Contemporary Jewish Museum

San Francisco

The angular structure creates a dramatic entry near Yerba Buena Lane.

Project Team

Owner
Contemporary Jewish Museum, San Francisco

Design Architect
Studio Daniel Libeskind, New York

Associate Architect
WRNS Studio, San Francisco

Structural Engineer
OLMM Consulting Engineers, San Francisco

Steel Erector
Olson Steel, San Leandro, Calif. (IMPACT Member)

General Contractor
Plant Construction Co., San Francisco

Consultant
ARUP, San Francisco

Photos and content submitted by OLMM Consulting Engineers

Celebrating Life: Steel Framing Unifies New and Existing Structures

A complex geometry and irregular form makes structural steel the best and most economical choice to bring San Francisco's Contemporary Jewish Museum to life, and revitalizes its neighborhood in the process.

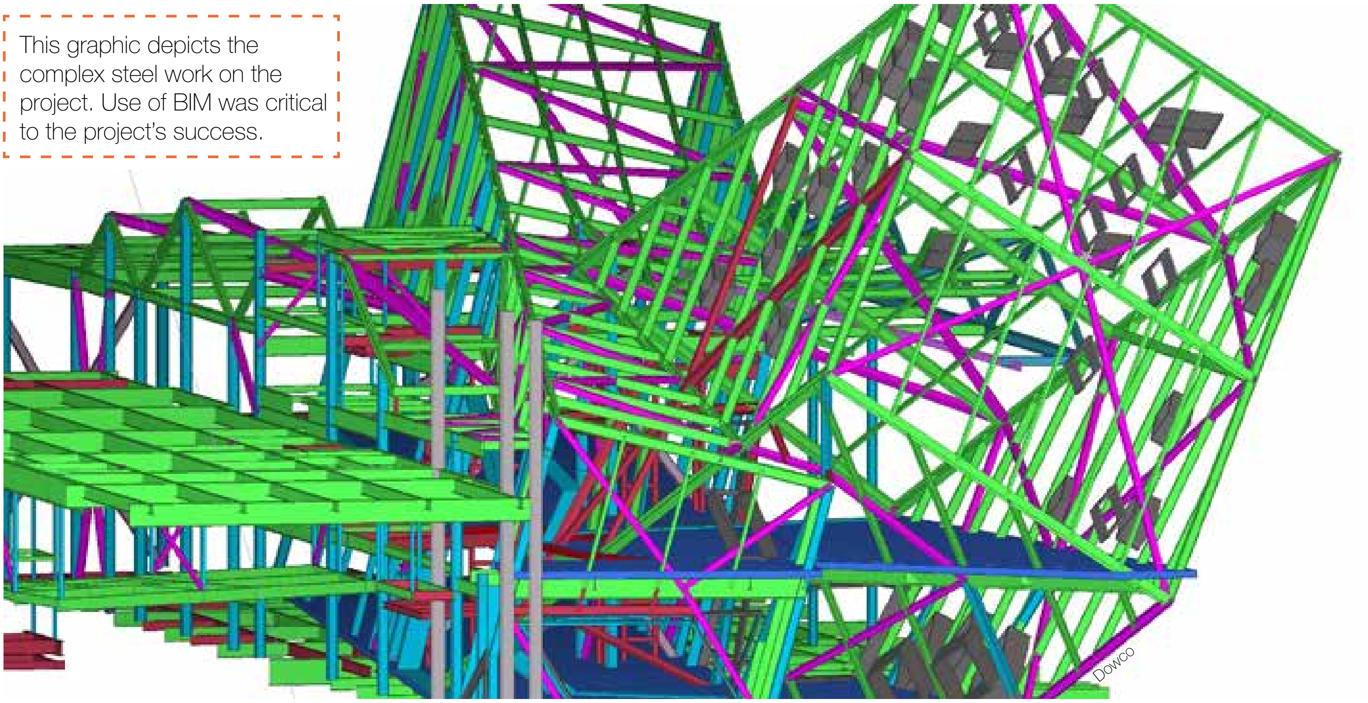
An aerial view shows the new structure jutting out of and intersecting with the historic Jesse Street Power Station portion of the museum.

The Contemporary Jewish Museum is one of the last pieces in the revitalization and transformation of the once decaying Yerba Buena district in downtown San Francisco. Nearly a decade after it's opening, the bold and striking 63,000-sq.-ft, $47.5 million museum building beautifully integrates modern materials and complex forms with the old Jesse Street Power Station, a national historic landmark designed by Willis Polk in 1907 during the "City Beautiful" movement. The historic features of the landmark substation, most notably its ornate brick and terra-cotta façade, steel trusses, crane and catwalk, were integrated into the building's structure.

The building's contemporary form was inspired by the Hebrew phrase l'chaim (to life!), which led to highly complex geometry and a very irregular structure. Given the complicated geometry, structural steel was the most appropriate and cost-effective framing system for the building.

Located in an area of high seismic activity, resistance to earthquake loads for the building is provided by steel braced frames. Although essentially a two-level structure, the highest point in this angular building rises almost 70 ft above the ground level. The complex geometry of the building blurs the lines between beams and columns, and which elements are resisting gravity loads and which are resisting lateral loads. Many columns are not vertical—some lean in two directions—and the braced frames carry not only the earthquake loads but also gravity loads.

Structural engineers built a 3D computer model of the building in order to perform detailed response spectrum dynamic analyses. Because

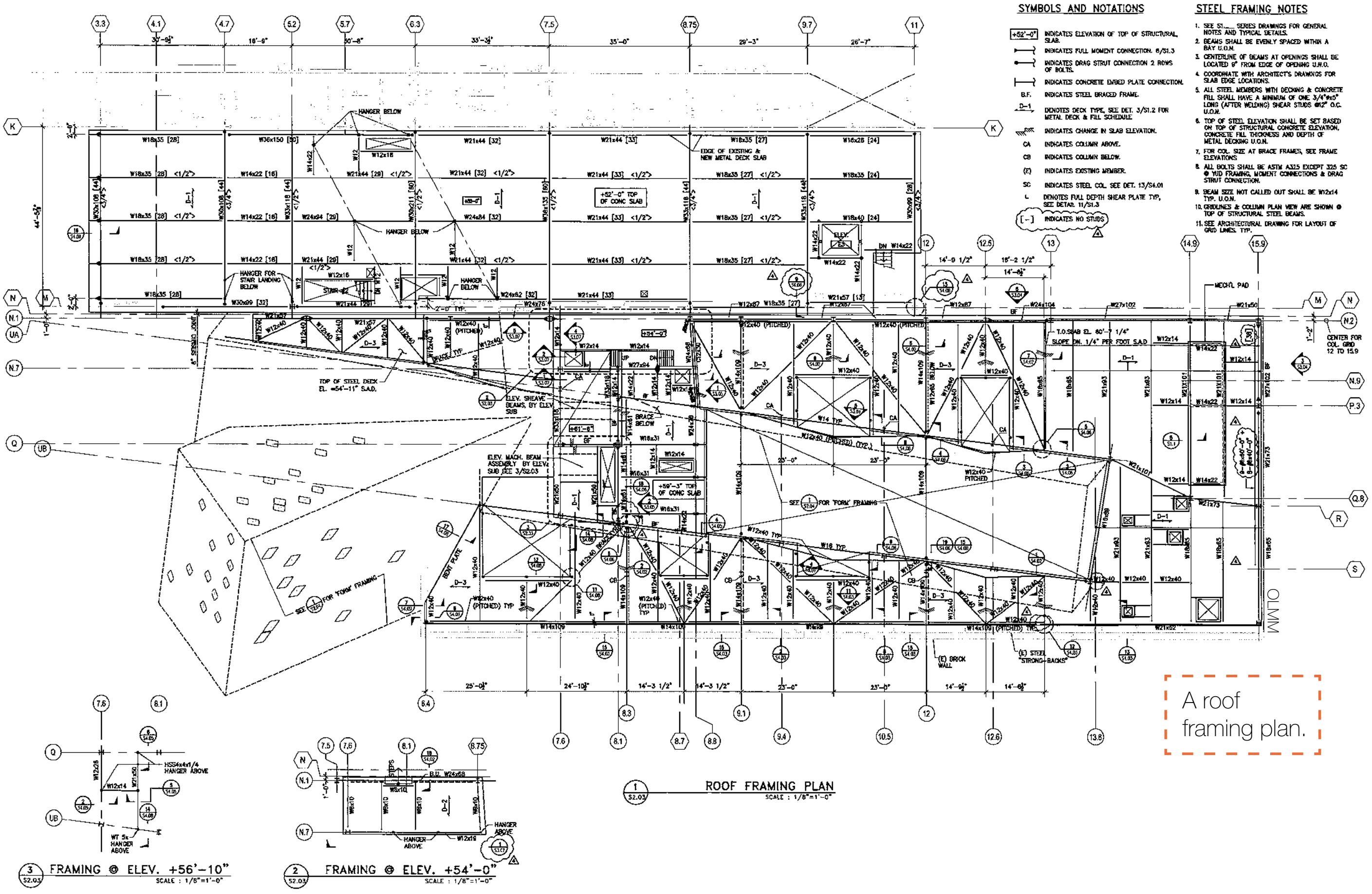


This graphic depicts the complex steel work on the project. Use of BIM was critical to the project's success.

Dowco

the braced frames also carry gravity loads, seismic design is required to ensure nearly-elastic behavior for the maximum credible earthquake.

Designing and detailing the complex geometry posed a significant challenge, especially regarding connections. At numerous locations, as many as eight steel members come together at different angles and in different planes, requiring creativity and imagination in designing and drawing



SYMBOLS AND NOTATIONS

+52'-0"	INDICATES ELEVATION OF TOP OF STRUCTURAL SLAB.
⊢—⟩	INDICATES FULL MOMENT CONNECTION. 6/S1.3
●—⟩	INDICATES DRAG STRUT CONNECTION 2 ROWS OF BOLTS.
⊢—⟩	INDICATES CONCRETE EMBED PLATE CONNECTION.
B.F.	INDICATES STEEL BRACED FRAME.
D-1	DENOTES DECK TYPE, SEE DET. 3/S1.2 FOR METAL DECK & FILL SCHEDULE
	INDICATES CHANGE IN SLAB ELEVATION.
CA	INDICATES COLUMN ABOVE.
CB	INDICATES COLUMN BELOW.
(E)	INDICATES EXISTING MEMBER.
SC	INDICATES STEEL COL. SEE DET. 13/S4.01
L	DENOTES FULL DEPTH SHEAR PLATE TYP, SEE DETAIL 11/S1.3
[-]	INDICATES NO STUDS

STEEL FRAMING NOTES

1. SEE S1.__ SERIES DRAWINGS FOR GENERAL NOTES AND TYPICAL DETAILS.
2. BEAMS SHALL BE EVENLY SPACED WITHIN A BAY U.O.N.
3. CENTERLINE OF BEAMS AT OPENINGS SHALL BE LOCATED 6" FROM EDGE OF OPENING U.N.O.
4. COORDINATE WITH ARCHITECT'S DRAWINGS FOR SLAB EDGE LOCATIONS.
5. ALL STEEL MEMBERS WITH DECKING & CONCRETE FILL SHALL HAVE A MINIMUM OF ONE 3/4"⌀x5" LONG (AFTER WELDING) SHEAR STUDS @12" O.C. U.O.N.
6. TOP OF STEEL ELEVATION SHALL BE SET BASED ON TOP OF STRUCTURAL CONCRETE ELEVATION, CONCRETE FILL THICKNESS AND DEPTH OF METAL DECKING U.O.N.
7. FOR COL. SIZE AT BRACE FRAMES, SEE FRAME ELEVATIONS
8. ALL BOLTS SHALL BE ASTM A325 EXCEPT 325 SC @ YUD FRAMING, MOMENT CONNECTIONS & DRAG STRUT CONNECTION.
9. BEAM SIZE NOT CALLED OUT SHALL BE W12x14 TYP. U.O.N.
10. GRIDLINES & COLUMN PLAN VIEW ARE SHOWN @ TOP OF STRUCTURAL STEEL BEAMS.
11. SEE ARCHITECTURAL DRAWING FOR LAYOUT OF GRID LINES. TYP.

A roof framing plan.

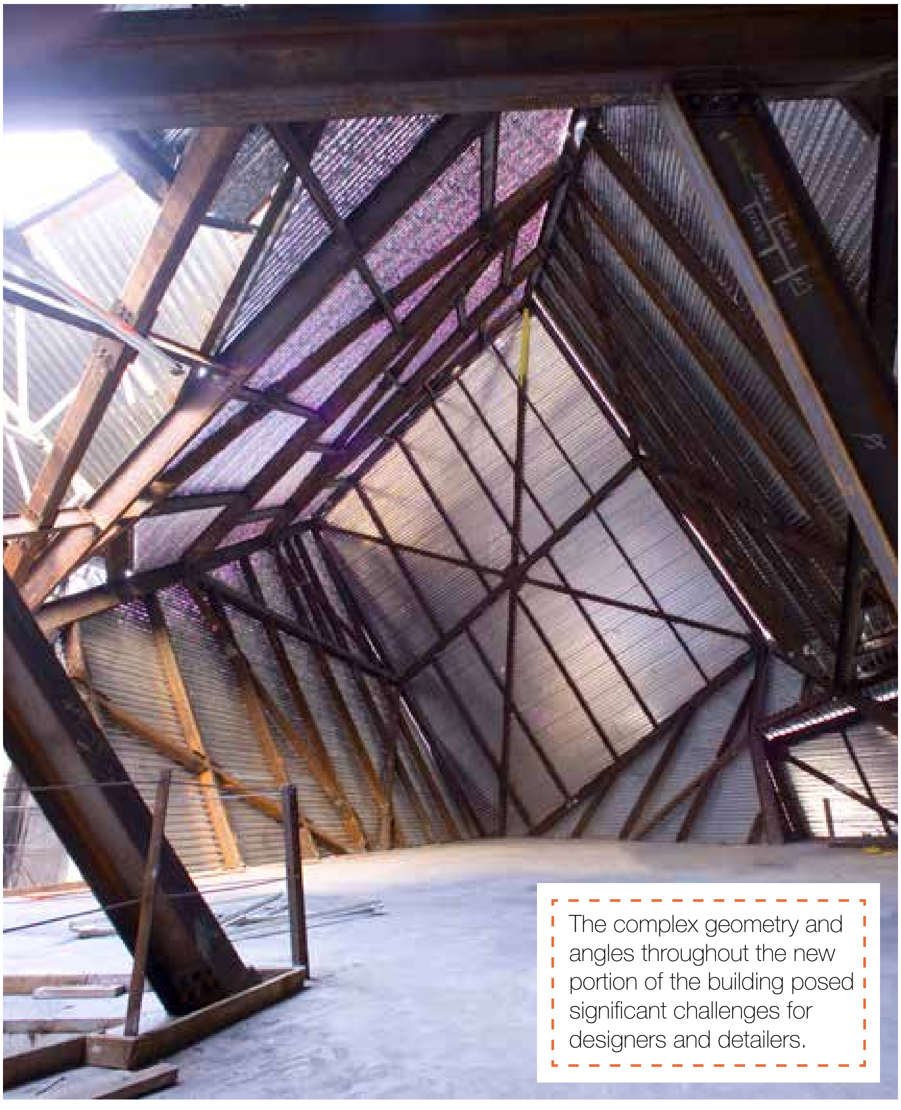
As many as eight steel members come together at different angles and planes in some connections.

up the connections. Engineers drew as many as four views of key connections to convey the intent of the design. Because there was such large risk for unresolved issues and multiple change orders if the project had been bid and constructed using only 2D drawings, the details ultimately were drawn in 3D.

To overcome those concerns, the engineer recommended that the client retain the services of a steel detailer, Dowco Consultants, Vancouver, B.C., to develop a 3D model of the structure as the design proceeded. This approach, a precursor to current BIM practice, led to a highly interactive design process.

The engineer provided AutoCAD files of design drawings to Dowco as they were developed. Dowco used that information to prepare its 3D model and sent that information back to the engineer for review and updating its drawings. Using this process enabled the team to identify and resolve a host of conflicts and potential problems. Making the model available to steel bidders led to reduced uncertainties, and, consequently, tighter bids.

The general contractor and the steel detailing, fabrication and erection team were brought on board early in the design phase, allowing for creative and practical solutions and close



The complex geometry and angles throughout the new portion of the building posed significant challenges for designers and detailers.

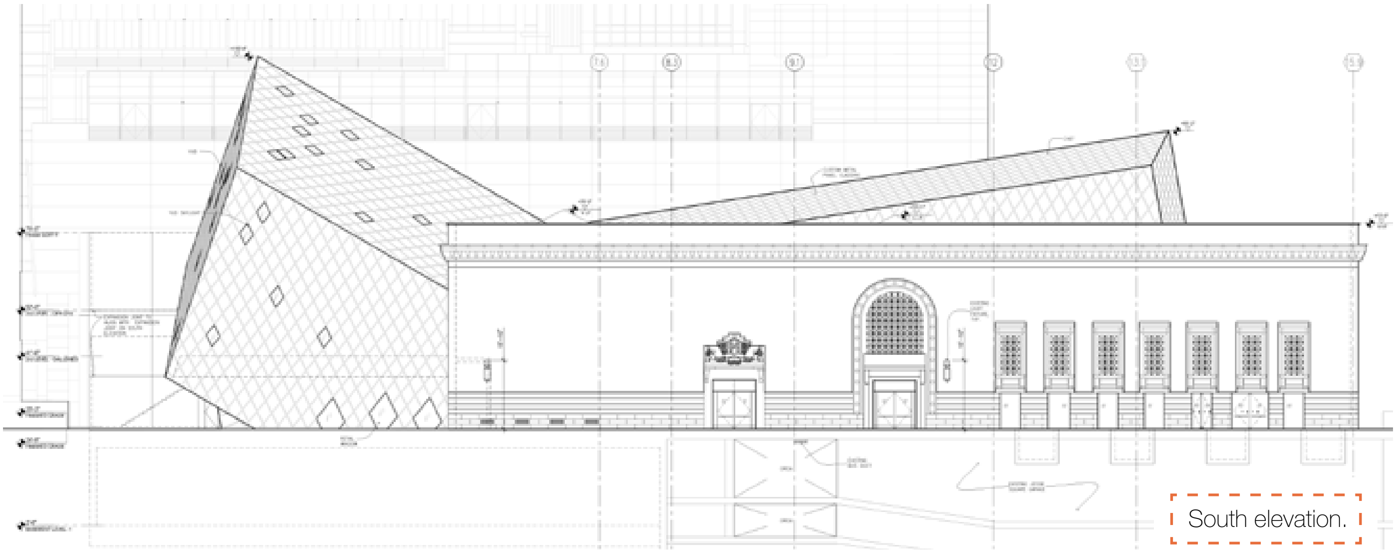
A view of the museum from its plaza with the cube balanced on one vortex behind the historic power station façade.

collaboration. That led to a project that was successfully completed within time and budget with only minor changes. The museum opened to wide acclaim and structural engineer OLMM was awarded the Outstanding Structural Engineering Project Award for the California region by ASCE for the project.

Building Facts

Completion Date:	2008
Historic portion of building:	1907
Construction Cost:	$47.5 million
Square Feet:	63,000 sq. ft

The sharp angles and dramatic geometry of the design brought forth with steel is striking in the main hall.



South elevation.

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