The courthouse exterior. Courtesy of NLA/HLM Architects.

United States Courthouse

Sacramento, CA

Robert D. McCartney, S.E.

Public entrances to courtrooms occur at the curved south side of the courthouse tower. Courtesy of NLA/HLM Architects.

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The main courthouse tower includes 32 courtrooms (19 courtrooms initially), judges' chambers, ancillary judicial areas, court-related executive offices and a 300-car below-grade parking garage.

Challenged by the constraints of a 2.5-acre urban site, this solution utilizes an original three-court per floor plan for the District Court floor and a four-court plan for both the Magistrate and Bankruptcy Court floors. While the concept of a three-court floor implies an inefficiency relative to the shared holding, this design yields a compact and highly efficient plan in which four Magistrate or Bankruptcy courts can be fitted below the larger district courts. This stacking concept does not require additional incompatible functions to be added to the Magistrate or Bankruptcy floor to augment the shortfall in habitable square footage. As a result of this compact plan, the site is freed up for future expansion (the parking area to the north of the tower), public space and a slightly larger base.

For the courthouse, the varying court layouts from floor-to-floor, as well as the complex circulation system (elevator cores especially), made it unlikely that an effective lateral system would be developed using a braced-frame approach.

Main elevator cores are located at the east end of the building, which would have meant an unbalanced system. There are also not enough interior walls that align for the full height of the building, due mostly to the varied court layouts. Finally, braces were not allowed at the building perimeter.

Middlebrook+Louie (M+L) prepared three structural systems for the final scheme (two steel and one concrete).

Some other aspects of the programming that affected the structural design options:

- The courtrooms themselves are large and require larger floor-to-floor dimensions. Floor heights are 20' in general to accommodate 16' ceilings. The floor height at the 16th level is 24'.
- Some floors require 150 psf live loads for libraries and file storage.
- CMU walls surround the holding cells at courtrooms.

To adapt to these conditions, M+L opted for what essentially is a perimeter moment frame system. Braced frames occur in the east-west direction at roof level of the building.

Steel was selected over concrete due to several factors:

- A steel system would weigh less, reducing the cost of the foundations and having less impact on seismic design considerations.
- Steel members could be smaller than concrete members, which is especially important in a facility with this level of specialized mechanical and electrical demands.
- Construction time would be shorter and more economical. (The steel erection took 5 1/2 months).

Column spacing is 32′ in the east-west direction, based on a 16′ planning module. In the north-south direction, column spacing is 38′ on the north side, 50′ at the interior bay (for maximum courtroom flexibility) and variable at the wall on the south side, which is curved.

Public Entry Building & Rotunda (Building B)

The public enters through a vestibule into a foyer/queuing space prior to the security checkpoint. The semi-oval rotunda is sky-lit to provide daylight into the expansive building base and creates a strong orientation point for the first time visitor. In addition to expressing the building circulation system, this rotunda will provide the human spirit with a strong sense of arrival and a feeling of dignity associated with our federal courts system.

Top: The atrium interior. Courtesy of NLA/HLM Architects.
Bottomt: Exterior view of atrium framing.

The public spaces are enhanced by one of the most comprehensive programs of public art in any federal building. Thirteen works of art represent the vision of fourteen major artists, who drew their inspiration from the natural, cultural and political history of the building's site.

First, the architects designed a uniquely shaped structure with several openings. They also needed a thin sandwich of materials between the structural system and the interior finishes. The interior finish is a stone panel system consisting of a thin veneer of stone mounted on a backing of honeycomb board, supported on light gage metal framing.

The rotunda is 60′ high. Gradually rising in a telescoping ovoid shape, the rotunda finishes in an elliptical skylight.

This unique building shape form resulted in a structure where columns meet beams at all different angles. Steel pipes, with their unidirectional properties, proved to be just the right solution to the architectural constraints and structural complexities of this dramatic public building.

Sixteen-inch diameter pipe columns (ASTM A500, Grade C, extra strong) are spliced at each level with two horizontal plates extending out from the columns, supporting the beam connection plates.

This detail was modified from the original, which had the beam connection plates fitted into slots cut into the pipe columns and then welded on the outside and inside. This proved very complex for the detailers, as the columns all sloped at different angles.

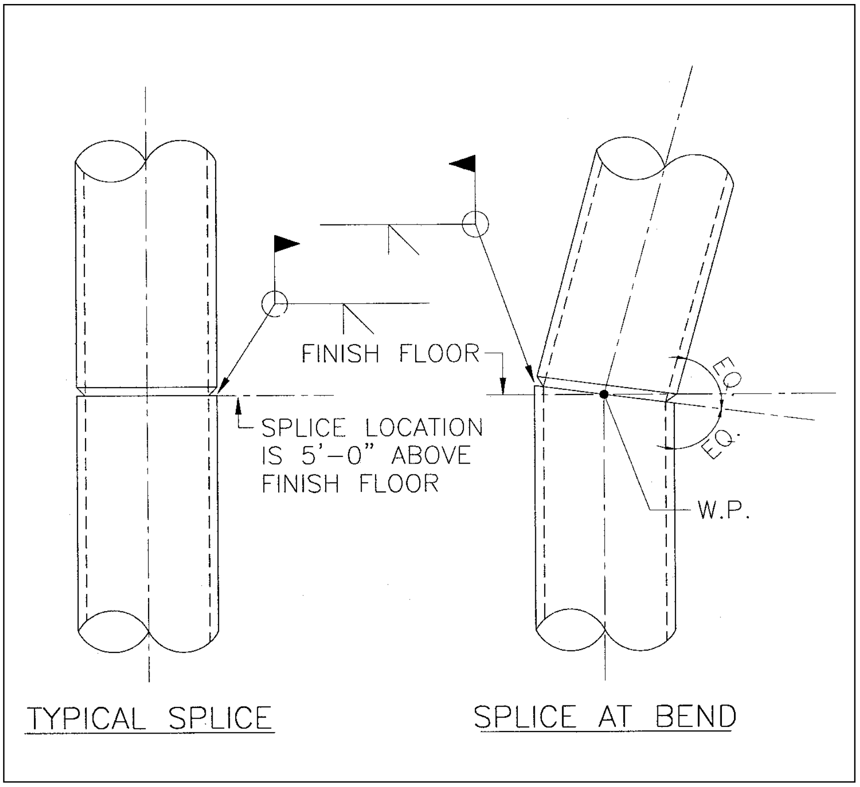
In addition, M+L had detailed two stiffener plates inside the pipe columns at each level. On top of that, M+L detailed a cover plate to be field-welded to the top beam flange and the sloping pipe column, which would have required the plate to be cut to a portion of an elliptical curve. It looked great on paper, but it was too tough to build.

By working back and forth with the detailer and fabricators, M+L arrived at the final design: two plates were cut through the column to serve as stiffeners at the beam connections. The top plate was also a continuity plate for all of the beams framing to the columns. The edges of the plates were cut straight, and the beam top flanges were complete-penetration welded to the plates. The two plates also provided a simple means for attaching the beam shear tabs.

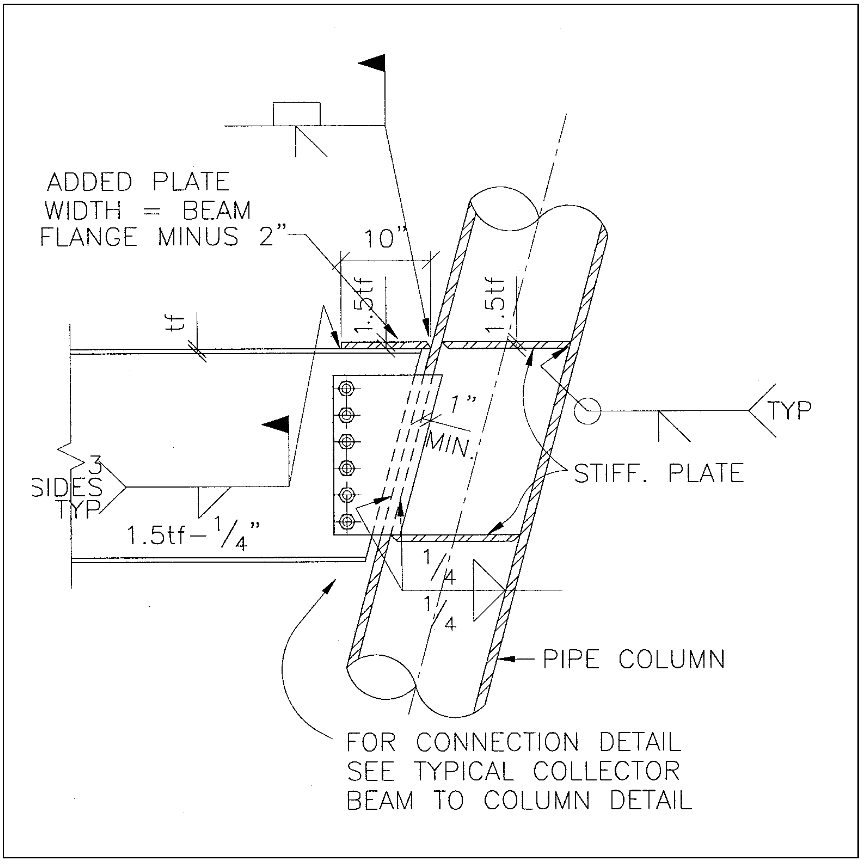
At the top of the pipe columns is a "rigid ring" box girder, 24" x 14", fabricated to different radii between columns and with sloping sides. Top and bottom flanges of each section were also fabricated to different radii

Other interesting facts about this project:

- All steel was produced in the U.S. (Arkansas, Oregon and Texas) in mini mills, which recycle autos, refrigerators, etc.
- The courthouse complex used 8,500 tons of steel.



Pipe column splice detail.



Typical beam to column connection detail.

- A future expansion is planned for the north side of this structure. Foundations and columns are designed for a new six-story building.
- The north and south plazas have a load capacity of up to 900 psf in some areas to accommodate heavy landscaping, trucks and fire truck loading.
- Because the building has a very wide face, wind forces controlled portions of the structural design.
- Provisions were made for an underground tunnel to a county jail across the street.

Robert D. McCartney, S.E., is Design Principal with Middlebrook + Louie Structural Engineers in San Francisco.

Atrium steel after application of spray-on fire protection.

OWNER:
United States General Services Administration

STRUCTURAL ENGINEER:
Middlebrook + Louie,
San Francisco, CA

ARCHITECT:
NLA – HLM Architects,
Sacramento, CA

STEEL FABRICATOR, ERECTOR AND DETAILER:
Herrick Corporation,
Pleasanton, CA

GENERAL CONTRACTOR:
Morse Diesel, Apple Valley, CA

SOFTWARE:
ETABS

HSS column splice with shear-connected beams.