LOUVRE ABU DHABI

ENGINEERING AN ICON
Saadiyat Island

- Cultural District and Mall
- Cruise Port

Abu Dhabi

Dubai and Yas Island
Louvre Abu Dhabi – Galleries and Vestibules

- 23 Permanent Galleries
- 4 Vestibules
- 15 passage
Permanent Galleries

• 23 Permanent Galleries
• 4 Vestibules
• 15 passage
Louvre Abu Dhabi – Engineering Challenges

**MARINE ENGINEERING**
- Scour of sea bed
- Exposure to open sea
- Wave protection

**CIVIL & STRUCTURAL ENGINEERING**
- Basement Watertightness
- Complex Dome
- 100 year design life
- Marine environment

**SPECIALISTS**
- Acoustics
- Daylight Control
- Lighting

**FAÇADE ENGINEERING**
- Dome cladding
- Cladding to galleries
- Moucharabieh
- Wearing Wall

**SECURITY**
- Terrorist target
- Protection of artwork
- Public assembly

**ICT**
- Building systems,
- Visitor interface

**MEP ENGINEERING**
- Gallery Environment
- Marine environment
- System sustainability
- Desert Climate

**FIRE ENGINEERING**
- No sprinklers
- Fire Fighting and escape
- Smoke management

**ICONIC LANDMARK PROJECT**
Enabling Works - Land Reclamation

Sequence:

- Build revetments on sea bed by dropping large stones from barges
- Pump in hydraulic fill to +4.00m AoD
- Install hydraulic cut-off walls
- De water site within hydraulic cut-off walls using deep well points
- Excavate fill to basement profile
- Install permanent piling
Structural Engineering - Piling
Structural Engineering - Basement Waterproofing
Structural Engineering - Basement Waterproofing
Structural Engineering – The Dome
Structural Engineering – The Dome
Structural Engineering – The Dome
Structural Engineering – Constructing the Dome

Supersize Elements
Approx 25m long x 6m wide
Weight approx 30 tonnes

- COMPONENTS PRE-FABRICATED AND DELIVERED TO SITE
- PRE-ASSEMBLED ON SITE INTO SSE
- LIFTED AND SUPPORTED ON TEMPORARY TOWERS
- CONNECTED WITH LOOSE MEMBERS
Super size preassembled elements on temporary supports
Loose members in this zone connecting super size elements

Purpose designed demountable temporary support towers

Spreader beams

Concrete structure (strengthened where necessary)

Piling (design check)
Structural Engineering - The Dome
Structural Engineering - The Dome
Dome Jacking
Dome Environment & Microclimate

Perforate Dome Roof for Solar Shading & Wind Protection

'Rain of Light'

Low e Coating

Dome Solar Shading

'Air Basin' Microclimate Floor Cooling

Gallery 21°C

Gallery Spill Air & Exhaust Air

Plaza Floor Cooling

Seawater Re-Cooling of Ground in Winter

Ground Energy for Microclimate Floor Cooling

Thermal Mass of Buildings & Floor

Photovoltaic (PV) Solar Collectors

MEP - Micro-climate
MEP Engineering - Climate control

- Galleries: 21 (+/- 0.5)
- Public spaces (non art): 25
- Shade temperature under dome: 28/35
- Temperature outside dome: 40/45

deg C
Diffuse Natural Light into Artwork Galleries

MEP Engineering - Galleries
Artwork Control Zone
0.2m-4.0m minimum clear height

<table>
<thead>
<tr>
<th>Specification</th>
<th>Setting</th>
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<tbody>
<tr>
<td>Air temperature set-point</td>
<td>21°C±1°C</td>
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<tr>
<td>Relative humidity set-point</td>
<td>50%rH±5%rH</td>
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<tr>
<td>Relative humidity rate of change</td>
<td>max 5%rH in 1 hour</td>
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<tr>
<td>Air velocity in occupied zone</td>
<td>max 0.25 m/s</td>
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<tr>
<td>Occupancy density</td>
<td>5 m² per person</td>
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<tr>
<td>Outside air rate</td>
<td>10 l/s/pers</td>
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Fire Engineering Strategy/Challenges

Fire Load Control & Operational Management Duties in Un-suppressed Areas (Galleries, Storage & Conservation Facilities)

Dome Fire Risk Assessment

Island Fire Load Control & Distance Matrix

Evacuation

Performance-based Fire & Smoke / Evacuation modelling

Artwork Loading Dock

Other Specific Fire Risk Assessments in unique / high hazard areas
Time-Lapse Video

8 Year Time-Lapse
LOUVRE ABU DHABI
2009 - 2017

Information Classification: General