The Pterodactyl is a unique office building which is constructed above the previously designed four-story parking garage structure in Culver City, California; where some of the existing columns are cantilevered beyond the top of the parking building to provide support for the mezzanine and roof support structure.

The outer shell of the building is constructed with metal stubs covered with fire resistant treated plywood to achieve narrowest possible profile, encompassing all structural elements and the utilities. The partial mezzanine level is constructed with light gauge metal deck (with concrete) over steel beams, complementing the orientation of boxes rigorously following an award winning philosophical architectural theory. Structurally, the rotated boxes provide just enough space at the corners and at their intersections so to efficiently house the structural support members. During the early design, through numerous meetings and studies the feasibility and constructability of each box was determined while preserving numerous architectural features of each box as well as their complex architectural interactions.

Placing such an irregular building over pre-existing building presented several structural challenges. (1) The structural design was limited by the size and orientation of the existing columns, which was not particularly placed in a favorable location or orientation for the support of individual box or their element. Some columns were not stiff enough to laterally brace the boxes, so each box was strategically reinforced internally and interconnected to others to reduce loads to a particular column. (2) On the other hand, the differential rigidity of each box in conjunction with their inter-connecting mezzanine space bridges had to be fully optimized to allow for mechanical and other-utility space and pass through. The boxes were initially designed individually, using careful stiffness assumptions. Then the boxes were brought together and reevaluated as a whole for compatibility. (3) Additionally, since the office building is laterally flexible in contrast with the very rigid elevator shaft made of a concrete block core; and the three access stairs unevenly stretching down to the top floor of the parking structure. Very specific slab connections and separation joints are used to completely control all inter-box movements as designed.

Our initial task of supporting the blended yet individual 9-box components that made up the office building over 6 by 3 rows of columns were achieved by “Ring” like frames attached to each column, coordinated within the interior design, which doubled as support beams (though not in straight line) holding up the main and secondary structural members. Interestingly, the columns size and orientation were based on the demands of the parking building and the Pterodactyl distinctive modular design did not particularly align with the support point location. So a few intricate stiffness sharing system of main structural members were utilized to further normalize the loads on to the weaker columns and to help comply with required deflection and vibration expectations. Another unique feature of the building was the westerly facing overhanging offices. Each box has unique over hang above the parking garage ramps. The design of each box against numerous degrees of freedom was particularly challenging due to the shape of each element, the location and stiffness of the supports, and by the desired cleanlines and style of the building envelope. So the “secondary” members “hiding” in longitudinal direction within the corners of the boxes, cantilevering out to holdup the “Ring” frame at the far end of the building, work in combination with the structural elements to provide the necessary gravity as well as providing lateral support rotational and racking movement.

Aggressive value engineering and coordination studies were performed to reduce the weight of material and evaluate visual consequence of the connections to satisfy the sculptural demands as well as the financial feasibility of this project. Our firm worked very closely with the teams at Eric Owen Moss Architects as well as with Samitaur Constructs to make this building possible. The structural engineering and the architectural software’s used for the design of the Pterodactyl were RISA-3D and Digital Project. Our office developed apps to maintain efficient bidirectional communication between the structural and architectural models.

Pterodactyl

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