

## Enabling a New Architectural Paradigm with Performance Based Design of a Base Isolated Sculptural Office Tower

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### Abstract

Due its height and expressive architectural design the (W)rapper Tower is set to become a landmark building in Los Angeles, CA. The structure is architecturally driven and features exterior curved steel boxes “Bands”, an eccentric Steel Plate Shear Wall (SPSW) core and Seismic Base Isolation. Performance Base Design (PBD) using LATBSDC guidance was adopted for the design and the performance of the Tower. The structure was assessed using Non-Linear Time History Analysis (NLTHA) in LS-Dyna with 63 earthquake simulations (nine suites of seven ground motions each). The analysis and post-processing used an automated workflow relying on cloud computing and custom database post-processing. This paper describes the development of the structural system and the analysis process employing numerous advanced modelling and visualization techniques.

**Keywords:** Steel, Bearings/Joints/Seismic Device, Buildings, Spatial Structures, Seismic Design and Response, Innovative Structural Systems, Information Technology, Performance Based Design, Tower/High-Rise

### 1 Project Description and Design Development

At 240ft and 16 stories, (W)rapper Tower will become the tallest building in the area of west Los Angeles, CA near Culver City. Together with its expressive architectural design, it will instantly be recognized as a local landmark. The structure of the Tower is architecturally driven and features exterior curved steel built-up box sections “Bands”, an eccentric Steel Plate Shear Wall (SPSW) core and Seismic Base Isolation.

The steel Band exoskeleton is an unclassified structural system and therefore base isolation was crucial in reducing the high seismic demands of the Los Angeles basin and making the architect’s vision possible at a reasonable cost.

This paper describes the development of the structural system and the base isolation from concept to construction documentation including the PBD process employing numerous novel analysis and visualization techniques.

#### 1.1 Concept

The (W)rapper Tower was first conceived by Eric Owen Moss Architects nearly 20 years ago. The project represents a new architectural paradigm for an office building where architecture seamlessly integrates with the structure, provides large open office space unobstructed by interior columns and creates a new landmark in an underdeveloped area of Los Angeles that would become a catalyst for local regeneration.

However, the long floor spans, irregular location and shape of the supports, absence of interior columns, eccentric core and location in a high seismic region represented major challenges for the structural engineers. It was clear that this unconventional architectural design would require a novel structural concept and use of advanced analysis techniques to gain adequate understanding of the behavior as well as minimize unnecessary conservatism from standard analysis approaches that could render the project financially unfeasible.