Guidelines GB 8.0 – Envelope Compliance Strategies

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Introduction

This document is being issued by Trakhees- CED (Sustainability) in the interest of the stakeholders to support them with the information required to comply with the regulatory requirements pertaining to the envelope.

Envelope being an important factor in assessing the thermal performance of the building requires utmost care especially in the design stages in terms of identifying the right combination of elements so as to achieve thermal compliance

Scope

This general guideline is applicable to all the stakeholders involved in the Green building projects within Dubai World business units under the Ports, Customs and Free Zone Corporation (PCFC).

Aim

The aim of this document is to highlight the importance of Envelope in Green Building design and accordingly provide typical envelope sections that may be explored by the stakeholders for their projects to achieve the thermal properties specified in the Regulations

Sections

For the sake of clarity, this document is divided into following sections

1. Envelope

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2. Envelope Components
3. Tight and Loose Envelope
4. Quick Facts
5. Envelope & Energy
6. Typical Sections – Walls
7. Typical Sections – Roofs
8. Typical Sections – Others
    a. Beam
    b. Column
    c. Ground
    d. Partition
    e. Floor

Envelope

A building envelope includes all the components that make up the shell or skin of the building. These components separate the exterior of the building from the interior, and are designed by the project architect or engineers to meet the needs of each individual application. The building envelope may also be defined as the components that separate conditioned areas from unconditioned space. Exterior or unheated living spaces are not included inside the envelope, while any living space that is equipped with heat or air conditioning would be included.

The Building Envelope or Building Enclosure is the physical separator between the interior and the exterior environments of a building. This, with the mechanical conditioning systems, serves as the outer shell to help maintain the indoor environment and facilitate the building's climate control. Building envelope design is a specialized area of architectural and engineering practice that draws from all areas of building science and indoor climate control.

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There are four basic functions of the building envelope. These include

1) Adding structural support
2) Controlling rain, air, heat, moisture and humidity control
3) Regulating temperature.
4) Controlling air pressure changes.

By serving these different functions, the envelope also affects ventilation and energy use within the building. Hence it is imperative that the building envelope must be carefully designed with regard to climate, ventilation, and energy consumption within the structure.

Envelope Components

The envelope is made up of all of the exterior components of the building, including walls, roofing, foundations, windows, and doors. Finish materials like siding and decorative items are not usually considered a part of the envelope. Insulation, building paper, and other components aimed at controlling moisture and airflow are typically included in the building envelope design.

Tight and Loose Envelope

Building envelopes are often characterized as "tight" or "loose." A tight envelope is precisely constructed to allow relatively few air leaks. This often requires significant quantities of insulation, caulk, sealants, and energy-efficient windows to create a tight shell for the building. Loosely-constructed envelopes allow air

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to flow more freely from the exterior to interior spaces. A loose envelope may be created by design, or may be the result of poor construction techniques.

The benefits of tight versus loose building envelopes are highly debatable. A tight envelope allows for a high level of control over indoor air quality, energy consumption, temperature, and humidity levels. It leads to fewer drafts and a more comfortable environment for occupants, and often results in less waste in heating and cooling costs. Tightly-designed envelopes also reduce the likelihood of mold or mildew caused by moisture infiltration, which may prolong the life of building components. At the same time, tighter buildings also limit how much natural ventilation can occur, which leads to more extensive mechanical ventilation requirements. If the mechanical ventilation system is inadequately designed, it may lead to indoor air quality and health related contingencies.

A loosely-constructed building envelope allows natural air transfers to occur, which improves indoor air quality and often eliminates the need for mechanical ventilation. At the same time these looser buildings tend to be more drafty and uncomfortable, and can make it difficult to regulate temperature levels. There is an increased chance of moisture-related mold, and higher quantities of heated or cooled air are able to escape through leaks in the envelope. This can increase energy bills and negatively impact the environment by increasing greenhouse gas levels.

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Quick Facts

Residential and commercial buildings account for almost 39 percent of total U.S. energy consumption and 38 percent of U.S. carbon dioxide (CO_2) emissions.

Space heating, cooling, and ventilation account for the largest amount of end-use energy consumption in both commercial and residential buildings. In the commercial sector they are responsible for 34 percent for energy used on site and 31 percent of primary energy use.

In the residential sector, space heating and cooling are responsible for 52 percent of energy used on site, and 39 percent of primary energy use.

The building envelope – the interface between the interior of the building and the outdoor environment, including the walls, roof, and foundation – serves as a thermal barrier and plays an important role in determining the amount of energy necessary to maintain a comfortable indoor environment relative to the outside environment.

Envelope & Energy

The building envelope is the interface between the interior of the building and the outdoor environment, including the walls, roof, and foundation. By acting as a thermal barrier, the building envelope plays an important role in regulating interior temperatures and helps determine the amount of energy required to

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maintain thermal comfort. Minimizing heat transfer through the building envelope is crucial for reducing the need for space cooling. In hot climates such as UAE, the building envelope can reduce the amount of energy required for cooling. Green Building regulations often cite energy and energy bill savings as a primary rationale for these initiatives.

The building envelope can affect energy use and, consequently, GHG emissions in a variety of ways as listed below

A. Design of the building envelope

The overall design can help determine the amount of lighting and cooling a building will require. Architects and engineers have developed innovative new ways to improve overall building design in order to maximize light and heat efficiency, for example through passive solar heating, which uses the sun's heat to warm the building when it is cold without relying on any mechanical or electrical equipment. Local climate is an important determinant for identifying the design features that will result in the greatest reductions of energy needs. These may include such things as south-facing windows in cool climates and shading to avoid summer sun in hot climates.

B. Building envelope materials and product selection

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Embodied energy

Embodied energy refers to the energy required to extract, manufacture, transport, install, and dispose of building materials, including those used in the building envelope. Efforts to reduce this energy use and associated emissions, for example through the substitution of bio-based products, can be made as part of a larger effort to reduce emissions from buildings.

Insulation and air sealing

Heat naturally flows from a warmer to a cooler space; insulation provides resistance to heat flow, thereby reducing the amount of energy needed to keep a building cool in the summer. Insulation is frequently discussed in terms of its ability to resist heat flow, or its R-value or in terms of thermal conductivity also referred to as “U” value. A variety of insulation options exist, including blanket, concrete block, insulating concrete forms, spray foam, rigid foam, and natural fiber insulation. Adding insulation strategically will improve the efficiency of the building; however, there is a word of caution. It is only effective if the building is properly sealed. Sealing cracks and leaks prevents air flow and is crucial for effective building envelope insulation. Leaks can generally be sealed with caulk, spray foam, or weather stripping.

Roofs

Roof design and materials can reduce the amount of air conditioning required in hot climates by increasing the amount of solar heat that is reflected, rather than absorbed, by the roof. For example, roofs with more

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stringent "U" value is capable of reducing the roof gain by more than 15% thereby having a direct impact on the total facility load and thereby the Air-conditioning equipment capacity.

Walls

Like roofs, the amount of energy lost or retained through walls is influenced by both design and materials. Design considerations affect the placement of windows and doors, the size and location of which can be optimized to reduce energy losses. Decisions regarding the appropriate material can be more complicated because the energy properties of the entire wall are affected by the design. Importantly, material selection and wall insulation can both affect the building's thermal properties.

A building's thermal mass – i.e., its ability to store heat – is determined in part by the building materials used. Thermal mass buildings absorb energy more slowly and then hold it longer, effectively reducing indoor temperature fluctuations and reducing overall heating and cooling requirements.

Windows, doors, and skylights

Collectively known as *fenestration*, windows, exterior doors, and skylights influence both the lighting and the HVAC requirements of a building. In addition to design considerations (the placement of windows and skylights affects the amount of available natural light), materials and installation can affect the amount of energy transmitted through the window, door, or skylight, as well as the amount of air leakage around the window components. New materials, coatings, and designs all have contributed to the improved energy efficiency of high-performing windows, doors, and buildings. Some of the advances in windows include:

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multiple glazing, the use of two or more panes of glass or other films for insulation, which can be further improved by filling the space between the panes with a low-conductivity gas, such as argon, and low-emissivity (low-e) coatings, which reduce the flow of infrared energy from the building to the environment. Study indicates that in residential buildings, using optimum window design and glazing specification is estimated to reduce energy consumption from 10 to 50 percent below accepted practice in most climates; in commercial buildings, an estimated 10 to 40 percent reduction in lighting and HVAC costs is attainable through improved fenestration.

C. Interactions with other building elements

The building envelope can affect the lighting and cooling needs of the building. These interactions are important to consider when retrofitting buildings to reduce their energy use in the most cost-effective manner. For example, with a new building it may be more cost-effective to choose a design with a more costly, high-performance building envelope that significantly reduces the need for heating and cooling with a smaller, less-costly HVAC system.

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Typical Section -

EXTERNAL WALL SEC					NO	1
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
120.00	15.000	8 IN Concrete Block With Polystyrene Insert (Light Mortar) Registered Manufacture Only	84.375		18.989	105.469
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	16.000		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.050		20.120	115.156

EXTERNAL WALL SECTION					NO	1
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.000	1.000	1 IN Outside surface resistance	0.000		0.250	
2.000	5.000	1 IN Inside vertical surface resistance	0.000		3.400	
120.010	10.000	10 IN Concrete Block With Polystyrene Insert (Light Mortar) Registered Manufacture Only	84.375		10.163	70.313
12.000	3.000	.5 IN Plaster (Cement / Sand)	116.250		0.601	29.063
3.000	3.000	1 IN Inside horizontal surface resistance	0.000		2.760	
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		#N/A	#N/A			
Sec.Thk	13.000		REV. (1) 13 10 2008			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.058		17.175	99.375

EXTERNAL WALL SEC					NO	1
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
12.00	0.600	.5 IN Plaster (Cement / Sand)	116.250		0.120	5.813
10.00	2.760	Solid Concrete Block (Cement Mortar)	140.000		0.313	32.200
71.00	5.000	Expanded Polysterene Insulation Block Insert 25, Type II Approved System Required	1.563		19.140	0.651
10.00	2.760	Solid Concrete Block (Cement Mortar)	140.000		0.313	32.200
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	11.620		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.049		20.487	75.707

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EXTERNAL WALL SEC					NO	1
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
	1.000	#N/A		#N/A		
11.00	0.500	Metal Surface		489.000	0.002	20.375
	1.000	#N/A		#N/A		
17.00	3.000	Rock Wool FUJ Slabs without facing Approved System Required		2.500	11.101	0.625
120.00	8.000	8 IN Concrete Block With Polystyrene Insert (Light Mortar) Registered Manufacture Only		84.375	10.128	56.250
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
	0.500	#N/A		#N/A		
2.00	1.000	1 IN Inside vertical surface resistance		0.000	0.680	
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	12.000			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.045		22.011	82.094

EXTERNAL WALL SEC					NO	1
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	Out side surface resistance		0.000	0.250	
442.25	3.000	2.4 IN RHP (Wall APPLY.) Rigid Polyurethane Insulation Panel with Steel & Alu.facing Sandwich Panel (RH-35/207) Registered 2007		2.188	16.979	0.547
26.00	0.500	Plaster (Cement / Sand)		116.250	0.100	4.844
2.00	1.000	Inside vertical surface resistance		0.000	0.680	
	1.000	0.000		0.000		
	1.000	0.000		0.000		
	1.000	0.000		0.000		
	1.000	0.000		0.000		
	1.000	0.000		0.000		
	1.000	0.000		0.000		
	1.000	#N/A		#N/A		
Sec.Thk	3.500			REV. 2 2007 15 2 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.056		18.009	5.391

Face Brick + R-7 Board + 4" LW Concrete Block

Wall Details

Outside Surface Color ..... **Dark**
Absorptivity **0.900**
Overall U-Value ..... **0.050** BTU/(hr-ft²-°F)

Wall Layers Details (Inside to Outside)

Layers	Thickness in	Density lb/ft³	Specific Ht. BTU / (lb - °F)	R-Value (hr-ft²-°F)/BTU	Weight lb/ft²
Inside surface resistance	0.000	0.0	0.00	0.68500	0.0
5/8-in gypsum board	0.625	50.0	0.26	0.56004	2.6
4-in LW concrete block	4.000	38.0	0.20	1.51515	12.7
R-7 board insulation	2.250	2.0	0.22	15.62500	0.4
Air space	0.000	0.0	0.00	0.91000	0.0
4-in face brick	4.000	125.0	0.22	0.43290	41.7
Outside surface resistance	0.000	0.0	0.00	0.33300	0.0
Totals	**10.875**	**-**		**20.06109**	**57.3**

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EXTERNAL WALL SECTION				NO	1
LAYER NO	THK in	DESCRIPTIONS	DENSITY lb/Ft³	R °f ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN out side surface resistance	0.000	0.250	
11.00	0.500	Metal Surface	489.000	0.002	20.375
4.00	2.000	1 IN Wall air space resistance	0.000	1.740	
10.00	2.760	Solid concrete block (Cement / Morter)	140.000	0.313	32.200
71.00	4.330	Expanded polysterene insulation block insert 25, TYPE II Appo sys reqd.	1.563	16.844	0.564
10.00	2.760	Solid concrete block (Cement / Morter)	140.000	0.313	32.200
12.00	0.500	0.5 In plaster (cement / Sand)	116.250	0.100	4.844
1.00	1.000	1 IN out side surface resistance	0.000	0.250	
	1.000	# NA	# NA		
	1.000	# NA	# NA		
	1.000	# NA	# NA		
AS PER DM Regu/ GREEN		U (Btu / °F ft² . H)		R	Mass
0.100	D	0.050		19.812	90.183

EXTERNAL WALL SECTION				NO	1
LAYER NO	THK in	DESCRIPTIONS	DENSITY lb/Ft³	R °f ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN out side surface resistance	0.000	0.250	
12.00	0.500	0.5 In plaster (cement / Sand)	116.250	0.12	5.813
10.00	2.760	Solid concrete block (Cement / Morter)	140.000	0.313	32.200
71.00	4.330	Expanded polysterene insulation block insert 25, TYPE II Appo sys reqd.	1.563	16.844	0.564
10.00	2.760	Solid concrete block (Cement / Morter)	140.000	0.313	32.200
12.00	0.500	0.5 In plaster (cement / Sand)	116.250	0.100	4.844
1.00	1.000	1 IN out side surface resistance	0.000	0.250	
	1.000	# NA	# NA		
	1.000	# NA	# NA		
	1.000	# NA	# NA		
AS PER DM Regu/ GREEN		U (Btu / °F ft² . H)		R	Mass
0.100	D	0.055		18.190	75.621

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Typical Section -

ROOF					NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²	
1.00	1.000	1 IN Outside surface resistance	0.000	0.250		
6.00	2.000	Terrazzo Tiles	160.000	0.160	26.667	
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250	0.100	4.844	
68.01	3.100	Rigid Polyfoam-50 ((Rcc Roof Slabs) - Registered 2007 - Certified DCL	3.125	19.452	0.807	
9.02	4.000	Light Weight Concrete (Light Weight Aggregate)	100.000	0.687	33.333	
9.00	8.000	Reinforced Concrete	150.000	0.624	100.000	
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250	0.100	4.844	
3.00	1.000	1 IN Inside horizontal surface resistance	0.000	0.920		
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	18.100		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)		R	Mass	
0.078	D	0.045		22.294	170.495	

ROOF					NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²	
1.00	1.000	Out side surface resistance	0.000	0.250		
176.00	1.000	Terrazzo Tiles	160.000	0.080	13.333	
26.00	2.000	Plaster (Cement / Sand)	116.250	0.401	19.375	
68.01	3.000	Rigid Polyfoam-50 ((Rcc Roof Slabs) - Registered 2007 - Certified DCL	3.125	18.824	0.781	
182.00	2.000	Light Weight Concrete (Light Weight Aggregate)	100.000	0.344	16.667	
180.00	4.000	Reinforced Concrete	150.000	0.312	50.000	
48.00	8.000	Hollow Concrete Block (Cement Mortar)	118.750	0.984	79.167	
26.00	0.500	Plaster (Cement / Sand)	116.250	0.100	4.844	
3.00	1.000	Inside horizontal surface resistance	0.000	0.920		
	1.000	0.000	0.000			
	1.000	#N/A	#N/A			
Sec.Thk	20.500		REV. 2 2007 15 2 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)		R	Mass	
0.078	D	0.045		22.215	184.167	

ROOF					NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²	
1.000	1.000	1 IN Outside surface resistance	0.000	0.250		
6.010	1.000	Cement Tiles	131.250	0.131	10.938	
12.000	2.000	.5 IN Plaster (Cement / Sand)	116.250	0.401	19.375	
68.000	3.000	Rigid Polyfoam-50 ((Steel Roof Slabs) - Registered 2007 - Certified DCL	3.125	18.824	0.781	
9.030	3.000	Foam Concrete	38.750	2.165	9.688	
9.000	3.000	Reinforced Concrete	150.000	0.234	37.500	
10.010	10.000	Hollow Concrete Block (Cement Mortar)	118.750	1.230	98.958	
12.000	0.500	.5 IN Plaster (Cement / Sand)	116.250	0.100	4.844	
3.000	1.000	1 IN Inside horizontal surface resistance	0.000	0.920		
		0.000	0.000			
		#N/A	#N/A			
Sec.Thk	22.500		REV. (1) 13 10 2008			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)		R	Mass	
0.078	D	0.041		24.256	182.083	

LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²	
1.00	1.000	1 IN Outside surface resistance	0.000	0.250		
6.01	1.600	Cement Tiles	131.250	0.210	17.500	
12.00	1.000	.5 IN Plaster (Cement / Sand)	116.250	0.200	9.688	
68.01	4.000	Rigid Polyfoam-50 ((Rcc Roof Slabs) - Registered 2007 - Certified DCL	3.125	25.099	1.042	
9.03	1.600	Foam Concrete	38.750	1.155	5.167	
9.00	10.000	Reinforced Concrete	150.000	0.780	125.000	
3.00	1.000	1 IN Inside horizontal surface resistance	0.000	0.920		
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
Sec.Thk	18.200		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)		R	Mass	
0.078	D	0.035		28.614	158.396	

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ROOF					NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
443.15	6.000	4 IN MMA Rigid Polyurethane Insulation Panel with Steel & Alu.facing Sandwich Panel Roof Apply (PR30/252) Registered 2007	2.125		30.706	1.063
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
Sec.Thk	6.000		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.078	D	0.032			30.956	1.063

ROOF					NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
444.08	2.000	2 IN TSP (Roof Apply) Rigid Polyurethane Insulation Panel with Steel & Alu.facing Sandwich Panel (TSP 35/205) 2007	2.188		12.335	0.365
4.00	2.000	1 IN Wall air space resistance	0.000		1.740	
17.00	2.000	Rock Wool FUJ Slabs without facing Approved System Required	2.500		7.401	0.417
11.03	0.500	Gypsum Board	50.000		0.451	2.083
	8.000	#N/A	#N/A			
	0.500	#N/A	#N/A			
	0.500	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	6.500		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.078	D	0.045			22.177	2.865

ROOF					NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	Out side surface resistance	0.000		0.250	
442.02	3.350	2 IN RHP (Roof APPLY.) Rigid Polyurethane Insulation Panel with Steel & Alu.facing Sandwich Panel (RH-4"Box Rib) Registered 20	2.188		21.020	0.611
3.00	1.000	Inside horizontal surface resistance	0.000		0.920	
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	#N/A	#N/A			
Sec.Thk	3.350		REV. 2 2007 15 2 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.078	D	0.045			22.190	0.611

ROOF					NO	4
LAYER NO	THK. IN	DESCRIPTIONS	DENSITY lb/ft3		R °F ft2.h/Btu	Mass lb/ft2
1,00	1,000	1 IN Outside surface resistance	0.000		0.250	
6.00	0.750	Terrazzo Tiles	160.000		0.060	10.000
12,00	1,000	,5 IN Plaster (Cement / Sand)	116.250		0.200	9.688
68.01	2.000	Rigid Polyfoam-50 (Rcc Roof Slabs)- Regsitered 2007 - Certified DCL	3.125		12,549	0.521
9,03	3,000	Foam Concrete	38.750		2.165	9.688
9.00	8.000	Reinforced Concrete	150,000		0.624	100,000
12,00	0,500	,5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
3,00	1,000	1 IN Inside horizontal surface resistance	0,000		0,920	
	1,000	# N/A	# N/A			
	1,000	# N/A	# N/A			
	1,000	# N/A	# N/A			
Sec. Thk	15.250		REV.(1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft2 h)			R	Mass
0.078	D	0.059			16.869	134.740

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Built-up Roof + R-7 Board + 4" LW Concrete

Roof Details

Outside Surface Color ..... **Dark**
Absorptivity **0.900**
Overall U-Value ..... **0.045** BTU/(hr-ft²-°F)

Roof Layers Details (Inside to Outside)

Layers	Thickness in	Density lb/ft³	Specific Ht. BTU / (lb - °F)	R-Value (hr-ft²-°F)/BTU	Weight lb/ft²
Inside surface resistance	0.000	0.0	0.00	0.68500	0.0
1/2-in gypsum board	0.500	50.0	0.26	0.44803	2.1
Air space	0.000	0.0	0.00	0.91000	0.0
4-in LW concrete	15.000	40.0	0.20	12.50000	50.0
R-7 board insulation	1.000	2.0	0.22	6.94445	0.2
Built-up roofing	0.375	70.0	0.35	0.33245	2.2
Outside surface resistance	0.000	0.0	0.00	0.33300	0.0
Totals	**16.875**	**-**		**22.15292**	**54.4**

ROOF				NO	4
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
1.000	1.000	1 IN Outside surface resistance	0.000	0.250	
6.050	0.600	Asphalt Roll Roofing	62.500	0.433	3.125
68.000	4.000	Rigid Polyfoam-50 ((Steel Roof Slabs) - Registered 2007 - Certified DCL	3.125	25.099	1.042
11.030	4.000	Gypsum Board	50.000	3.608	16.667
11.000	3.000	Metal Surface	489.000	0.010	122.250
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		#N/A	#N/A		
Sec.Thk	11.600		REV. (1) 13 10 2008		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)	R	Mass
0.078		D	0.034	29.399	143.083

ROOF				NO	1
LAYER NO	THK in	DESCRIPTIONS	DENSITY lb/Ft³	R °f ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN outside surface resistance	0.000	0.250	
10.00	3.000	Solid Concrete Block (Cement Mortar)	140.000	0.413	35.000
68.01	3.100	Rigid Polyform -50 ((RCC Roof slab) - Registered 2007 - certified DCL (From roof care Co. L.L.C)	3.125	19.840	0.808
9.00	8.000	Reinforced concrete	150.000	0.234	100.000
10.01	8.000	Solid concrete Block (cement Morter)	140.000	0.413	100.000
2.00	1.000	1 IN Inside vertical surface resistance.	0.000	0.980	0.000
AS PER DM Regu/ GREEN		U (Btu / °F ft² . H)		R	Mass
0.074		D 0.045		22.130	235.808

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ROOF				NO	1
LAYER NO	THK in	DESCRIPTIONS	DENSITY lb/Ft^3	R ^{0}f ft^2.h/Btu	Mass lb/ft^2
1.00	1.000	1 IN outside surface resistance	0.000	0.250	
442.14	2.000	2 IN RHP (Roof & wall apply) rigid polyurethene insulation panel with 0.7 mm tck prepainted aluminium metal profiled sheet (SRI Value >=78) and Aluminium foil.	2.188	14.450	0.365
2.00	1.000	1 IN Inside vertical surface resistance.	0.000	0.680	0.000
AS PER DM Regu/ GREEN		U (Btu / ^{0}F ft^2 . H)		R	Mass
0.074		D 0.065		15.380	0.365

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Typical Section -

External

EXTERNAL BEAMS SEC					NO	2
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
103.00	2.160	2.16 IN 'Expanded Polystyrene 35 (XPS) (ROF- POLY) External Insulation System only By Using Registered XPS (Registered 2006	2.188		8.425	0.394
9.00	8.000	Reinforced Concrete	150.000		0.624	100.000
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	11.160		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.100	D	0.098			10.180	110.081

EXTERNAL BEAMS SEC					NO	2
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
12.00	1.000	.5 IN Plaster (Cement / Sand)	116.250		0.200	9.688
100.00	1.800	1.6 IN Polyurethane Foam - External Insulation System only By Using Registered PO & CC (H & C) Registered 2006 - Registered D	2.813		10.391	0.422
9.00	8.000	Reinforced Concrete	150.000		0.624	100.000
12.00	1.000	.5 IN Plaster (Cement / Sand)	116.250		0.200	9.688
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	11.800		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.100	D	0.081			12.346	119.797

EXTERNAL BEAMS SEC					NO	2
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
11.01	0.500	Opaque Spandrel Glass	157.875		0.073	6.578
4.00	1.000	1 IN Wall air space resistance	0.000		0.870	
17.00	2.000	Rock Wool FUJ Slabs without facing Approved System Required	2.500		7.401	0.417
9.00	8.000	Reinforced Concrete	150.000		0.624	100.000
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	10.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	12.000		REV. (1) 25 9 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.100	D	0.100			9.998	111.839

EXTERNAL BEAMS SEC					NO	2
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	Out side surface resistance	0.000		0.250	
26.00	0.500	Plaster (Cement / Sand)	116.250		0.100	4.844
100.00	1.600	1.6 IN Polyurethane Foam - External Insulation System only By Using Registered PO & CC (H & C) Registered 2006 - Registered D	2.813		9.236	0.375
26.00	0.900	Plaster (Cement / Sand)	116.250		0.180	8.719
2.00	1.000	Inside vertical surface resistance	0.000		0.680	
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	0.000	0.000			
	1.000	#N/A	#N/A			
Sec.Thk	3.000		REV. 2 2007 15 2 2007			
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
0.100	D	0.096			10.447	13.938

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EXTERNAL DROP BEAMS SECTION					NO	2
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft^3	R °F ft^2.h/Btu	Mass lb/ft^2
1.000	1.000	1 IN Outside surface resistance		0.000	0.250	
12.000	2.000	.5 IN Plaster (Cement / Sand)		116.250	0.401	19.375
101.000	3.000	2.16 IN Expanded Polystyrene 35 (EPS) (SENE - POLY) External Insulation System only By Using Registered EPS (Registered 200		2.188	11.701	0.547
9.000	10.000	Reinforced Concrete		150.000	0.780	125.000
12.000	2.000	.5 IN Plaster (Cement / Sand)		116.250	0.401	19.375
2.000	5.000	1 IN Inside vertical surface resistance		0.000	3.400	
		0.000		0.000		
		0.000		0.000		
		0.000		0.000		
		0.000		0.000		
		#N/A		#N/A		
Sec.Thk	17.000			REV. (1) 13 10 2008		
AS PER DM REGU.		Outside color	U (Btu / °F ft^2 h)		R	Mass
0.100		D	0.059		16.933	164.297

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Column

EXTERNAL COLUMNS SEC					NO	3
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance		0.000	0.250	
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
103.00	2.160	2.16 IN 'Expanded Polystyrene 35 (XPS) (ROF- POLY) External Insulation System only By Using Registered XPS (Registered 2006		2.188	8.425	0.394
9.00	8.000	Reinforced Concrete		150.000	0.624	100.000
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance		0.000	0.680	
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	11.160			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.098		10.180	110.081

EXTERNAL COLUMNS SEC				NO	3
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
1.000	1.000	1 IN Outside surface resistance	0.000	0.250	
12.000	2.000	.5 IN Plaster (Cement / Sand)	116.250	0.401	19.375
101.000	3.000	2.16 IN Expanded Polystyrene 35 (EPS) (SENE - POLY) External Insulation System only By Using Registered EPS (Registered 200	2.188	11.701	0.547
9.000	10.000	Reinforced Concrete	150.000	0.780	125.000
12.000	2.000	.5 IN Plaster (Cement / Sand)	116.250	0.401	19.375
2.000	5.000	1 IN Inside vertical surface resistance	0.000	3.400	
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		#N/A	#N/A		
Sec.Thk	17.000		REV. (1) 13 10 2008		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)	R	Mass
0.100		D	0.059	16.933	164.297

EXTERNAL COLUMNS SEC				NO	3
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	Out side surface resistance	0.000	0.250	
26.00	5.000	Plaster (Cement / Sand)	116.250	1.002	48.438
100.00	1.600	1.6 IN Polyurethane Foam - External Insulation System only By Using Registered PO & CC (H & C) Registered 2006 - Registered D	2.813	9.236	0.375
26.00	9.000	Plaster (Cement / Sand)	116.250	1.804	87.188
2.00	1.000	Inside vertical surface resistance	0.000	0.680	
	1.000	0.000	0.000		
	1.000	0.000	0.000		
	1.000	0.000	0.000		
	1.000	0.000	0.000		
	1.000	0.000	0.000		
	1.000	#N/A	#N/A		
Sec.Thk	1.000		REV. 2 2007 15 2 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)	R	Mass
0.100		D	0.077	12.973	136.000

EXTERNAL COLUMNS SEC					NO	3
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance		0.000	0.250	
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
100.00	1.600	1.6 IN Polyurethane Foam - External Insulation System only By Using Registered PO & CC (H & C) Registered 2006 - Registered D		2.813	9.236	0.375
9.00	8.000	Reinforced Concrete		150.000	0.624	100.000
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance		0.000	0.680	
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	10.600			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.091		10.991	110.063

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EXTERNAL COLUMNS SEC					NO	3
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft^3	R °F ft^2.h/Btu	Mass lb/ft^2
1.00	1.000	1 IN Outside surface resistance		0.000	0.250	
11.01	0.500	Opaque Spandrel Glass		157.875	0.073	6.578
4.00	1.000	1 IN Wall air space resistance		0.000	0.870	
17.00	2.000	Rock Wool FUJ Slabs without facing Approved System Required		2.500	7.401	0.417
9.00	8.000	Reinforced Concrete		150.000	0.624	100.000
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance		0.000	0.680	
	1.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	10.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	12.000			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft^2 h)		R	Mass
0.100		D	0.100		9.998	111.839

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Groun

INSULATED GROUND (HORIZONTAL/VERTICAL)					NO	5
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance	0.000		0.920	
6.02	1.000	Ceramic Tiles	125.000		0.120	10.417
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
82.01	2.000	ISO.LD EXTRUDED POLYSTYRENE INSULATION Board TYPE IV Approved System Required	1.625		9.589	0.271
9.02	4.000	Light Weight Concrete (Light Weight Aggregate)	100.000		0.687	33.333
13.00	1.000	Sand	140.000		0.083	11.667
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	8.500		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.087		11.500	60.531

INSULATED GROUND (HORIZONTAL/VERTICAL)					NO	5
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
3.000	1.000	1 IN Inside horizontal surface resistance	0.000		0.920	
6.060	2.000	Marble	171.875		0.100	28.646
12.000	2.000	.5 IN Plaster (Cement / Sand)	116.250		0.401	19.375
68.010	2.500	Rigid Polyfoam-50 ((Rcc Roof Slabs) - Registered 2007 - Certified DCL	3.125		15.687	0.651
9.020	6.000	Light Weight Concrete (Light Weight Aggregate)	100.000		1.031	50.000
13.000	3.000	Sand	140.000		0.249	35.000
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		#N/A	#N/A			
Sec.Thk	15.500		REV. (1) 13 10 2008			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.054		18.387	133.672

INSULATED GROUND (HORIZONTAL/VERTICAL)					NO	5
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
1.00	1.000	1 IN Outside surface resistance	0.000		0.250	
6.02	1.000	Ceramic Tiles	125.000		0.120	10.417
9.02	3.000	Light Weight Concrete (Light Weight Aggregate)	100.000		0.515	25.000
75.00	4.500	NP-Insert -Expanded Polystyrene type II Approved System Required	1.563		18.040	0.586
9.00	8.000	Reinforced Concrete	150.000		0.624	100.000
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
		#N/A	#N/A			
Sec.Thk	16.500		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.051		19.550	136.003

INSULATED GROUND (HORIZONTAL/VERTICAL)					NO	5
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance	0.000		0.920	
6.02	1.000	Ceramic Tiles	125.000		0.120	10.417
12.00	2.000	.5 IN Plaster (Cement / Sand)	116.250		0.401	19.375
9.00	4.000	Reinforced Concrete	150.000		0.312	50.000
68.01	2.000	Rigid Polyfoam-50 ((Rcc Roof Slabs) - Registered 2007 - Certified DCL	3.125		12.549	0.521
9.02	4.000	Light Weight Concrete (Light Weight Aggregate)	100.000		0.687	33.333
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	13.000		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
0.100		D	0.067		14.990	113.646

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NON INSULATED GROUND FLOOR					NO	6
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
6.02	1.000	Ceramic Tiles		125.000	0.120	10.417
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
9.02	4.000	Light Weight Concrete (Light Weight Aggregate)		100.000	0.687	33.333
13.00	1.000	Sand		140.000	0.083	11.667
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	6.500			REV. (1) 25 9 2007		
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
N.R	D	0.523			1.911	60.260

NON INSULATED GROUND FLOOR				NO	6
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.000	1.000	1 IN Inside horizontal surface resistance	0.000	0.920	
6.060	1.000	Marble	171.875	0.050	14.323
12.000	2.000	.5 IN Plaster (Cement / Sand)	116.250	0.401	19.375
9.020	6.000	Light Weight Concrete (Light Weight Aggregate)	100.000	1.031	50.000
13.000	1.000	Sand	140.000	0.083	11.667
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		0.000	0.000		
		#N/A	#N/A		
Sec.Thk	10.000		REV. (1) 13 10 2008		
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)		R	Mass
N.R	D	0.403		2.484	95.365

NON INSULATED GROUND FLOOR					NO	6
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
6.02	1.600	Ceramic Tiles		125.000	0.192	16.667
9.02	3.000	Light Weight Concrete (Light Weight Aggregate)		100.000	0.515	25.000
75.00	4.500	NP-Insert -Expanded Polystyrene type II	Approved System Required	1.563	18.040	0.586
9.00	8.000	Reinforced Concrete		150.000	0.624	100.000
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	17.100			REV. (1) 25 9 2007		
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)			R	Mass
N.R	D	0.049			20.292	142.253

NON INSULATED GROUND FLOOR				NO	6
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance	0.000	0.920	
6.02	1.000	Ceramic Tiles	125.000	0.120	10.417
12.00	2.000	.5 IN Plaster (Cement / Sand)	116.250	0.401	19.375
9.03	4.000	Foam Concrete	38.750	2.886	12.917
70.02	1.500	Styr- Expanded Polysterene Insolite Insulation Sheet Type XI Approved System Required	1.000	4.706	0.125
9.00	8.000	Reinforced Concrete	150.000	0.624	100.000
	1.000	#N/A	#N/A		
	1.000	#N/A	#N/A		
	1.000	#N/A	#N/A		
	1.000	#N/A	#N/A		
	1.000	#N/A	#N/A		
Sec.Thk	16.500		REV. (1) 25 9 2007		
AS PER DM REGU.	Outside color	U (Btu / °F ft² h)		R	Mass
N.R	D	0.104		9.658	142.833

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Partitions

PARTITIONS					NO	7
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
		#N/A	#N/A			
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
12.02	0.500	.5 IN Gypsum Plaster (Gyps)	75.000		0.172	3.125
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
10.00	6.000	Solid Concrete Block (Cement Mortar)	140.000		0.680	70.000
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
12.02	0.500	.5 IN Gypsum Plaster (Gyps)	75.000		0.172	3.125
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	8.000		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.387		2.584	85.938

PARTITIONS					NO	7
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
2.000	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
12.000	1.000	.5 IN Plaster (Cement / Sand)	116.250		0.200	9.688
10.010	6.000	Hollow Concrete Block (Cement Mortar)	118.750		0.738	59.375
12.000	1.000	.5 IN Plaster (Cement / Sand)	116.250		0.200	9.688
2.000	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		0.000	0.000			
		#N/A	#N/A			
Sec.Thk	8.000		REV. (1) 13 10 2008			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.400		2.499	78.750

PARTITIONS					NO	7
LAYER NO	THK. in	DESCRIPTIONS	DENSITY lb/ft³		R °F ft².h/Btu	Mass lb/ft²
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
10.01	8.000	Hollow Concrete Block (Cement Mortar)	118.750		0.984	79.167
12.00	0.500	.5 IN Plaster (Cement / Sand)	116.250		0.100	4.844
2.00	1.000	1 IN Inside vertical surface resistance	0.000		0.680	
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
	1.000	#N/A	#N/A			
Sec.Thk	9.000		REV. (1) 25 9 2007			
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.393		2.545	88.854

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Typical

TYPICAL FLOOR					NO	8
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
6.02	1.000	Ceramic Tiles		125.000	0.120	10.417
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
9.00	6.000	Reinforced Concrete		150.000	0.468	75.000
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	8.000			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.380		2.629	95.104
1.0000	1.000	1 IN Outside surface resistance		0.000	0.250	

TYPICAL FLOOR					NO	8
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.000	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
6.060	2.000	Marble		171.875	0.100	28.646
12.000	2.000	.5 IN Plaster (Cement / Sand)		116.250	0.401	19.375
9.000	5.000	Reinforced Concrete		150.000	0.390	62.500
10.010	8.000	Hollow Concrete Block (Cement Mortar)		118.750	0.984	79.167
12.000	2.000	.5 IN Plaster (Cement / Sand)		116.250	0.401	19.375
3.000	3.000	1 IN Inside horizontal surface resistance		0.000	2.760	
		0.000		0.000		
		0.000		0.000		
		0.000		0.000		
		#N/A		#N/A		
Sec.Thk	19.000			REV. (1) 13 10 2008		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.168		5.956	209.063
1.000	1.000	1 IN Outside surface resistance		0.000	0.250	

TYPICAL FLOOR					NO	8
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
6.00	1.000	Terrazzo Tiles		160.000	0.080	13.333
9.02	3.000	Light Weight Concrete (Light Weight Aggregate)		100.000	0.515	25.000
9.00	8.000	Reinforced Concrete		150.000	0.624	100.000
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
		#N/A		#N/A		
		#N/A		#N/A		
		#N/A		#N/A		
		#N/A		#N/A		
		#N/A		#N/A		
		#N/A		#N/A		
Sec.Thk	12.000			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.327		3.060	138.333
1.0000	1.000	1 IN Outside surface resistance		0.000	0.250	

TYPICAL FLOOR					NO	8
LAYER NO	THK. in	DESCRIPTIONS		DENSITY lb/ft³	R °F ft².h/Btu	Mass lb/ft²
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
6.02	1.000	Ceramic Tiles		125.000	0.120	10.417
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
9.03	4.000	Foam Concrete		38.750	2.886	12.917
9.00	4.000	Reinforced Concrete		150.000	0.312	50.000
12.00	0.500	.5 IN Plaster (Cement / Sand)		116.250	0.100	4.844
3.00	1.000	1 IN Inside horizontal surface resistance		0.000	0.920	
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
	1.000	#N/A		#N/A		
Sec.Thk	10.000			REV. (1) 25 9 2007		
AS PER DM REGU.		Outside color	U (Btu / °F ft² h)		R	Mass
N.R		D	0.187		5.359	83.021
1.0000	1.000	utside surface resistance		0.000	0.250	

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Conclusion

The above guideline attempts to familiarize the stakeholder with several envelope possibilities based on the information received from the stakeholders. This guideline should however not be construed as a scope that is specifically required by Trakhees- CED (Sustainability) towards compliance. It is strongly recommended that the stakeholders, while using the guideline for an objective understanding, take to the recourse of strong fundamental design integration and analysis to ascertain the true thermal characteristics and performance of the sections being used by them for their projects. It is prudent to contact the specialists for validation of the performance characteristics.

We wish you good luck in this journey. Should you need any assistance please do not hesitate to contact the department.

Disclaimer

This Guideline for Envelope compliance strategies has been issued to assist the stakeholders in finalizing the right strategy in their attempt to comply with Trakhees' Regulatory requirements. As such, this is an attempt to disseminate the information Trakhees- CED has gathered from the stakeholders (i.e. Consultants, Contractors and others) in the course of its regulatory activities.

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