

# Quality Assurance and Testing of Facades

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FITI



future skyline



# THE CHALLENGES



DESIGN

PERFORMANCE

COST

TIME LINES

QUALITY



# FAÇADE DESIGN REQUIREMENTS

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HIGH WIND PRESSURE



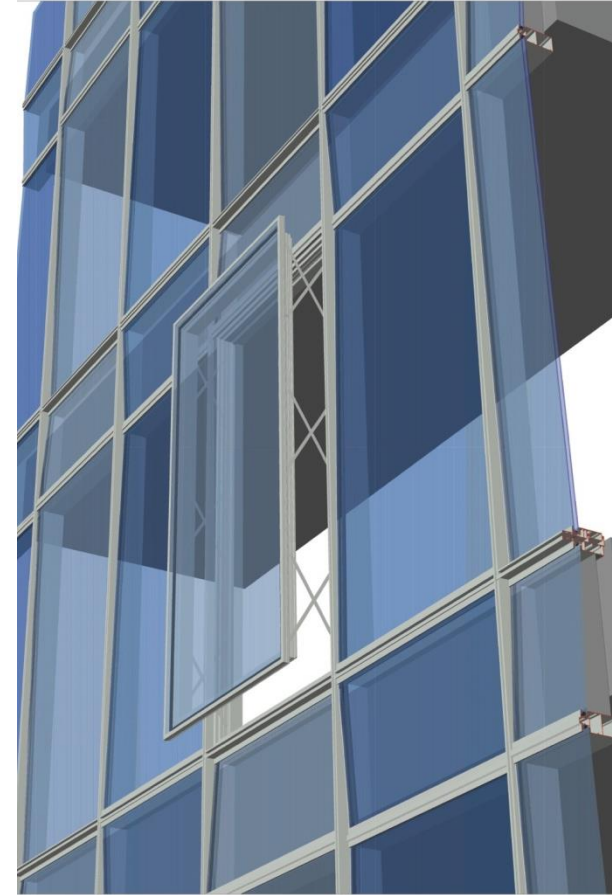
PEDESTRAIN COMFORT



WORKMANSHIP DEPENDENCY



SAFETY



FIRE / VENTILATION

# Why Façade Testing?

Last chance for correction of design to meet performance.

Key to stability certification to the building.

Must for every building validation and certification.

Must for safety as a whole.



# MAIN PERFORMANCE PARAMETERS

Weather

Structural

Seismic

Thermal

Acoustics

Fire



# Weather - AIR LEAKAGE

## Air Infiltration

- Under positive pressure
- Air infiltration means heat entering inside.

## Air Exfiltration

- Under negative pressure
- Air exfiltration means loss of cool air.

Either way is loss of air-conditioning

Also loss in Acoustical performance.

Cannot be verified in drawings alone.



# Air Performance Standards

## AS-NZ

- 5.76  
 $\text{m}^3/\text{hr}/\text{m}^2$

## ASTM –AAMA

- 1.8  
 $\text{m}^3/\text{hr}/\text{m}^2$

## CWCT

- 2.06  
 $\text{m}^3/\text{hr}/\text{m}^2$

## CAN BE ACHIVED

- 0.50  
 $\text{m}^3/\text{hr}/\text{m}^2$





# Air Test Pressure

## AS-NZ

- 150 Pa

## ASTM –AAMA

- 75 – 300Pa

## BS-EN

- 150- 600 Pa

## CONSIDERATI ON

- 10 – 15%  
OF DWP



# Weather - WATER LEAKAGE

## Water Leakage

- Under positive pressure
- Damages interior, False ceiling and furnishings.
- Ineffective utilization of floor space near façade perimeter.
- Fungal growth

Cannot be verified in drawing alone.

Scientific system design to be Followed.



# Water Test Pressure

## AS-NZ

- 300 Pa

## ASTM –AAMA

- 137 – 720 Pa

## BS-EN

- 20% of DWP

## CONSIDERATION

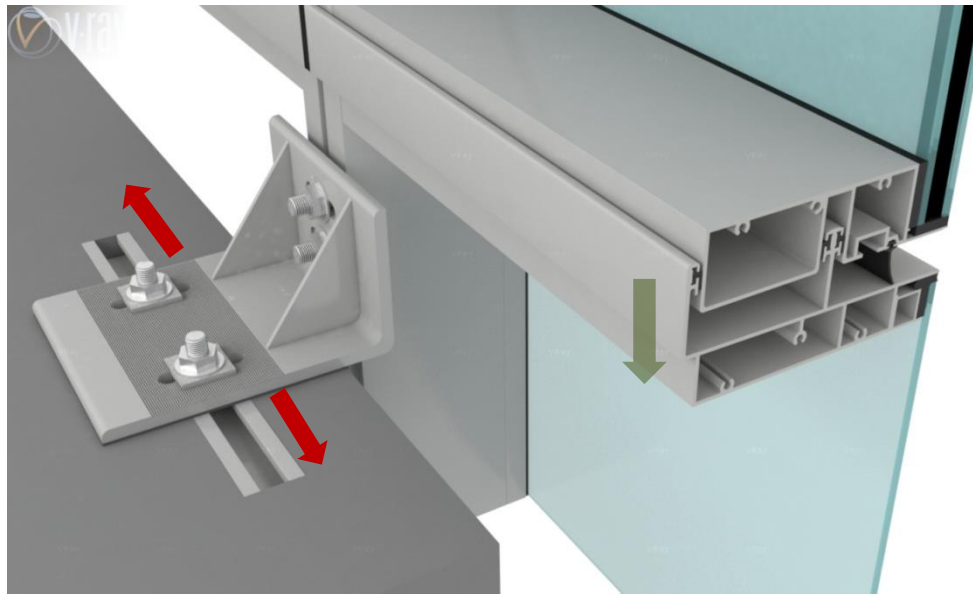
- 15-20% OF DWP



# SEISMIC & LIVE LOAD MOVEMENTS

## Intermediate Floor Drift

- 0.4 % of Floor Height –  $L/250$
- Flexible Joints at Floor Level to Release Forces.
- Cast In Chanel With T-Bolt Allowing Movement.



UNITISED WITH SLIDER STACK JOINT

# PERFORMANCE TEST SEQUENCE

- 50% Structural load –
- Vent Open Close 5 times
- Air Infiltration test – 300Pa (As per ASTM E 283)
- Static Water Test – 450Pa (As per ASTM E 331) –
- Dynamic Water Test – 450Pa (As per AAMA 501.1) –
- Structural Wind load Test – 1000Pa (As per ASTM E 330)
- Repeat Static Water Test – 300Pa (As per ASTM E 331) –
- Proof Load Test – 1500Pa (As per ASTM E 330)





## Case Study – Kohinoor Square

Diamond Skin Design



## ARCHITECTURAL REQUIREMENT

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Articulated Façade  
Vision glass inclined  
outward & inward.

Spandrel glass inclined  
inward & outward.

Profile fin projection  
visible in elevation.

# WIND ANALYSIS

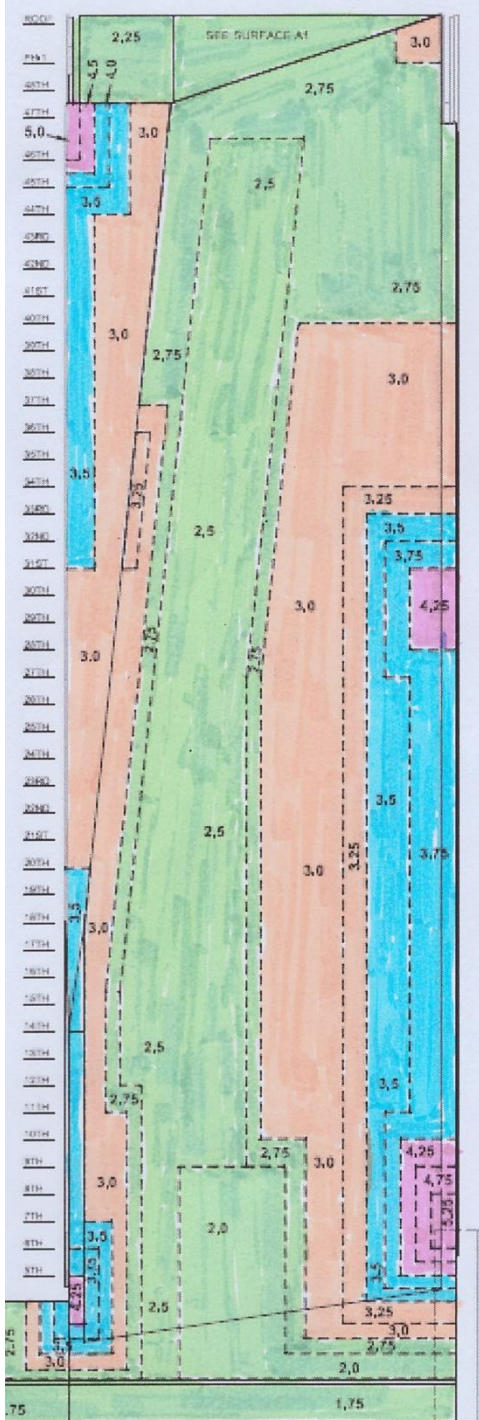
## Wind Pressure Zoning

- 2 – 2.75 Kpa
  - 3 – 3.25 Kpa
  - 3.5 – 4 Kpa
  - 4.25 – 5.25 Kpa — 10 %
- 90 %

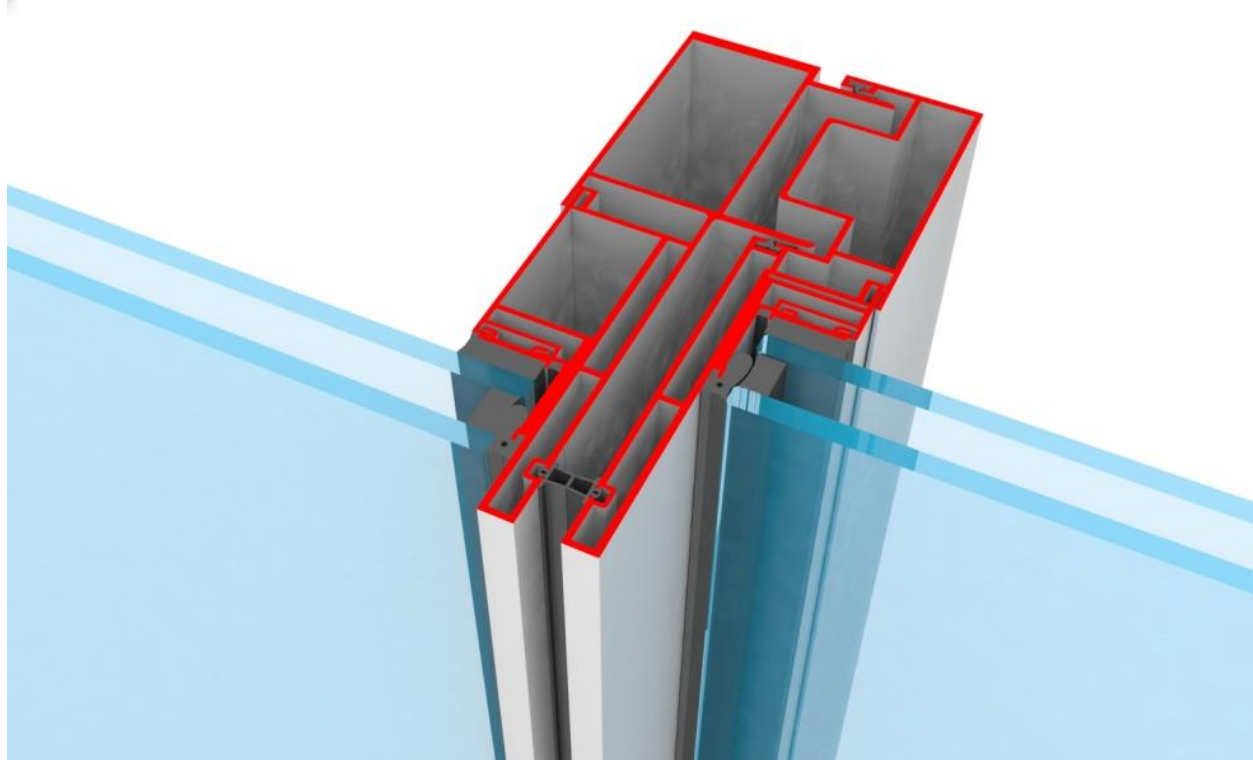
## System Design

4 Kpa

Remaining 10% after checking the reserve strength.







## SYSTEM DESIGN

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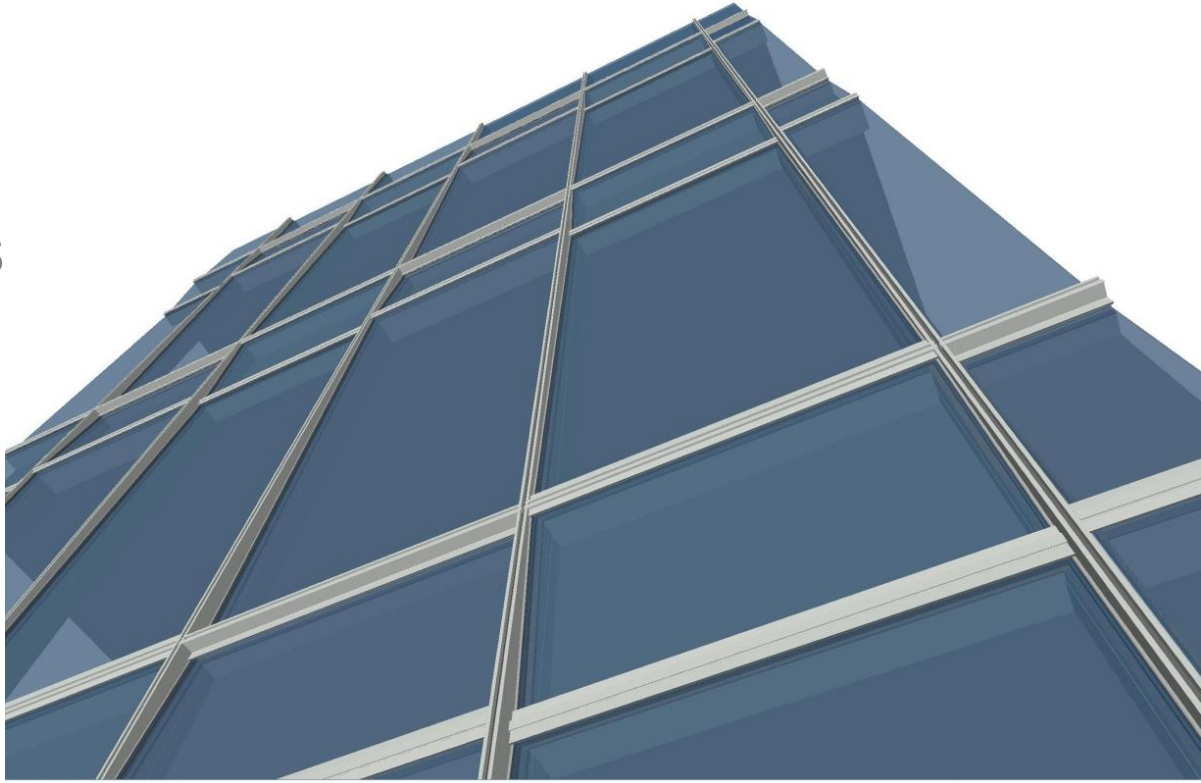
Articulated Unitized system -1.5 m x 3.9 m units  
250mm Deep profile.

Glass articulation in Mullion Fin projection.

Telescopic base profile to receive articulation.

# ENGINEERING OF GLASS

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High reflective glass.

Vision glass - 32mm IGU glass of 1.5 m x 3.0 m (8 +16AG+8)

Glass fabrication Quality - Flatness of glass within 2 mm.

Annual weather cycle 20% of DWP (800 Pa )

Pressure drop at height

## DESIGN VALIDATING

Design validation by performance test process carried out at Laboratory.

Air leakage test at 300 Pa.

Water leakage test at  
750 Pa- 1200 Pa – 1500 Pa.

Wind load serviceability test at  
Step 1 – Passed 4 kpa.  
Step 2 – Passed 6 kpa.  
Step 3 – Reserved strength of  
7.3 kpa.

Seismic inter story floor drift at  
15mm.



@ 6.0 Kpa Positive Wind Pressure



## Case Study – Brigade Gateway, World Trade Centre

Skewed Glazing System



## ARCHITECTURAL REQUIREMENT

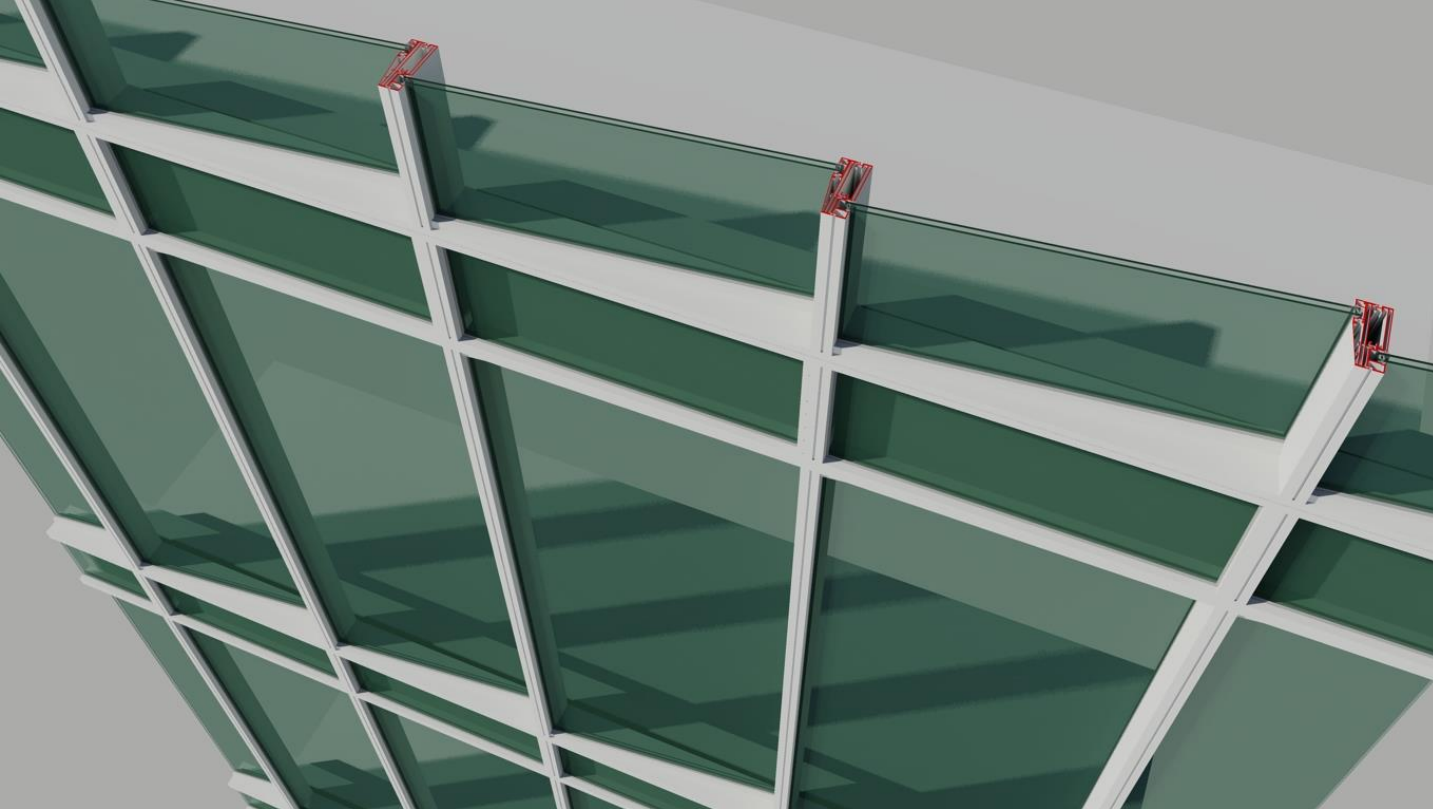
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Vision glass skewed in Plan.

Spandrel glass straight in plan.

Visible mullion 200mm deep as Fin projection ( South elevation )

Façade curved in plan.



Vision glass – Floor to Ceiling – 1.5m x 3.6 m  
Wind pressure – 1.6 kpa

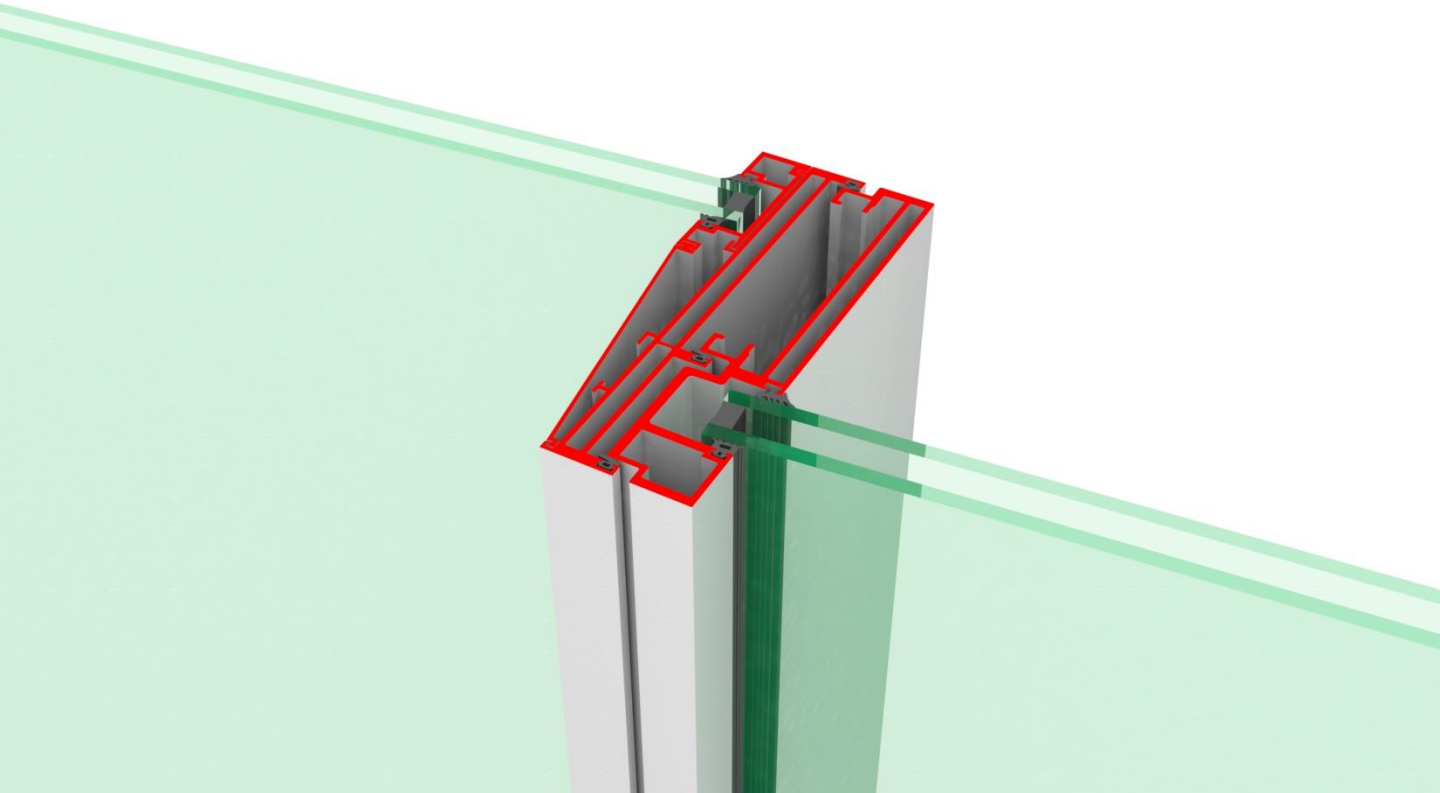
## ENGINEERING OF GLASS

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Glass fabrication Quality - Flatness of glass within 2 mm.

Annual weather cycle 20% of DWP

Pressure drop at height.



Unitized Element Design - 1.5m x 4.2m units

## SYSTEM DESIGN

System – Structurally Glazed with mechanical holding

250mm Split mullion with 3 barrier gasket system.

200mm deep mullion projection acting as vertical Fin.



# DESIGN VALIDATING

Design validation by performance test process carried out at Laboratory.

Air leakage test at 300 Pa.

Water leakage test at 600 pa

Wind load serviceability test at  
Step 1 – Passed 1.8 kpa  
Step 2 – Passed 2.7 kpa

Seismic inter story floor drift at 24mm.



THANK YOU

