

Envelope Design evolution with new systems

Hector Nieto
Construction Systems Consultant

- Background



- MATRADE Exhibition Convention Centre, 2007

- Background



○ 2018 Kuala Lumpur Building

Why Evolve?

- Traditional Construction systems

- Construction should be more efficient? Are we going to keep building like 30 years ago?
- Construction systems should be different from this evolution?



- Why we are not open to try new systems?

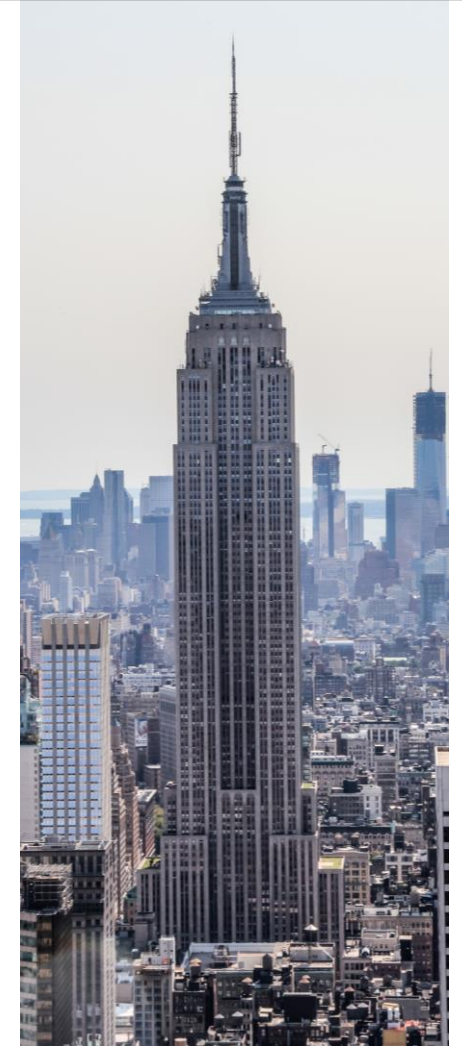
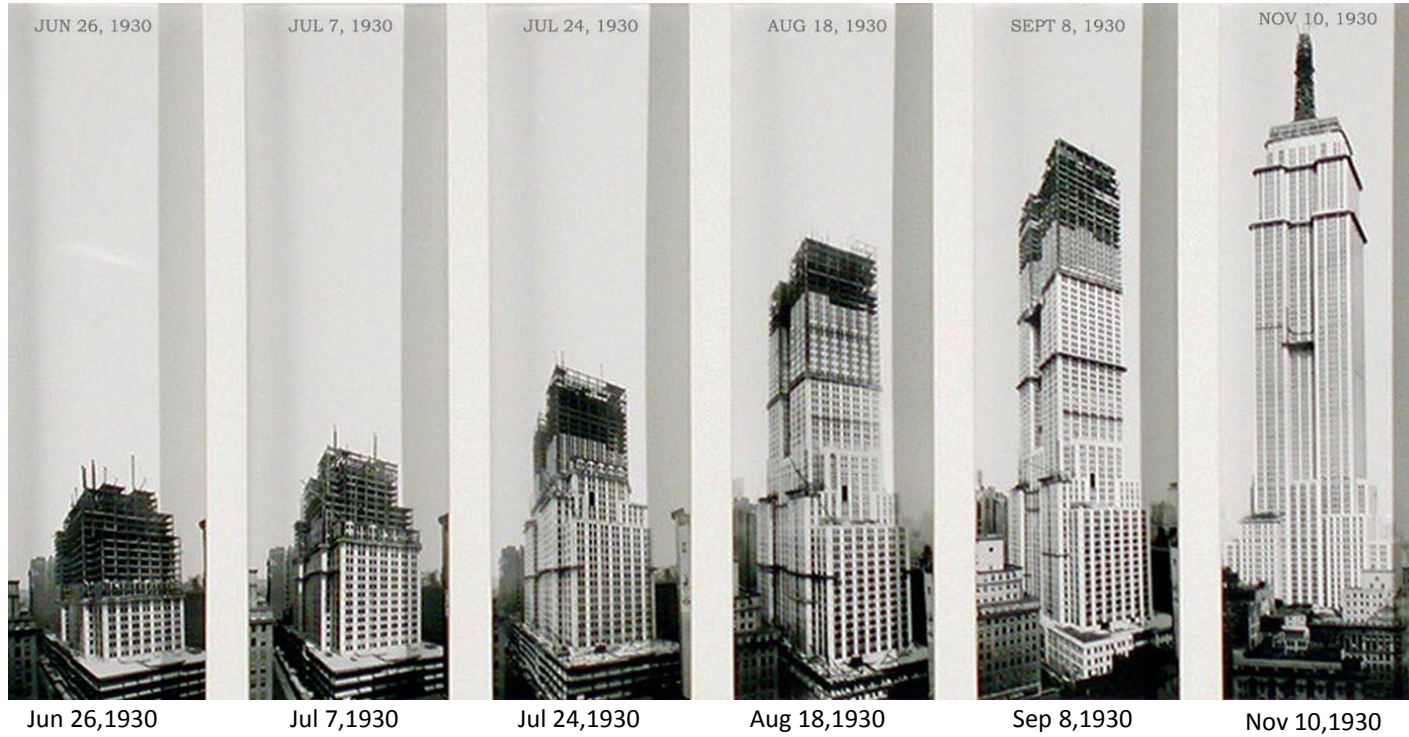
- Cultural preference to solidness.
- Security
- It's easier to find labor / materials
- Is what we know



- Why light weight construction?



Home Insurance Building,
Chicago 1885



Empire State Building,
New York

- Why to change?

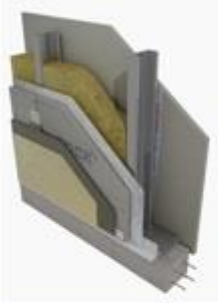
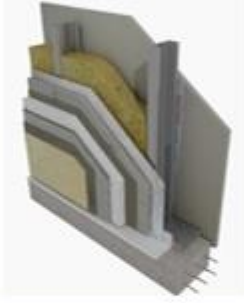

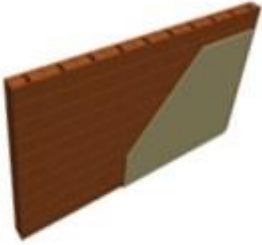
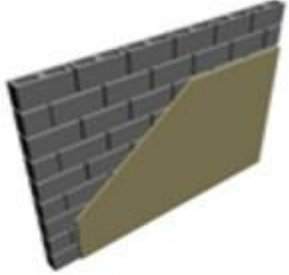
- What are the benefits for architects and developers
 - Differentiate through innovation
 - The Speed and results of the traditional system are already known by you
 - The benefits could be even more attractive once it's tested
- Who are the ones in charge of pushing new systems?
 - Architects, Designers
- Why other countries had changed?
 - Innovation, Speed, Efficiency, and Sustainability drivers



- Are the materials we using efficient enough?

- R Value or U value
- STC acoustics
- Fire resistant
- Sustainability
- Flexible or easy to adapt to changes

- Are the materials we using efficient enough?

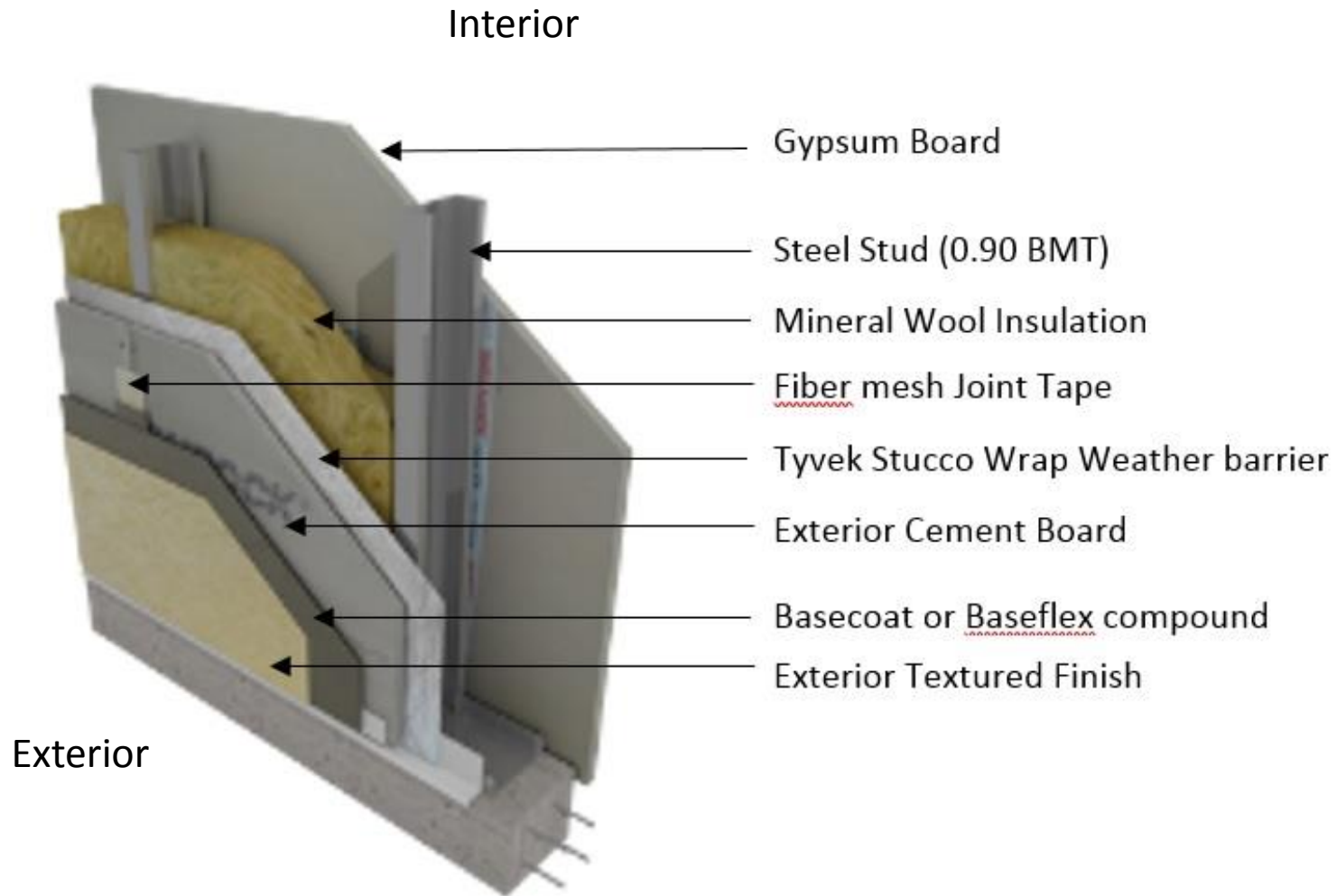
#	SYSTEM	DEFS		EIFS		CONCRETE WALL		BRICK WALL		AAC BLOCK	
1	DESCRIPTION	12.7 mm Cement board, 150mm Steel Stud & Track 0.90 BMT, 16mm Gypsum Board, 6" Mineral wool insulation.		25mm EPS insulation, 12.7 mm Cement board, 150mm Steel Stud & Track 0.90 BMT, 16mm Gypsum Board, 6" Mineral wool insulation.		100 mm Concrete Wall		120mm x 150mm x 240mm Brick Wall		120mm x 150mm x 240mm AAC Block	
2	IMAGE										
3	WIDTH	182mm		208mm		100mm		150mm		150mm	
5	ACOUSTIC (STC)	6" Mineral Wool	50	6" Mineral Wool	50	No Plastering	45	No Plastering	39	No Plastering	45
		Acoustic Test	SA-840313	Acoustic Test	SA-840313	Acoustic Test	No	Acoustic Test	No	Acoustic Test	No
6	THERMAL (R Value)	Including Insulation	23.22	Including Insulation	28.22	Including Insulation	0.52	Including Insulation	0.52	Including Insulation	1.84
7	Fire Resistance	Resistance (Hr)	1	Resistance (Hr)	1	Resistance (Hr)	1	Resistance (Hr)	1	Resistance (Hr)	1
8	Installation Coverage	Coverage (m2)	35	Coverage (m2)	35	Coverage (m2)	15	Coverage (m2)	8	Coverage (m2)	6

* The Figures are indicative & needs to be evaluated by a Qualified agency.

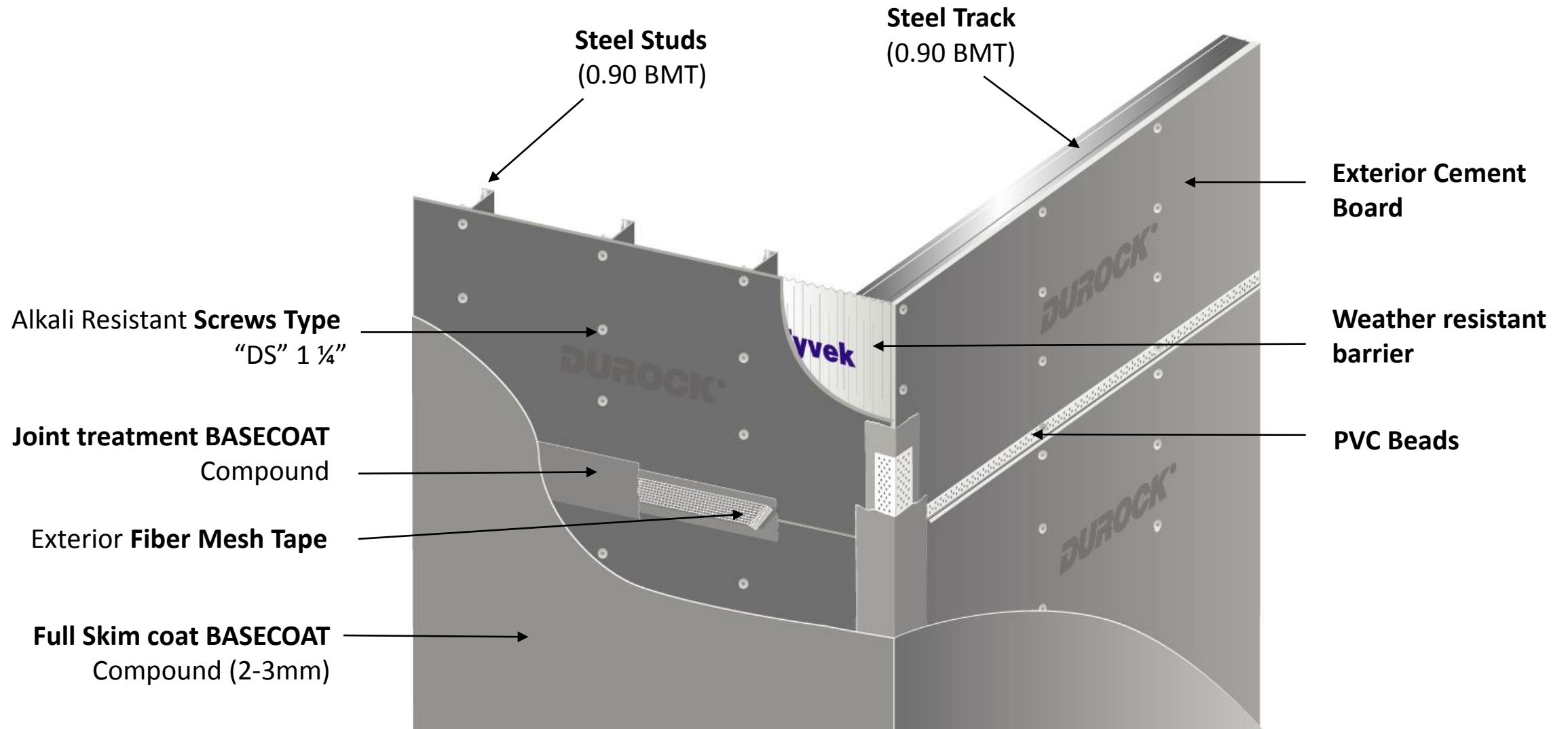
- Lightweight Construction Systems

- **DEFS**
 - Applications
 - How it works
 - What is the main benefit
- **EIFS**
 - Applications
 - How it works
 - What is the main benefit
- **Steel Framing – Residential application**
 - Second Floor Construction
 - EIFS application
 - Full House

DEFS SYSTEM (Direct Applied Exterior Finish System)



DEFS SYSTEM Components



DEFS SYSTEM Installation process



Step 1: Framing

Existing Concrete Slab

**Step 2: Weather resistant
barrier**

**Step 3: Exterior cement
board**

DEFS SYSTEM Installation process



**Step 4: Install
PVC beads**

Step 5: Joint Treatment

Step 6: Full Skim Coat

DEFS SYSTEM Installation process



Step 7: Primer installation

Step 8: Finish Application

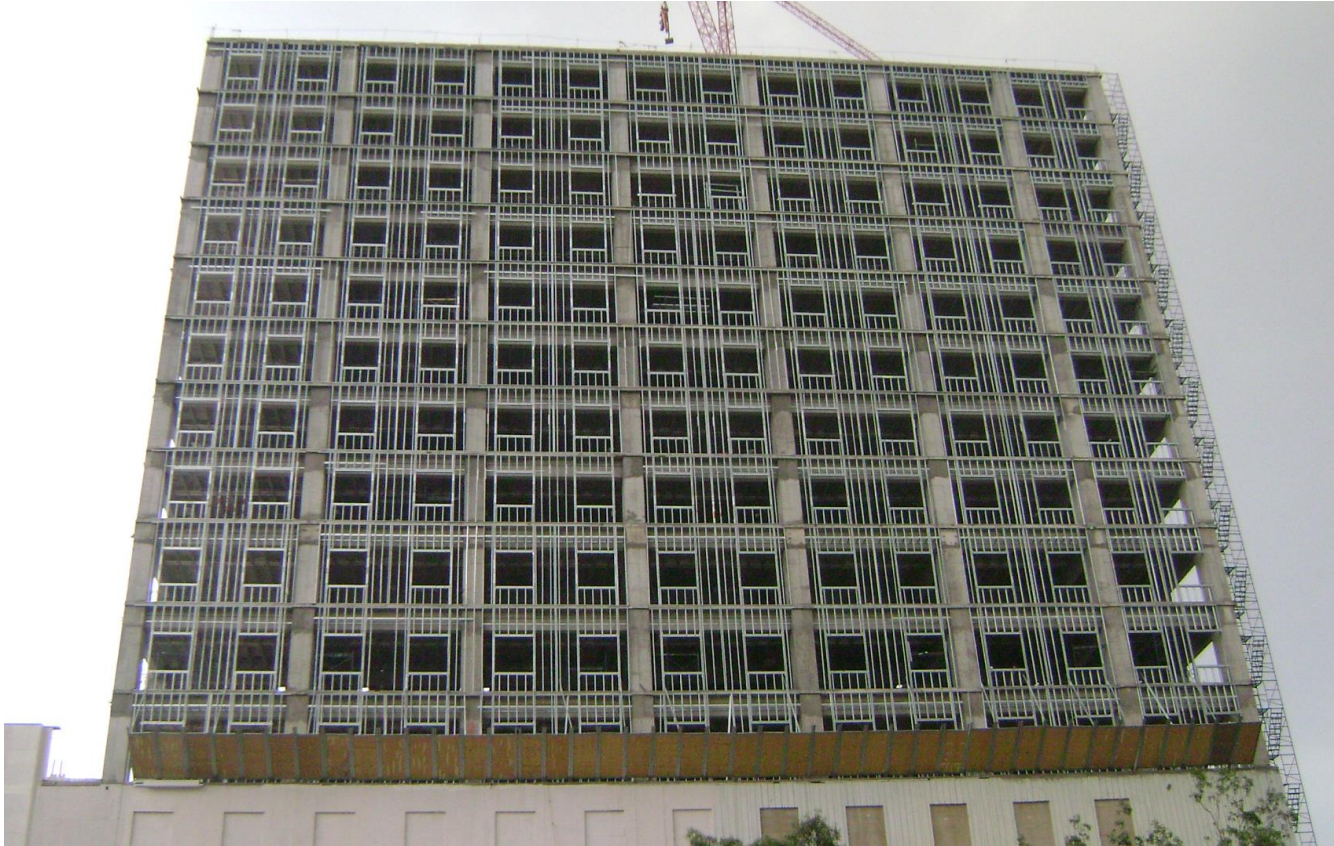
DEFS SYSTEM Example Application



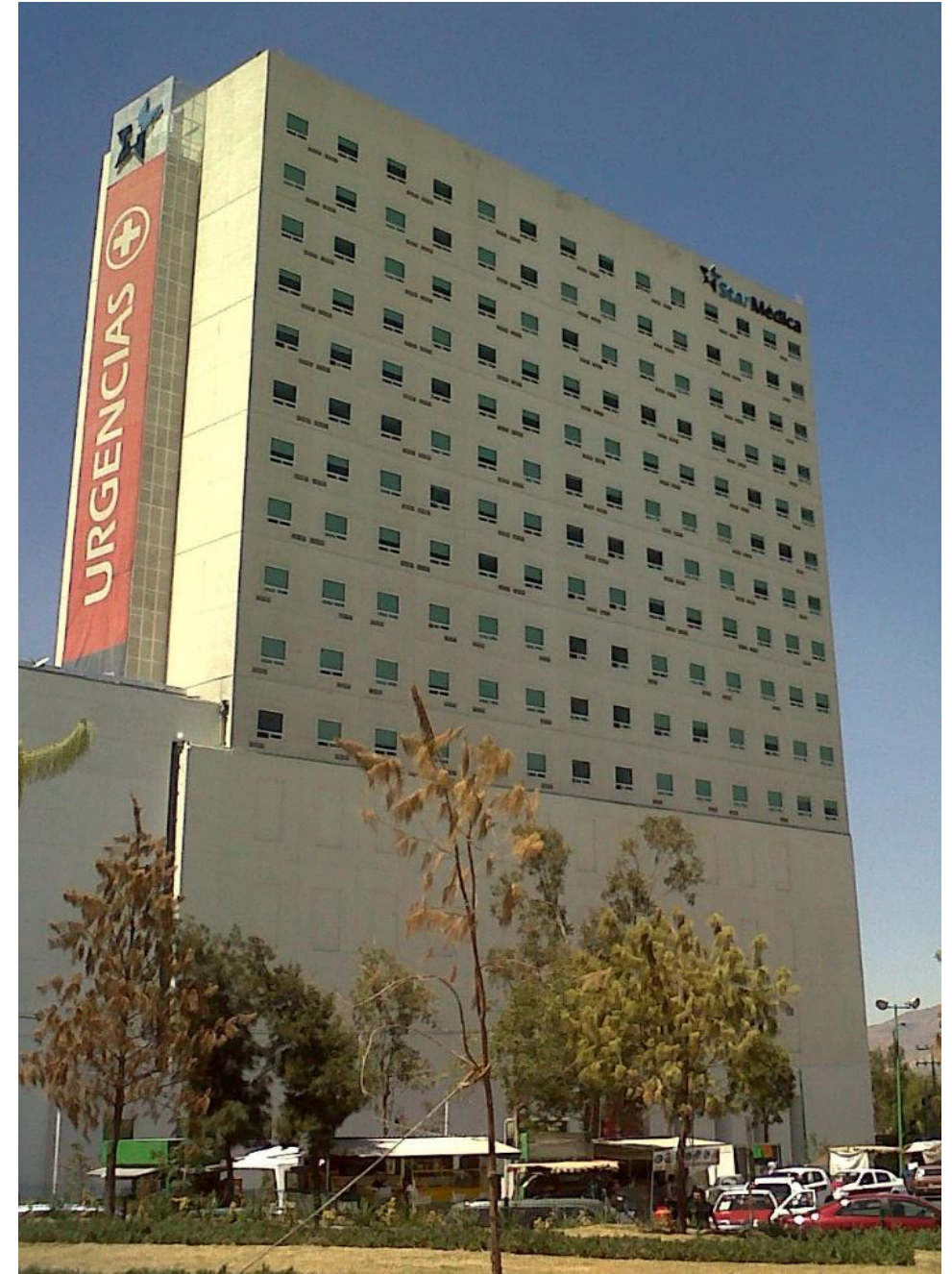
Star Medica Hospital 2008, Mexico City



DEFS SYSTEM Example Application



Star Medica Hospital 2008, Mexico City



DEFS System main advantages

Compared to conventional exterior wall systems, DEFS system can bring;

- Versatility on exterior wall design and finishing
- Up to 10 times light weight exterior wall structure
- Up to 6 times faster in exterior wall construction
- Up to 10 times lower U-value (better thermal insulation performance)
- Much lower maintenance cost from wall crack and water penetration issues
- Proven exterior drywall solution over 25 years (Durability)
- Flexible system performance design (Fire, acoustic, and thermal)

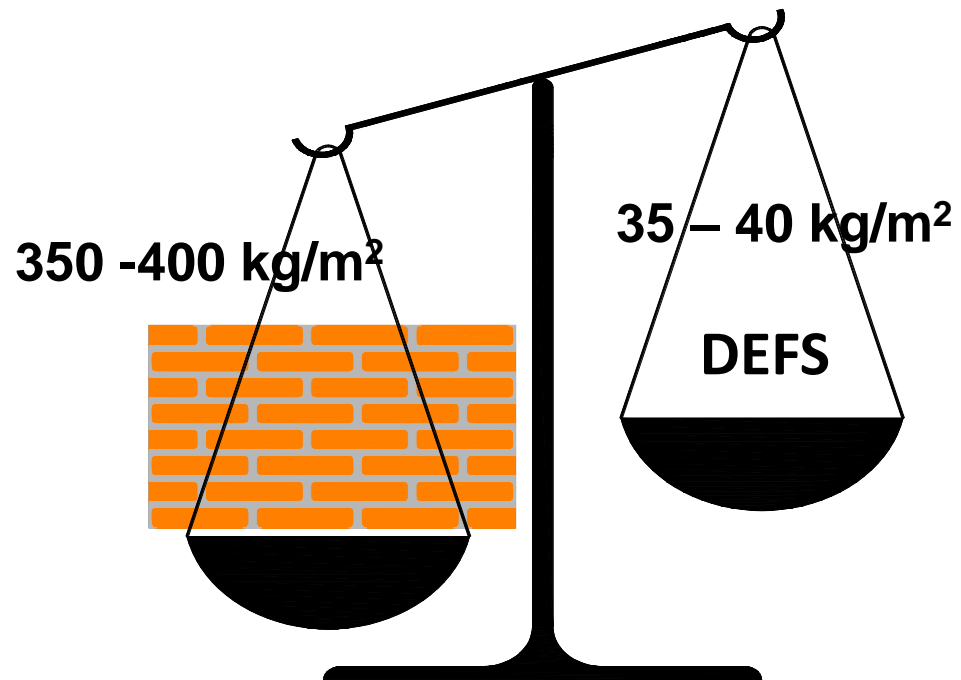
Versatility

- Unlimited Designs.
- Numerous finishing and coatings.
- Non Structural – Decorative Building Elements
- Can be curved (radius up to Min. 8 ft./ 2.44m)



Lightweight

- The structural cost is highly reduced.
- Avoids structural reinforcement on refurbishments.
- Flexible system design available according to local wind load requirement
- Seismic resistance from flexible metal frame design.



Speed of Construction

Brick wall (100m ²)	DEFS System (100m ²)	Remark (2 skillful workers/day)
Lining and brick claying 6 days	Framing and lining works (both sides) 1.5 days	Brick laying work: Max. 1.2 meters/day due to mortar setting issue
Exterior side rendering 10 days	Exterior side rendering 2.0 days	Brick (12-15mm thick rendering) Vs. Durock Basecoat (3mm thick rendering)
Interior side rendering 10 days	Inside joint treatment 0.5 day	Brick (10-12mm thick rendering) Vs. Durock (no rendering required interior side)
<u>Total 26 days</u>	<u>Total: 4 days</u>	<u>6 times faster</u>

- One assistant worker is not included in the speed calculation.

- No special working environment required compared to conventional systems (scaffoldings)



Clay brick



AAC block

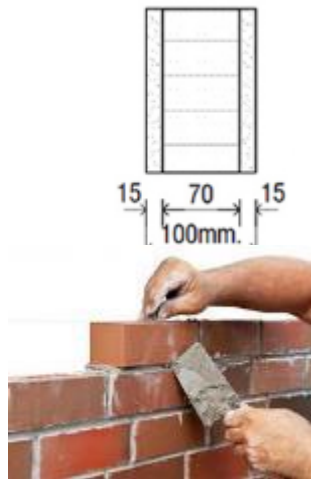


FC board

Energy Savings

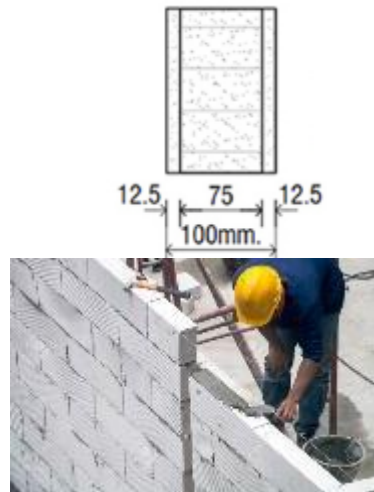
- Cavity Wall construction. Option of insulation to maximize energy savings.
- Lower U value helps to make energy efficient buildings.
- Can meet ECBC requirements of 0.44 U value.
- In case of brick or AAC exterior walls, very difficult or expensive to increase U value.

Brick



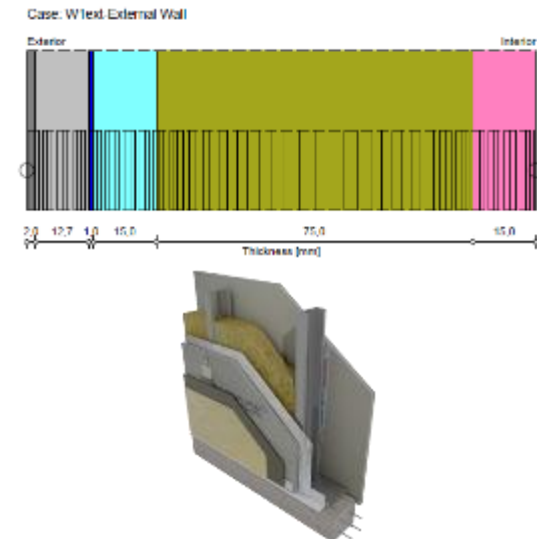
U value =
3.43 W/m².K

AAC



U value =
1.20 W/m².K

DEFS-SYSTEM



U value =
0.35 W/m².K

Maintenance Cost Savings

Conventional exterior wall (brick or AAL block) causes

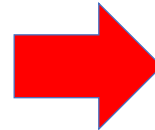
- Many cracks due to no mechanical fixing to the structure.
- Crack correction works every couple of years.
- Water penetration issues once wall crack occurred.

Unlikely masonry exterior wall systems;

- DEFS system provides much better crack resistance in case of structural movement or earthquake. Only requires surface crack correction if requires.
- Superior waterproofing management, thanks to 3 layers of waterproofing systems (Final finishing, Cement board, Tyvek).



Wall crack on masonry wall (interior & exterior)



Rain leakage through cracks (inside)



Crack fill works (interior & exterior)

Durability

- Proven exterior solution in US, Mexico, and Middle East for last 20 years.
- With an adequate maintenance lasts the same time than a traditional system.

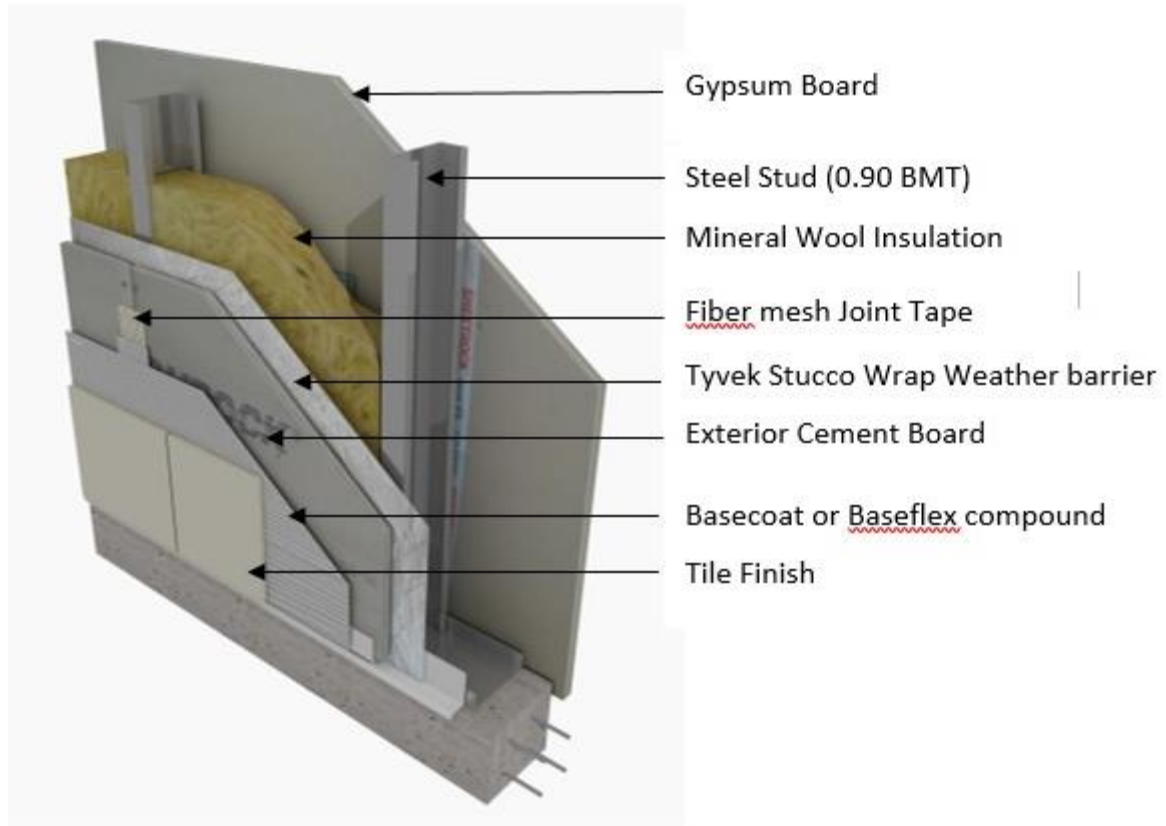


1994



2017

DEFS SYSTEM CERAMIC TILE



ABC Hospital, Santa Fe Mexico City

DEFS SYSTEM CERAMIC TILE



Helion Zambrano, Monterrey 2012



Helion Zambrano, Monterrey 2012

DEFS SYSTEM CERAMIC TILE

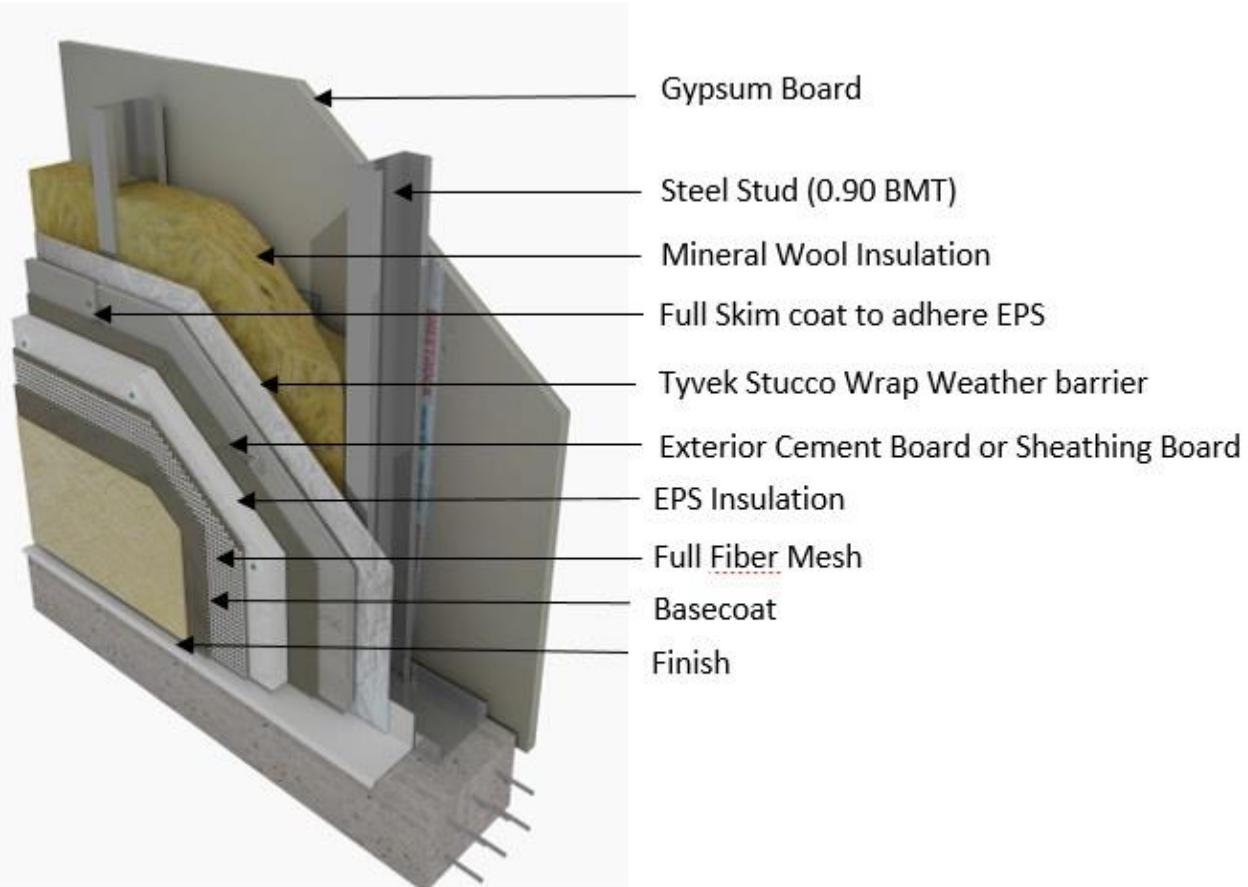


Helion Zambrano, Monterrey 2012



Helion Zambrano, Monterrey 2012

EIFS SYSTEM (Exterior Insulation Finish System)



Vertical construction applications

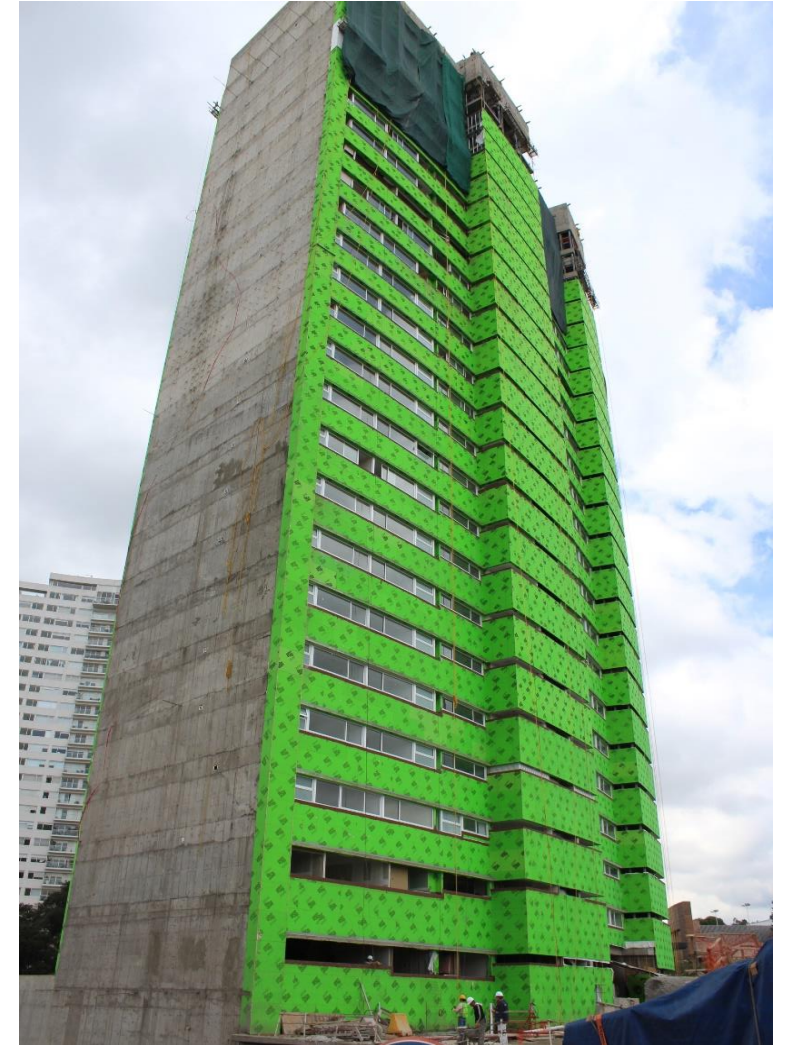
- Full Facade EIFS system in combination with Concrete structure



Parque Reforma, Mexico City 2012

Vertical construction applications

- Full Facade EIFS system in combination with Concrete structure



Parque Reforma, Mexico City 2012

Vertical construction applications

- Full Facade EIFS system in combination with Concrete structure



Parque Reforma, Mexico City 2012

Types of Facades

SLAB TO SLAB FACADE – DEFS System



Steel Studs
(0.90 BMT)

Steel Track (0.90 BMT)

Concrete Slab

Weather resistant barrier

Exterior cement board

SLAB TO SLAB FACADE – DEFS System



- Advantages of Slab to Slab Application
 - No need of secondary structure
 - Faster installation of the framing from the inside of the building
- Limitations of Slab to Slab Application
 - Suggested for buildings less than 10 stories high
 - Good Construction controlled of unlevelled slabs, between 3 to 5cm

CURTAIN WALL – DEFS System



- Advantages of Curtain Wall Application
 - Better control of the alignment of the façade.
 - Easy to create false exterior volumes in the façade without adding extra weight to the structure compared with concrete or brick.
 - Recommended option for buildings higher than 10 stories.
- Limitations of Curtain Wall Application
 - The secondary structure and anchors should be determined by the structural engineer of the project

- Curtain Wall type



- Work as a furring to complete the design of concrete structures.
- Reduce the time of construction without using any formwork.

- Curtain Wall type
-



ITESM Santa Fe, Mexico City 2004

Vertical construction applications , curved walls

- Full Facade DEFS system in combination with Steel structure



San Jose Maria Escriva Church, Sordo Madaleno Arquitectos 2009



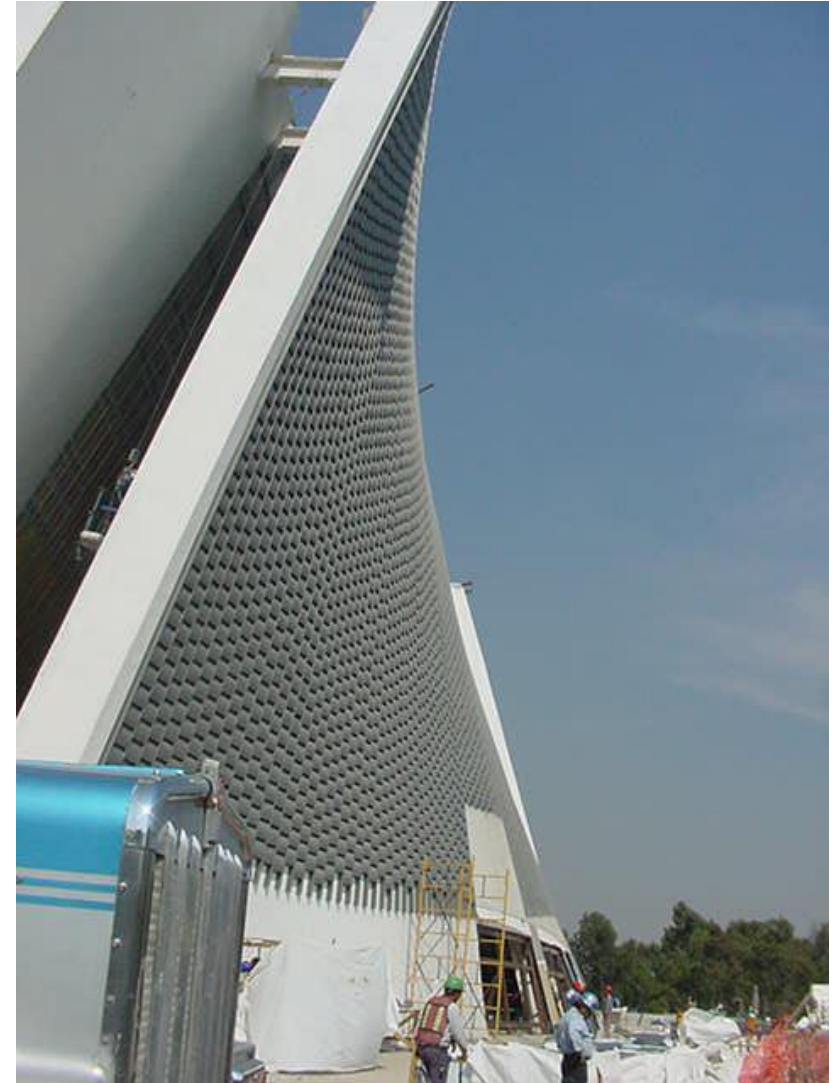
San Jose Maria Escriva Church, Sordo Madaleno Arquitectos 2009

Vertical construction applications , curved walls

- Full Facade DEFS system in combination with Steel structure



San Jose Maria Escriva Church, **Sordo Madaleno Arquitectos** 2009



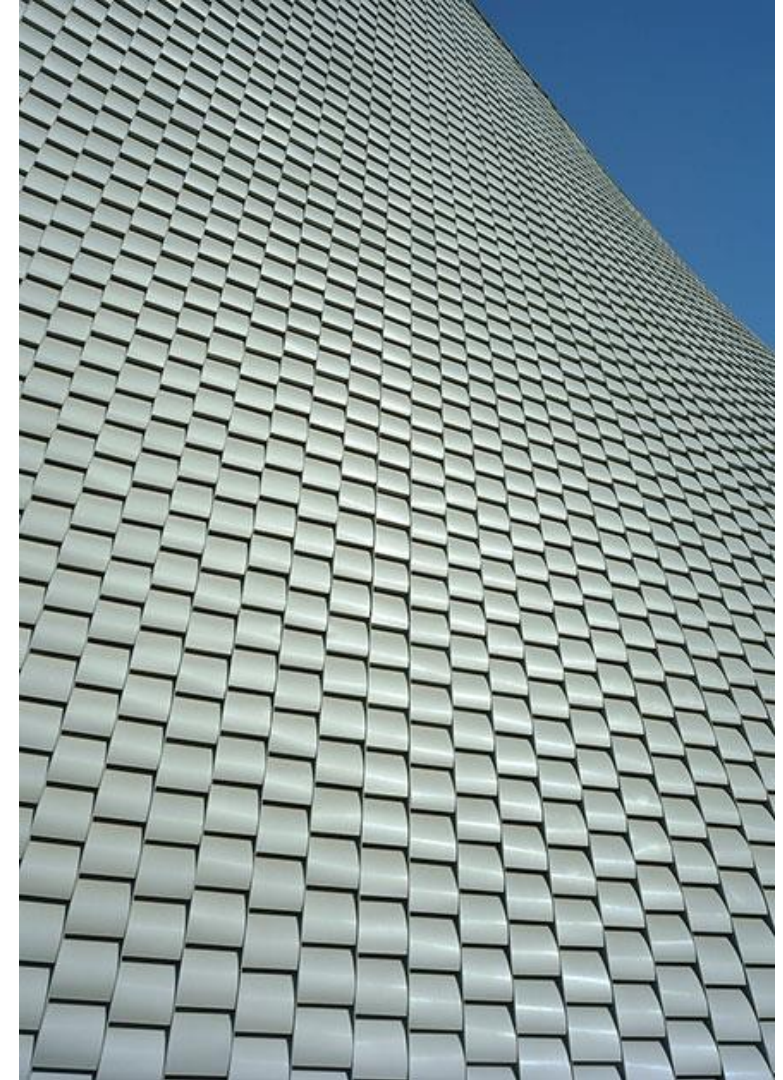
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Vertical construction applications , curved walls

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San Jose Maria Escriva Church, **Sordo Madaleno Arquitectos** 2009



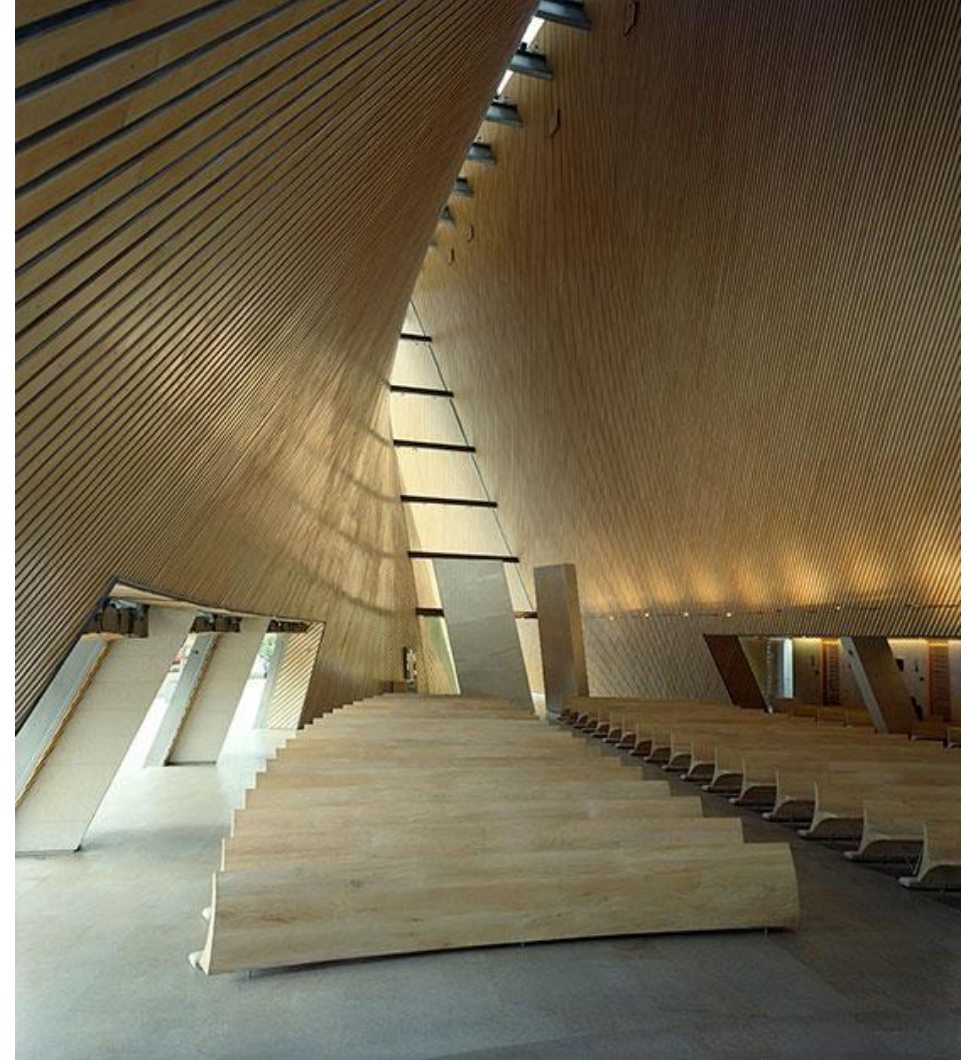
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Vertical construction applications , curved walls

- Full Facade DEFS system in combination with Steel structure



San Jose Maria Escriva Church, **Sordo Madaleno Arquitectos** 2009



San Jose Maria Escriva Church, **Sordo Madaleno Arquitectos** 2009

Exterior application curved walls

- Full Facade DEFS system in combination with Concrete Structure



CRIT Teleton, **Sordo Madaleno Arquitectos** 2007



CRIT Teleton, **Sordo Madaleno Arquitectos** 2007

Exterior application curved walls

- Full Facade DEFS system in combination with Concrete Structure



CRIT Teleton, Sordo Madaleno Arquitectos 2007



CRIT Teleton, Sordo Madaleno Arquitectos 2007

Vertical construction applications , Slab to Slab application

- Full Facade DEFS system in combination with Steel structure



Torreon Government Building 2012



Vertical construction applications , Slab to Slab application

- Full Facade DEFS system in combination with Steel structure



Vertical construction applications , Slab to Slab application

- Full Facade DEFS system in combination with Steel structure



Torreón Government Building 2012

Vertical construction applications , Slab to Slab application

- Full Facade DEFS system in combination with Steel structure



Torreon Government Building 2012



Housing with Light weight construction

- Main barriers:
 - Mind changing on the culture of the people refer to solidness and a “house for all life”.
 - Understand the benefits of using light weight construction compare with brick or other systems.



Main benefits of Light weight construction

- Dry construction and Speed of construction
 - Reduce \$ Labor costs , less people to do the job.
 - 8 – 9 m2 vs 36 m2, 4 times faster.



First Floor with Light weight construction



- Ground Floor regular brick
- First Floor with Siding and Steel Framing with OSB

Second Floor with Light weight construction



- Second Floor extension or remodeling

First Floor with Light weight construction + EIFS Finish



- Ground floor Traditional System construction
- First Floor with EIFS System and Steel Framing with Cement board

Full house with Steel Framing

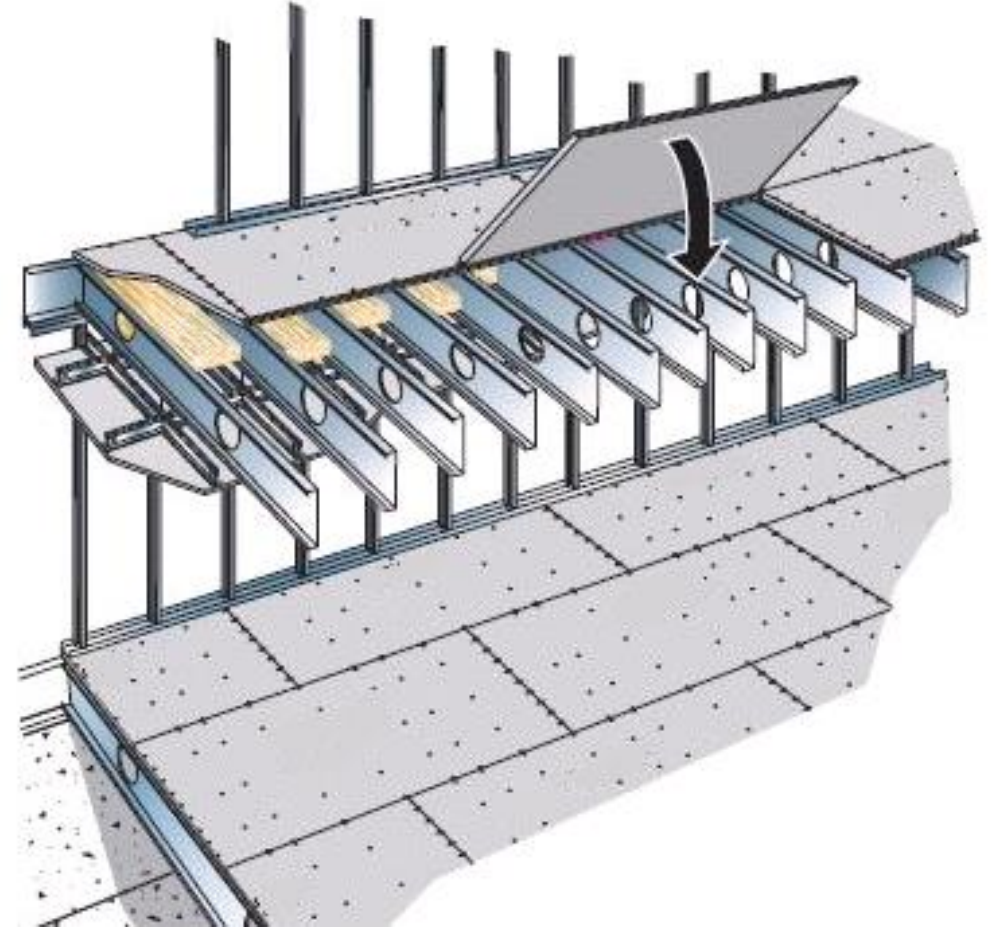


Full house with Steel Framing



Structural System - Properties

- Non-combustible
- Structural
- Lightweight
- Do not promote mold
- Dimensionally stable
- Do not degrade in presence of moisture



Structural System – Easy Installation , Cutting

Cut with carbide-tipped circular saw, just like plywood



Structural System – Easy Installation , Fastening



Full building construction – Structural System



First Floor – Structural System



Curtain Wall – Structural System



Floor Joists – Structural System



Roof Deck – Structural System



Final Product Structure: October 2 to March 15

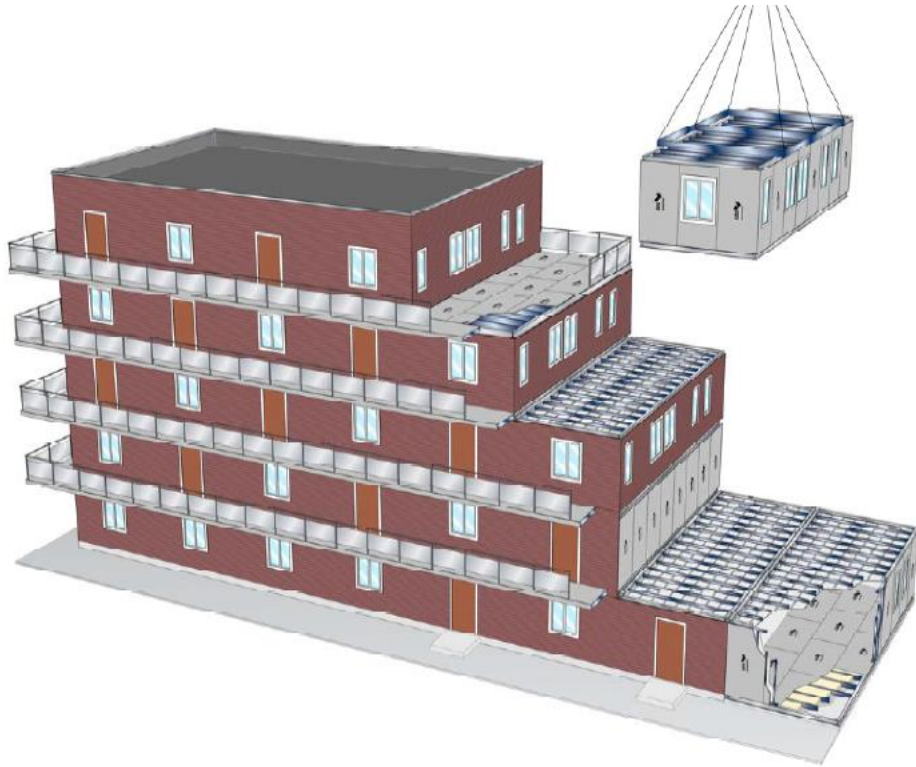


Extend the Envelope of the Building

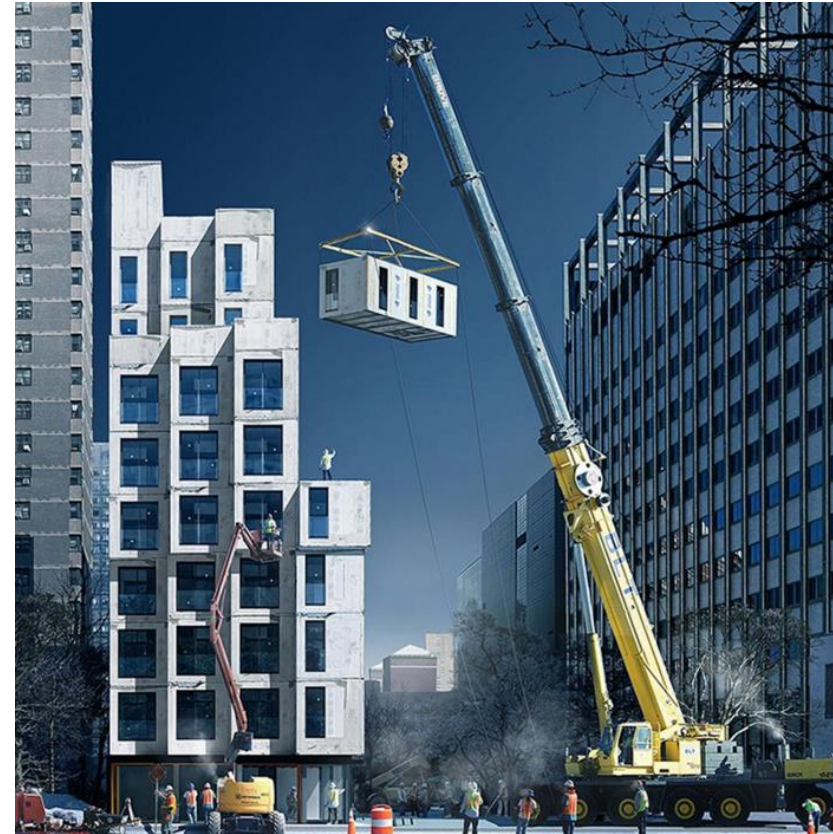


Modular Construction – Structural System

Excellent for construction
on site without room



Excellent speed of construction



Unusable property – Transform in Useable



Full Building Dry Construction



Thanks

Questions?