WYLY THEATER

STRUCTURAL CASE STUDY

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PROJECT OVERVIEW

Firm: REX + OMA

Location: Dallas, Texas

Client: Dallas Theater Center

Partners: Rem Koolhaas, Joshua Prince-Ramus

Executive Architect: Kendall/Heaton Associates

Structure: Magnusson Klemencic Associates

Mechanical: Transsolar / Cosentini / Plus Group

Theater Design: Theatre Projects Consultants

Facade: A. Zahner Company

Project Year: 2009

Project Area: 82,882.11 square feet

Building Type: Mid-rise

Building Usage: Theater

Seats: 575

Site Usage: Performance, Gathering Space

Height: 151 feet

Floors: 10

Awards: 2011 AIA Honor Award
ARCHITECTS

Rem Koolhaas, OMA

Joshua Prince-Ramus, REX
DESIGN CONCEPT

- Instead of following the traditional format of a theater, where the front and back of the house flank the main auditorium, they decided to stack them vertically. By doing this we are able to add more public space to it.

- By stacking the different components of the theater, the architects liberated the performance chamber's entire perimeter and allowed performers to mix fantasy and reality when they desired.

- In addition to the architects wishing to flip the idea of the theater on its head, they wanted the Wyly to stand its ground in size when compared to its next door neighbors: Norman Foster’s Winspear Opera House and I. M. Pei’s Meyerson Symphony Center.

- “I hate the traditional theater profile of the door, auditorium, back of house, and front of house. Instead, we chose to pile the front-of-house and back-of-house functions on top of and below the auditorium, making for a smaller footprint overall.”
  - Rem Koolhas
LAYOUT

- The Wyly Theater is a compact, 12-story building with different heights.
- The theater can be set up in different ways
  - Proscenium
  - Thrust
  - Arena
  - Traverse
  - Studio theater
  - Bipolar sandwich
  - Flat floor configuration.
Layout
SOIL

Clay Soil

- Highly expansive and extremely absorbent
- Common in the North Texas Area
- The soil consists of tiny packed particles that are dense and can be difficult to work with.
FOUNDATION

- **Lowest floor**
  - Two stories deep surrounded by three concrete retaining walls with ramp leading down to the entrance

- **Concrete drilled pier foundation**
  - 40ft deep
FORCES OF NATURE

- Primarily sees wind forces
  - Highest Average wind speed - 11.8 mph
  - Lowest Average wind speed - 8 mph
- Has potential of seismic activity
  - Last seismic activity recorded in May 2018
    - 3.5 magnitude
  - This is combated by using a rigid frame
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<th>Magnitude</th>
<th>Depth</th>
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<td>2.3</td>
<td>5 km</td>
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Map of seismic data, showing locations and magnitudes of seismic events.
STRUCTURAL SYSTEM
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Reinforced Concrete Columns
- Battered and Vertical
- 6 members
- 18in x 4ft
- Largest 166ft

Steel Belt Truss
- 32ft in depth

Reinforced Concrete Shear Wall
- 135ft in height
- 85ft in width
NODAL POINT CONNECTIONS

- Custom steel members cast in the concrete.
- Steel members connected in nodal points.
- Bolt holes in steel to bolt steel members going into joint.
- Critical alignment.
**SHEAR WALL CONNECTIONS**

- Steel members welded to an angle that is embedded in shear wall.
- Steel frame acts as a wind bracing.
WALLS

- Theatre walls are all glass.
- Aluminum Tubes were made in Argentina
- Meant to look like drapes
- Composed 466 anodized aluminum tubes
- Walls are suspended from the ceiling above.
ROOF

- Acts as a tension element.
- Consists of metal decking for concrete slabs
- Supported with I-beams
STRUCTURAL ANALYSIS

Load tracing
STRUCTURAL ANALYSIS

- Uniform distributed occupancy live load of 100 psf on all floors
- An additional 50 psf snow load is added on the roof
- Wind load of 30 psf on the South side
STRUCTURAL ANALYSIS

**Moment**: the largest bending moment occurs at the foundation of the mega-column.
STRUCTURAL ANALYSIS

Shear: the largest y-direction shear occurs when two mega-columns meet. If there is no belt truss the shear might be greater.
The axial force: the greatest axial force occurs in the mega-column. The mega-columns bear the majority load, since the most of the load transfer to the mega-columns.
Deflection: The mega-columns show a little deflection while the other w-section structural frames show greater deflection. The mega-columns are steel reinforced concretes that have greater cross sections, which can resist more stress.

“Recent Earthquakes Near Dallas, Texas, United States.” Today's Earthquakes in Pennsylvania, United States, earthquaketrack.com/us-tx-dallas/recent


http://oma.eu/partners/rem-koolhaas

http://www.cladglobal.com/architecture-design-features?codeid=31972