



2020 West El Camino Avenue, Suite 800
Sacramento, CA 95833
hcai.ca.gov



HOSPITAL BUILDING SAFETY BOARD
Structural and Nonstructural Regulations Committee

Tuesday, April 11, 2023
10:00 a.m. – 2:00 p.m.

Teleconference Meeting Access:

[HBSB Teams SNRS Committee](#)

Access Code:

Committee Members Present

Jim Malley, Chair
Farzad Naeim, Vice Chair
Cody Bartley
Louise Belair
Bruce Clark
Mark Hershberg
Marshall Lew
Jennifer Thornburg

HCAI Staff Present

Arash Altoontash
Mike Hooper
Joe LaBrie
Roy Lobo
David Neou
Carl Scheuerman
Ali Sumer
John Gray

HBSB Staff Present

Ken Yu, Executive Director
Evelt Torres

1 **1. Call to order and Welcome**

2 Jim Malley, Committee Chair, called the meeting to order on April 11, 2023, at 10:00
3 a.m., and HBSB Executive Director Ken Yu called roll.

4

5 **2. Roll Call and Meeting Advisories/Expectations**

6 Five members of the Committee present constitute a quorum. There being six present at
7 the time of roll, a quorum was established.

8

9 Mr. Yu read the meeting rules and procedures.

3. Review and approve the draft November 7, 2022, meeting report/minutes

Presenter: Jim Malley, Committee Chair

Discussion and input

Mr. Yu raised a question about Mr. Scheuerman's last name being spelled incorrectly and requested it be corrected throughout the document. Mr. Malley stated it would be corrected.

MOTION:

The committee voted in favor of approving the meeting notes from November 11, 2022, and to correcting Mr. Scheuerman's last name throughout the document.

- Farzad Naeim, Vice Chair - Yes
- Cody Bartley - Yes
- Louise Belair - Yes
- Bruce Clark - Yes
- Mark Hershberg - Abstain
- Marshall Lew - Yes
- Jennifer Thornburg - Yes

4. Findings and Lessons Learned from the Turkey Earthquake

Presenter: Ali Sumer, HCAI; and Maryann Phipps, Estructure

Mr. Sumer stated the earthquake in Turkey February 6, 2023, caused more than 50,000 deaths as of February 23, 2023. The first earthquake to strike was a Max. PGA: 1.23g and the second earthquake was .65g (METU).

- The first earthquake was a 7.8 magnitude event occurring at 4:17 a.m. on February 6, 2023. It shook almost 1/3 of the country and also affected Syria.
- There was an aftershock event eleven minutes later, and it was a 6.7 event, and a total of almost 6 more aftershock events followed.
- Nine hours later, the second earthquake event took place. It was a 7.5 magnitude event.
- Two weeks later, another 6.3 magnitude event.

Mr. Sumer presented a chart showing the current building damage status:

- Collapsed - 35,355 or 2%
- Urgent Demolition - 17,491 or 1%
- Severe - 179,786 or 11%
- Moderate - 40,228 or 2%
- Lightly Damaged - 431,421 or 25%
- Undamaged - 860,006 or 50%
- Not Assessed - 147,895 or 9%

1 Mr. Sumer expressed that the purpose of the reconnaissance effort was to learn about
2 the shaking affecting modern engineered buildings and the ability of a large set of strong
3 motion records. They focused on structural and nonstructural performance of the
4 affected hospitals, to gather the observations data, and think about how to improve the
5 design, construction and practices, and hopefully look at building code, seismic
6 guidelines, construction, and inspection practices.

7
8 Mr. Sumer stated they gathered the following information from thirty-three hospitals:

- 9 • Size
- 10 • Private/government/university
- 11 • Fixed base vs. base isolated
- 12 • Various construction years
- 13 • Ground motion record station
- 14 • Correlating record vs. surrounding damage

15 They gathered information by way of:

- 16 • Internet searches
- 17 • Drive-by
- 18 • Walk-by
- 19 • Inside visits
- 20 • Interviews

21
22 Ms. Phipps commented that the electricity was out and restored within 1-7 days in the
23 most heavily affected areas; the water was out and restored after a few weeks,
24 depending on the location affected; the gas was not restored at the time of their visit; and
25 communications were restored quickly.

26
27 Ms. Phipps commented on the nonstructural performance of the buildings:

- 28 • Cladding: consisted of unreinforced masonry, covered in plaster, initially resisted
29 some load, but cracked-up and dislodged. It was very brittle, and this damage was
30 very common.
- 31 • Marble/stone: mechanically anchored, but then started to spall and fell apart.
- 32 • Curtainwall: light system (common in the U.S.) that performed well.
- 33 • Partitions: nearly all partitions were unreinforced masonry infill; it was brittle and
34 sustained a lot of damage.
- 35 • Ceilings: suspended wall-board ceilings and acoustic tiles (similar to the U.S.) but
36 no bracing was observed. The ceiling grid, lights, etc. came down.
- 37 • Egress: stairs that were not properly reinforced crumbled. The elevators had
38 seismic switches that shut off automatically and required an elevator technician to
39 return to turn them back on. Some damage was noted to the elevators.
- 40 • Equipment: in older hospitals, nothing was anchored inside, however, there was a
41 lot of equipment, at grade, that showed no evidence of movement. The newer

1 hospitals' equipment was anchored and no damage to anchored equipment was
2 observed. Bulk oxygen storage tanks were unmoved, and it was noted that long,
3 deep anchored systems worked the best.

- 4 • Distribution systems: piping systems did not appear to be braced, however, not a
5 lot of visual damage was noted, however, the water systems were turned off at
6 the time. Flex lines were noted and seemed to hold up well.
- 7 • Medical equipment: most of the anchored equipment did not move. Whether it is
8 useable after the earthquake is still under review. Many things will need to be
9 recalibrated by a specialized technician. Data cabinets, though lightly restrained,
10 remained in place. Suspended monitors, hung but not laterally braced, performed
11 well. OR booms, anchored for gravity loads but not braced for lateral loads,
12 performed well. A sterilizer that was unanchored shifted and broke the water and
13 electrical connections. In the IVF clinic, incubators fell off the counter, bio safety
14 cabinet hood fell off, microscopes fell off tables, and the incubators did not work.
15 Furnishings and contents such as lockers and blood samples, fell over.

16
17 Mr. Sumer commented that California currently has 3,000 general acute care buildings
18 with structural and nonstructural ratings and the target date to be ready for a large-scale
19 earthquake is 2030.

20
21 Mr. Sumer commented on their takeaways and reflections of the event. Hospitals are the
22 first building type everyone thinks about in a disaster because this is the most needed
23 service after an earthquake. There was some good performance from unanchored
24 equipment, but they are still trying to categorize. Unbraced MEP distribution systems
25 remained in place most of the time, but they are unsure if they will function properly after
26 the utilities are restored. Unbraced ceilings that were either partially or completely
27 collapsed is a concern, and heavy partitions and adhered masonry showed poor
28 performance overall.

29
30 Mr. Sumer stated that all hospitals in California have an emergency operation plan
31 (EOP), but that timely, appropriate (not too conservative) safety assessments matter
32 greatly.

33
34 Ms. Phipps commented on the resilience strategies. Before the earthquake:

- 35 • Pre-planning for structural evaluation of post-earthquake building conditions.
- 36 • Exercise emergency generator and provide redundancy where possible.
- 37 • Construct on-site wells where possible or provide large storage tanks.
- 38 • Limit use of brittle materials.
- 39 • Prepare for elevator shutdown.
- 40 • Prevent nonstructural damage by anchoring and bracing of nonstructural
41 equipment.

- Be prepared to repair wall cracking as soon as possible; have materials on hand.
- Have trained medical teams with equipment and trucks set up field hospitals near damaged hospitals.

After the earthquake:

- Have on-call, experienced structural engineers.
- Staff tend to evacuate. If evacuation decision is made, shutting down a hospital cannot easily be undone.
- Repair nonstructural wall cracks quickly to assuage staff and patient concerns.
 - Psychological concern is big.

Discussion and Input

Mr. Lizundia commented on the complexity of recovery; it is trickier than expected. There is not an on/off switch. The notion of recovery for all buildings is more complex, subtle, and multi-faceted than expected. It is understandable how afraid people are, from how they think and experience the event.

Mr. Wray commented that we tend to evaluate these buildings and assign SPC and NPC categories to seismically deficient buildings. It was very hard to separate where one building starts and one stops, and how one building might affect another.

Mr. Malley asked, on the nonstructural, if they use fire sprinklers. Ms. Phipps replied that they do use sprinklers and they often use flex heads.

Mr. Malley requested clarification regarding the fixed base hospital built in 2020, in Pazarcik. He believed Turkey required hospital construction by that date, be isolated and noted that it looked like a big, fixed base hospital. Mr. Sumer explained that the nuance was the number of beds vs. when the project was started. The project started much earlier than the law, and construction went on longer. Some projects were grandfathered in without isolation if they started prior to the law going into effect.

Mr. Malley asked about nonstructural performance between isolated vs. fixed base; assuming isolated buildings do much better, was that indeed the case. Ms. Phipps replied that she believed there was much less nonstructural damage in the isolated hospitals. She said she believed it is an excellent tool to reduce nonstructural damage, particularly where the nonstructural damage was driven by the brittle partition walls. Ms. Phipps went on to say that anything that can be done to reduce that damage would put you way ahead. It was effective, however, there was not a base isolated hospital near a fixed base hospital to see how they compared side-by-side.

Mr. Sumer commented that in general, based hospitals did very well. The amount of seismic demand was not as high as the epicenter, but it was significant.

1 Mr. Lizundia commented that one of the new isolated hospitals was a beautiful building
2 from the outside and inside, and that a lot of money was put into it. Yet, the isolation
3 plane in numerous locations, did not provide the ability for displacement to occur across
4 the isolation plane. Weather it was partitions, plumbing lines, sprinkler lines, etc. He
5 remarked that the level of quality assurance special inspection, nonstructural design by
6 an engineer in Turkey, is a lot less than what is required in California. Mr. Lizundia
7 believed that underscored the value of what HCAI does in the field in making sure things
8 are built the way engineers designed them and that standards are followed because
9 there was an otherwise spectacular building that was missed, and the damage was
10 disappointing.

11
12 Mr. Lobo asked Ms. Phipps if when the OR booms were not braced but held in place,
13 they may have knocked something else out while that was happening. The boom may
14 have remained, but if everything else was lying around it, they really must be braced.
15 Ms. Phipps explained that she was not suggesting that bracing be eliminated but thinks
16 overemphasis on the exact design load is less important than making sure there is a
17 scope of things that need to be anchored correctly and having them secured.

18
19 Mr. Kara (Turkish medical doctor part of the EERI team) commented how important it is
20 to take the needs of medical staff into account as well, and that first responders are also
21 the victims of an earthquake. They are expected to continue working, and to respond in
22 unexpected and unusual conditions. Making them feel safe and believe in the buildings'
23 structure will affect the success of the response.

24
25 Mr. Malley thanked everyone for what they brought to the team and the tremendous
26 amount of information they gathered.

27
28 Break for lunch at 12:50 p.m.

29
30 **5. Updates to Policy Intent Notice (PIN) 62, OSHPD Preapproval of Manufacturer's**
31 **Certification (OPM)**

32 **Presenter:** Roy Lobo and Jeffery Kikumoto, HCAI

33
34 Mr. Lobo announced that PIN 62 is being updated, which previously referenced the 2016
35 California Building Code (CBC), to now reference the 2022 CBC. Both the 2019 CBC
36 and 2022 CBC adopt ASCE 7-16. The changes between 2019 and 2022 are very
37 minimal with regards to OPMs. There was a section added to the California
38 Administrative Code (CAC) 7-115(d).

39
40 Mr. Lobo stated that the 2025 CBC will adopt ASCE 7-22. There is a big change from
41 7-16, which is the force equation from nonstructural components. He stated all OPMs will
42 need to be updated, however, the capacity will remain the same. Anyone submitting for

1 an OPM should be aware the force equation will need to be included in both the 2022
2 CBC and the 2025 CBC.

3 Mr. Lobo detailed the following changes to PIN 62:

- 4 • 2016 CBC will change to 2022 CBC, Section 1705A throughout the document.
- 5 • 13.2 will change to 14.2 throughout the document.
- 6 • ASCE/SEI 7-10 will change to ASCE/SEI 7-16 throughout the document.
- 7 • 1616A will change to 1617A throughout the document.
- 8 • Certification Basis: language will be added to #5. For sway bracing assemblies,
9 component tests shall be supplemented by assembly tests when required by the
10 building official.
- 11 • Implementation for OSHPD Projects: will add language to #9. Incorporation by
12 either inclusion in its entirety or in part, and by reference will be removed.
13 Language will be added that preapprovals must be incorporated without any
14 modification. Non pertinent preapproval sheets, sections, details, or notes shall be
15 struck or otherwise noted.
- 16 • Layout Drawings: language will be added to #11(A)(a). Architect or Structural
17 Engineer.
- 18 • Layout Drawings: language will change to #11(A)(b). Architect or Engineer, and
19 “Structural” and “of Record” will be removed.
 - 20 ○ This proposed change is because minor things can be done by the
21 architect or a general contractor. It does not need to be a Structural
22 Engineer of Record.
- 23 • Validity: language will change on #14 exception. 2013 to say 2019 CBC, or 2016 to
24 say 2022 CBC.
- 25 • OPM Application Submittal Requirements: the email has been updated on #17.
26 OPM@hcai.ca.gov.
- 27 • OPM Application Submittal Requirements: language has been changed #17(b).
28 OSHPD has been removed and replaced with HCAI.
- 29 • Original signed changes from Paul Coleman to Chris Tokas and the date will
30 change from 2016 to 2023.
- 31 • Language has been added to include the CAC 7-115 for 2022.
- 32 • CBC language has been changed from bracing, to bracing components. And
33 language has been added to say or using an alternative testing protocol approved
34 by the building official.
- 35 • In the FAQ: language has changed on #10. CBC to CEBC. And Section 3401A.4.1
36 is deleted and changed to Chapter 3A §302A.3.
- 37 • In the FAQ: language has been added at #5. Can OPM, based on 2016 CBC be
38 used on projects governed by the 2013 CBC? The code year has been updated to
39 2022 and applies to projects under the 2013/2016 or 2019 CBC. Also, note,
40 2013/2016 CBC based on OPMs must first be updated to the 2022 CBC in order to
41 use on 2022 CBC based project requirements.

Discussion and Input

- None.

Information and Action item

- None.

MOTION: [Bartley/Thornburg]

The committee voted unanimously to support adopting the changes and for the OPM as it relates to PIN 62.

6. Testing Criteria for Allowable Load Rating of Vibration Isolators

Presenter: Roy Lobo and Timothy Piland, HCAI

Mr. Lobo stated that these are isolators that support chillers, generators, and other things like this, for vibration control. A lot of these isolators may not have been seismically rated and there is a need to figure out what is the best rating system to use.

Mr. Lobo commented that the requirement in Section 13.2.1 of ASCE 7 for nonstructural components, supports, or attachments are met by manufacturer's certification based on testing, analysis, or experience. The OPM does not do equipment approval, but if the equipment is sitting on an isolator, then those isolators can be qualified through this program.

Mr. Lobo explained that FM 1950 is for sway bracing but there are no real criteria for testing vibration isolators. ASHRAE 171 is the new standard for rating nonstructural components for wind and seismic restraints, but it is not adopted by the current code. The new ASCE 7-22 force equation demands will now be part of the 2025 CBC, which change the demand significantly.

Mr. Lobo listed some key takeaways:

- Seismic Force-Resisting System: Same component responds very differently in different seismic force-resisting systems. Depending on the PCA/PGA and materials, the component ratings will be different. Based on the data obtained, a reinforced concrete building compared to a steel building will have different ratings.
- Building Model Periods $T_{n,bldg.}$: Longer period means less amplification. Cantilever systems have more "whipping" action.
- Component Period T_{comp} : Normalized x-axis is helpful to understand the influence of building component response.
- Component/Anchorage Ductility, μ_{comp} : Ductility substantially reduces component response, particularly at resonance.

1 Mr. Lobo posed the question, "What criteria should be used for rating of vibration
2 isolators?" The CBC permits alternative testing protocols approved by the building official
3 for establishing rating capacities of nonstructural components.

4
5 Mr. Lobo posed the question, "What is the effect of loading protocol?"

- 6 • Monotonic testing:
 - 7 ○ Does not provide fatigue and the cyclic behavior of the components.
 - 8 ○ You can get different behavior from cyclic to monotonic.
 - 9 ○ We are trying to see how to use this information with the testing they are
 - 10 going to be doing, but it is not tested yet.

11
12 Mr. Lobo stated some common trends:

- 13 • One-sided response at "large" drifts.
- 14 • Few "large" excursions; mostly less than 3 "large" drift excursions.
- 15 • More like "monotonic" as opposed to "numerous fully reversed cycles".

16
17 Mr. Lobo posed the question, "Why bother with loading protocols?"

- 18 • Objectives of testing:
 - 19 ○ Evaluation of behavior.
 - 20 ○ Study of damage and failure modes.
 - 21 ○ Development of design/detailing criteria.
 - 22 ○ Analytical modeling.
- 23 • Dilemmas:
 - 24 ○ Single test should represent many different conditions existing in a
 - 25 structure.
 - 26 ○ The demands imposed by ground motion on the structure depend strongly
 - 27 on structural characteristics.
 - 28 ○ The imposed demands are a function of ground motion characteristics,
 - 29 which depend strongly on soil type, source-to-site distance, and many
 - 30 other geophysical parameters.
 - 31 ○ Various performance levels of interest, from immediate occupancy to
 - 32 collapse.
 - 33 ○ Loading history is never "right".

34
35 Mr. Lobo commented on the impact of damping on seismic demand on nonstructural
36 elements: the more damping you have, the more reduction you will get in your response.
37 Having some amount of ductility is helpful, and the more ductility you have, the more
38 your response changes for the better. That protects the system, and it protects the
39 anchorage to the concrete, bolts, etc. We are not doing the right amount of anchorage.
40 Ultimately, the desire is to keep the cost low with the highest performance.

1 Mr. Lobo mentioned that they are trying to work with the manufacturers to capture the
2 ductility. If they have the ductility rating at 1.6, then they do not need to lower the
3 capacity rating. However, if they find the ductility rating was greater than 1.6, they get
4 some benefits.

5
6 Mr. Lobo stated that the plan is to put this on the website so the manufacturers can come
7 to HCAI with their plan to qualify and rate these vibration isolators. If they have
8 comments they can send them to HCAI, we can present it to the board, and see if
9 comments come back.

10 11 **Discussion and input**

12 Mr. Malley asked about the ASCE 7-22 approach and trying to add some information for
13 the manufacturers to better apply it in a way that will be acceptable to HCAI. Mr. Lobo
14 responded that HCAI wants them to take maximum advantage of what the isolator can
15 provide. Also, that there are different performance objectives such as IO, LS, CP, etc.
16 We need to know at which state in the testing criteria does it stop acting as an isolator
17 and want to capture that information, as well as the ductility.

18 19 **Information and Action item**

20 The documents will be added as part of the meeting minutes.

21 22 **MOTION: [Bartley/Thornburg]**

23 The committee voted unanimously to support moving forward with testing the market
24 with the revised criteria for allowable load rating of vibration isolators.

25 26 **7. Committee Goals for 2023**

27 **Presenter:** Jim Malley, Committee Chair

28
29 Mr. Malley gave a review of Structural and Nonstructural Regulations Committee goals
30 for 2022:

- 31 • Support HCAI with review of code changes (ongoing).
- 32 • Support HCAI with review of new/revised PINs, CANs, and OPDs (ongoing).
- 33 • Implementation of SPC-4D and NPC-4D (the goal was removed by the
- 34 committee).
- 35 • Issues regarding repurposing hospital buildings (ongoing).
- 36 • Develop pre-approved details (moved to 2023 goal).
- 37 • Revisit NPC-5 requirements (goal was removed).

38
39 Mr. Malley gave a list of potential committee goals for 2023:

- 40 • Seismic compliance issues related to NPC-3, NPC-4D, and NPC-5.
- 41 Streamlining the compliance process to meet deadlines.

- Review of the Code amendments that are now obsolete or may have been addressed in the model code. Be ready to pull those out in the next revision.
- Develop and implement procedures and enforceable building standards to ensure safe and sustainable healthcare facilities.
- Encourage the introduction of new products, materials, and methods that would benefit the public by early adoption rather than wait for their incorporation in the building code.
- Increase IOR competency.
- Implementation of small and rural relief program and increase technical assistance awareness.
- Implementation of AB 1882 requirements. Reach out to stakeholders via seminars and webinars to raise awareness.
- Training and outreach to industry code changes and tips for working with HCAI. In-person training meetings were highly requested.

Discussion and input

Mr. Malley asked how best to streamline the seismic compliance issue process. Mr. Lobo replied that Mr. Sumer has a document prepared that states what is required for NPC-5. There is a water rationing guide and requirements for those. All new buildings must be NPC-5 certified and HCAI is looking into how to standardize those things.

Mr. Malley asked if HCAI is doing a different version of that for NPC-3 and NPC-4D.

Mr. Lobo replied that like what happens from NPC-2, certain elements must be done; NPC-3 bracing in critical areas, NPC-4D is the whole area. He explained that identifying those items and what needs to be done is a bookkeeping exercise; Making a plan, talking to HCAI, then upgrading that rating from NPC-2.

Mr. Malley asked, if staff is going to develop an outline of what is expected to be shared. Mr. Lobo replied that there is only one for NPC-2 or NPC-3, and that it can be updated as we learn more.

Mr. Malley asked if HCAI will develop new guidance for the three, specifically an outline of how it would be tackled. Mr. Lobo replied in the affirmative.

Mr. Malley commented that review of the code amendments is straightforward, and that the Committee will do it line-by-line and figure out what needs to be pulled out.

Mr. Lobo noted that the goal is to remove all amendments that are already incorporated into the model code and ASCE 7. Things that are now superseded, will be taken out and that at some point, there will be no amendments.

1 Mr. Malley asked if the items that are in ASCE 7-22 now, will get revised for CBC 2025.
2 Mr. Lobo replied that whatever amendments that are already accounted for in ASCE 7-
3 22 can be removed.

4
5 Ms. Thornburg asked what the timeline is for developing the 2025 code. Mr. Lobo replied
6 that it is going to start within the next six months.

7
8 Ms. Thornburg asked if those have to be proposed to the BSC a year from now.
9 Mr. Lobo replied in the affirmative.

10
11 Mr. Malley asked if they would be based on the 2024 IBC. Mr. Lobo replied that it would
12 depend on when it will be out. He noted, however, that ASCE 7-22 is already out so any
13 amendments that conflict or are not in line with 7-22 will be taken out.

14
15 Mr. Malley asked what the goal was for developing and implementing procedures and
16 enforceable building standards. Mr. Lobo replied that the goal is to use the latest
17 knowledge and technology, while at the same time limiting the number of tests. He
18 explained that you can always do the maximum, but testing costs money, so what is the
19 minimum to get where we need to be.

20
21 Mr. Malley commented that the keyword is enforceable; it will be clear that it either meets
22 needs or it does not. Mr. Lobo agreed and added that it is important that whatever is put
23 in the OPMs, is enforceable and practical.

24
25 Mr. Malley commented that it is important that the community know that OSHPD is open
26 when new products, materials and ideas come forward because it takes a while for those
27 to be put into codes. Mr. Lobo agreed and noted that HCAI has a PCS program for
28 components and systems. Although it may not be adopted yet, having a preapproved
29 system means it can be used. He added that looking at it in advance, helps HCAI adopt
30 it sooner or with less changes.

31
32 Mr. Malley suggested having Joe LaBrie provide an Inspection Services Unit (ISU)
33 update at a future meeting, allowing the Committee to brainstorm with staff how to
34 address IOR competency. Ms. Colosi noted that the plan and goal of the ISU is to have
35 the IOR academy up to guide current and new IOR candidates and give them more
36 information in order to perform better. Mr. Malley remarked that if ISU staff wants to have
37 a dialogue with the Committee regarding other ideas, it can be placed on a future
38 Committee meeting agenda.

39
40 Mr. Malley asked about the plans for training and outreach, and whether the education
41 and outreach series will be completed. Mr. Lobo replied in the affirmative, adding that
42 there will be Education and Outreach seminar, "Tips from Experts," later this year.

1 Mr. Malley appreciated the feedback and said that he is looking forward to future
2 discussion on some of these items. He thanked everyone for their time.

3
4 **Information and Action item**

- 5 • None

6
7 **MOTION:**

- 8 • None

9
10 **8. Comments from the public/Committee members on issues not on this agenda**

11
12 **Discussion and input**

- 13 • None

14
15 **Information and Action item**

- 16 • None

17
18 **9. Adjournment**

19 Mr. Malley adjourned the meeting on April 11, 2023, at approximately 3:40 p.m.