The Whitney Museum
A Building Envelope Case Study

Georgia Ewen-Campen / Heintges Consulting Architect & Engineers
Whitney Museum of American Art

Architect:  Renzo Piano Building Workshop
          in collaboration with Cooper Robertson
Structural Engineer: Robert Silman Associates
MEP Engineer:  Jaros Baum & Bolles
Facade Consultant:  Heintges
Roofing Consultant:  Henshell & Buccellato
Energy Consultant:  Viridian
Construction Manager: Turner Construction
Curtain Wall: Gartner
Precast Fabricator: BPDL
Facade Design

Massing / Materiality

Light / Transparency
Facade Design

Massing / Materiality

Light / Transparency
Performance Criteria

Light
Performance Criteria

Air
Performance Criteria

Natural Light Control

Interior Environment

Condensation Mitigation
Performance Criteria

Natural Light Control

Interior Environment

Condensation Mitigation
Performance Criteria

Natural Light Control

Interior Environment

Condensation Mitigation

Moisture
Facade Overview

Wall Type 1:
Precast concrete panels

Wall Type 2:
Unitized curtain wall with steel plate rain screen

Wall Types 3, 4, 5, 8 + 10:
Large insulating glass units capture-glazed onto custom steel framing

Wall Type 6:
Tension cable wall with monolithic glazing

Wall Type 7:
Steel sawtooth monitors with north-facing clerestory windows.
Facade Overview

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Steel-clad curtain wall

Thermal Performance

Condensation Mitigation

Quality Control

Unitized curtain wall with steel plate rain screen
Steel-clad curtain wall

Thermal Performance

Condensation Mitigation

Quality Control

Unitized curtain wall with steel plate rain screen
Steel-clad curtain wall

Thermal Performance

Condensation Mitigation

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Unitized curtain wall with steel plate rain screen
Steel-clad curtain wall

Thermal Performance
Condensation Mitigation
Quality Control

Thermal Insulation
Wintertime Design Conditions:

Exterior Temperature: 13 °F
Interior Temperature: 72 °F
Interior Relative Humidity: 45%
Dewpoint: 49 °F
Steel-clad curtain wall

Thermal Performance

Condensation Mitigation

Quality Control

Galvanized steel air seal sheet
Steel-clad curtain wall

Thermal Performance

Condensation Mitigation

Quality Control
Steel-clad curtain wall

Thermal Performance
Condensation Mitigation
Quality Control
Steel-clad curtain wall

Thermal Performance

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Thermal Performance

Condensation Mitigation

Quality Control
Precast panels

Thermal Performance

Condensation Mitigation

Quality Control
Preceded panels

Thermal Performance

Condensation Mitigation

Quality Control

L-shaped precast panels
Precast panels

Thermal Performance

Condensation Mitigation

Quality Control

*L-shaped precast panels*
Precast panels

Thermal Performance
Condensation Mitigation
Quality Control
Precast panels

Thermal Performance

Condensation Mitigation

Quality Control

Closed cell spray foam insulation
Precast panels

Thermal Performance

Condensation Mitigation

Quality Control

Closed cell spray foam insulation
Precast Panels

Thermal Performance

Condensation Mitigation

Quality Control

Interface conditions
Precast Panels

Thermal Performance

Condensation Mitigation

Quality Control
Precast Panels

Thermal Performance

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Quality Control
Precast panels

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Condensation Mitigation

Quality Control
Precast panels

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Quality Control

KEY INTERFACE CONDITION #8
Precast panels

Thermal Performance

Condensation Mitigation

Quality Control

Interface conditions
Precast panels

Thermal Performance
Condensation Mitigation
Quality Control

Interface conditions
Glazed curtain wall

Natural Light Control
Condensation Mitigation
Quality Control
Glazed curtain wall

Natural Light Control

Condensation Mitigation

Quality Control
Glazed curtain wall

Natural Light Control
Condensation Mitigation
Quality Control
Glazed curtain wall

Natural Light Control

Condensation Mitigation

Quality Control

Controlling light levels
Glazed curtain wall

Natural Light Control

Condensation Mitigation

Quality Control

UV control

UV transmittance by wave length

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Glazing from outside to inside

Low Iron Pilkington Optiwhite 10 mm with combi neutral 70/40
12 mm argon
Laminated glass:
Low iron Pilkington Optiwhite 5 mm
1,52 mm PVB- interlayer (Trolfol BG R20)
Low iron Pilkington Optiwhite 5 mm

- light transmittance: approx. 73%
- light reflectance (outside): approx. 13%
- light reflectance (inside): approx. 13%
- solar direct transmittance: approx. 36%
- solar direct reflectance (outside): approx. 38%
- solar direct reflectance (inside): approx. 37%
- solar factor (g-value): approx. 39%
- shading coefficient: approx. 45%

- UV-transmittance: approx. 0%
- UV-reflectance: approx. 8%
- UV-absorption: approx. 92%

- color rendering index: approx. 97

thermal transmittance (NFRC) Ug: approx. 1,36 W/m²K
Glazed curtain wall

Natural Light Control

Condensation Mitigation

Quality Control

Mechanical Shades
Glazed curtain wall

Natural Light Control

Condensation Mitigation

Quality Control

Mechanical Shades
Glazed curtain wall

Natural Light Control

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Quality Control

Blocking direct solar penetration
Glazed curtain wall

Natural Light Control

Condensation Mitigation

Quality Control

Ceramic frit
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control

Pre-fabricated framing
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control

Daylighting
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control

Daylighting
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control
Glazing U-value: 0.12 Btu/hr ft² °F
System U-Value: 0.11 Btu/hr ft² °F

Dew Point: 49 °F (9.5 °C)
Rooftop Monitors

Natural Light Control

Condensation Mitigation

Quality Control

Thermal cycling: AAMA 501.5
Rooftop Monitors

Natural Light Control
Condensation Mitigation
Quality Control

Flood testing and vector mapping
Tension Cable Wall

Natural Light Control

Condensation Mitigation

Quality Control

Lobby
Tension Cable Wall

Natural Light Control

Condensation Mitigation

Quality Control

Design options
Tension Cable Wall

Natural Light Control

Condensation Mitigation

Quality Control
Tension Cable Wall

Natural Light Control

Condensation Mitigation

Quality Control

Tension measurement
Tension Cable Wall

Natural Light Control

Condensation Mitigation

Quality Control
Tension Cable Wall

Natural Light Control

Condensation Mitigation

Quality Control
Thank you

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