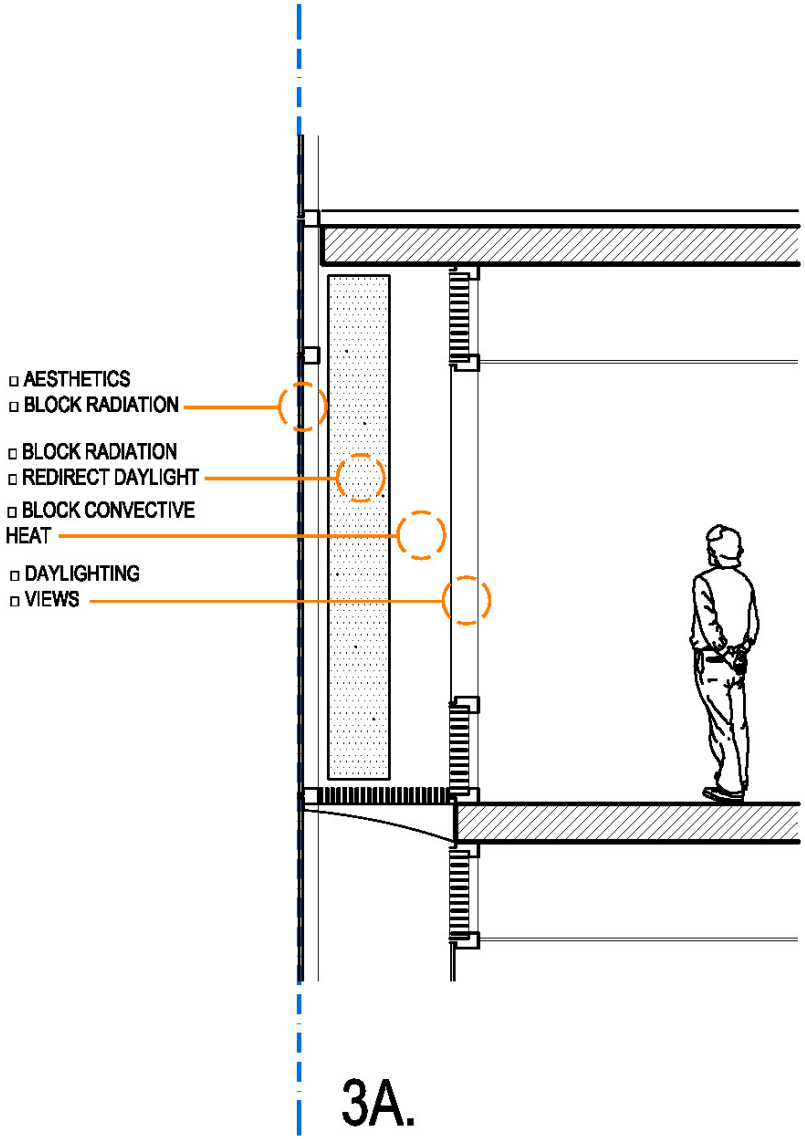


Double Skin Facades





Double Skin Facades



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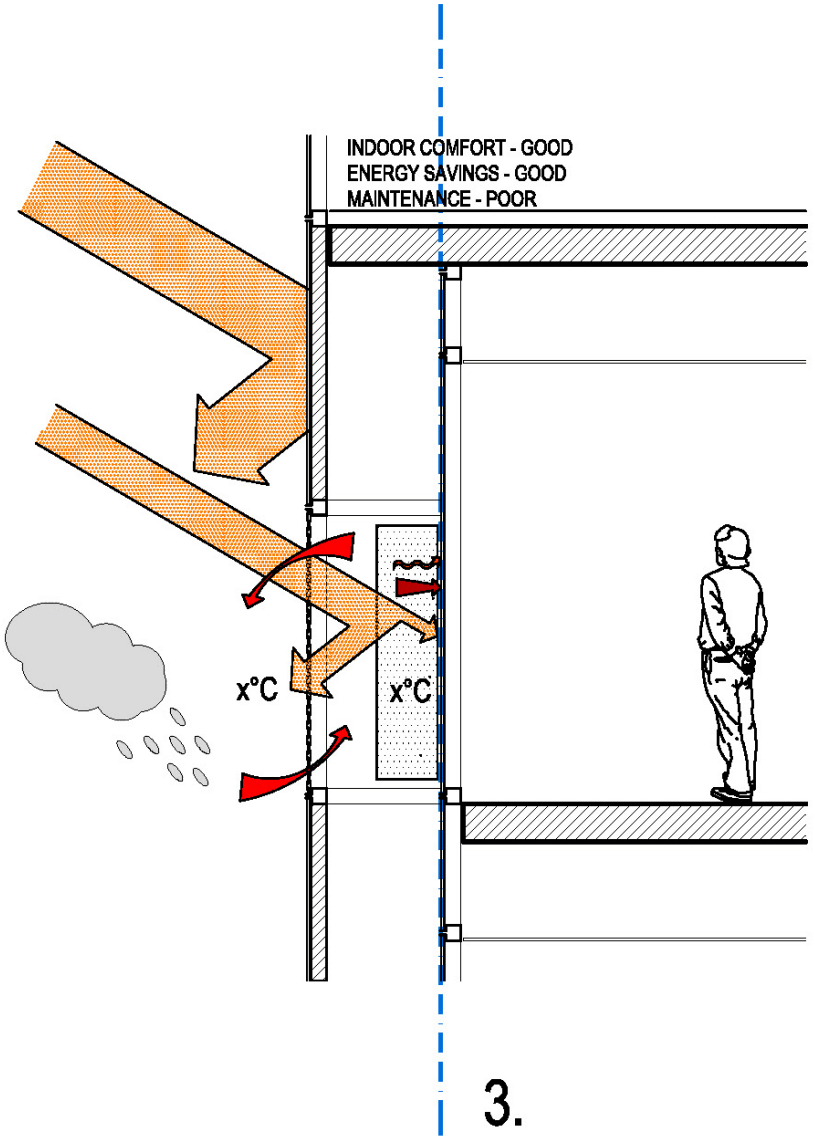

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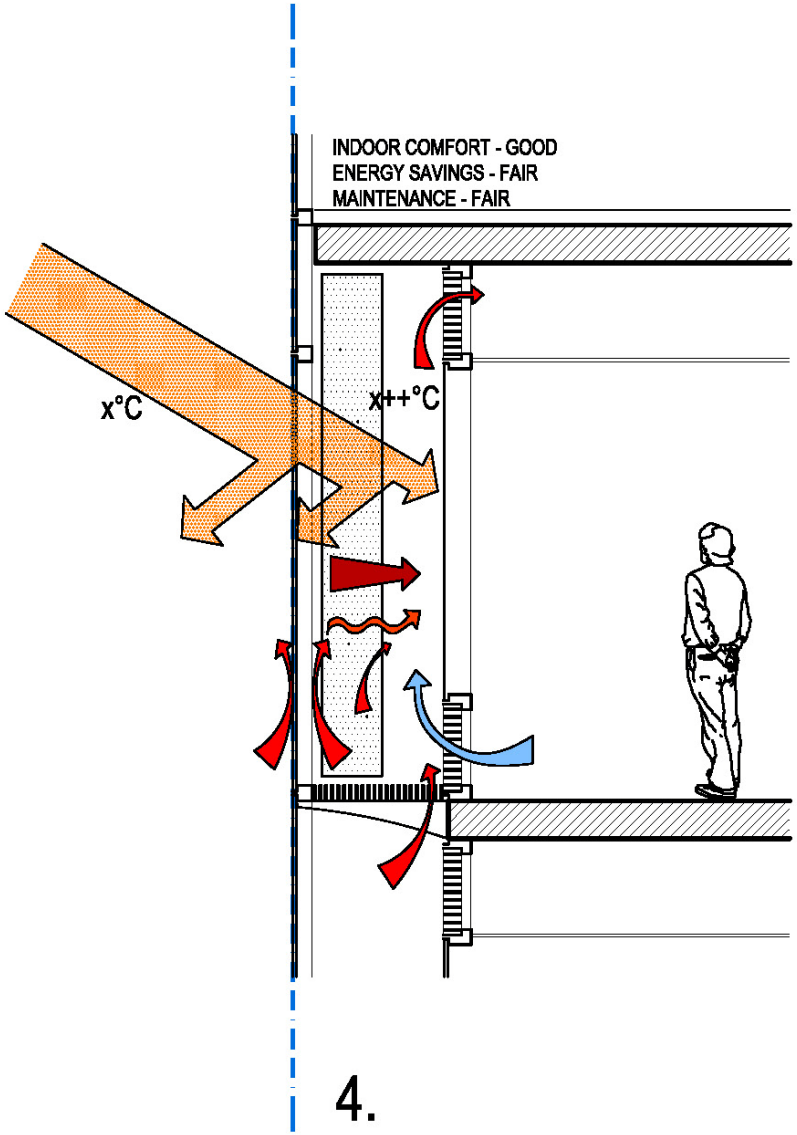
Double Skin Facades



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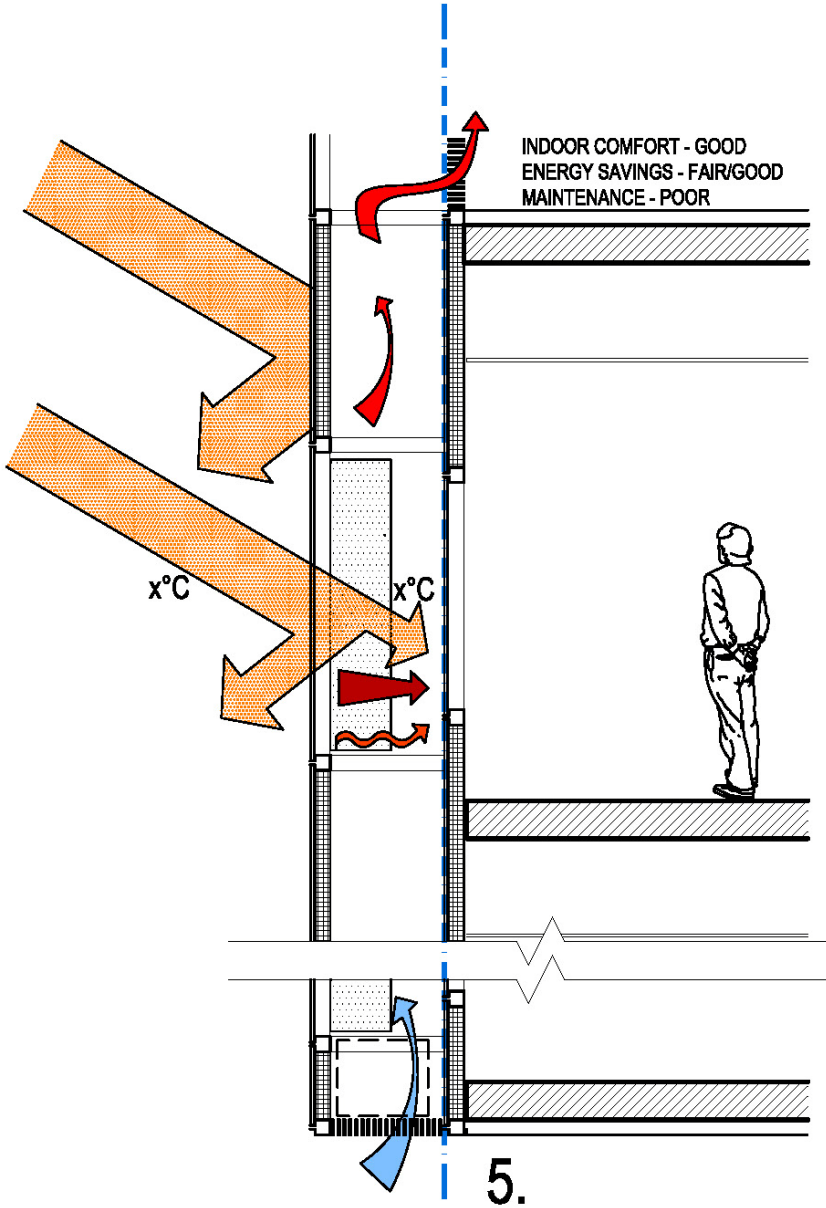

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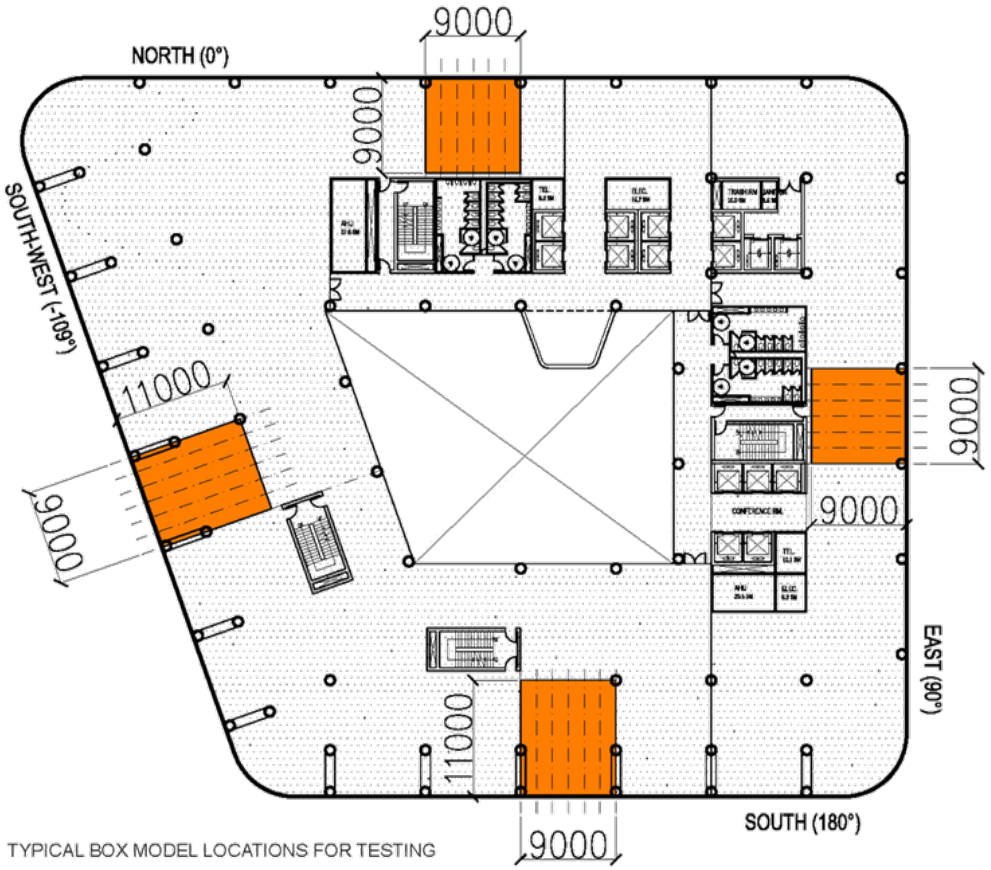
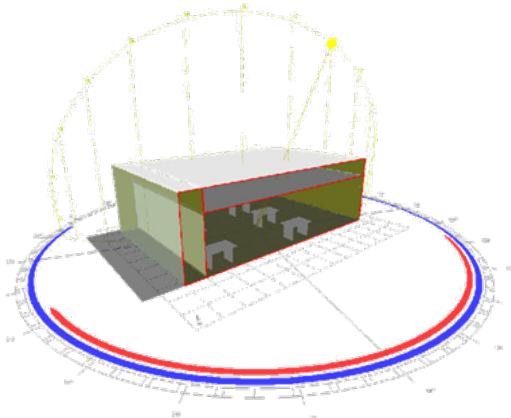
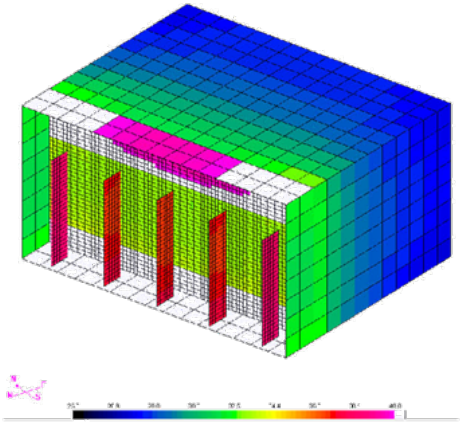


TYPICAL BOX MODEL LOCATIONS FOR TESTING

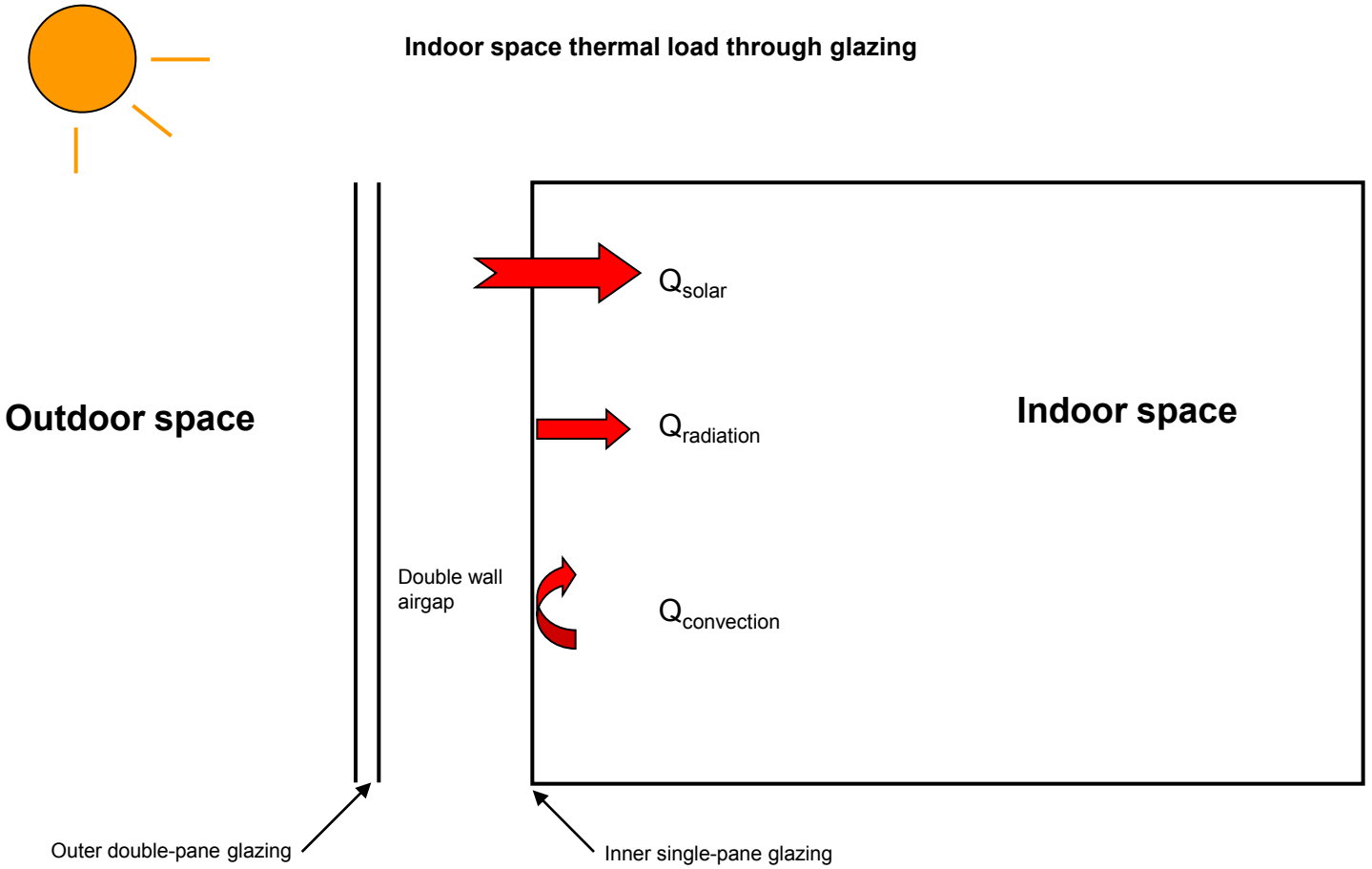


TYPICAL BOX MODEL FOR DAYLIGHTING (ECOTECT)



TYPICAL BOX MODEL FOR SOLAR LOADS (RAD-THERM)

Indoor space thermal load through glazing



$$Q_{total}=Q_{solar}+Q_{radiation}+Q_{convection}$$

Where:

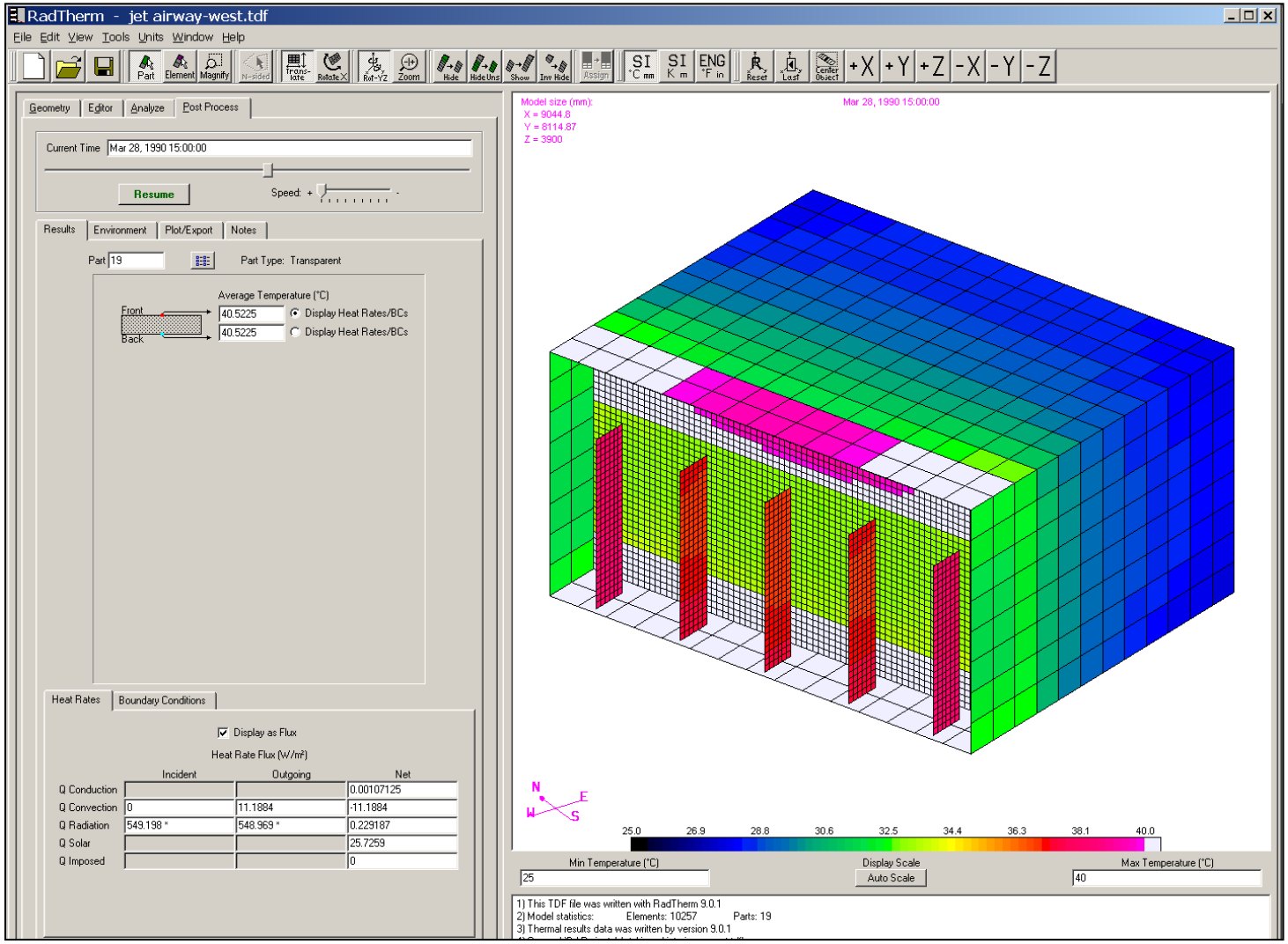
Q_{total} is the total heat entering the indoor space through glazing.

Q_{solar} is the solar heat entering the indoor space through glazing.

$Q_{radiation}$ is the heat entering the indoor space by thermal radiation from the glazing internal surface.

$Q_{convection}$ is the heat entering the indoor space by thermal convection from the glazing internal surface.

Radtherm Thermal Analysis Software



Surface physical properties of modeled double wall glazing system

Parameters of glazing system

1) External double pane glazing

Outer layer: VE 2-2M with 6mm thickness

Eout=0.84, Ein=0.04

Reflectance=0.05

Transmittance=0.28

Air-gap: 13 mm thickness

Inner layer: clear glass with 3mm thickness

Eout=0.84, Ein=0.84

Reflectance=0.08,

Transmittance=0.76

2) Internal single pane glazing

Clear glass with 3 mm thickness

Eout=0.84, Ein=0.84

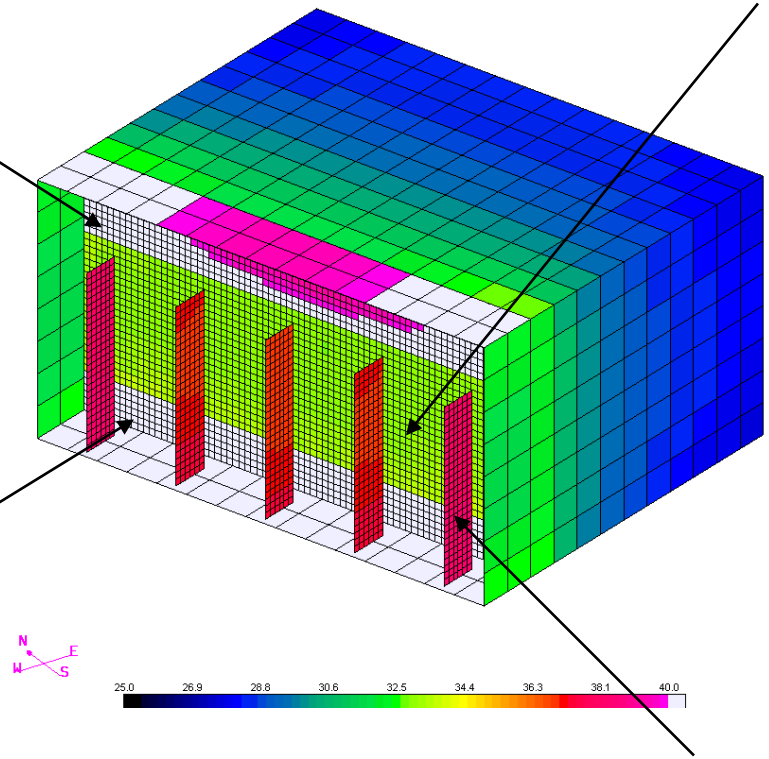
Reflectance=0.08

Transmittance=0.76

Upper spandrel pane: polished aluminum

Absorptivity=0.08

Emissivity=0.05



Lower spandrel panel: polished aluminum

Absorptivity=0.08

Emissivity=0.05

Metal fin

North surface: polished aluminum

Absorptivity=0.08

Emissivity=0.05

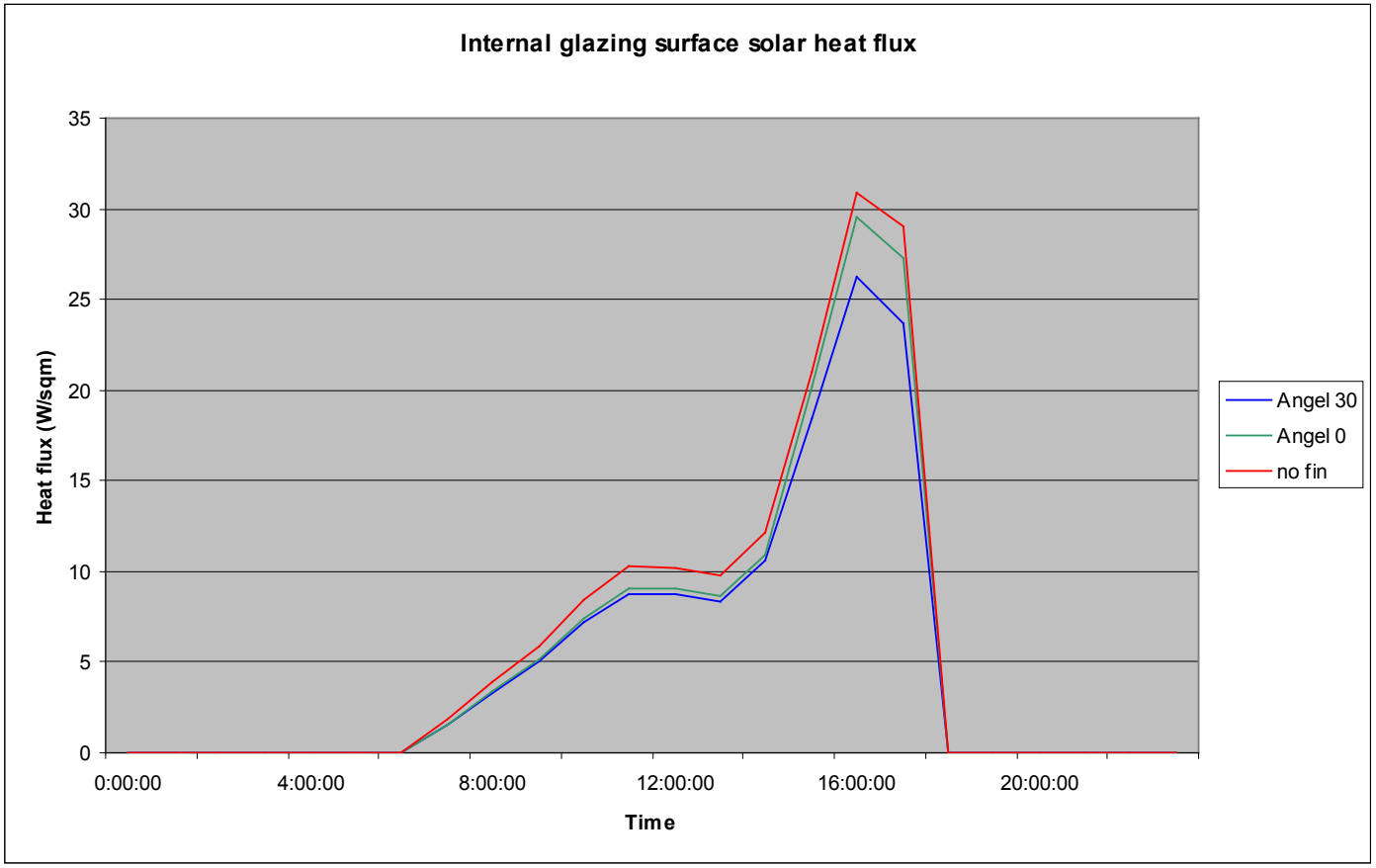
South surface: galvanized aluminum

Absorptivity=0.49

Emissivity=0.22

Figure. Surface physical properties of modeled double wall glazing system

West-facing internal glazing surface solar heat flux comparison



Fin distance = 1500 mm

Fin width = 600 mm

Fin shade can reduce solar radiation penetrating into the building space.

Comparison in the Figure above shows that the peak solar radiation heat flux can be reduced by 1.3~4.7 W/sqm of window area. Fins with angle of 30 degree give the largest solar heat flux reduction.

EXTERNAL WALL ANALYSIS MATRIX

WEST FAÇADE

			External Wall				Air Cavity	Shading Device			Ventilation	Internal Wall				Results Internal Wall Surface (#2)					
		Type	WWR (%)	U-Value (w/m²k)	SHGC	VLT	Depth (mm)	Type	Spacing (mm)	Depth (mm)	Ventilation Strategy	WWR (%)	U-Value (w/m²k)	SHGC	VLT	Peak Wall Temp. (ºC)	Peak glazing total load (W/m²)	Peak glazing solar load (W/m²)	Int. Wall Shading (%)	DF (%)	Energy Usage (kWh/m²)
		SINGLE WALL SYSTEM																			
	S1	Base Run - ECBC Code Complaint (VRE 2-38 single pane)	40%	3.25	0.25	0.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	51.3	219.3	142.1		1.9	
	S2	IGU + Low-e coat (6mm-12mm-6mm, VRE 2-54, Green)	70%	1.70	0.24	0.40	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.0	148.0	112.1			
		IGU + Low-e coat (6mm-12mm-6mm, VE 2-2M, Green)	70%	1.66	0.32	0.60	NA	NA	NA	NA	NA	NA	NA	NA	NA					3.2	
	S3	IGU + Low-e coat (6mm-12mm-6mm, VRE 1-38, Clear)	70%	1.60	0.23	0.36	NA	NA	NA	NA	NA	NA	NA	NA	NA						
		DOUBLE WALL SYSTEM																			
External Wall	D1	Ext. - Clear SG (6), Int. - Clear SG (6)	100	5.81	0.84	0.89	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89	42.9	540.9	455.3			
	D2	Ext. - IGU (6-12-6), Int. - Clear SG (6)	100	2.80	0.70	0.79	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89	46.5	560.8	436.5			
	D3	Ext. - IGU + Low-e coating (6-12-6, VE 2-2M, Green), Int. - Clear SG (6)	100	1.66	0.32	0.60	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89	40.2	260.4	179.6			
		Ext. - IGU + Low-e coating (6-12-6, VRE 2-54, Green), Int. - Clear SG (6)	100	1.70	0.24	0.40	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89	37.0	202.8	136.5			
	D4	Ext. - IGU + Cricursa Cal. Film, Int. - Clear SG (6)	100	?	0.44	0.57	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89						
	D5	Ext. - Tripple Laminate (Cricursa) Cal. Film + Chromascreen, Int. - Clear SG (6)	100	?	?	?	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89						
	D6	Ext. - WWR Reduction	75	?	?	?	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89						
Air Cavity		Ext. - IGU + Low-e coating (6-12-6, VRE 2-54, Green), Int. - Clear SG (6)	100	1.7	0.24	0.40	300	NA	NA	NA	Sealed	55	5.81	0.84	0.89	36.3	177.5	117.5			
			100	1.7	0.24	0.40	600	NA	NA	NA	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	NA	NA	NA	Sealed	55	5.81	0.84	0.89	37.2	182.7	115.4			
			100	1.7	0.24	0.40	1200	NA	NA	NA	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1500	NA	NA	NA	Sealed	55	5.81	0.84	0.89	37.7	191.9	111.1			
Shading Device		Ext. - IGU + Low-e coating (6-12-6, VRE 2-54, Green), Int. - Clear SG (6)	100	1.7	0.24	0.40	1000	Vertical	1500	600	Sealed	55	5.81	0.84	0.89	37.2	194.3	128.4			
			100	1.7	0.24	0.40	1000	Vertical	750	600	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	Vertical	500	600	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	Vertical	750	300	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	Vertical	500	300	Sealed	55	5.81	0.84	0.89	38.3	201.3	130.2			
			100	1.7	0.24	0.40	1000	30º CCW	1500	600	Sealed	55	5.81	0.84	0.89	37.0	178.9	113.8			
			100	1.7	0.24	0.40	1000	30º CCW	750	600	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	30º CCW	500	600	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	30º CCW	750	300	Sealed	55	5.81	0.84	0.89						
			100	1.7	0.24	0.40	1000	30º CCW	500	300	Sealed	55	5.81	0.84	0.89	37.2	175.7	109.7			
Ventilation		Ext. - IGU + Low-e coating (6-12-6)), Int. - Clear SG (6)									IAW										
											IAW										
											IAW										
Internal Wall		Ext. - IGU + Low-e coating (6-12-6)), Int. - Clear SG (6)	100	?	?	?	1000	Vertical	1500	600	IAC	100	5.7	0.82	0.88						
			100	?	?	?	1000	Vertical	1500	600	IAC	75	5.7	0.82	0.88						
			100	?	?	?	1000	Vertical	1500	600	IAC	50	5.7	0.82	0.88						
			100	?	?	?	1000	Vertical	1500	600	IAC	40	5.7	0.82	0.88						
			100	?	?	?	1000	Vertical	1500	600	IAC	30	5.7	0.82	0.88						

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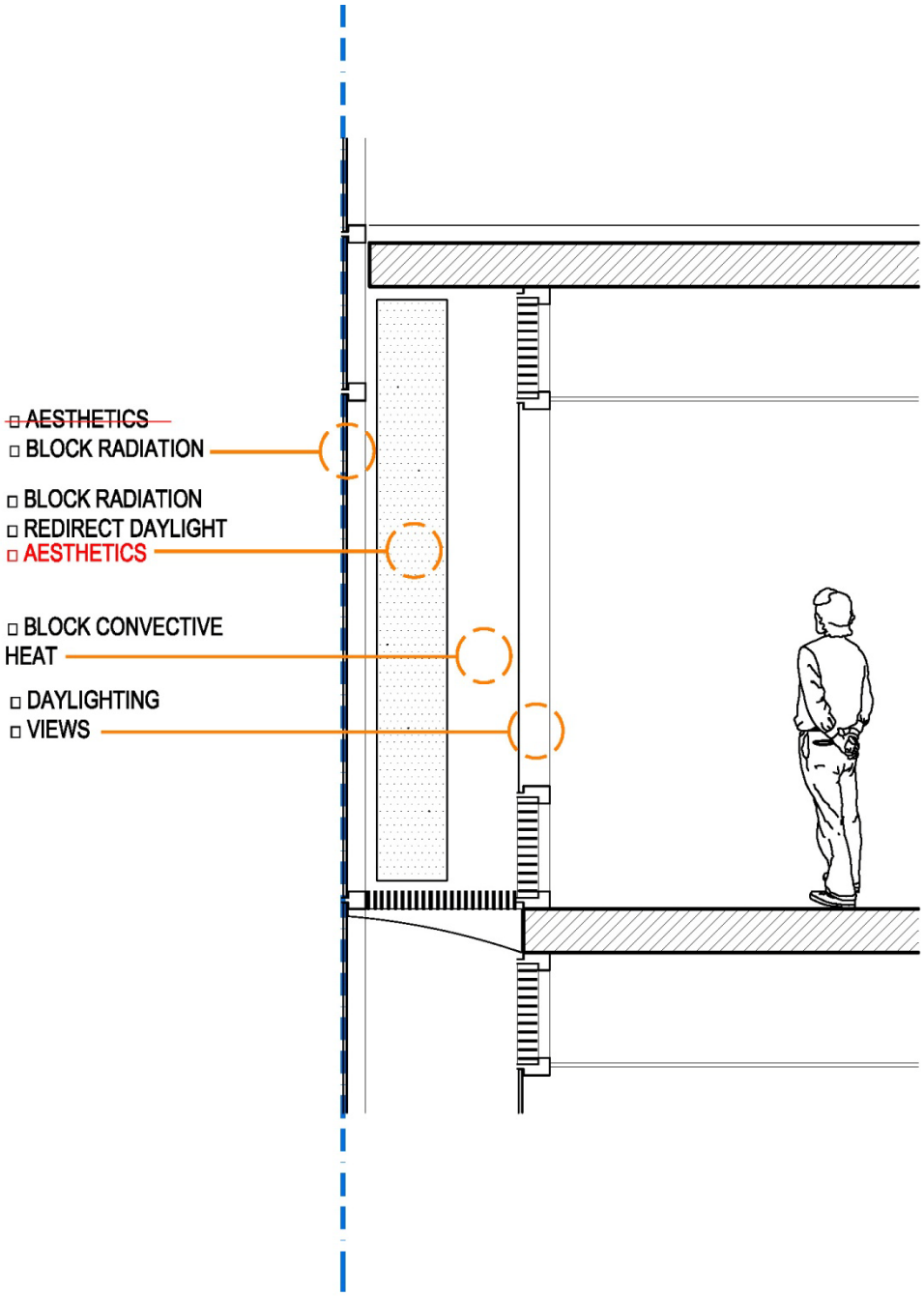

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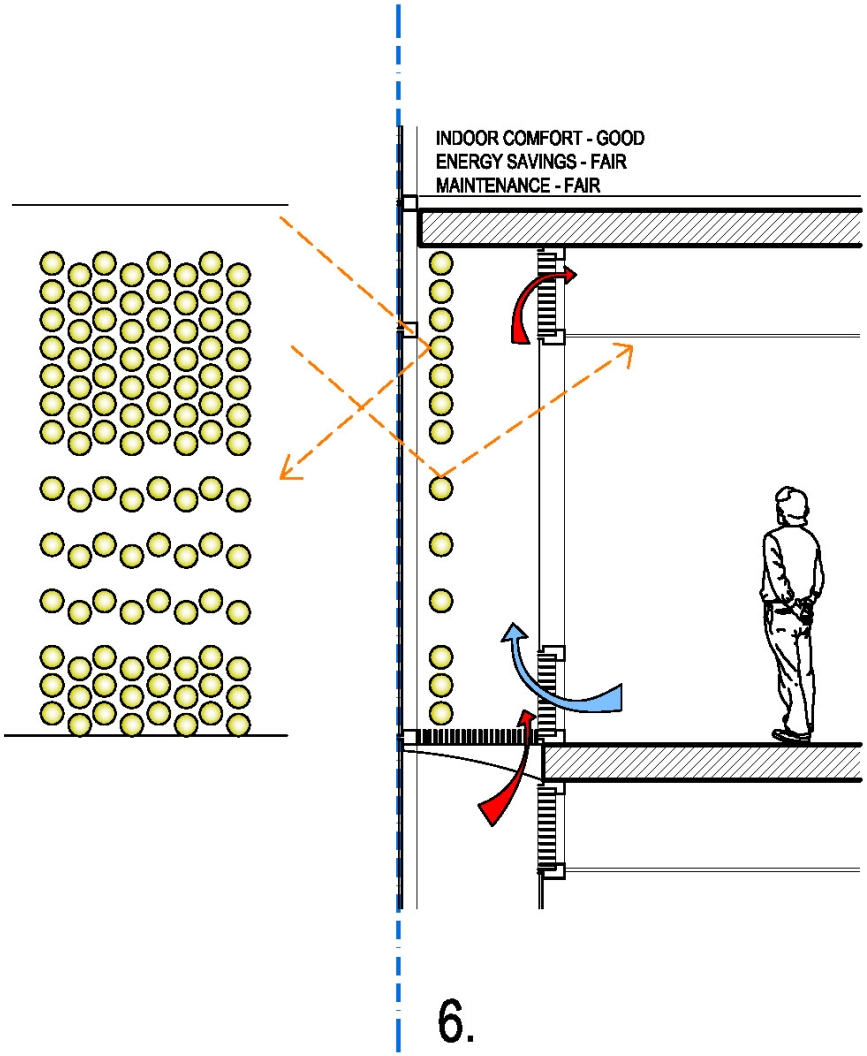

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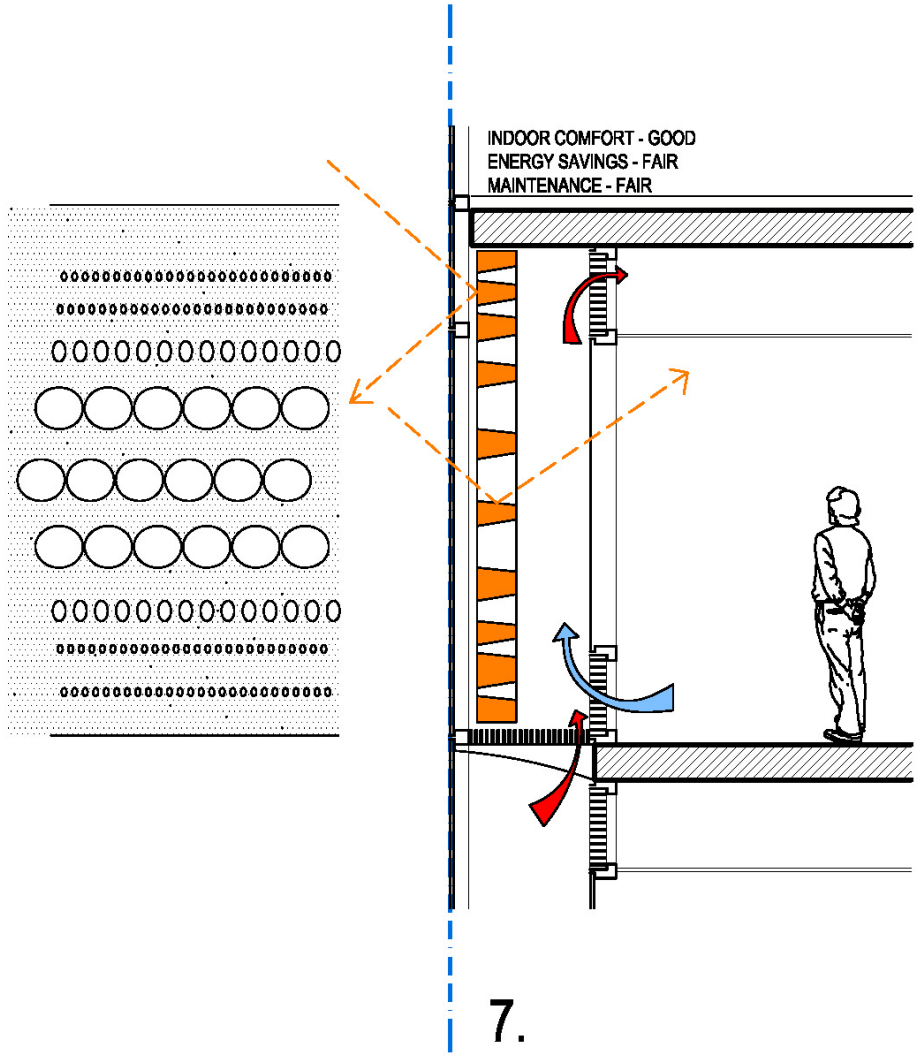

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