
To: Tom Stubbs
Company Name: **109 KENTUCKY STREET LLC**
From: Luke Wilson, SE
Date: May 5th, 2022
Regarding: 109 Kentucky St - Window Openings
Project: Project Number

Prior to commencing the Construction Documents Phase, ZFA Structural Engineers performed a Conditions Assessment for the existing structure located at 109 Kentucky Street located in Petaluma, CA.

The condition assessment was based on the guidelines put forth in the American Society of Civil Engineers (ASCE) 41 Standard for Evaluation and Retrofit of Existing Buildings. Per ASCE 41 the existing building was determined to have a soft story. ASCE 41 defines a soft story as:

SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above.

Per ASCE 7-16 a soft story is also defined as a Vertical Structural Irregularity. Structural irregularities are known issues that can cause undesirable performance in a building during a Code Level Design Event.

Based on the analysis done for the condition assessment, the 1st story was estimated to have approximately 50% of the stiffness of the 2nd story. This is driven by:

- The difference in story height (approximately 20ft at ground floor and 10 feet at the 2nd floor). Note, the mezzanine level could not be considered a floor level for these calculations.
- The historic store front opening configuration along Kentucky Street and Western Avenue at the first floor compared to the relatively solid wall at the 2nd floor.

Story stiffness is based on the length, thickness, material, and aspect ratio (height to width) of each individual wall pier along each wall line in the story. The wall length, thickness and material cannot be easily modified in the case of an existing building, therefore the adjustment of window size to adjust the aspect ratios of wall piers was considered.

- The existing openings along Kentucky Street wall line were relatively small, and the walls acted as a single homogeneous continuous wall. The enlargement of the (3) existing windows were sized to create two distinct wall segments, which reduced the effective wall length from approximately 78 feet total to 41 feet six inches and 12 feet respectively.
- The existing openings along the Western Ave wall line were relatively small, and the walls acted as a single homogeneous continuous wall. The enlargement of the (3) existing windows were sized to create two distinct wall segments, which reduced the effective wall length from approximately 86 feet total to 44 feet and 18 feet respectively.
- The enlargement of the (3) existing windows in the wall line along the alley reduced the total wall length from approximately 64 feet to 60 feet and the aspect ratio of each pier adjacent to the windows was increased by making the windows taller.

The cumulative effect of the adjusted openings was an overall reduction of the stiffness of the 2nd story, while still maintaining the required strength. The final ratio of stiffness between the first and second story is 77% in the east-west direction and 102% in the north-south direction. With these modifications the building no longer is considered to have a soft story structural irregularity.