Structural & Seismic Review Committee

January 10, 2019

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TRANSBAY JOINT POWERS AUTHORITY

Structural & Seismic Review Committee

- The SSRC was formed in November 2008 to provide guidance on the transit center structural engineer's design assumptions
- At the request of the San Francisco Department of Building Inspection (DBI), the SSRC's scope of work was expanded in November 2009 to assist DBI with independent peer review of the structural plans, per Administrative Bulletin 82 – Guidelines and Procedures for Structural Design Review
- The structural plan review was closely coordinated with DBI and finalized in 2014

SSRC Members

Loring Wyllie	Senior Principal, Degenkolb Engineers
Mason Walters	Senior Principal, Forell/Elsesser Structural Engineers, Inc.
Jack Moehle	Professor of Structural Engineering UC Berkeley College of Engineering
Robin McGuire	Senior Principal, Lettis Consultants International, Inc.
Frieder Seible	Professor Emeritus, Structural Engineering UC San Diego Jacobs School of Engineering
Joe Penzien	Professor Emeritus, Civil Engineering UC Berkeley College of Engineering
Jonathan Bray	Professor of Geotechnical Engineering Faculty Chair in Earthquake Engineering Excellence UC Berkeley College of Engineering

SSRC Purpose

Independent Peer Review of Structural Design:

- Design criteria
- Seismic and structural systems for code compliance
- Design ground motions
- Structural analysis and review of computer programs
- Design details for adequacy

Findings:

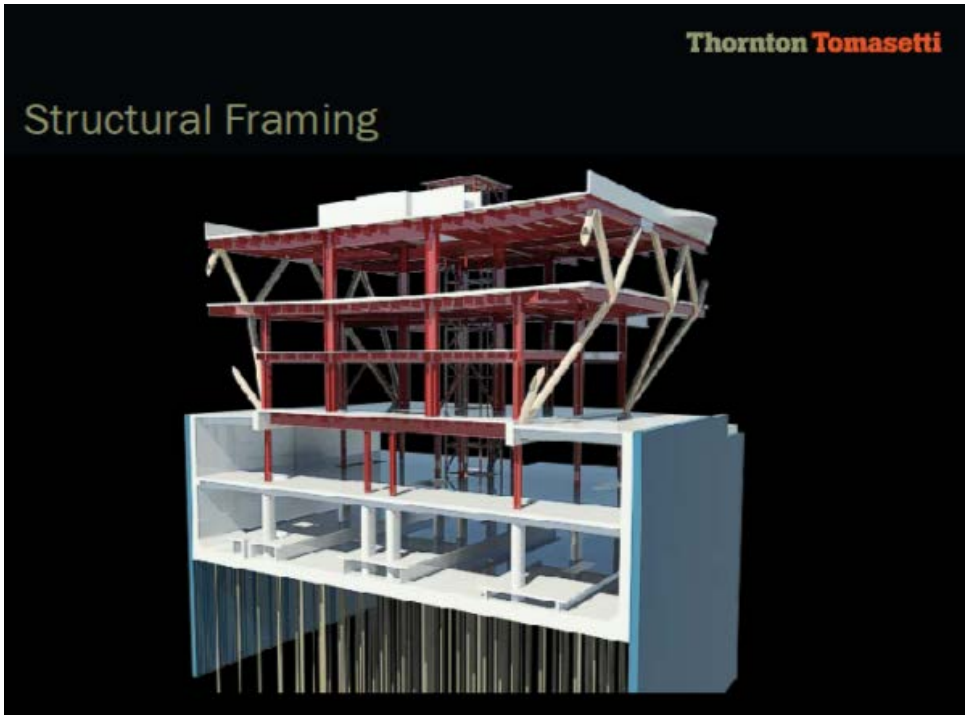
- Structural design was reviewed thoroughly and found to meet or exceed code compliance

Structural Review Scope

STRUCTURAL REVIEW ELEMENT	DBI SCOPE OF STRUCTURAL SERVICE CATEGORY
Ground Motion Hazard Evaluation	• Earthquake Hazard Determination • Site-Specific Ground Motion Characterization
Structural Basis of Design	• Seismic Performance Goals • Basis of Design, Design Methodology & Acceptance Criteria
Soil Structure Interaction Analysis	• Mathematical Modeling & Simulation • Interpretation of Results and Analysis
2D Finite Element Analysis	• Mathematical Modeling & Simulation • Interpretation of Results and Analysis
3D Finite Element Analysis	• Mathematical Modeling & Simulation • Interpretation of Results and Analysis
Buttress Design (review of ARUP's peer review reports, workshop attendance)	• Basis of Design, Design Methodology & Acceptance Criteria • Interpretation of Results and Analysis
Shoring Design	• Basis of Design, Design Methodology & Acceptance Criteria
Substructure (train box) Construction Documents	• Member Selection & Design • Detail Concepts & Design • Construction Documents including Drawings & Specifications
Superstructure (primary steel frame) Construction Documents	• Member Selection & Design • Detail Concepts & Design • Construction Documents including Drawings & Specifications
Bus Ramp	• Earthquake Hazard Determination • Site-Specific Ground Motion Characterization • Seismic Performance Goals • Basis of Design, Design Methodology & Acceptance Criteria • Mathematical Modeling and Simulation • Interpretation of Results and Analysis

Structural Basis of Design

- Seismic Performance Goals:
  - **Frequent:** 50-year return – no structural damage
  - **Rare:** 975-year return – immediate occupancy
  - **Maximum Considered:** 2,475-year return – collapse prevention
- Design Methodology & Acceptance Criteria
- Structural Steel Special Moment-Resisting Frame (SMRF) Testing
- Eccentric Braced Frame (EBF) System & Testing



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Ground Motion Hazard Evaluation

- Earthquake Hazard Determination
- Site-Specific Ground Motion Characterization
- Differing Site Conditions along the Building Footprint
- Criteria Upgrade for Pulse Type Motions – now standard practice

Buttress & Shoring Design

- Basis of Design, Design Methodology & Acceptance Criteria
- Interpretation of Results & Analysis
- Shoring system to prevent dewatering outside of the project site

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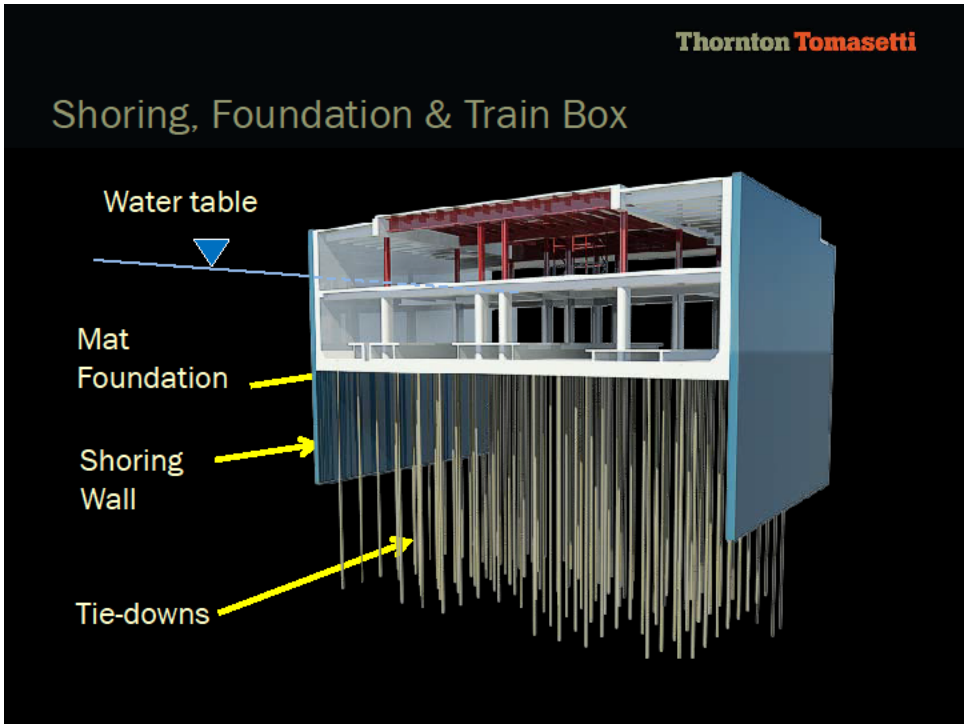
Substructure (Train Box) Construction Documents



- Detail Concepts & Design
- Member Selection & Design
- Construction Documents including Drawings & Specifications (plan check services for DBI)

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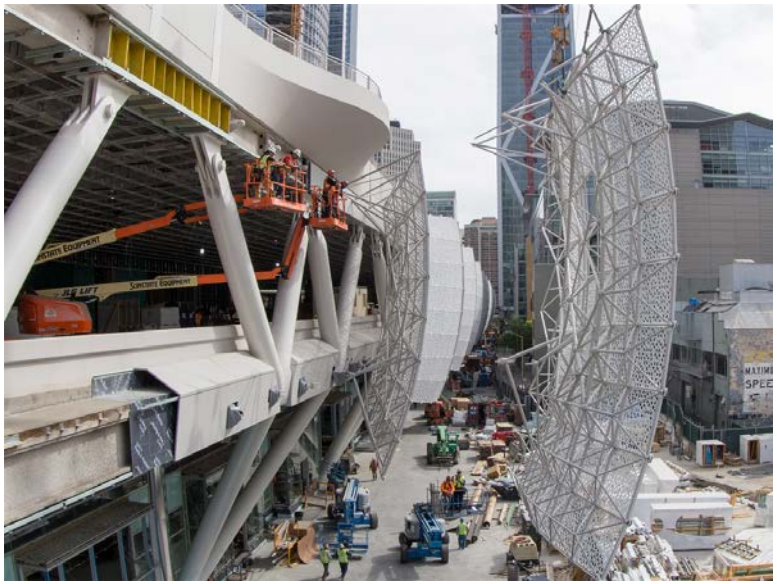
Superstructure (Steel & Concrete Above Grade) Construction Documents

- Detail Concepts & Design
- Member Selection & Design
- Construction Documents including Drawings & Specifications (plan check services for DBI)
  - Structural steel SMRFs
  - Longitudinal EBFs
  - Light Column
  - Cast Nodes
- Specialty Glazing & Exterior Cladding Systems



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Bus Ramp Design and Construction Documents

- Earthquake Hazard Determination
- Site-Specific Ground Motion Characterization
- Seismic Performance Goals
- Basis of Design, Design Methodology & Acceptance Criteria
- Mathematical Modeling and Simulation
- Interpretation of Results and Analysis

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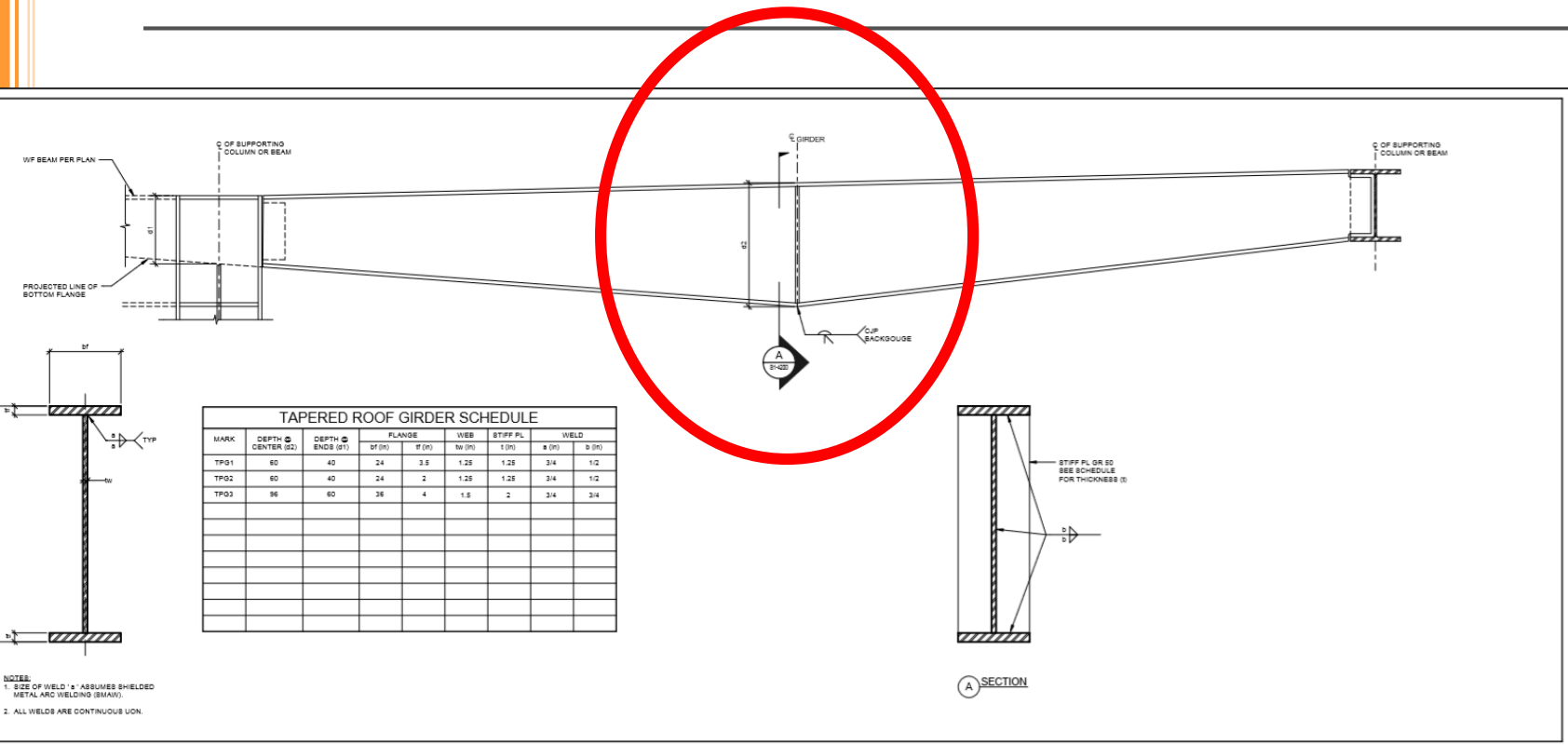
Girder



TAPERED ROOF GIRDER SCHEDULE

MARK	DEPTH @ CENTER (d2)	DEPTH @ ENDS (d1)	FLANGE		WEB	STIFF PL	WELD	
			bf (in)	tf (in)	tw (in)	t (in)	a (in)	b (in)
TPG1	60	40	24	3.5	1.25	1.25	3/4	1/2
TPG2	60	40	24	2	1.25	1.25	3/4	1/2
TPG3	96	60	36	4	1.5	2	3/4	3/4

NOTES:
1. SIZE OF WELD 'a' ASSUMES SHIELDED METAL ARC WELDING (SMAW).
2. ALL WELDS ARE CONTINUOUS UON.

TYPICAL TAPERED ROOF GIRDER SCHEDULE
NOT TO SCALE

Transbay Transit Center
TRANSBAY JOINT POWERS AUTHORITY

Thornton Tomasetti
Thornton Tomasetti, Inc.
6080 Center Drive, Suite 260
Los Angeles CA 90045-5318
T 310.665.0010 F 310.665.0101

Key Map

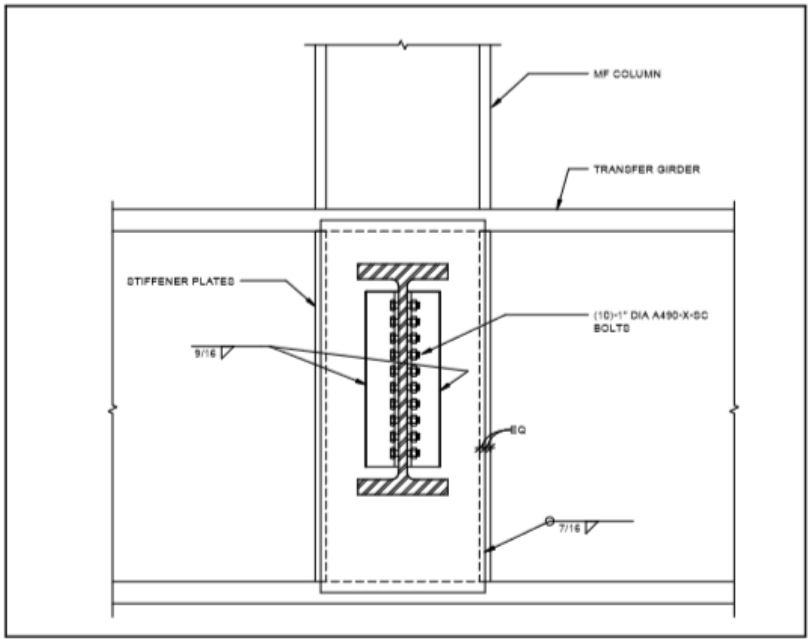
REVISIONS

NO.	DATE	DESCRIPTION	BY
1	12/19/13	ISSUED FOR CONSTRUCTION	BG
2	2/7/13	ISSUED FOR CONSTRUCTION	BG

08-04-CMGC-000

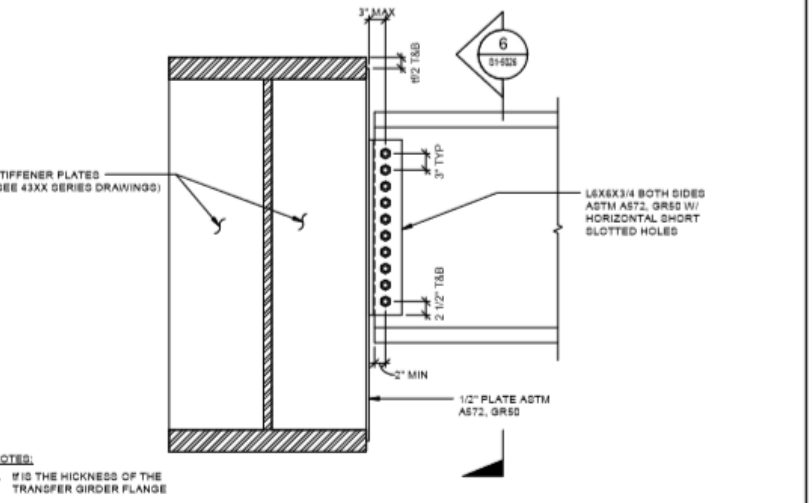
BAY TRANSIT CENTER PROGRAM
RANSBAY TRANSIT CENTER
SAN FRANCISCO, CA

TAPERED ROOF GIRDER
SCHEDULE & DETAILS



6 SECTION
SCALE: 1" = 1'-0"

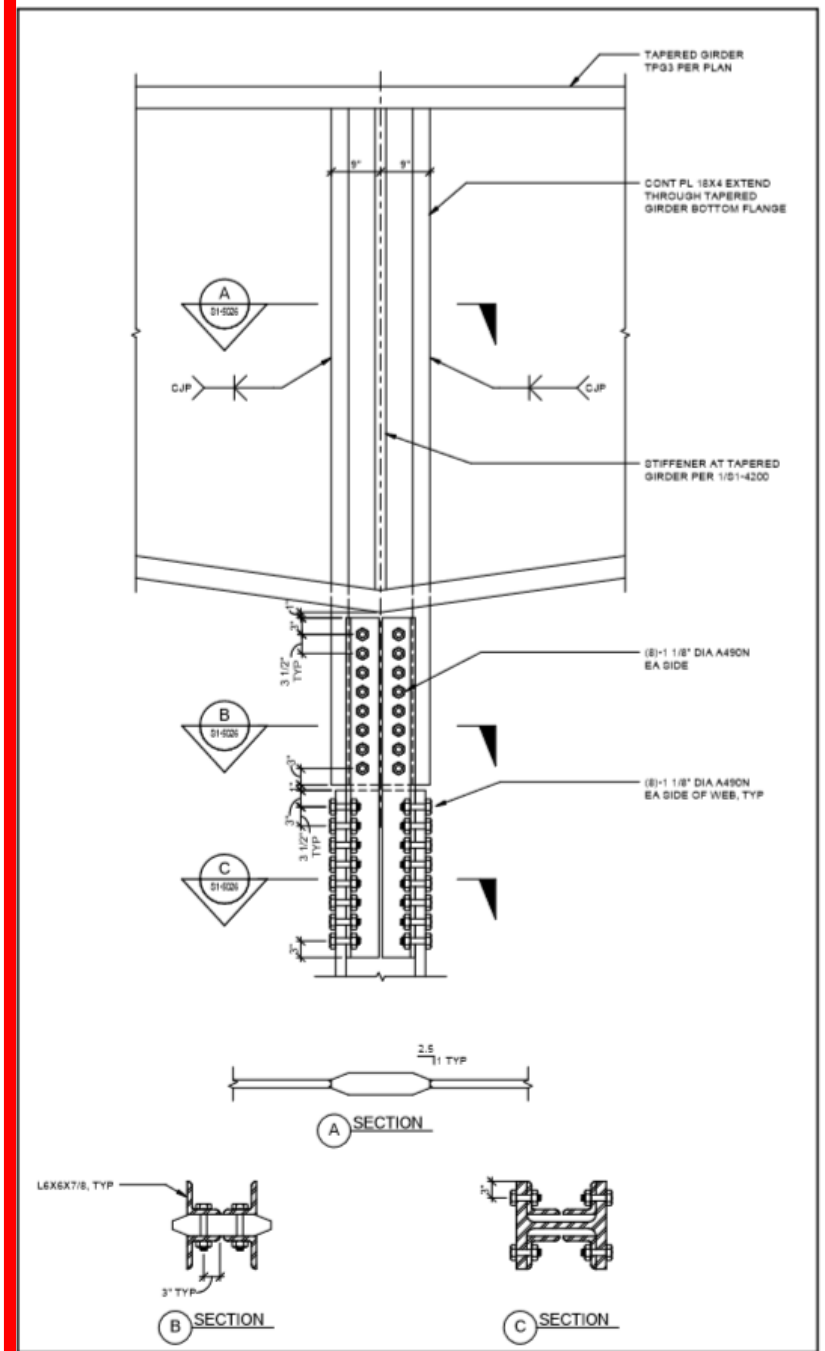
0 1/2 1 2 3
SCALE IN FEET



V DOUBLE ANGLE CONNECTION AT GLS 19.9, 20.1, 22, 24

SFER GIRDER

0 1/2 1 2 3
SCALE IN FEET



9 HANGER DETAIL AT ROOF LEVEL
SCALE: 1" = 1'-0"

0 1/2 1 2 3
SCALE IN FEET

08-04-CMGC-000

TRANSBAY TRANSIT CENTER PROGRAM
TRANSBAY TRANSIT CENTER
SAN FRANCISCO, CA

STEEL BEAM DETAILS

NO.	DATE	DESCRIPTION
A	02/19/13	ISSUED FOR CONSTRUCTION
A	03/19/13	PER AB No. 0103
A	05/31/13	100% CONSTRUCTION DOCUMENTS
A	07/11/13	ISSUED FOR CONSTRUCTION
A	07/18/13	PER AB No. 0105

PRINCIPAL ENGINEER B. GIBB
PROJECT MANAGER A. C
PROJECT ENGINEER A. BEA
DESIGNED BY BEATTIE
DRAWN BY DECHPORMBUK
CHECKED BY L. JOSEPH
DATE 07/18/2013
SCALE AS NOTED
SIZE E
PROJECT NO 140
SHEET NUMBER S1-5026
SEQUENCE NUMBER 511 of 6

Summary

- Review was thorough
- Design concept is sound
- Design is conservative
- Construction permits were issued based on SSRC's recommendation
- Design met or exceeded applicable codes and standards

Questions?

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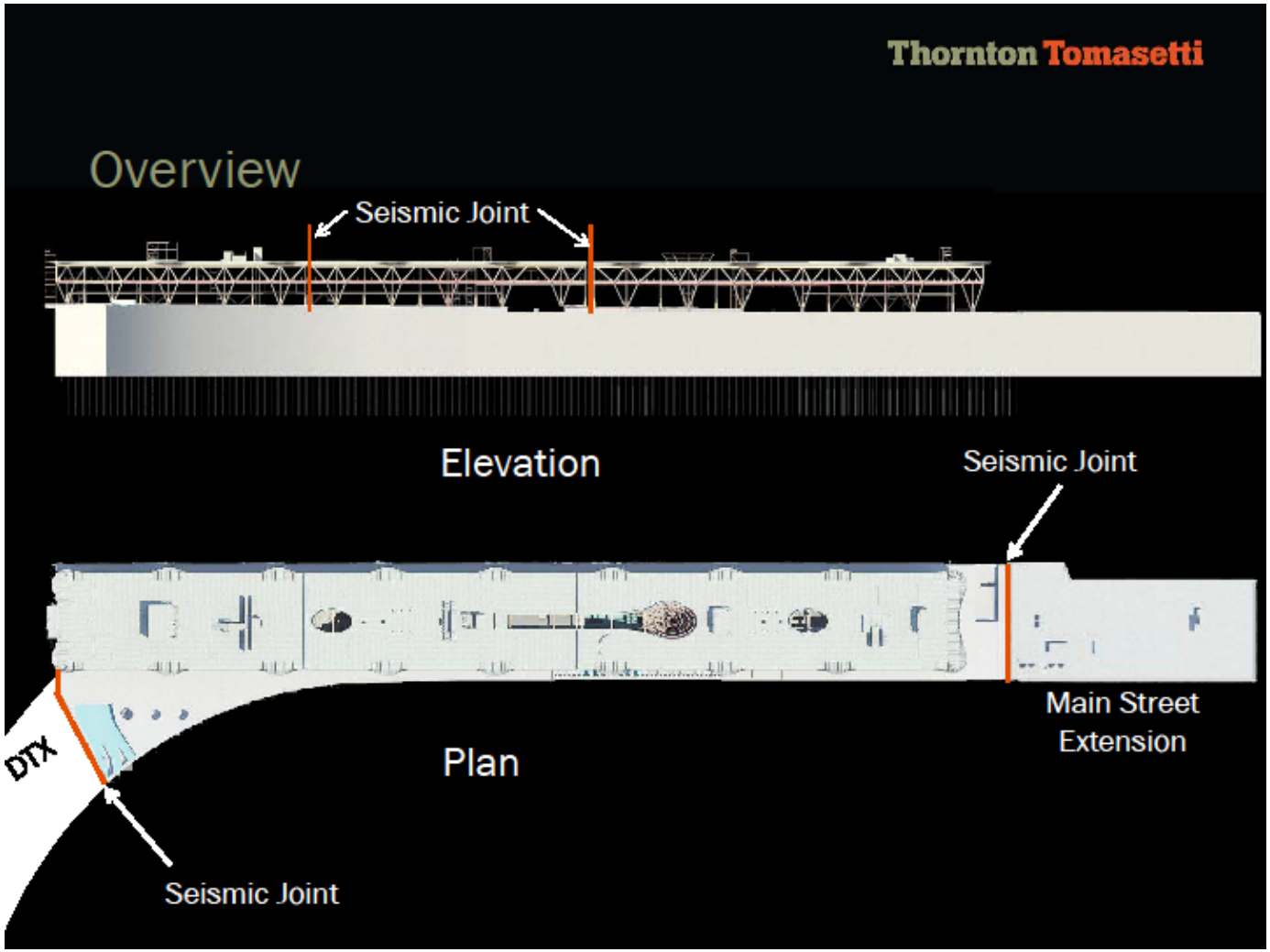
201 Mission Street, Suite 2100 San Francisco, CA 94105 • 415.597.4620 • www.tjpa.org

Structural System



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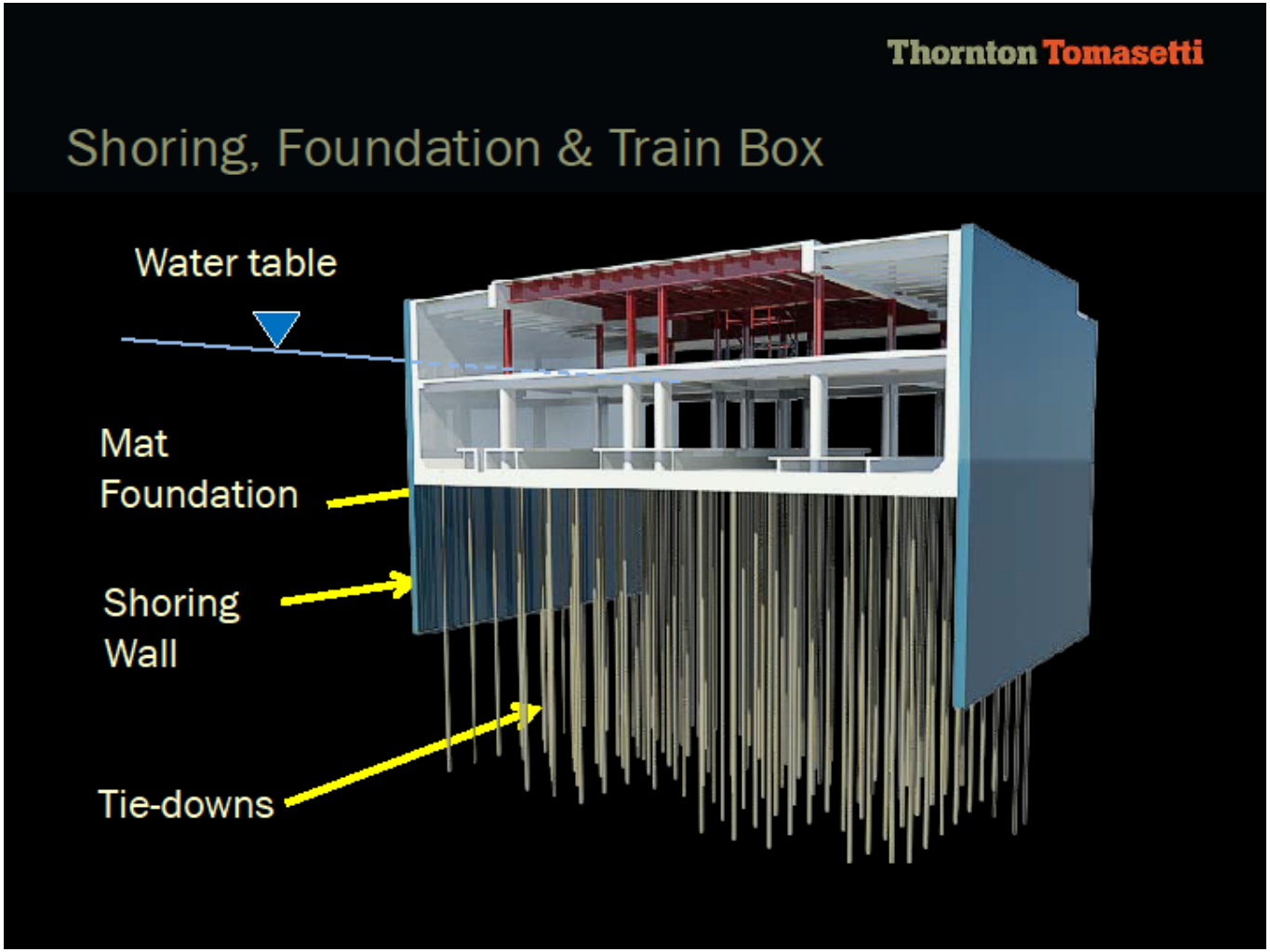
Structural System



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Structural System

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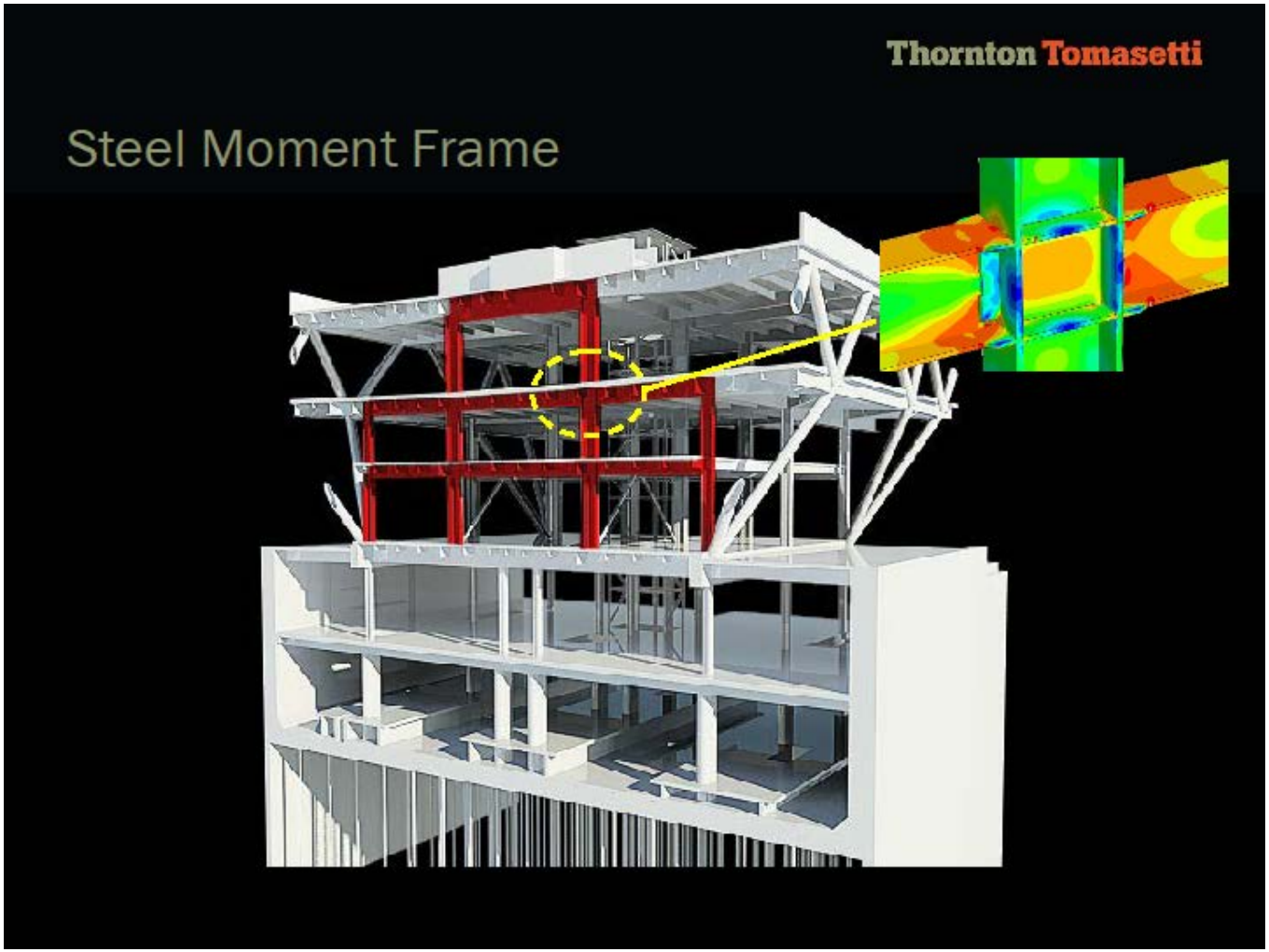
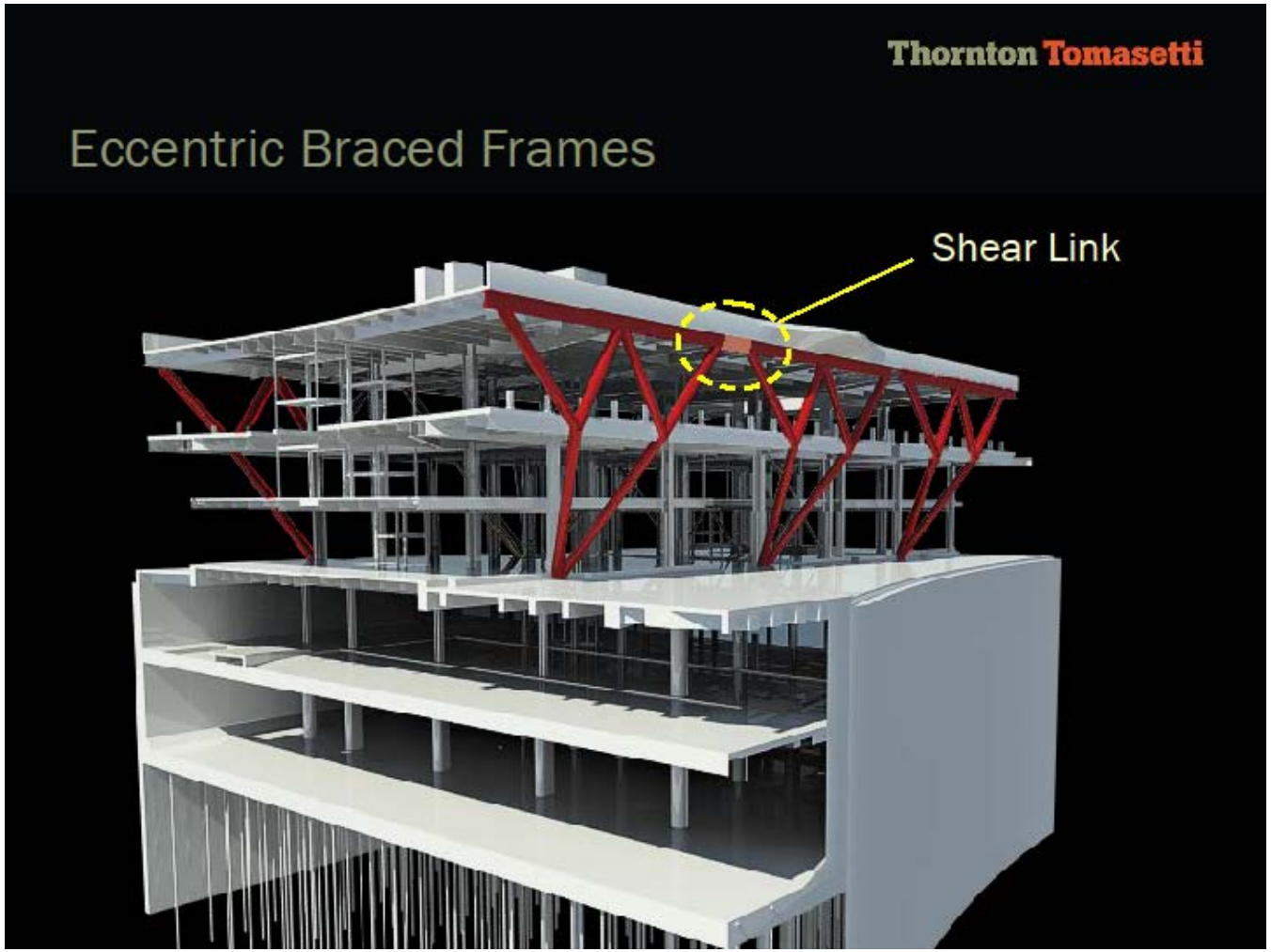
Structural System



Structural System



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Structural System