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STRUCTURAL ADVISORY BOARD MEETING AGENDA

Meeting Date : January 13th , 2017

Location : 1900 SW 4th Ave, BDS Conf. Room 5(b)

Board Members : Blake Patsy, KPFF engineers
David Nilles, JHI Engineering
Brandon Erickson, Erickson Structural Engineers

Staff Members: Amit Kumar, BDS Sr. Structural Engineer
Greg Wilken, BDS, Structural Engineer
Eric Thomas, BDS, Structural Engineers

Appealant Mackenzie

Topic: Belmont Self Storage Building. Appeal ID:
Building Permit #

Agenda: 12:00 Noon-12:05PM Introductions
12:05PM- 12:30PM Working Lunch and Introduction to project
12:30 PM- 12:45 PM Presentation by Mackenzie
12:45PM – 1:30PM Discussion and Decision

Items for discussion:
1) Review applicability of 2011 Structural Advisory Board decision regarding use of Corrugated metal deck as a vertical lateral element to this project
2) Review use of corrugated deck lateral system on upper three stories on top of a 3 story podium.
3) Review applicability of two-stage analysis procedure
4) Review modeling of stiffness of various elements of the lateral system

See attached Executive summary

Structural Advisory Board Meeting January 13, 2017

Executive Summary

Background:

The proposed structure is a six story, 94,000 square foot self-storage building with overall dimensions of 175ft x 95ft and a roof height of approximately 60ft. The building consists of 3 levels of light gauge bearing/shear walls supported by 3 levels of post-tensioned concrete slabs supported by concrete columns and non-bearing special reinforced CMU shear walls.

The construction of the upper 3 levels consists of the following:
1. Standing seam metal roof supported by light gauge z-purlins with a diagonal strap braced diaphragm across the entire roof structure.
2. Roof framing is supported by 4" x 16ga metal stud framing at 30" on center. Lateral walls are sheathed with either 22ga shallow Vercor steel deck or 16ga flat strap cross bracing.
3. Typical floor framing consists of 2 ½" of normal weight concrete over W2 x 19ga composite metal floor deck.
4. Floor framing is supported by 4" or 6" x 14ga metal stud framing at 30" on center.
5. Lateral walls are sheathed with either 22ga shallow Vercor steel deck or 16ga flat strap cross bracing.

The construction of the lower 3 levels consists of the following:
1. The 4th floor transfer slab is a 12" thick two-way concrete post-tensioned slab. The 2nd and 3rd floor slabs are 8" thick two-way concrete post tensioned slabs.
2. Concrete slabs are typically supported by 18" x 20" concrete columns with typically 20ft x 25ft bay spacing.
3. Lateral support is provided by exterior 12" non-bearing special reinforced CMU shear walls. Walls are typically located at the four exterior walls of the structure, except at the 2nd floor diaphragm where CMU walls occur on three sides only. 8" CMU walls at the stairs and elevators are not included as part of the main lateral force resisting system.

The proposed structure plans to utilize the two-stage analysis procedure of ASCE 7-10 section 12.2.3.2 with the flexible upper 3 levels consisting of corrugated metal sheathed and strap braced light frame shear walls and the rigid lower portion consisting of special reinforced CMU shear walls.

The Issue the applicant is asking the Structural Advisory Board to consider:

The proposed lateral system for the upper 3 stories consists of light-framed shear wall sheathed with corrugated metal panels. Additionally, some walls of the upper 3 stories consist of light-framed walls using flat strap bracing. The lower 3 stories consist of non-bearing special CMU shear walls.

Item #1:

Although light framed shear walls sheathed with corrugated metal panels is not a pre-approved seismic force resisting system in accordance with ASCE 7-10, limited use has been allowed within the City of Portland on a case-by-case basis where the design adheres to the limitations set forth in the structural advisory decision from August 2011.

The 2011 Structural Advisory Board concluded the following (repeated here for reference):

1) The proposed lateral system using metal stud with corrugated steel sheathing as vertical elements of the lateral load resisting system is a viable lateral system.
2) It is not appropriate to consider this system as a pre-approved lateral system covered under the preapproved system of "Light framed walls sheathed with wood structural panels rated for shear resistance or steel sheets" ASCE 7-05 with seismic coefficients R = 6.5, Cd = 4, and $\Omega o = 3$.
3) It would be appropriate to use the following seismic coefficients: R = 4.0, Cd = 3.5, and $\Omega o = 2.0$.
4) This system can be used only in structures less than or equal to 35 ft in height.
5) The decking material shall be a minimum of 26 gage.
6) The thickness of the metal stud backing shall be greater than or equal to the thickness of the metal deck.
7) The lateral capacity of the system may be based on testing or calculated using principles of mechanics, using values of fastener strength and sheathing shear resistance per procedures of AISI standard, S100 "North American Specification for the design of Cold formed Steel", and AISI S213, "North American Standard for the design of Cold formed Steel Framing – Lateral Design".
8) The thickness of the metal studs shall be such that the governing failure mode for the fasteners is "Shear limited by Tilting and Bearing", section E4.3.1 of AISI S100.

Item #2:

The two-stage analysis procedure of ASCE 7-10 section 12.2.3.2 is used to justify that the light gauge framing meets the structural system height limitations set forth by the 2011 Structural Advisory Board decision regarding light framed shear walls sheathed with corrugated metal panels. Historically, the City of Portland has only allowed two levels of podium construction when utilizing the two-stage analysis procedure.

In addition, it appears that accurately capturing the stiffness of each portion is critical to capture the impact of higher modes of the stiffer lower portion on the upper more flexible portion. There are several unresolved questions related to the structural modeling of the flexible and rigid portions of the building that relate to the stiffness and period calculations needed to validate the two-stage analysis procedure. These items include rigidities assumed for the light framed walls (both corrugated metal shear walls and strapped walls), checking the stiffness and period in both directions of the structure, as well as effects of a potential torsional irregularity at the 2nd floor of the structure. The analysis also utilizes the average stiffness at each level for the stiffness comparisons, while the more appropriate method may be to compare the stiffness of the upper 3 levels as a whole to the stiffness of the lower 3 levels as a whole.