

Cathedral of Christ the Light

Structural Analysis



Arabzadeh, Hoermann, Littman

Overview

Location



Overview

Foundation
and
Soil Description

Reliquary Wall

Oculus Ceiling

Mexicali

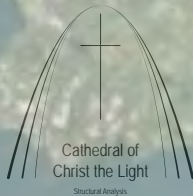
San Luis Rio

Lateral Load
Resistance

Load-Tracing

Tucson

Location



San Francisco

Oakland

Overview

Foundation
and
Soil Description

Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Location



Overview

Foundation
and
Soil Description

Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

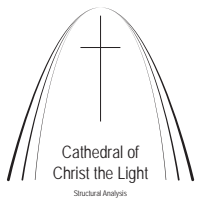
Load-Tracing



Craig Hartman



Design Concept



Overview

Foundation
and
Soil Description

Reliquary Wall

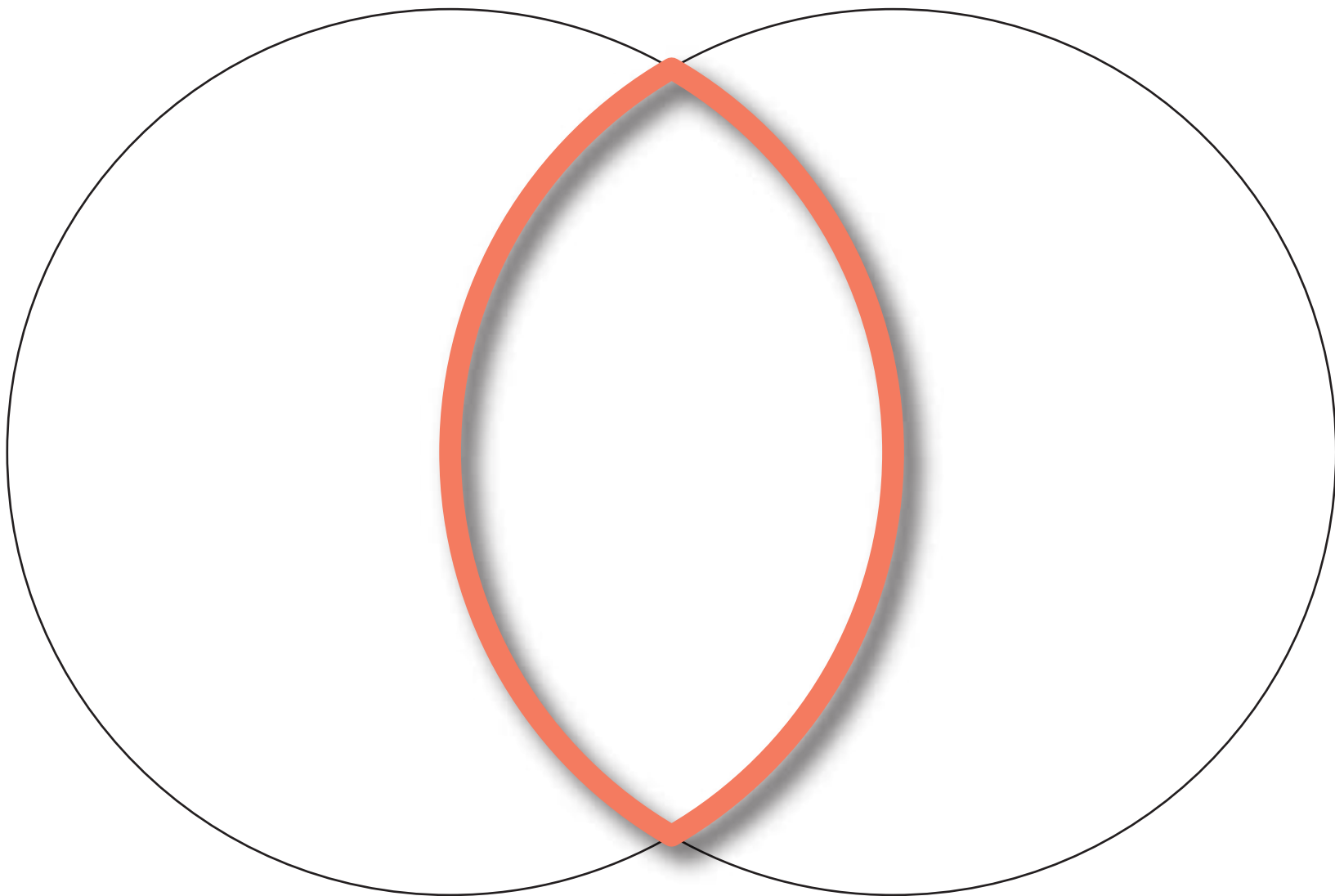
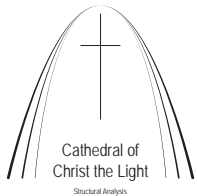
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Design Concept



Pisces Shape
Floor Plan
Ceiling Layout

Overview

Foundation
and
Soil Description

Reliquary Wall

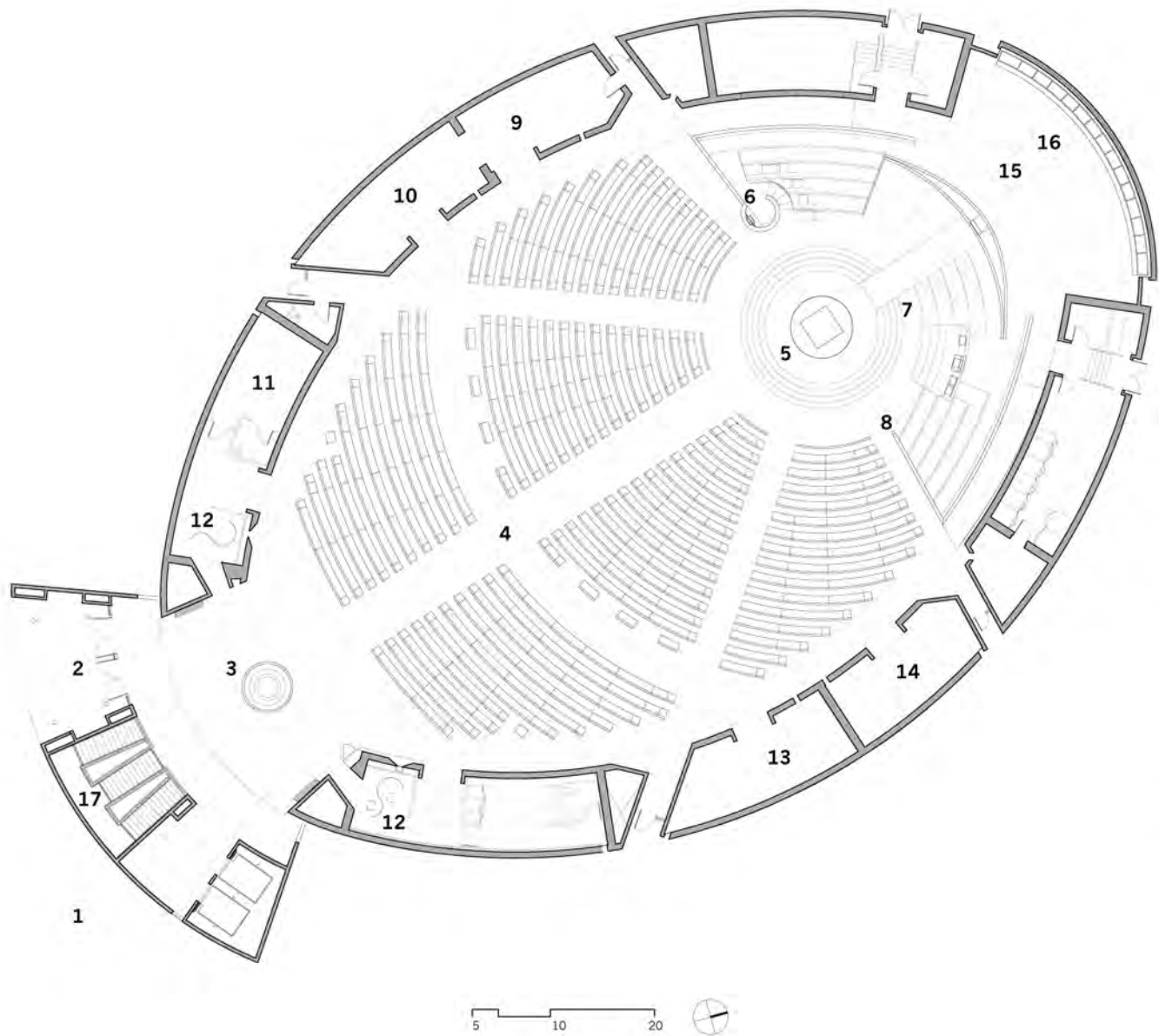
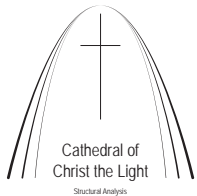
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Building Layout



- 1 PLAZA
- 2 ENTRYWAY
- 3 BAPTISTRY
- 4 CENTER AISLE
- 5 ALTAR
- 6 AMBO
- 7 CATHEDRA
- 8 MARY-MOTHER OF THE CHURCH OF OAKLAND
- 9 CHAPEL OF THE SEASONS
- 10 CHAPEL OF ALL SAINTS
- 11 COMMUNITY ROOM
- 12 RECONCILIATION CHAPELS
- 13 CHAPEL OF THE HOLY FAMILY
- 14 CHAPEL OF THE SUFFERING CHRIST
- 15 OMEGA WINDOW
- 16 BLESSED SACRAMENT CHAPEL
- 17 STAIRS TO MAUSOLEUM

Overview

Foundation
and
Soil Description

Reliquary Wall

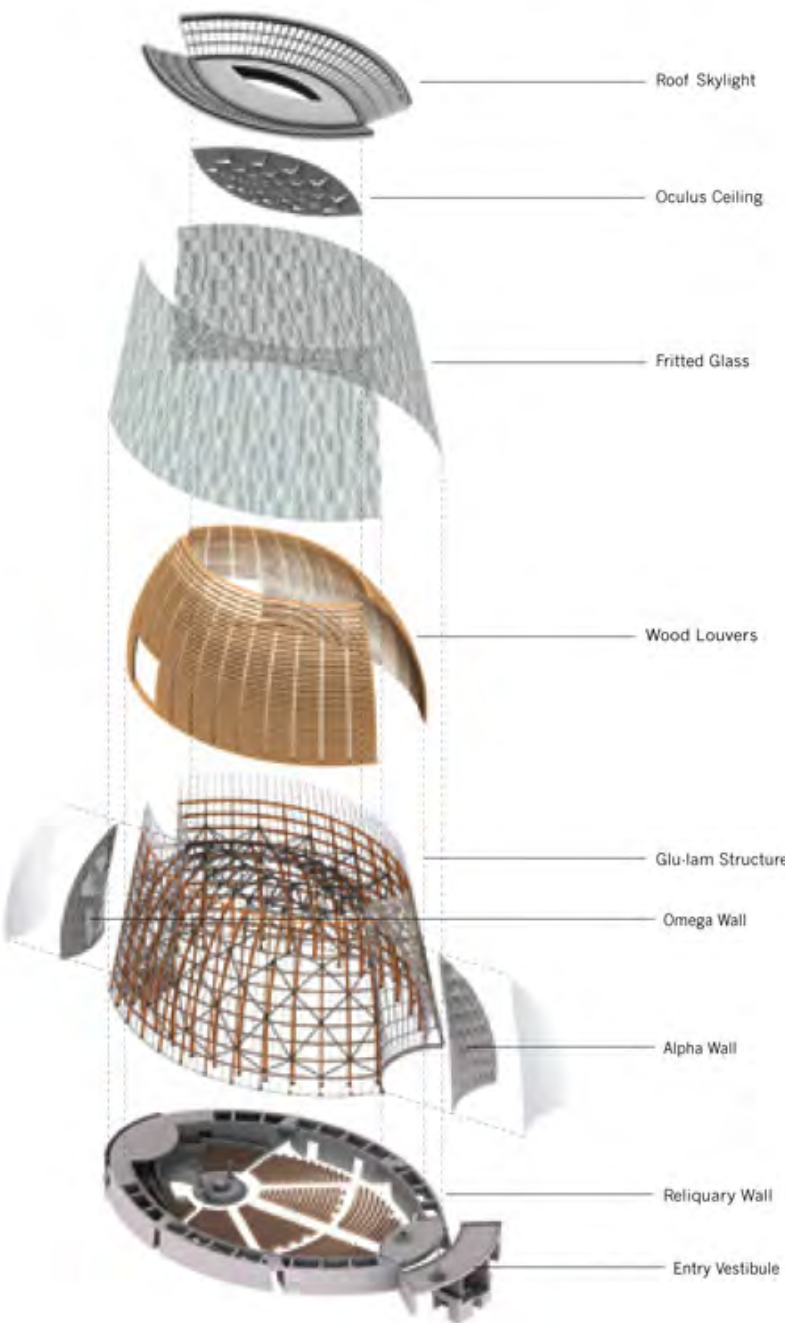
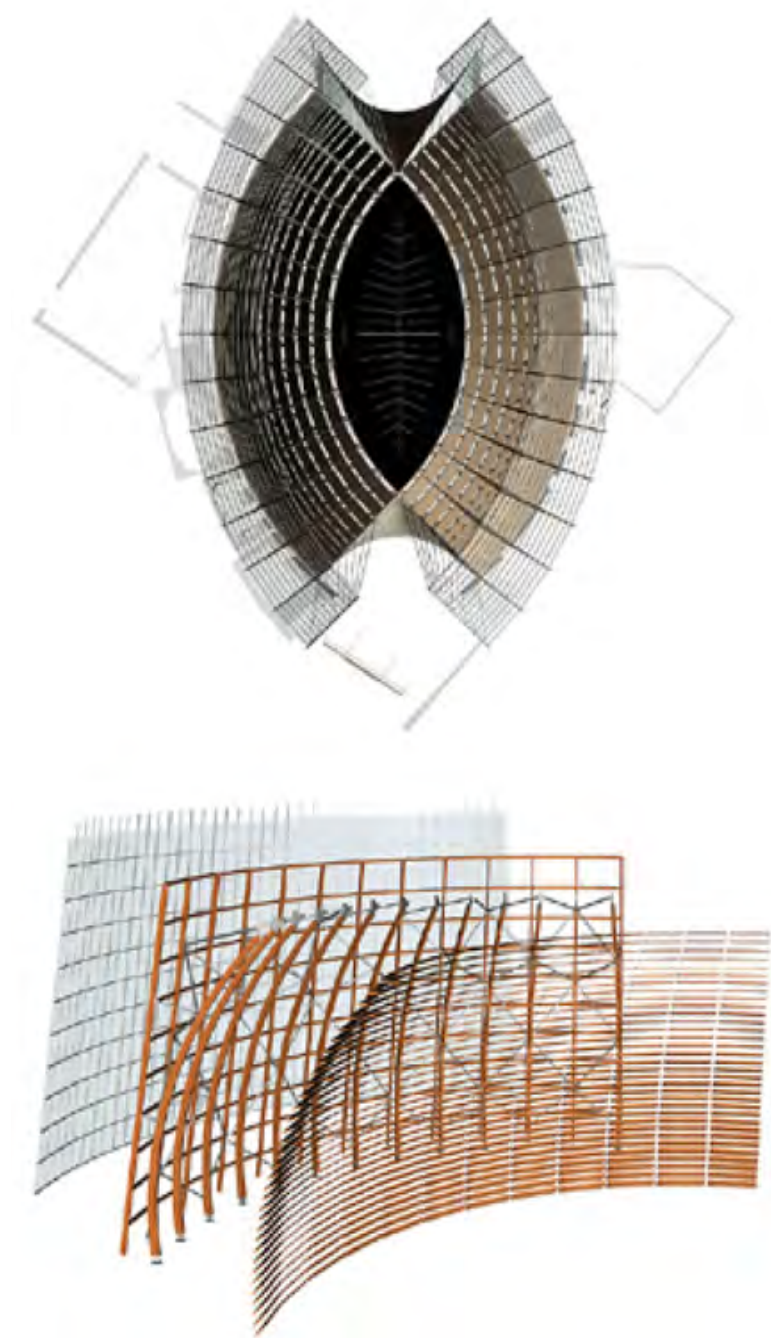
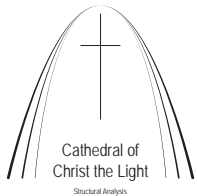
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Structural Features



Oculus Ceiling - Steel Truss

Ribs - Wood (DFL)

Reliquary Wall - Concrete

Overview

Foundation
and
Soil Description

Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Foundation & Soil



Overview

**Foundation
and
Soil Description**

Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Global - Fault Lines Galore



Overview

**Foundation
and
Soil Description**

Reliquary Wall

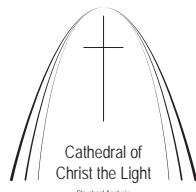
Oculus Ceiling

Mexicali

Lateral Load
Resistance

Load-Tracing

Base Isolation



Overview

**Foundation
and
Soil Description**

Reliquary Wall

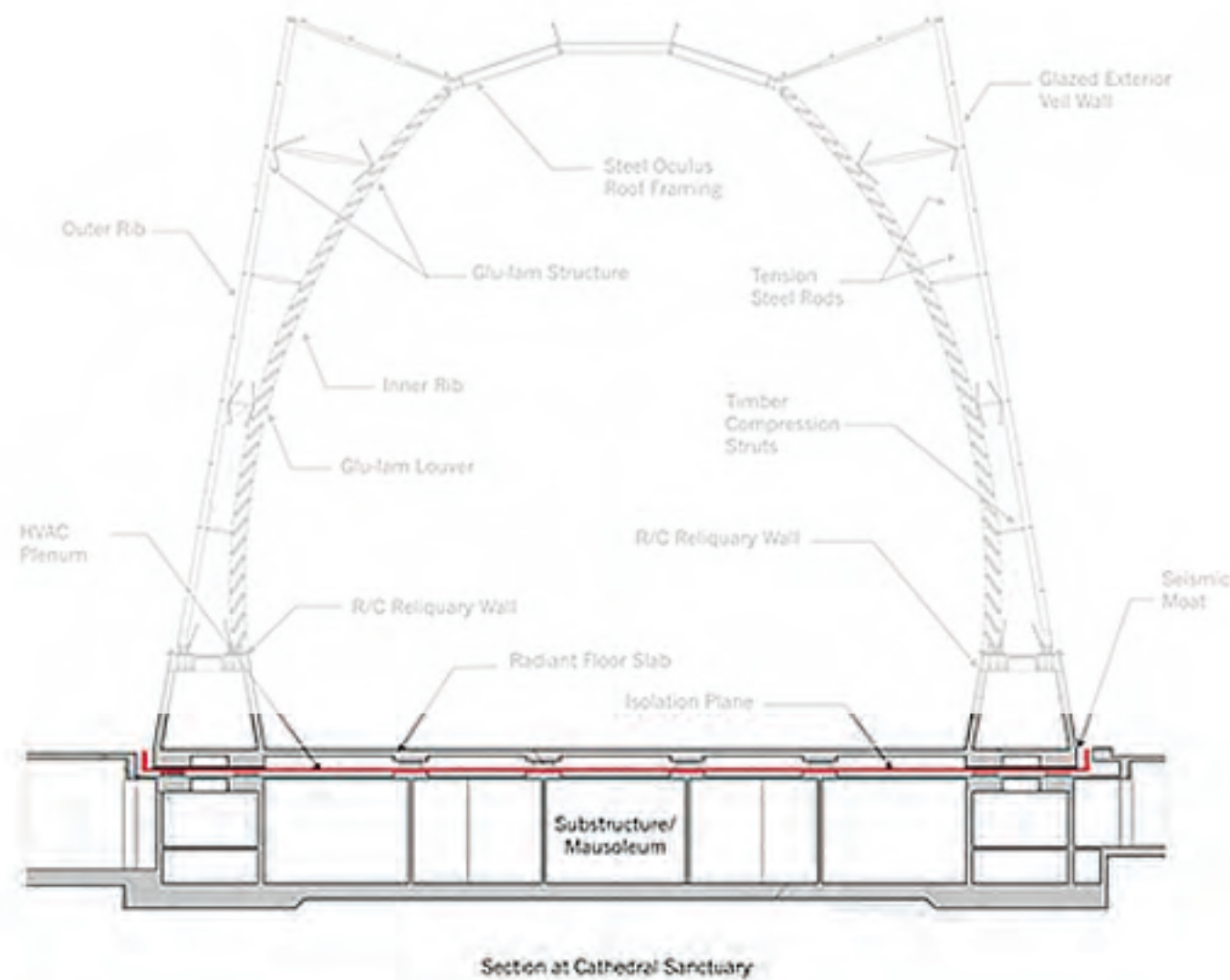
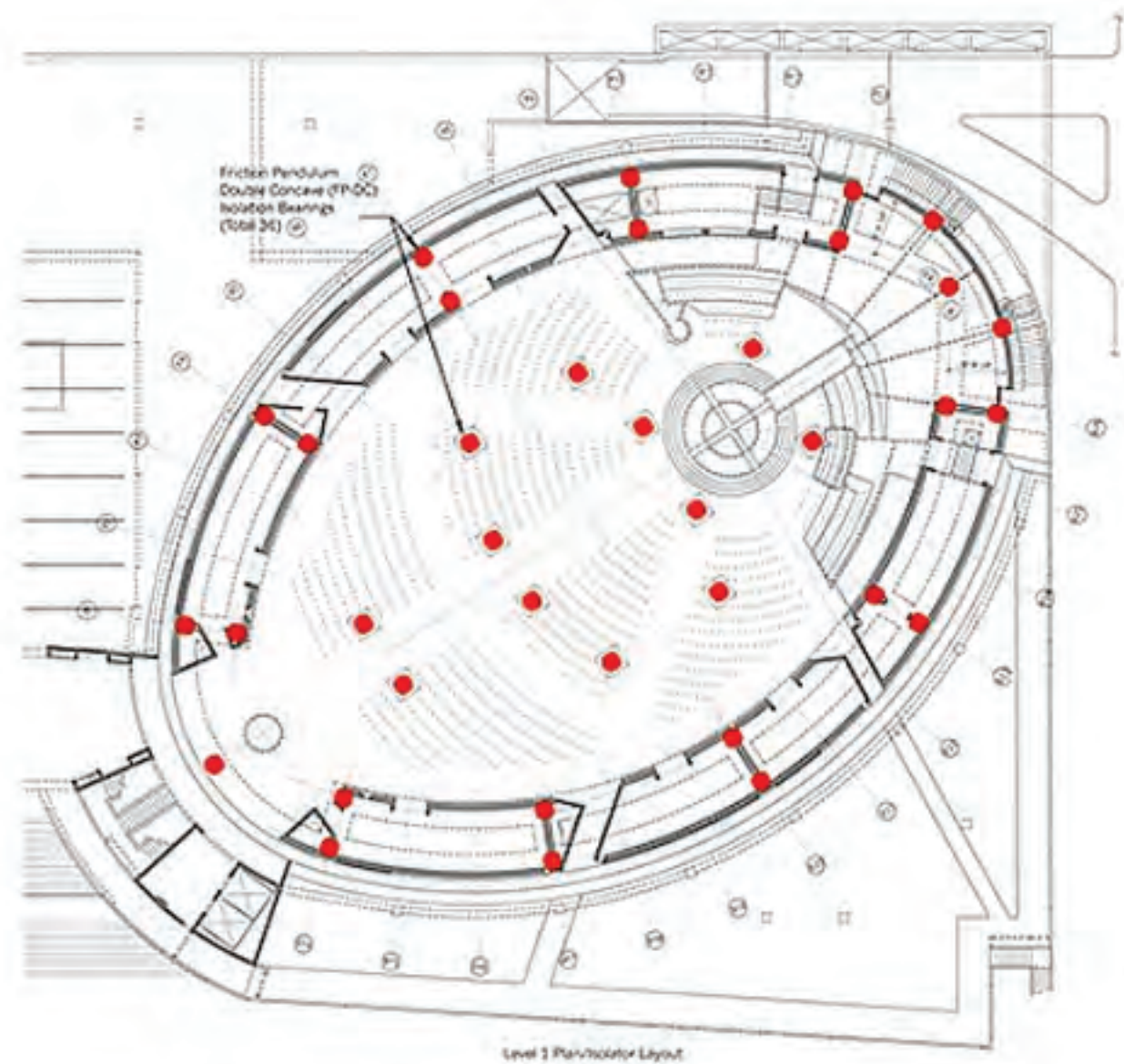
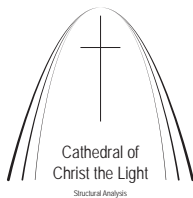
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Base Isolation



Independent Foundations
36 Base Isolation Units

Overview

Foundation
and
Soil Description

Reliquary Wall

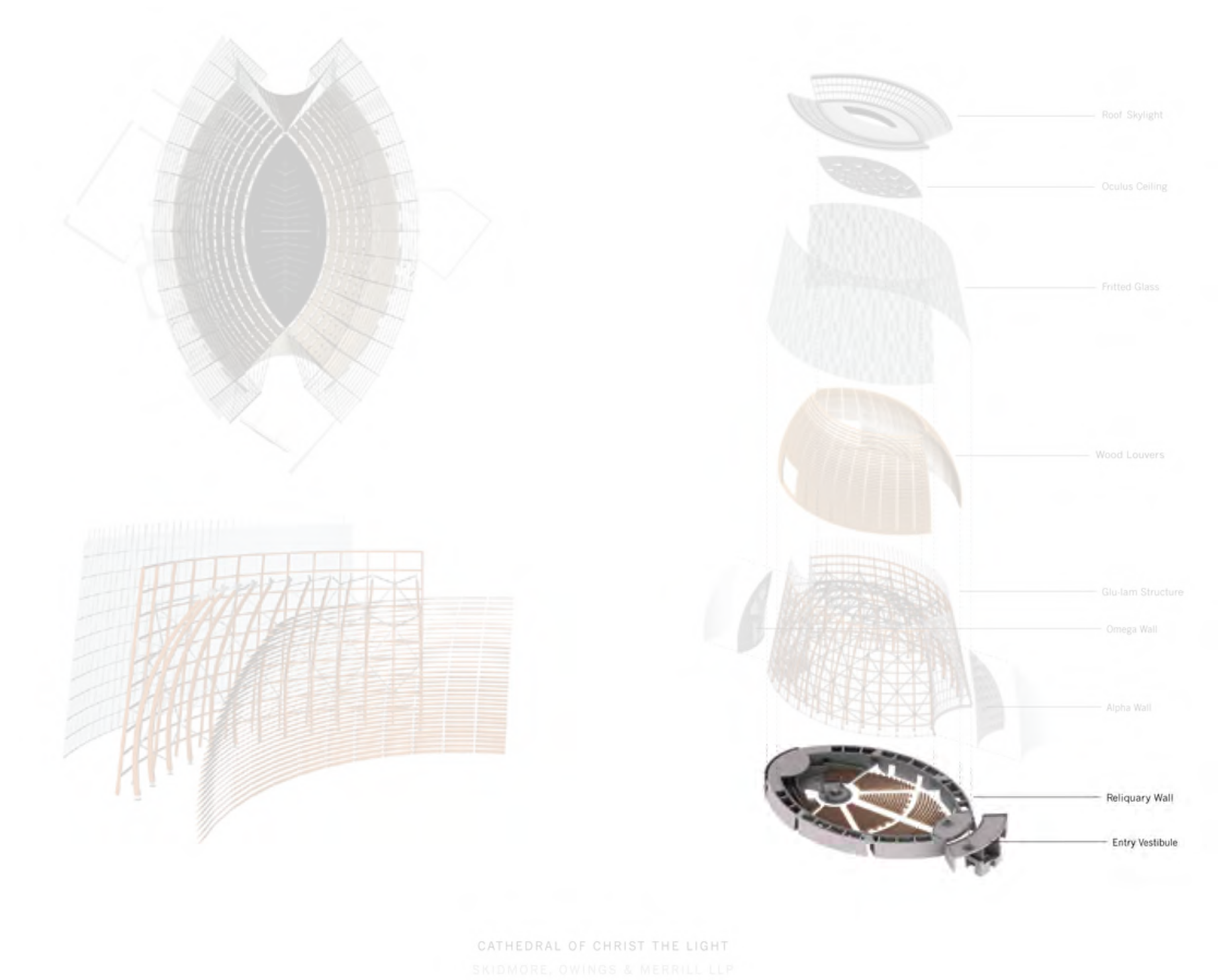
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Reliquary Wall



Overview

Foundation
and
Soil Description

Reliquary Wall

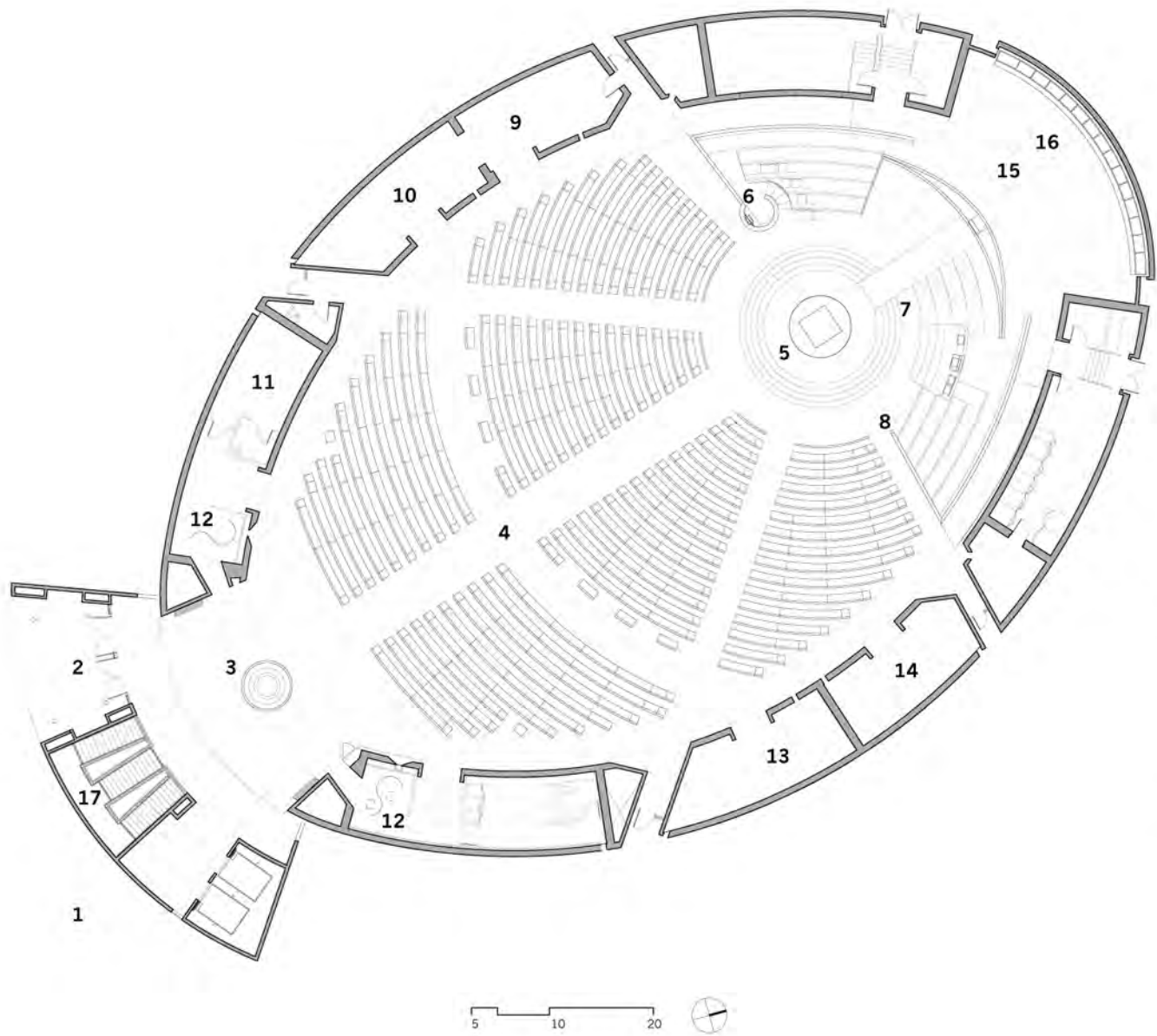
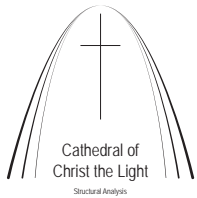
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Plan



- 1 PLAZA
- 2 ENTRYWAY
- 3 BAPTISTRY
- 4 CENTER AISLE
- 5 ALTAR
- 6 AMBO
- 7 CATHEDRA
- 8 MARY-MOTHER OF THE CHURCH OF OAKLAND
- 9 CHAPEL OF THE SEASONS
- 10 CHAPEL OF ALL SAINTS
- 11 COMMUNITY ROOM
- 12 RECONCILIATION CHAPELS
- 13 CHAPEL OF THE HOLY FAMILY
- 14 CHAPEL OF THE SUFFERING CHRIST
- 15 OMEGA WINDOW
- 16 BLESSED SACRAMENT CHAPEL
- 17 STAIRS TO MAUSOLEUM

Overview

Foundation
and
Soil Description

Reliquary Wall

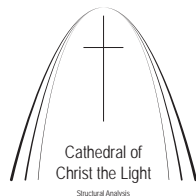
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Reliquary Wall - **Finished**



Overview

Foundation
and
Soil Description

Reliquary Wall

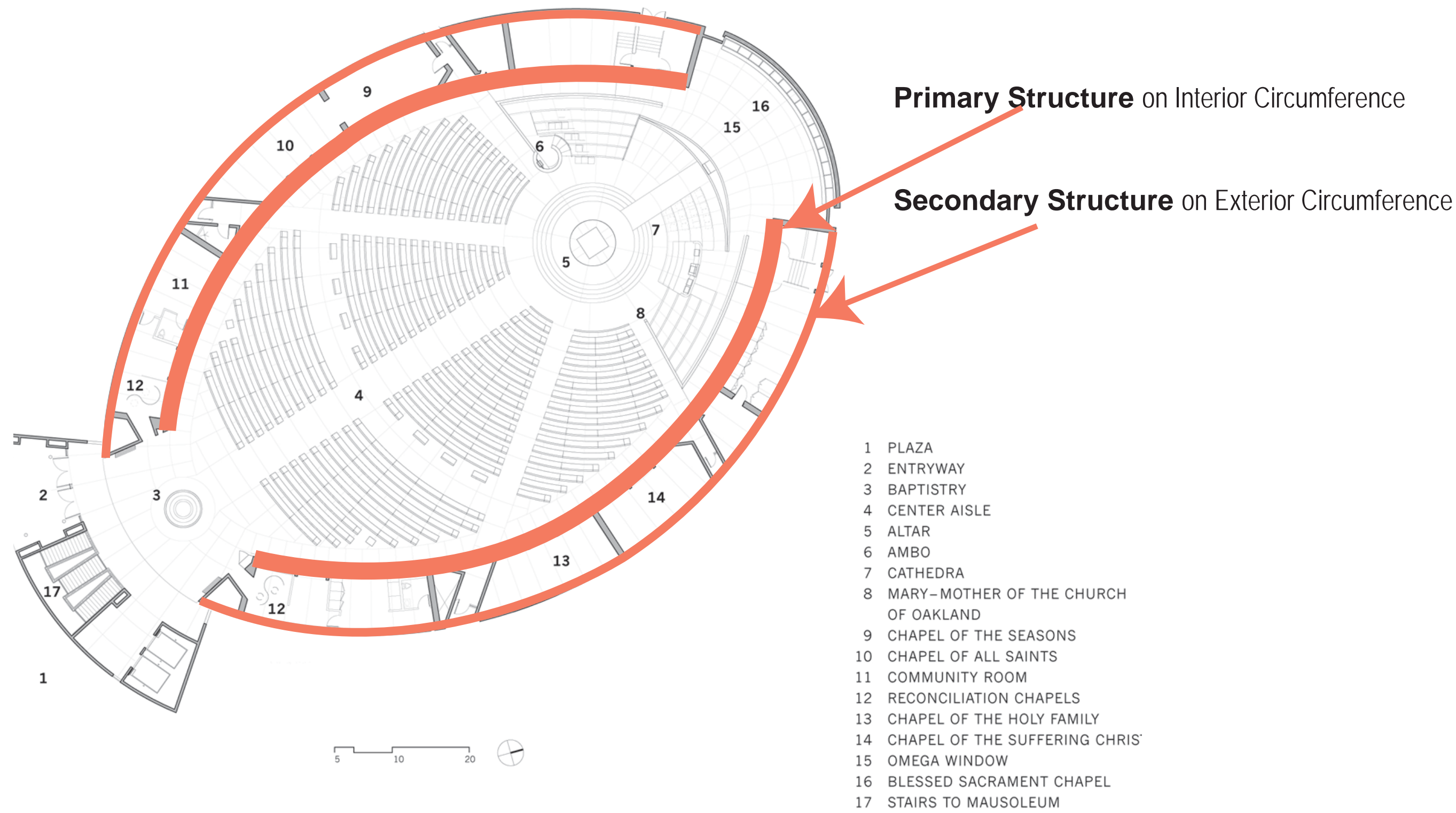
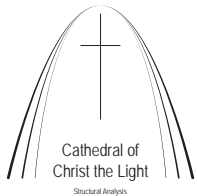
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Reliquary Wall



Overview

Foundation
and
Soil Description

Reliquary Wall

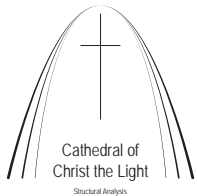
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Reinforcement



Overview

Foundation
and
Soil Description

Reliquary Wall



Oculus Ceiling

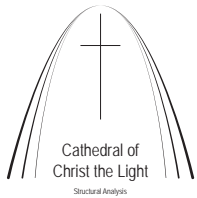
DFL

Lateral Load
Resistance

Load-Tracing

Bearing
Upper and Lower Limits
Cracking and Crushing

Mixtures: **Slag & Fly Ash**



Overview

Foundation
and
Soil Description

Reliquary Wall

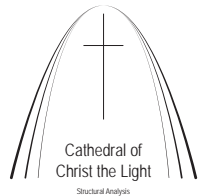
Oculus Ceiling

DFL

Lateral Load
Resistance

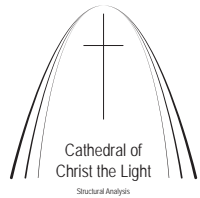
Load-Tracing

Cast-in-Place Concrete: **formwork**



Tapering | Bearing

Cast-in-Place Concrete: **formwork**



Overview

Foundation
and
Soil Description

Reliquary Wall

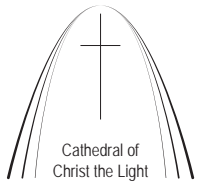
Oculus Ceiling

DFL

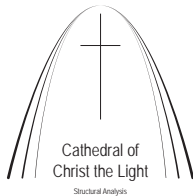
Lateral Load
Resistance

Load-Tracing

Cast-in-Place Concrete



Reliquary Wall - **Finished**



Overview

Foundation
and
Soil Description

Reliquary Wall

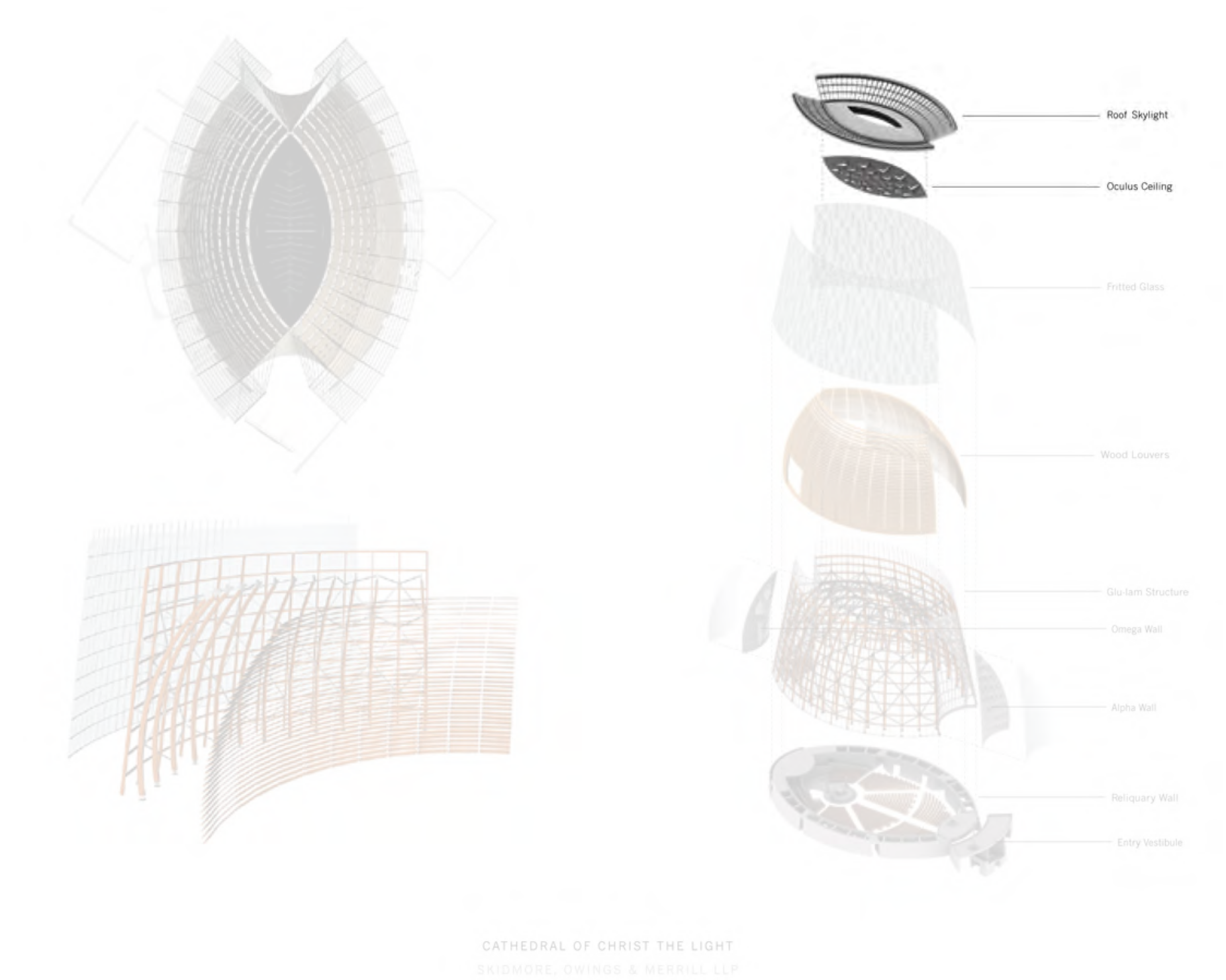
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Oculus Ceiling



Overview

Foundation
and
Soil Description

Reliquary Wall

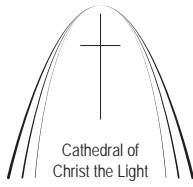
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Oculus Ceiling



Construction
Scaffolding
Oculus Ceiling

Overview

Foundation
and
Soil Description

Reliquary Wall

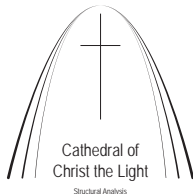
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Pin Connection



Connection

Deformations

Overview

Foundation
and
Soil Description

Reliquary Wall

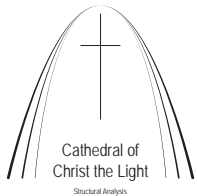
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Oculus Ceiling



Truss System resisting compression forces

Overview

Foundation
and
Soil Description

Reliquary Wall

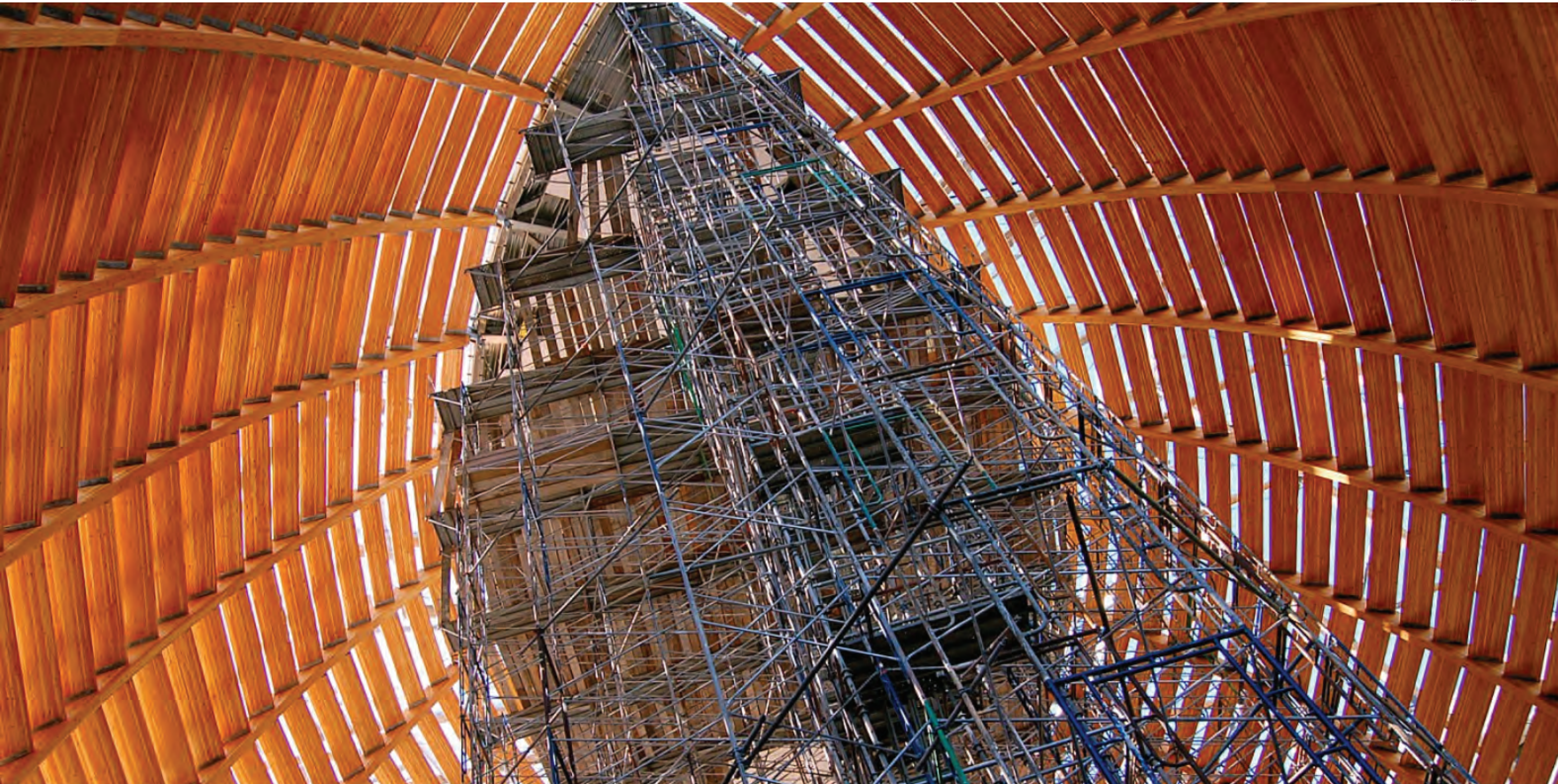
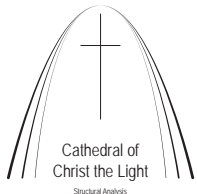
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Oculus Ceiling



Overview

Foundation
and
Soil Description

Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing



Overview

Foundation
and
Soil Description

Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing



Overview

Foundation
and
Soil Description

Reliquary Wall

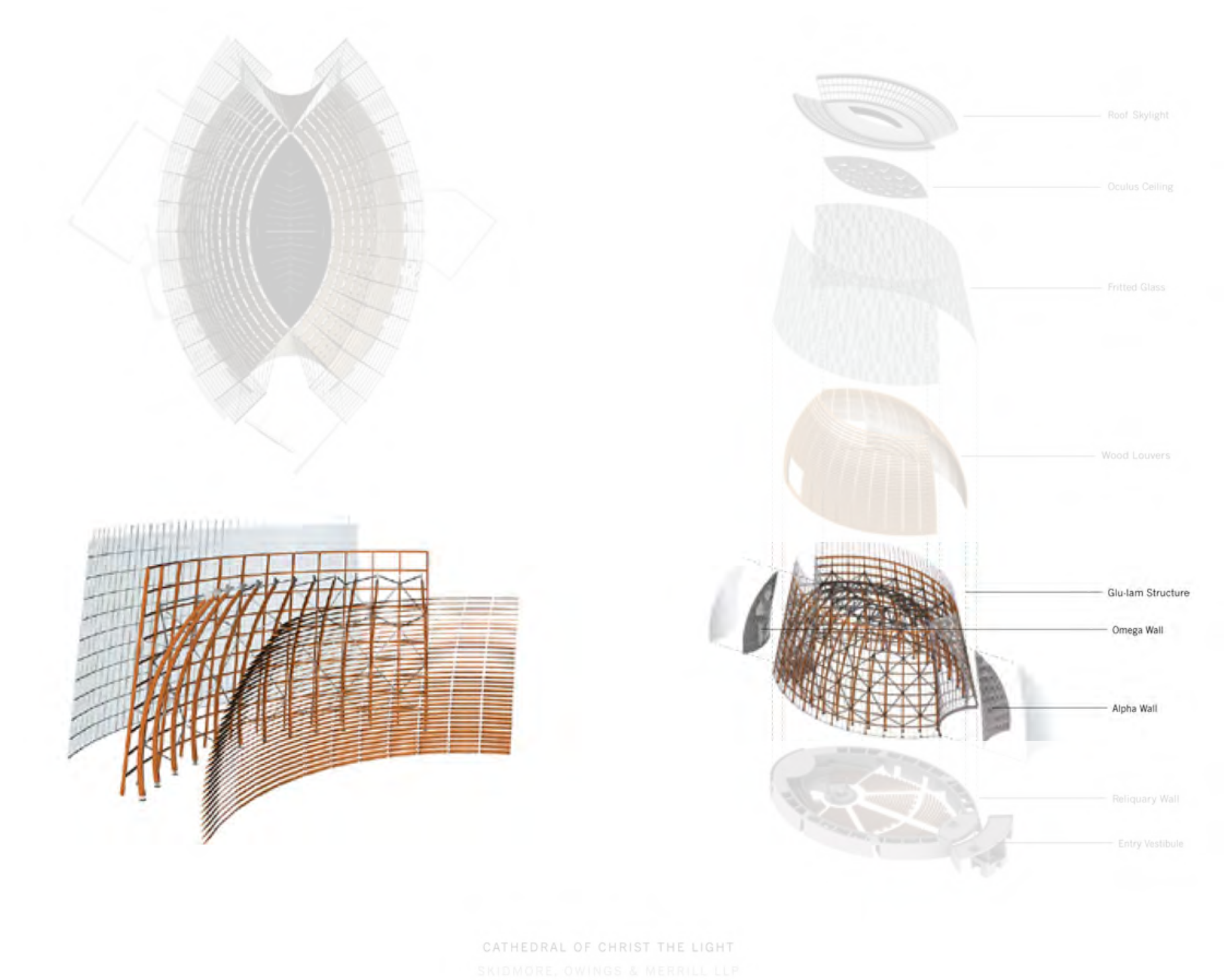
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Douglas Fir Larch



Overview

Foundation
and
Soil Description

Reliquary Wall

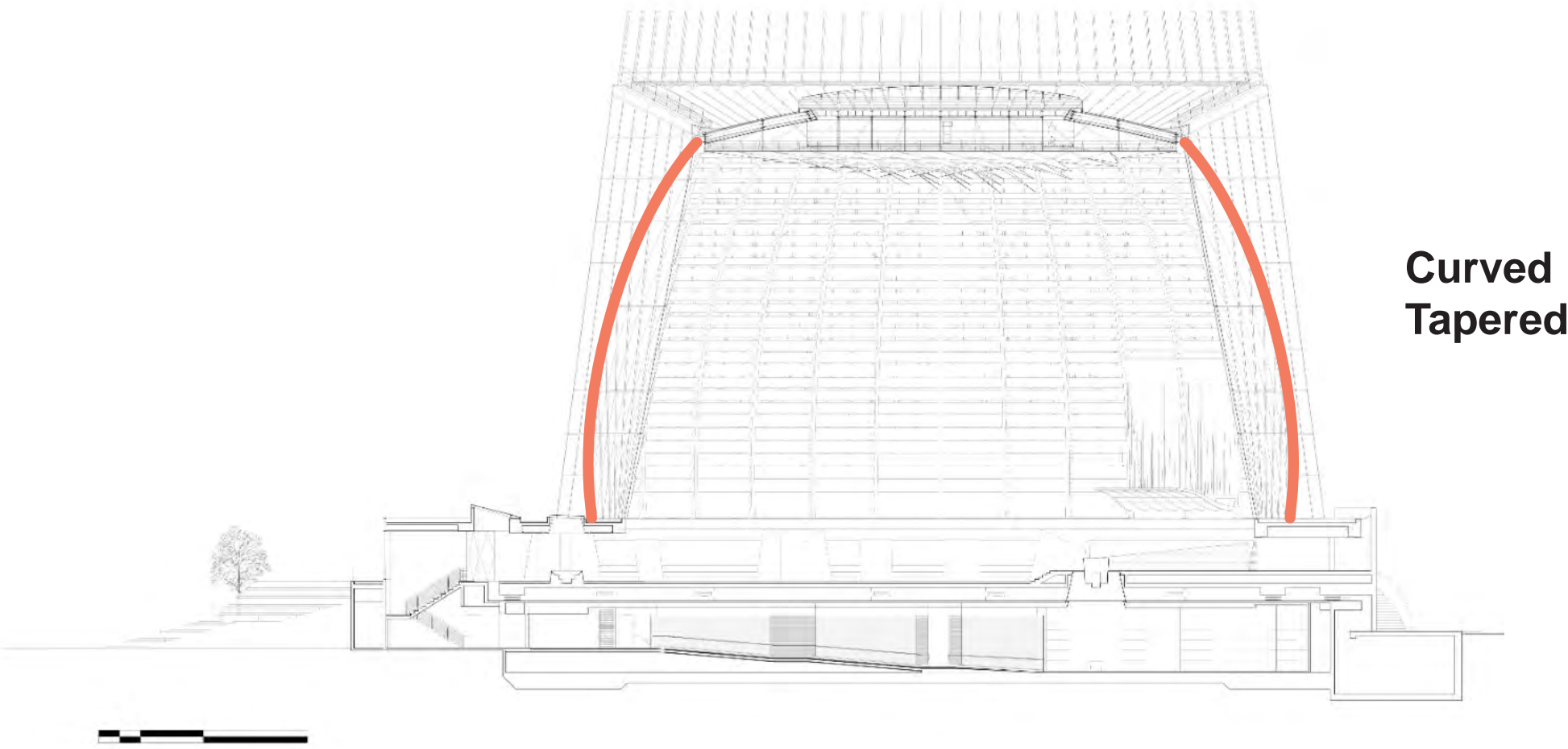
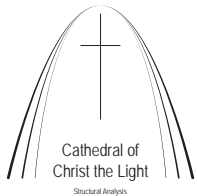
Oculus Ceiling

DFL

Lateral Load
Resistance

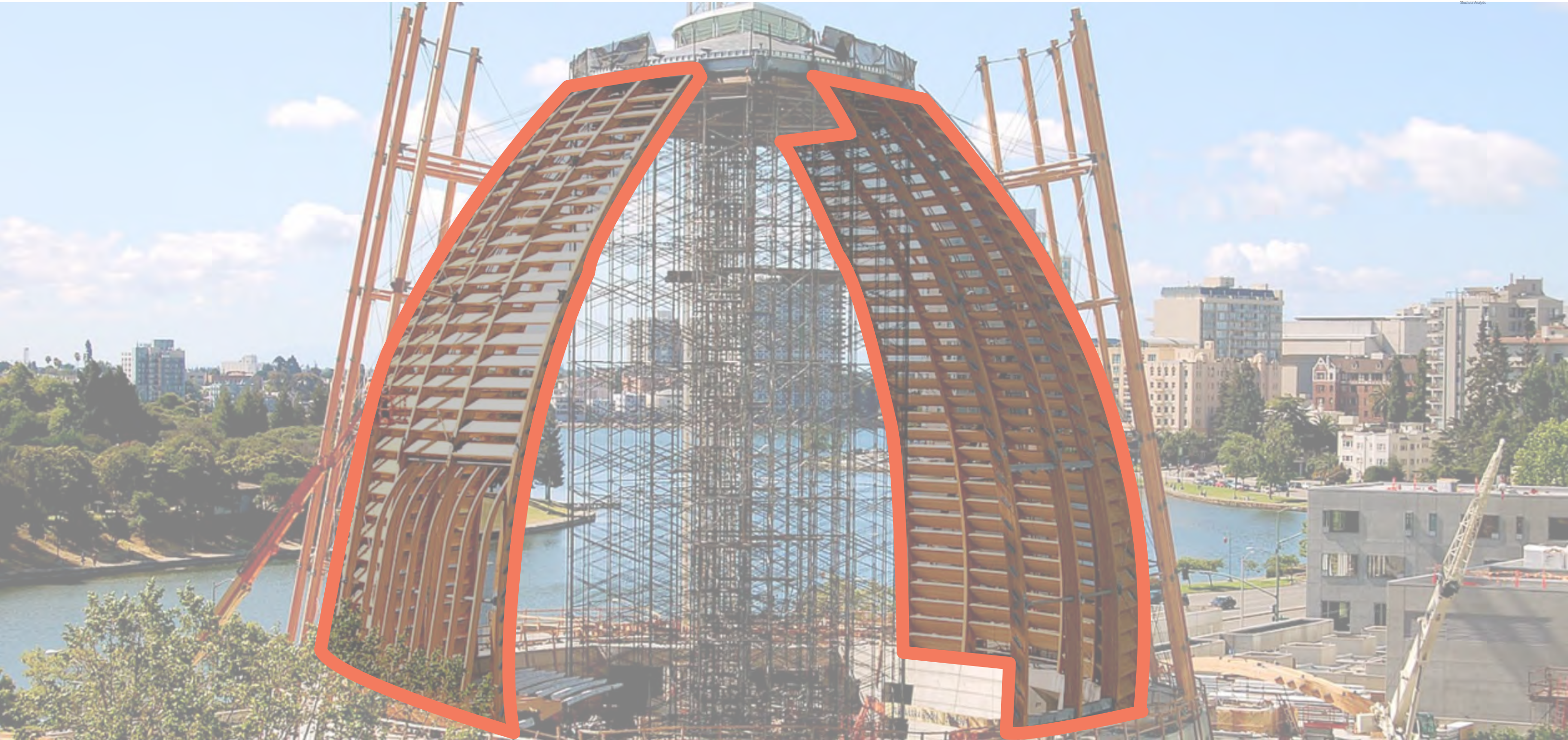
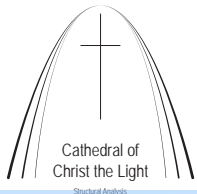
Load-Tracing

Primary Structure - Ribs



**Curved
Tapered**

Primary Structure - Ribs



Overview

Foundation
and
Soil Description

Reliquary Wall

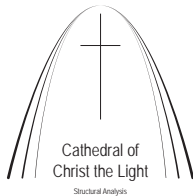
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Primary Structure: **Connection to Oculus Ceiling**



Overview

Foundation
and
Soil Description

Reliquary Wall

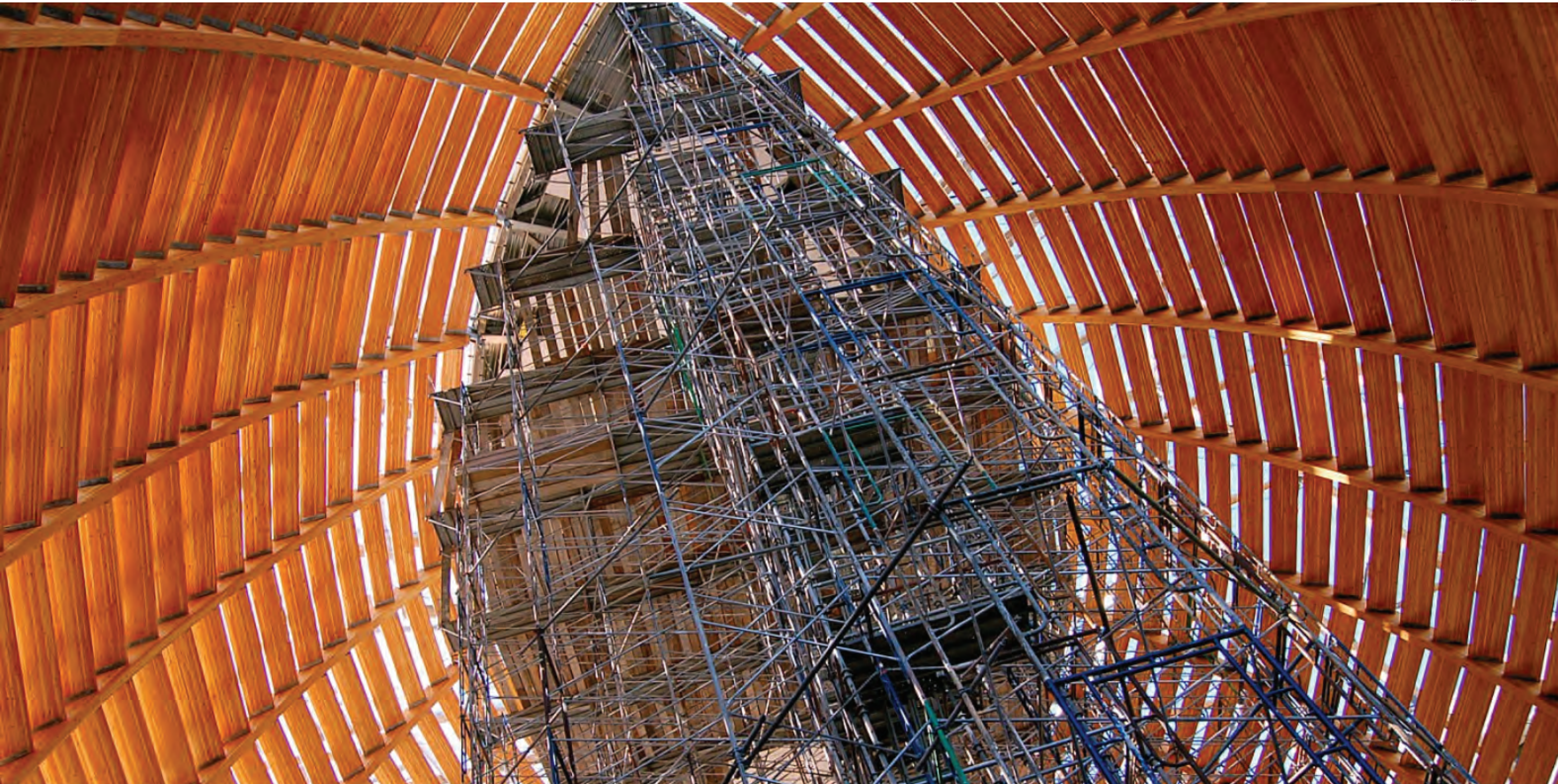
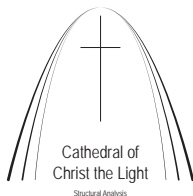
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Primary Structure: **Connection to Oculus Ceiling**



Overview

Foundation
and
Soil Description

Reliquary Wall

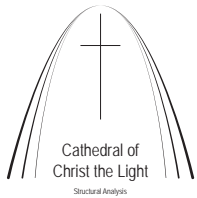
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Primary Structure: **Connection to Reliquary Wall**



Overview

Foundation
and
Soil Description

Reliquary Wall

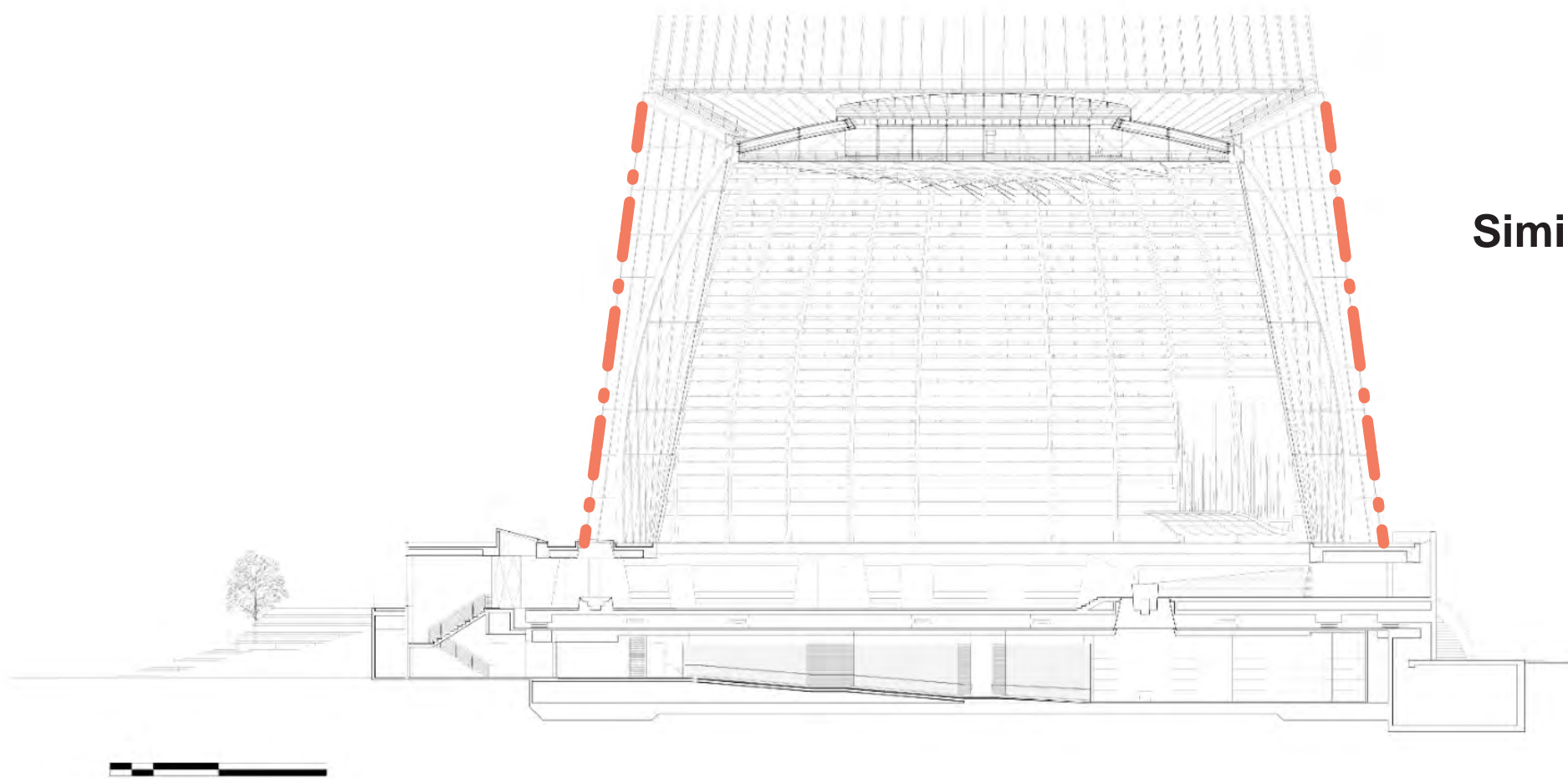
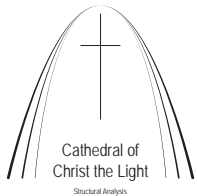
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

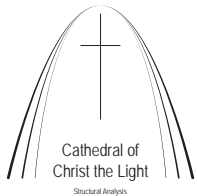
Secondary Ribs



Similarities and Differences
from Primary Ribs

Enclosure

Secondary Structure



Overview

Foundation
and
Soil Description

Reliquary Wall

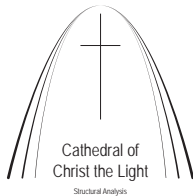
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

System Connection



Overview

Foundation
and
Soil Description

Reliquary Wall

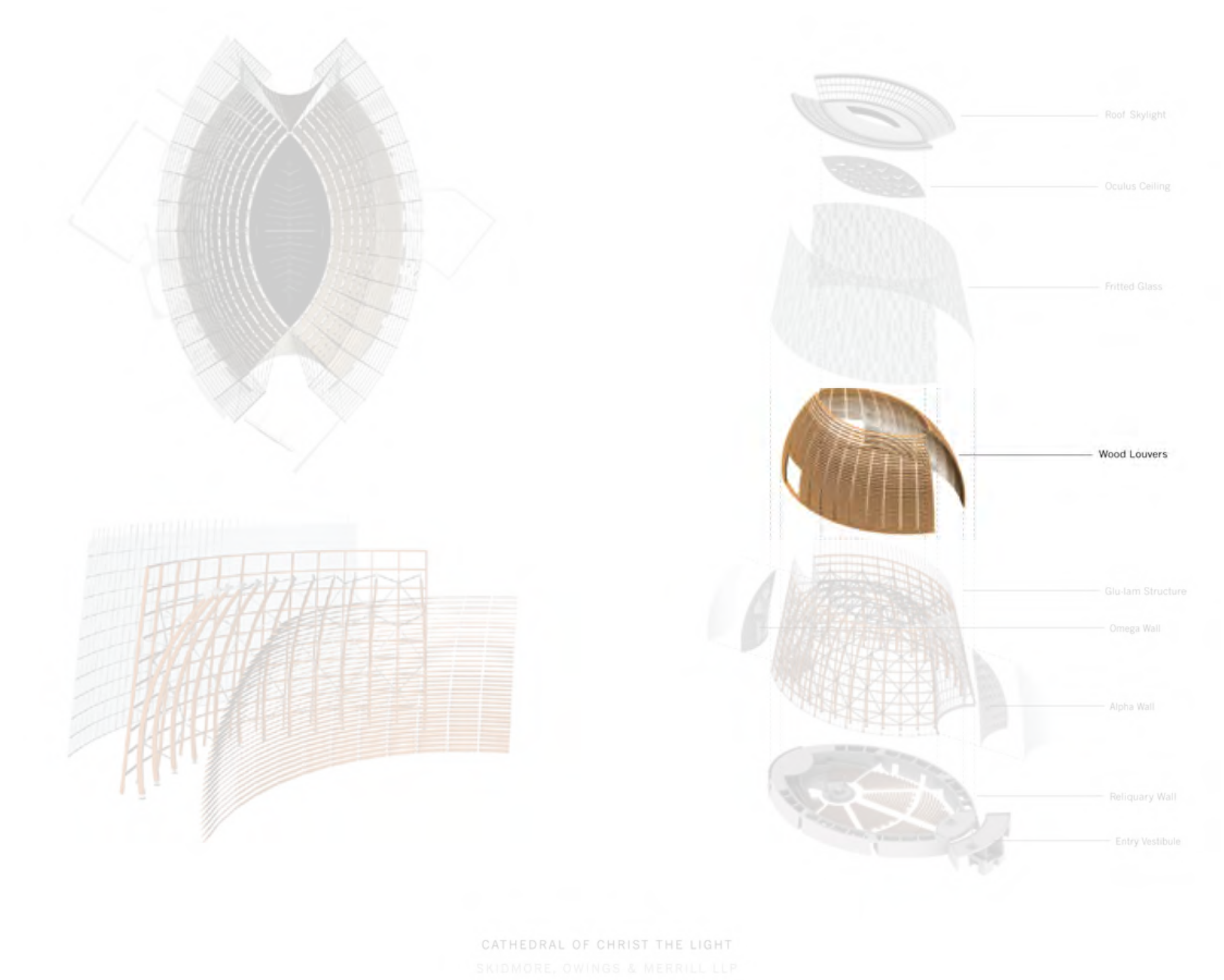
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Lateral Load Resitance



Overview

Foundation
and
Soil Description

Reliquary Wall

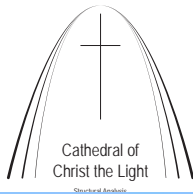
Oculus Ceiling

DFL

**Lateral Load
Resistance**

Load-Tracing

Superstructure



Overview

Foundation
and
Soil Description

Reliquary Wall

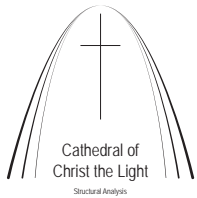
Oculus Ceiling

DFL

**Lateral Load
Resistance**

Load-Tracing

Rods



Ties primary and secondary structure together perpendicularly

Overview

Foundation
and
Soil Description

Reliquary Wall

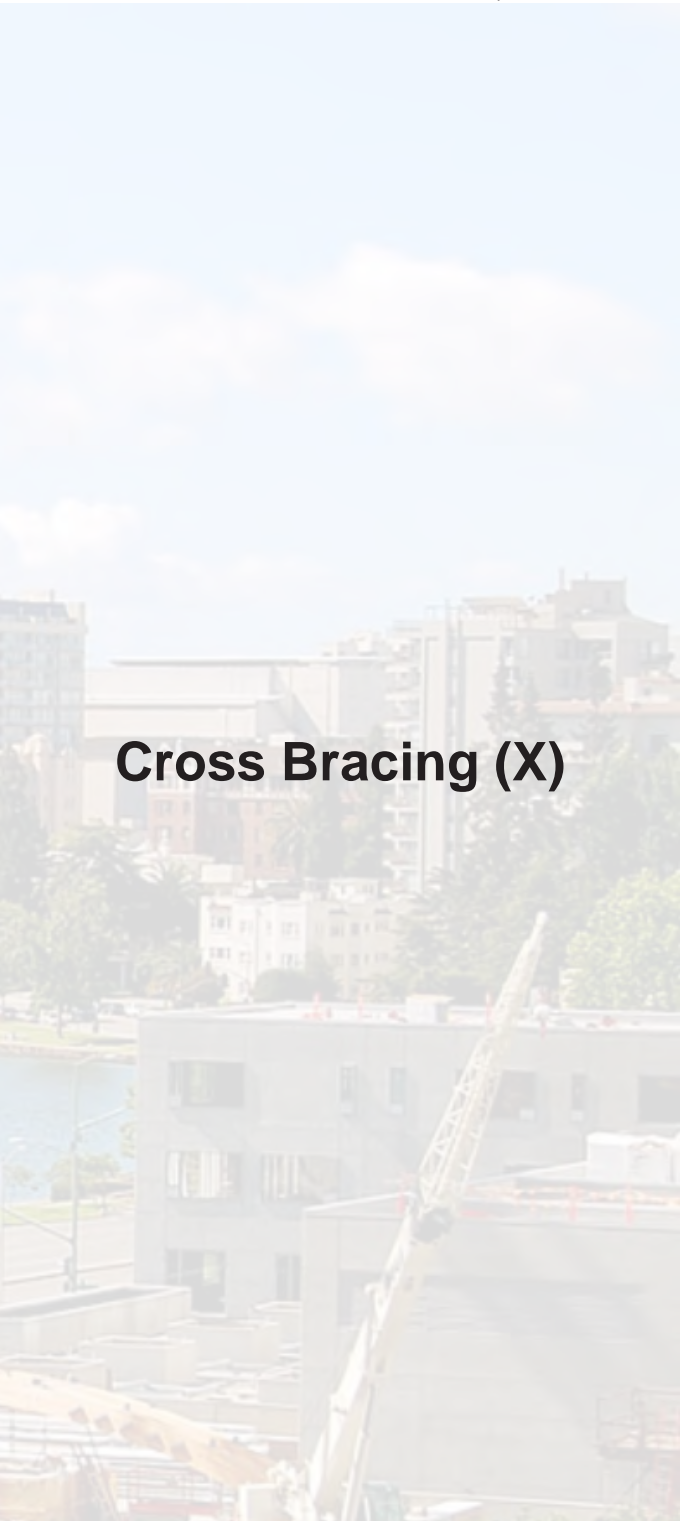
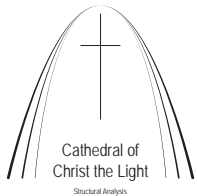
Oculus Ceiling

DFL

**Lateral Load
Resistance**

Load-Tracing

Tension Cables



Cross Bracing (X)

Overview

Foundation
and
Soil Description

Reliquary Wall

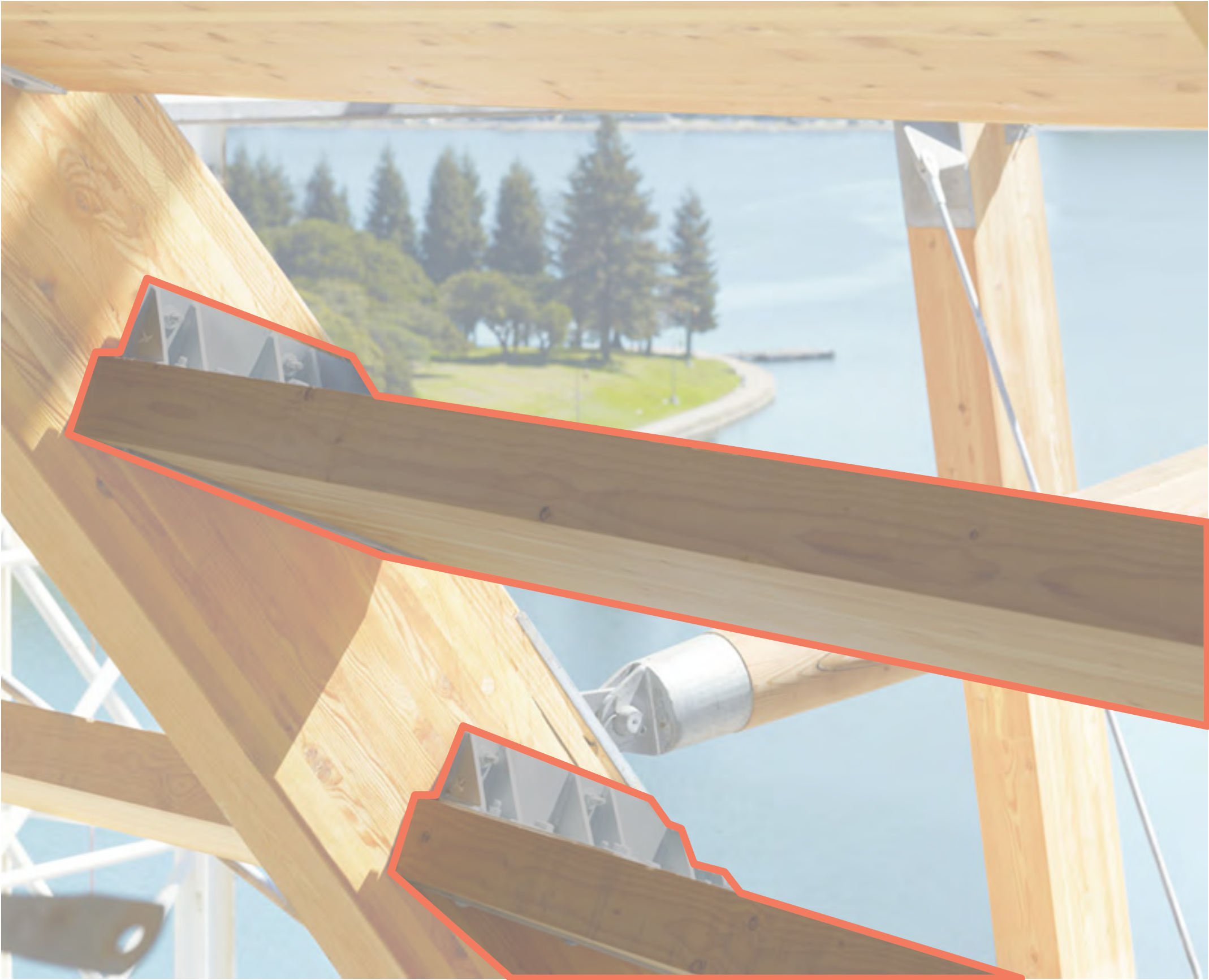
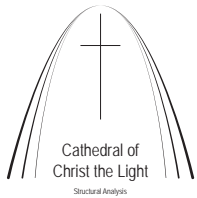
Oculus Ceiling

DFL

**Lateral Load
Resistance**

Load-Tracing

Louvres



Overview

Foundation
and
Soil Description

Reliquary Wall

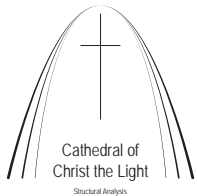
Oculus Ceiling

DFL

**Lateral Load
Resistance**

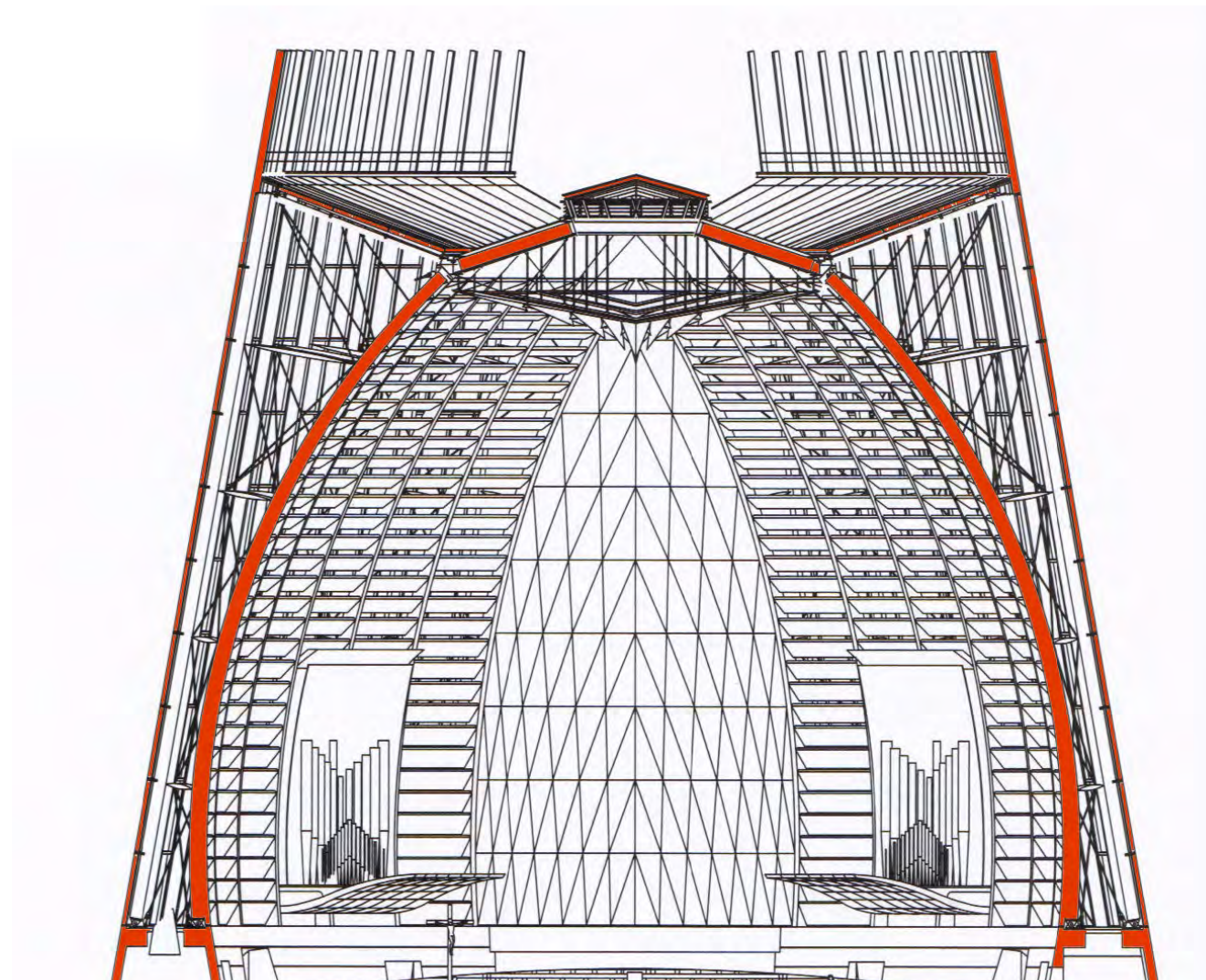
Load-Tracing





Louvres Controlling Light

Load Tracing



Overview

Foundation
and
Soil Description

Reliquary Wall

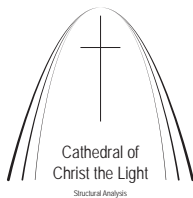
Oculus Ceiling

DFL

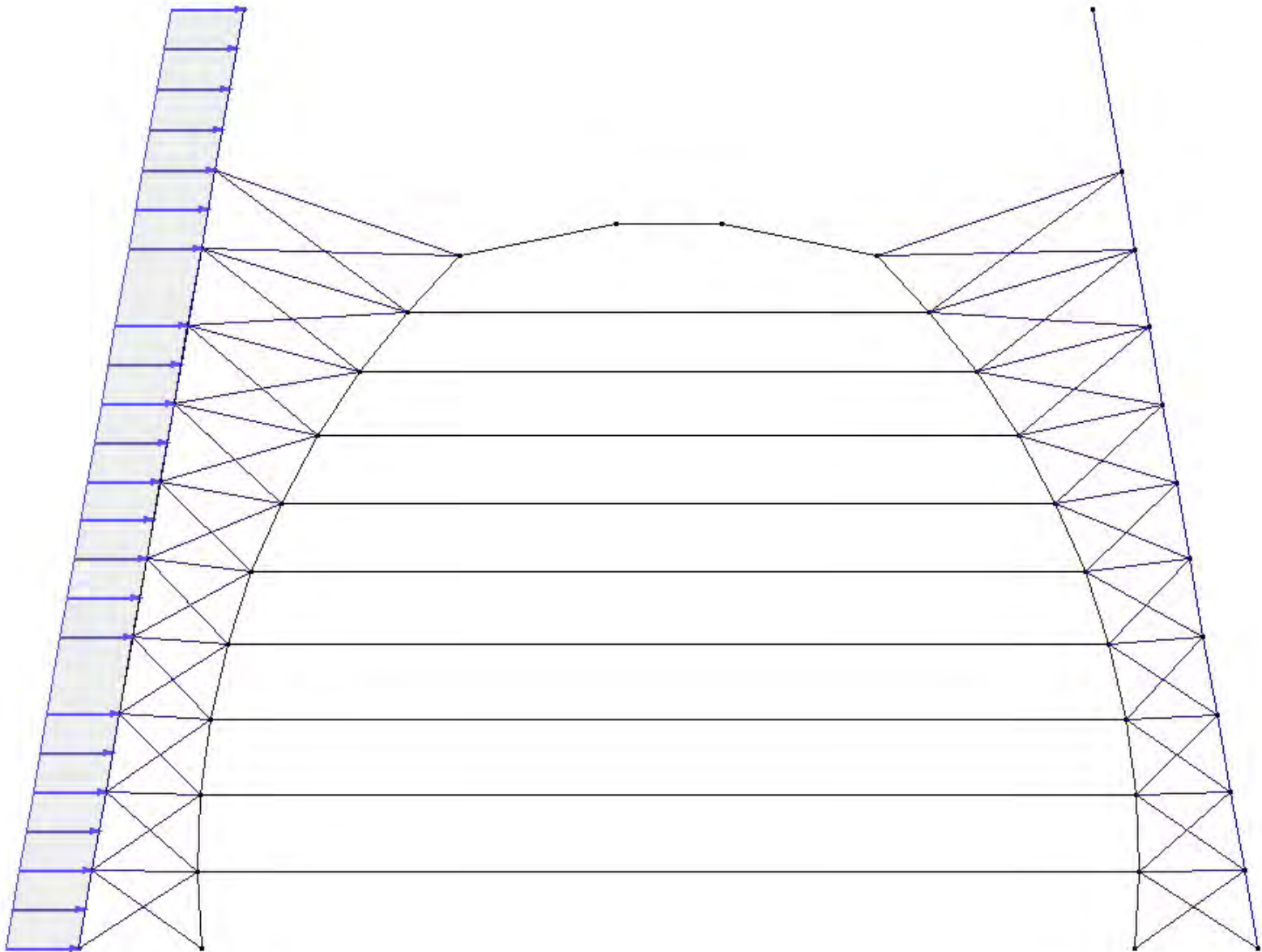
Lateral Load
Resistance

Load-Tracing

Applied Load



Sections	
■	HSS10x10x5/8
■	HSS8x8x5/8
■	HSS32x32x5/8
■	P1/2
■	(No Section)
Default Color	
■	All loads



Overview

Foundation
and
Soil Description

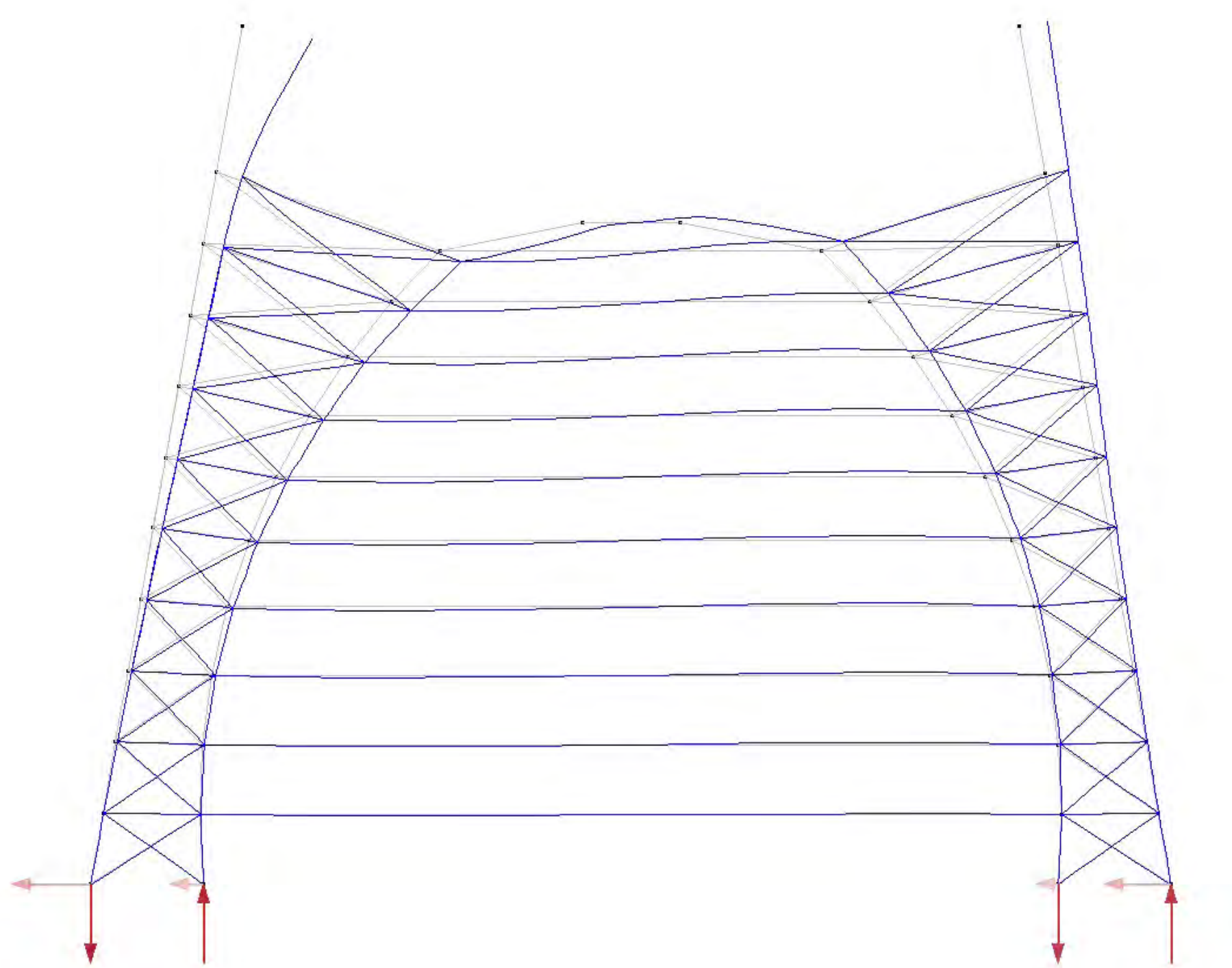
Reliquary Wall

Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing



Overview

Foundation
and
Soil Description

Reliquary Wall

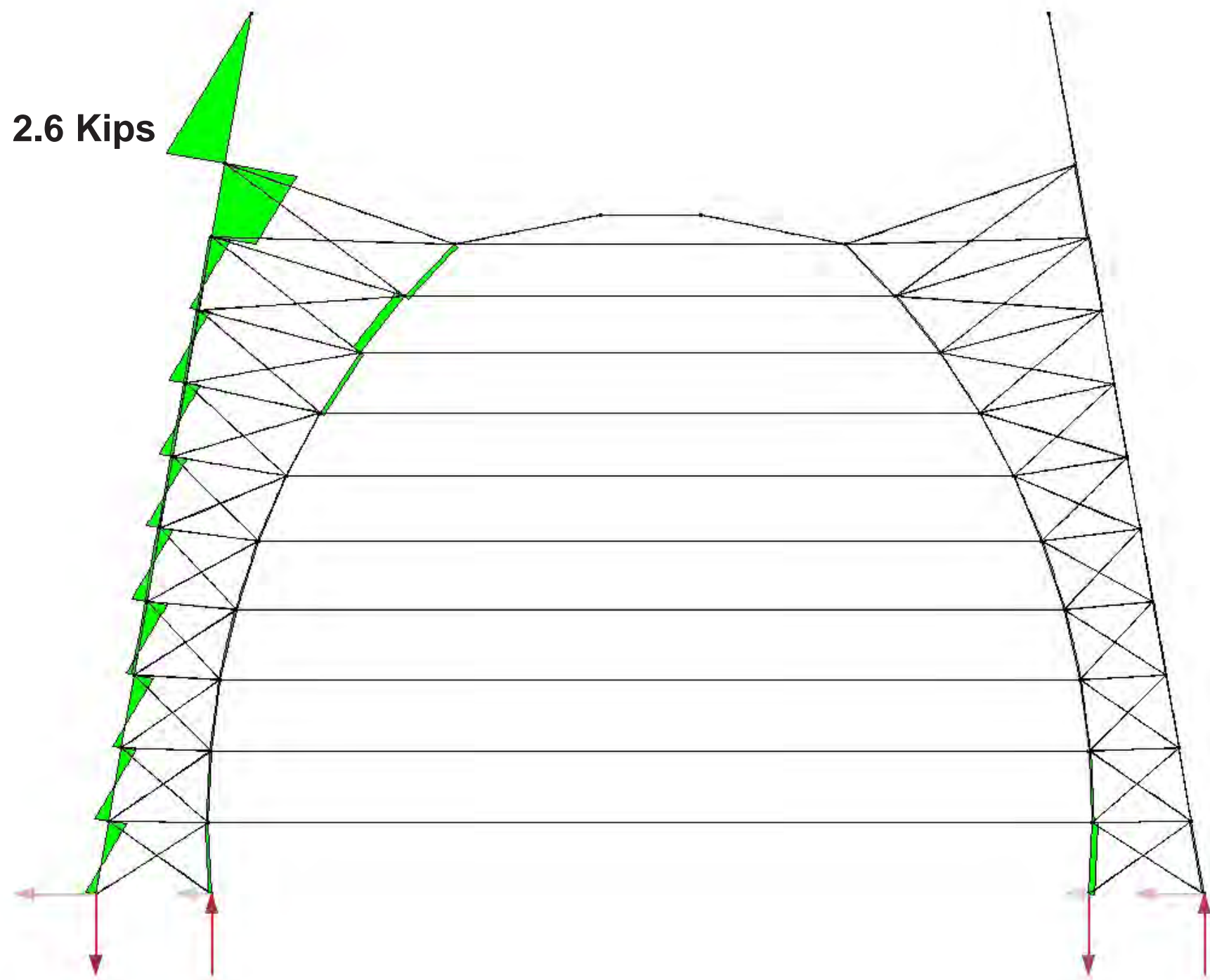
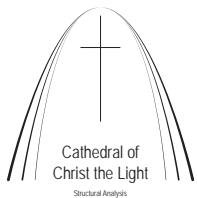
Oculus Ceiling

DFL

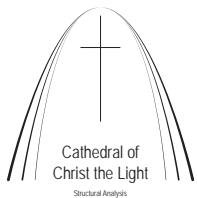
Lateral Load
Resistance

Load-Tracing

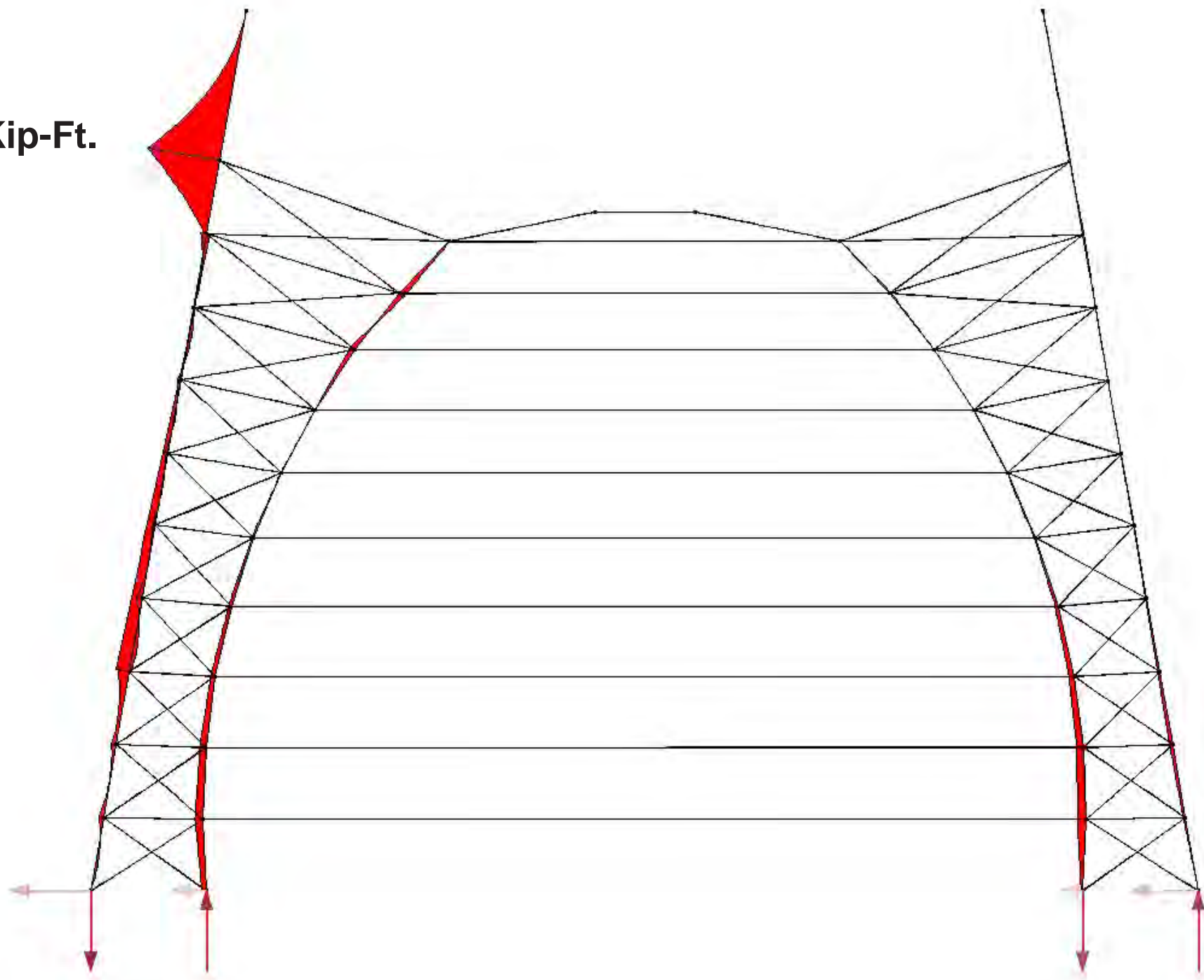
Shear



Moment



23.25 Kip-Ft.



Overview

Foundation
and
Soil Description

Reliquary Wall

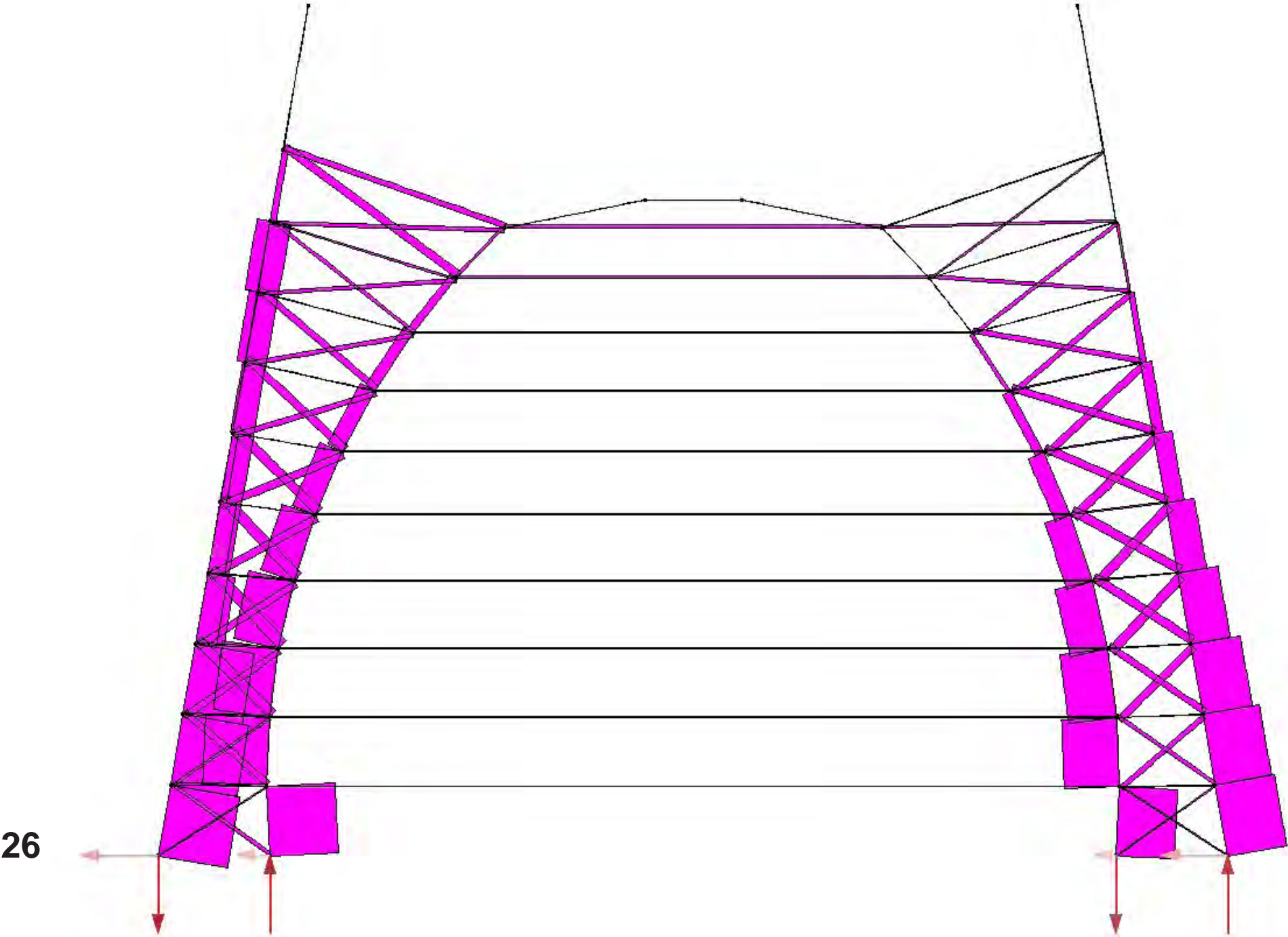
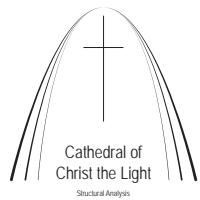
Oculus Ceiling

DFL

Lateral Load
Resistance

Load-Tracing

Deformation



Overview

Foundation
and
Soil Description

Reliquary Wall

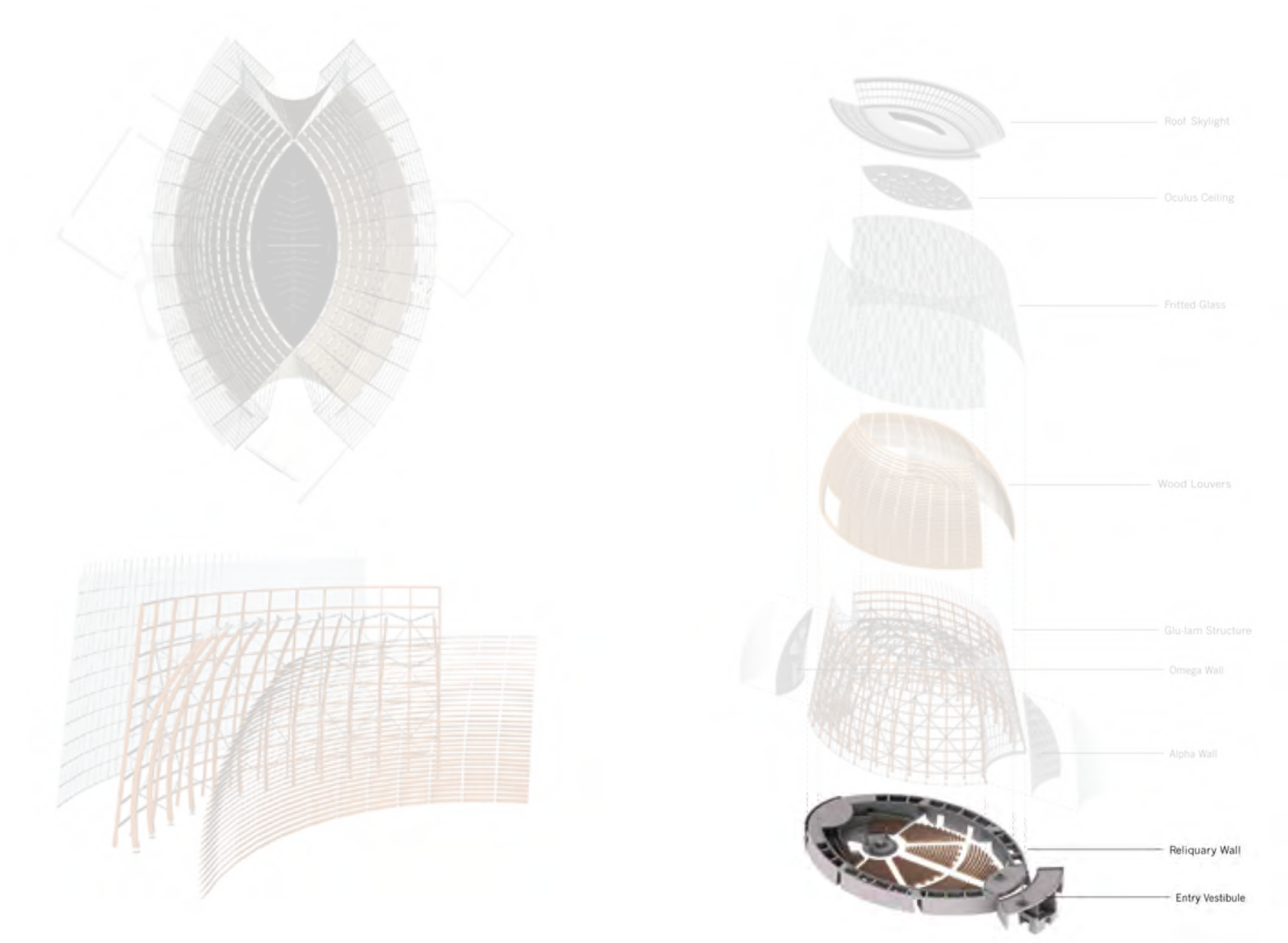
Oculus Ceiling

DFL

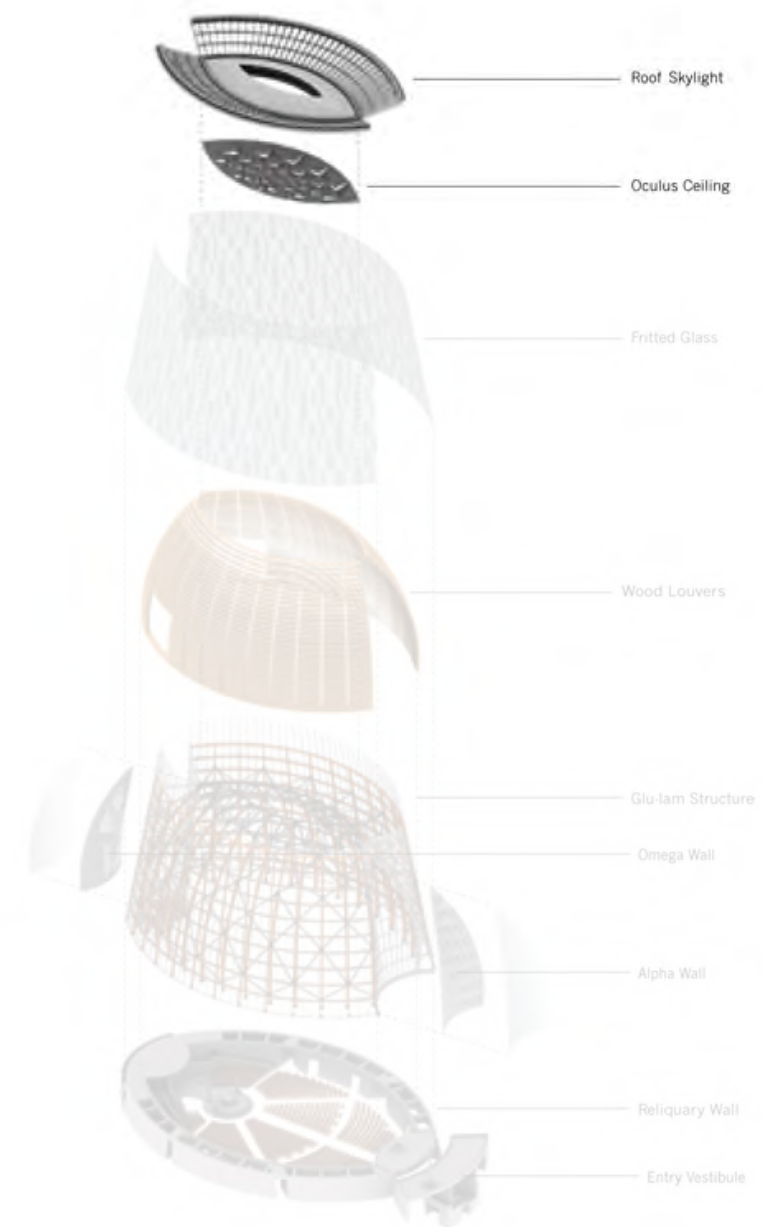
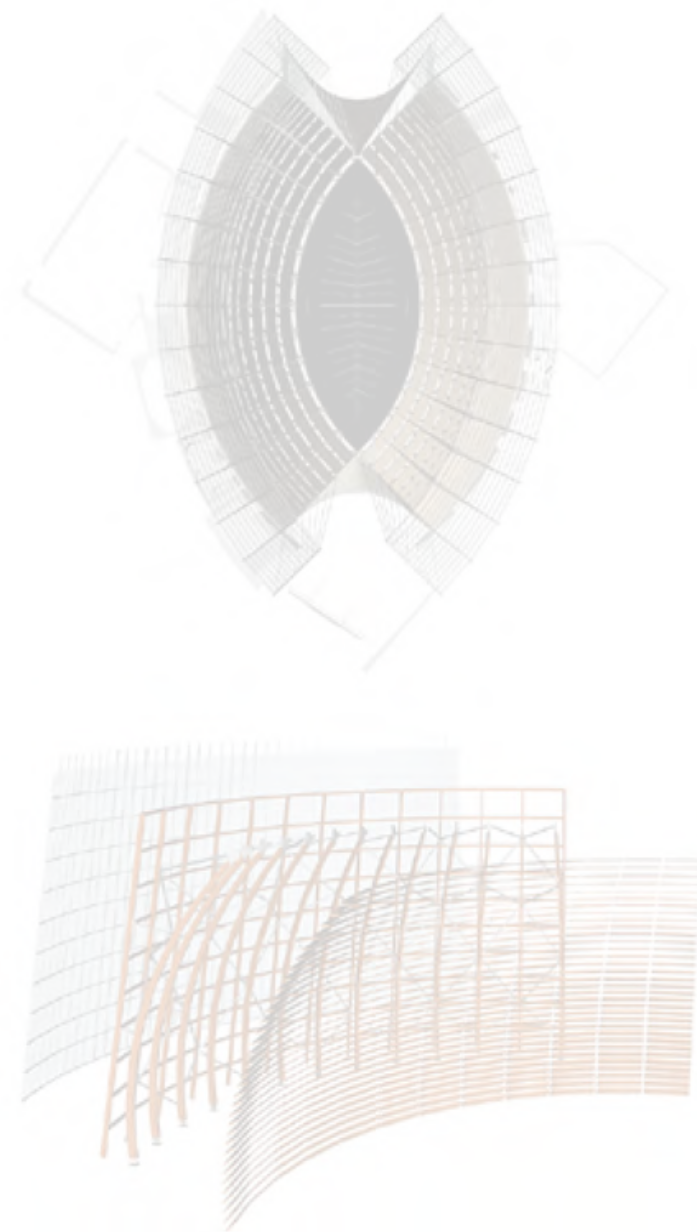
Lateral Load
Resistance

Load-Tracing

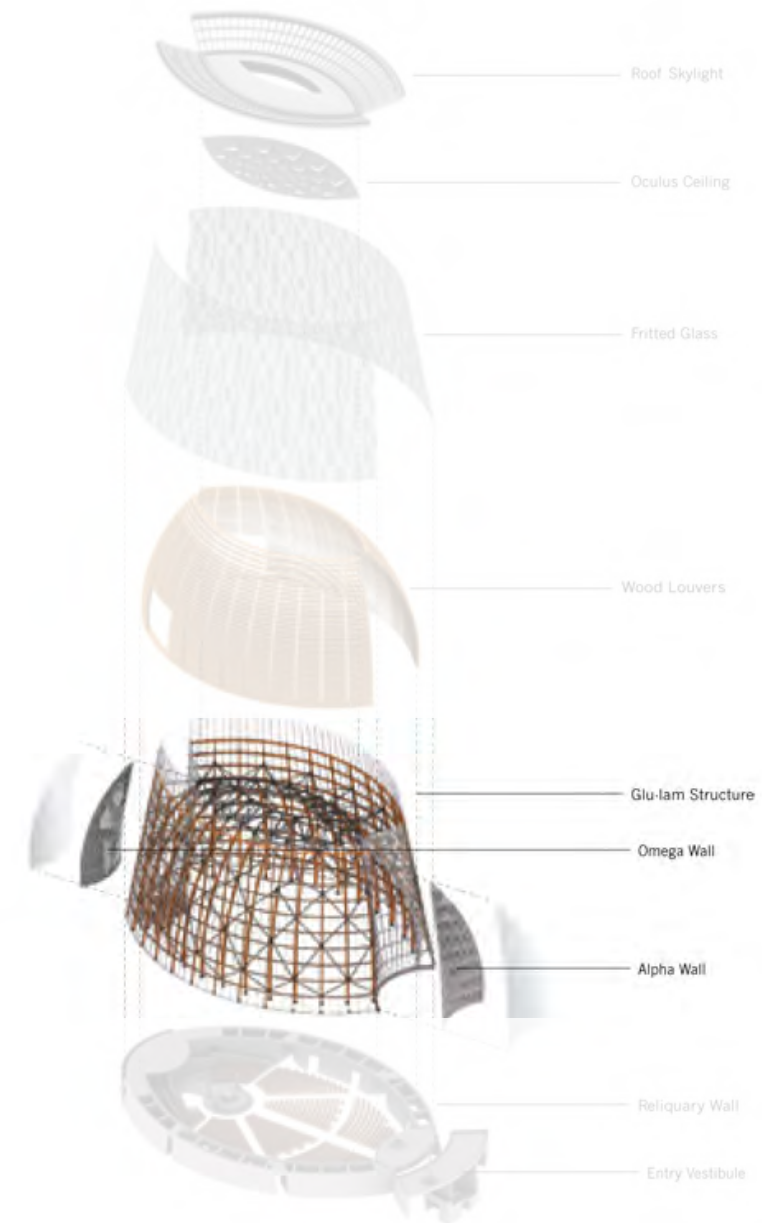
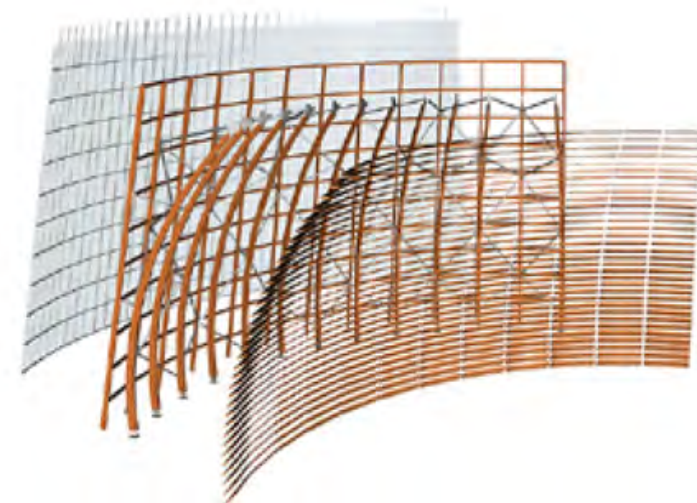
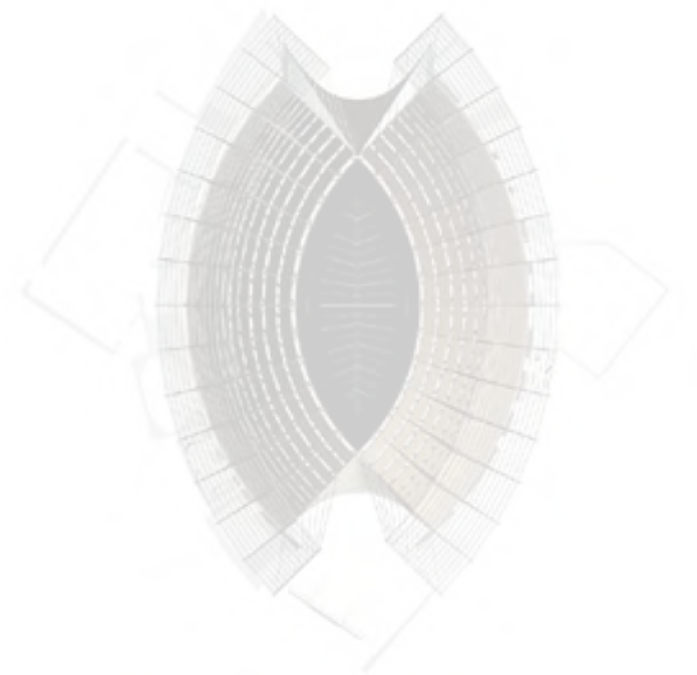
Conclusion



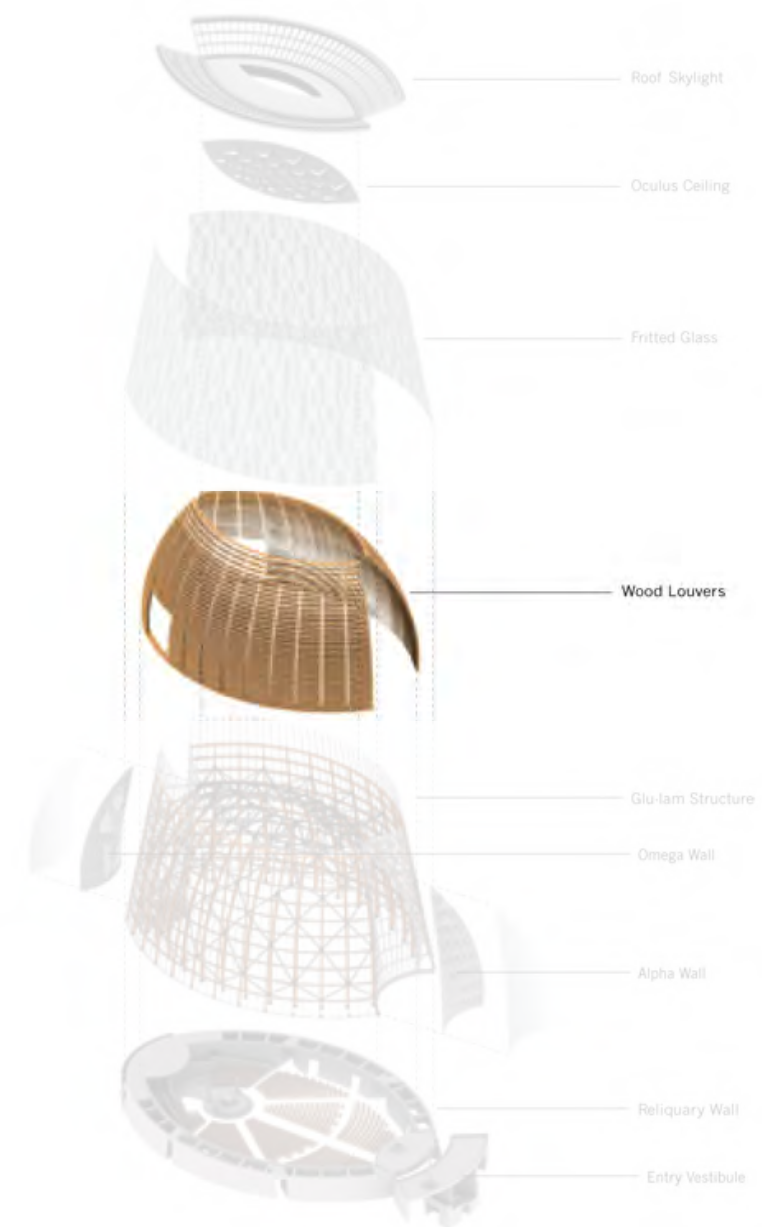
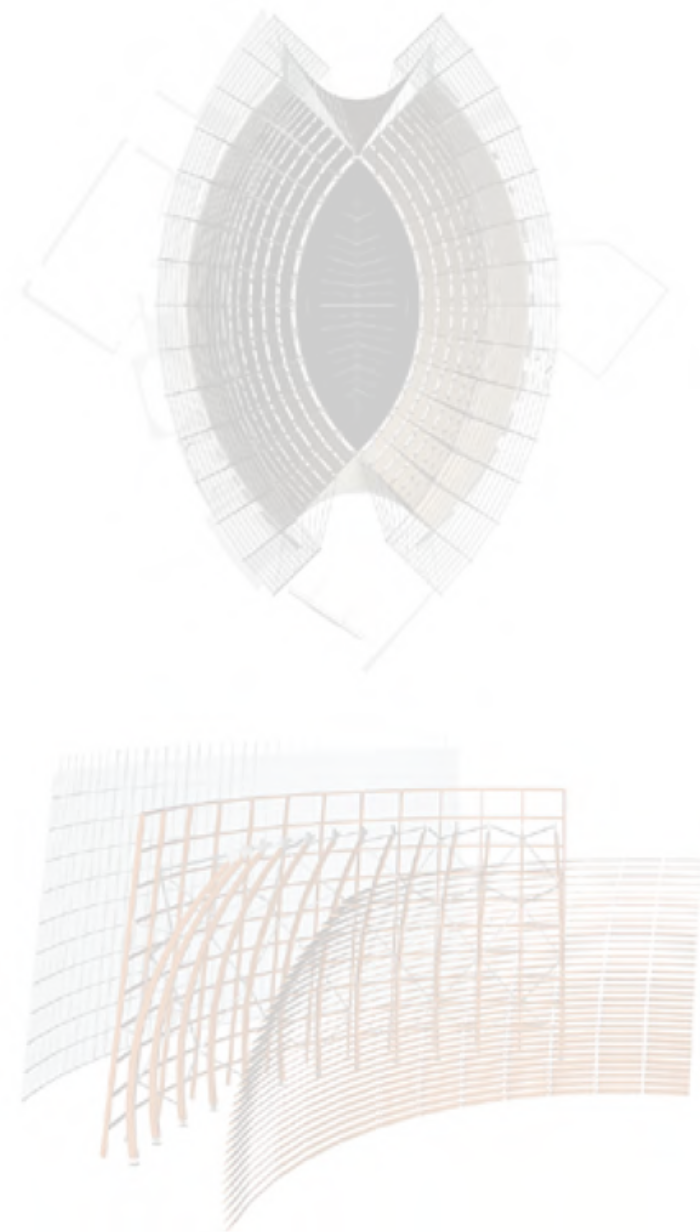
CATHEDRAL OF CHRIST THE LIGHT
SKIDMORE, OWINGS & MERRILL LLP



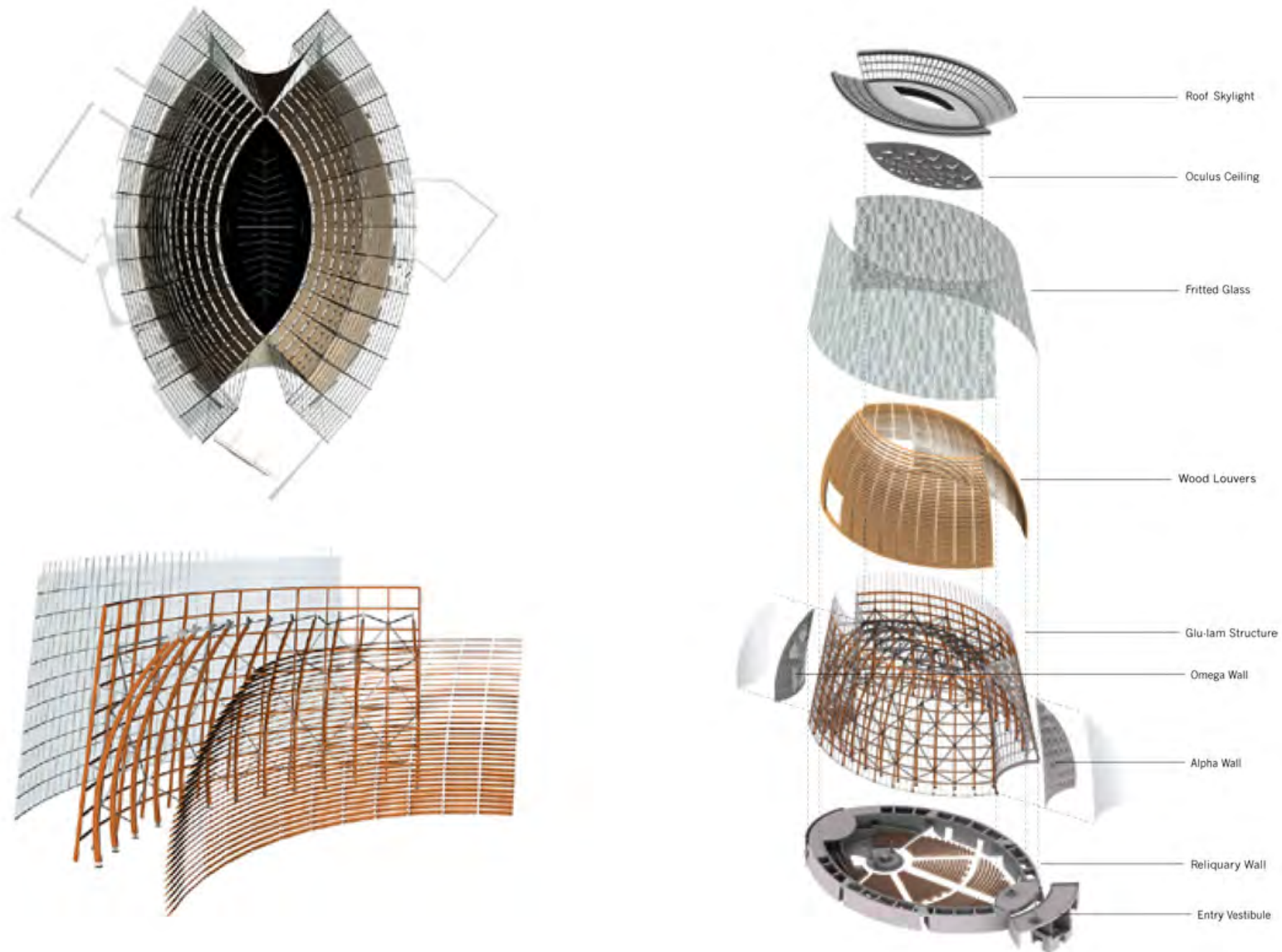
CATHEDRAL OF CHRIST THE LIGHT
SKIDMORE, OWINGS & MERRILL LLP



CATHEDRAL OF CHRIST THE LIGHT
SKIDMORE, OWINGS & MERRILL LLP



CATHEDRAL OF CHRIST THE LIGHT
SKIDMORE, OWINGS & MERRILL LLP



CATHEDRAL OF CHRIST THE LIGHT
SKIDMORE, OWINGS & MERRILL LLP



Image Citations

- 1 SOMs Website | http://www.som.com/projects/cathedral_of_christ_the_light
- 2 SOMs Structural Website | http://www.som.com/projects/cathedral_of_christ_the_light__structural_engineering
- 3 Google Maps
- 4 The Catholic Voice | <http://www.catholicvoiceoakland.org/2008/08-10-06/inthisissue2.htm>
- 5 Bruce Lyon | <https://brucelyonsblog.wordpress.com/2010/04/11/the-vase-of-life-vesica-piscis-and-21-6/>
- 6 House Variety | <http://housevariety.blogspot.com/2011/08/cathedral-of-christ-light-by-som.html#.VH1FCDHF-So>
- 7 Autodesk | <http://usa-stg.autodesk.com/adsk/servlet/item?siteID=123112&id=12138853>
- 8 Arch. Design Blog | <http://architecturedesignblog.com/amazing-temples-around-world/>
- 9 Mike Douglas Photography | <http://www.mikewatsonphotos.com/Churches-and-Cathedrals/i....>
- 10 Project | http://www.ce.berkeley.edu/~paulmont/165/Powerpoint_07/Group%2018.pdf

