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A National Approach to Seismic Functional Recovery for New Construction

A roundtable discussion convened by the International Code Council and California Building Officials

Prepared by: Susan Dowty
Regional Manager, Government Relations, International Code Council

PRESENTED BY THE ICC FAMILY OF SOLUTIONS





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INTRODUCTION

Articles recently appearing in major newspapers and other media outlets have called into question the performance of buildings designed using current U.S. seismic codes and standards. The basic criticism argues that the codes and standards are written to allow people to safely evacuate in a moderately large earthquake; however, they do not ensure that buildings are fully functional following the event.

Developed over decades, building codes consider acceptable performance goals, societal needs, and economic considerations. As society recognizes the potential economic losses associated with major earthquakes, questioning our minimal standards for design is a natural evolution. Multiple initiatives are underway to explore options for communities to more quickly recover functionality after an earthquake.

The National Earthquake Hazards Reduction Program Reauthorization Act of 2018 requires the convening of a committee of experts to prepare and submit a report on recommendations for improving the built environment and for critical infrastructure to reflect performance goals in terms of post-earthquake re-occupancy and functional recovery time, all to be completed no later than June 30, 2020.

In 2018 and 2019, California Assemblymember Adrin Nazarian introduced bills, both of which did not pass, that would have required the California Building Standards Commission (CBSC) to assemble a functional recovery working group comprised of certain state entities and members of the construction and insurance industries. Both bills would have required this working group to consider whether a “functional recovery” standard is warranted for all or some building occupancy classifications and to investigate the practical means of implementing the standard.

In response to these activities seeking to promulgate seismic design for functional recovery, the Code Council and the California Building Officials (CALBO) hosted a Seismic Roundtable at the California State Capitol in Sacramento on July 25, 2019. The event brought together subject matter experts and interested parties from the West Coast and across the country for a full-day discussion on the development of a nationally applicable approach to seismic functional recovery for new construction. The roundtable provided attendees with a unique opportunity to provide feedback to be used to shape the effort to develop such an approach.

The primary objectives of the Seismic Roundtable were to facilitate communication between organizations and representatives from local, state, and federal agencies to better understand each other’s work in seismic functional recovery for new construction, and to facilitate collaboration and the sharing of ideas to better coordinate efforts and streamline progress toward achieving functional recovery solutions.

FUNCTIONAL RECOVERY

The term “functional recovery” means that buildings are not only designed and constructed for life safety, but also to support the basic intended functions of the building’s pre-earthquake use and occupancy within a maximum acceptable time. In other words, a building built for functional recovery would be able to be used for its intended purpose – whether that be eating, sleeping, shopping or learning – soon after the earthquake.

For the purpose of the event, the working definition of “Functional Recovery” was set to mean design and construction intended to result in a building for which postearthquake structural and nonstructural capacity are maintained or can be restored to support the basic intended functions of the building’s preearthquake use and occupancy within a maximum acceptable time, where the maximum acceptable time might differ for various uses or occupancies (based on proposed California Assembly Bill 393).

“Functional recovery and seismic design are issues not limited to California code officials,” as pointed out by CALBO President Sharon Goei during the roundtable. “CALBO is pleased to partner with our structural and seismic safety counterparts in federal, regional, state and local government to ensure that we are leading the way in resiliency and preparatory efforts.”

SUMMARY

More than 80 subject matter experts from the West Coast and across the U.S. attended the roundtable to address the development of a nationally applicable approach to functional recovery. Participants of the discussion represented a



diverse group with varied technical backgrounds, including the National Institute of Standards and Technology (NIST), Federal Emergency Management Agency (FEMA), American Society of Civil Engineers (ASCE), Earthquake Engineering Research Institute (EERI), Structural Engineers Association of California (SEAOC), Applied Technology Council (ATC), jurisdictions, state agencies, universities, and more (see Participant List).

The morning sessions focused on providing an overview of what is being done with respect to functional recovery at the local, state, and national levels as well as how the concept of functional recovery has progressed over time, and what is currently available. To view presentation videos, click [here](#).

In his keynote, California Assemblymember Adrin Nazarian, representing the 46th California Assembly District, told roundtable attendees that, “As the fifth largest economy in the world, California cannot hit the pause button after a massive earthquake. It is our duty to ensure that we save lives and preserve property by making our buildings the strongest in the world, capable of surviving and thriving in the aftermath of an earthquake. We have the technology, we just need the will.”

The afternoon session was facilitated by John Bwarie, CEO of Stratiscope, a company that has worked extensively with individuals, associations and jurisdictions on solutions for improving seismic resiliency. With John’s direction and guidance, individual roundtable and entire group discussions took place in the afternoon to identify paths to achieve functional recovery and ways to achieve that goal more quickly and in cooperation across disciplinary, professional, and organizational boundaries. The participants completed worksheets and used flipcharts to facilitate new ideas, solutions, and perspectives. The afternoon discussions were progressive in nature with activities designed to build on the previous discussions with the final outcome of the day being a roadmap.

PATHWAYS

The roundtable participants identified numerous pathways to achieving a national approach for seismic functional recovery design of new construction. Tables worked together to identify their preferred pathways and then the entire group worked together to prioritize the identified preferred pathways. In descending order of priority, the identified preferred pathways were:

State Level Legislative Solutions

- Assign certain building uses to a functional recovery program with a metric of functional recovery time:
 - Find a legislative champion
 - Conduct research and background studies to make the case on topics such as:
 - Cost/benefit analysis
 - Return on investment
 - Owner/developer status
 - Establish a legislative process
 - Write the draft provisions

Voluntary Standard Appendix

- Identify structural and non-structural design criteria
- Define a performance matrix
- Establish goals by occupancy and/or function
 - Establish that the incentive is the building's return to use
- Codify tax and insurance incentives
- Conduct validation studies

Tax, Financing, and/or Insurance Rebates

- Seek stakeholder input
- Define qualifying performance levels
- Develop case studies of real situations
- Develop and promote educational resources



Alternative IBC “Recovery Categories”

- Develop a code change proposal for ICC with concept development
- Educate participants/voters in the ICC process
- Obtain ICC membership approval for the IBC code change
- Educate local and state adopting agencies about the alternative and the reasons for adopting it

Require Community-Driven Functional Recovery Targets on Plans

- Identify ways to include targets in local Hazard Mitigation Plans (HMP)
- Establish a city plan and safety element
- Encourage the passage of state mandates for jurisdictions to establish ordinances or create plans
- Develop and provide tools and education at every level
- Establish a reasonable inventory date

Mandatory Performance Rating (similar to LEED)

- Require a LEED-style performance rating for new buildings as an incentive system
- Go through the legislative process to require a rating

Guidance to Ordinance with Social Justice Consideration

- Use a social justice lens to develop an ordinance that provides the following incentives:
 - Tax
 - Insurance
 - Government award requirement
 - Continuing Education Units (CEUs)
 - Density and Floor Area Ratio (FAR)
 - Inspection fee waivers
- Education:
 - CEUs
 - Public outreach
 - Hazard disclosure
 - Sale and realtor

BARRIERS

In a speed exercise, roundtable participants identified as many potential barriers as possible without trying to solve them. The following barriers were identified:

- Perceived construction cost implications
- Kneejerk objections to costs, namely the perception of cost and how the cost is shared
- Actual Costs
- Lack of interest
- Lack of proof or ability
- The legislative process in general, including:
 - Limitations of government budgets and competition for dollars
 - Risk that the requirement would be an unfunded mandate
 - Political viability
- Concern for gaining support of regional issues in national process
- Voters in IBC process may not be engaged with mandate issued from elected officials

- Lack of consensus and a tendency toward assuming “the perfect is the enemy of the good”
- Perceptions of the cost/benefit balance
- Public perception that the current codes are adequate and do not need much change
- Special interests that have an incentive to not do this, e.g. disreputable construction firms
- Education of stakeholders, from community members to technical experts
- Apathy, inertia, and competing priorities
- Technical issues
- Recognition of need
- Unacceptable ratings

SOLUTIONS

Roundtable participants collectively brainstormed potential solutions to the barriers that were deemed to be the most critical, namely: cost, political will, consensus building, lack of awareness, competing priorities, perceived liability, and buy-in. Each roundtable was assigned one of the identified critical barriers and discussed potential solutions. Below are the potential solutions that were presented to the entire group, which also discussed and refined.

Actual and Perceived Costs

Case studies and actual projects should be prepared to identify cost benefits. Tax and insurance incentives (and possibly a density bonus) should be identified and legislated; attendees disagreed whether these incentives should be funded through property tax increases, however. Tax increases could also be combined with a rating system to justify the higher value and cost as a way to equitably distribute costs.

Municipalities should offer ways to finance the necessary work and conduct educational outreach to sell the return-on-investment argument and to explain the costs of not designing for functional recovery. Roundtable participants also stressed 1) the need to recognize that owner equity is higher when designing for functional recovery, and 2) the need to ensure transparency to the public when making the transition to functional recovery.

The messaging should emphasize that while costs will go up, the increase will be worthwhile. This can be accomplished in part by shifting the perception from cost to value and by recognizing that it is difficult for the cost barrier to be overcome by individuals. Costs will need to be borne by the entire industry, and this may require a mandate. It is important to recognize that at a certain point, the higher cost for single-family homes and commercial buildings needs to be normalized.

Political Will

It will be important to identify champions at an early date, programs that fund pre-disaster consensus, and alternatives to costs, e.g. by allowing greater density in zoning codes. Functional recovery applications could also be identified for other societal needs (e.g. resilient affordable housing) and linked to social impacts (e.g. the increase in homelessness and spread of urban blight). Another way to promote political will might be to frame functional recovery as a way to ensure the preservation of public safety in the aftermath of an earthquake.

Awareness at a national level can be accomplished by increasing stakeholder consensus, simplifying the language, and working with media and other recognized experts and leaders to spread the message. An industry-wide consensus will need to be developed to effectively attract political support.

Consensus Building

Consensus can be built by developing a clear statement of need, amassing convincing evidence to show the value of functional recovery, and providing metrics for both the plan and the solution. A viable solution requires a well-developed plan and the advocacy of champions and stakeholders alike.

Vehicles and platforms for collaboration among professionals, such as workshops and roundtables, standards working groups, and coalitions, will also help develop an industry-wide consensus. Outside the building industry, consensus will require mechanisms for public input and prioritization, support from other organizations and associations, and stakeholder buy-in. Throughout the process, effort will need to be made to maintain the coalition and ensure consistent messaging, particularly through coordinated media plans and strategies.

Subject matter experts can be an individual champion, though it should be recognized that there may be pros and cons associated with any champion. Opponents should be brought into the discussion early so that their concerns can be understood and addressed.

Apathy and Lack of Awareness

Apathy can be overcome through a combination of technical consensus and political will. Outreach to the public, schools, officials, engineers, and owners should include personal stories from events such as earthquakes and hurricanes as well as heartwarming positive stories; scare tactics should be avoided. An emphasis on the economic impact to business and communities, and the resulting job losses and lost wages of noncompliance, are key to overcoming stakeholder apathy. Again, tax, insurance, and other incentives should be identified and codified.

The industry needs to push back against complacency and the idea that the existing code is fine as it is by demonstrating the value vs. the cost, thereby proving that functional recovery is an economic enhancement for the whole community. One way to do this is through clear and consistent messaging that emphasizes the notion of “leveling the playing field.” Another media outreach strategy could include the use of a red/green dot map of at-risk buildings to emphasize that it is within the control of citizens to ensure functional recovery is codified in the building code.

Building owners can be made aware of functional recovery requirements and benefits through the use of self-inventory questionnaires to identify how long it would take them to recover from a seismic event, and by demonstrating how incentives will enable owners and jurisdictions to both save and make money.

Competing Priorities

The industry can help establish priorities by identifying the technical requirements, performance levels, and acceptable downtime involved. Performance levels should be defined by occupancy or function, critical and essential facilities should be identified, and categories should be established. Acceptable downtimes for each established category can be developed and presented in the form of an easy-to-read matrix. In the interest of saving both time and money, tools that are already available in the industry should be relied on whenever possible.

The topic can be kept in the news by highlighting high-consequence events and linking them to potential local disasters. Opportunities should be sought to meet with community leaders, such as local chambers of commerce and elected officials, to identify and elevate the issues and to help prioritize the types and risks of hazards. In all outreach efforts, it is important to emphasize that functional recovery design does not define safety or focus on dollar loss.

Perceived Liability

The liability facing owners who do nothing needs to be made clear. The importance of standardization in reducing liability needs to be recognized, as does the value of institutional transparency. To accomplish this, messaging that is trusted, such as the American Red Cross, should be relied upon. Another idea offered would be to draft a good Samaritan law for design professionals.

Cooperation and Buy-In

Buy-in could be accomplished by developing model overlay zoning for key geographic areas and codifying restrictions on new buildings to ensure they are built to an approved functional recovery standard.

WORKING TOGETHER

To facilitate the continuation of parties working collaboratively together, each participant was requested to record their personal commitment and offer names of others that can participate in the effort to achieve functional recovery faster. Personal commitments included:

- Advocate for and continue to support the functional recovery effort
- Create building solutions and products that support functional recovery
- Work with ICC and the California Building Standards Commission (CBSC) to understand code adoption in order to provide technical solutions in a format that can be adopted and implemented
- Institutionalize concepts with ICC members and industry at large through writing and speaking
- Link code solutions with community resilience efforts via the Alliance for National and Community Resilience (ANCR).
- Work on a similar roundtable effort in other states

- Participate in establishing a common vocabulary for functional recovery
- Carry out research in academic environment
- Sponsor and/or support state legislation for functional recovery
- Provide information to the SEAOC membership
- Advocate and keep ICC focused on this issue
- Engage California Building Code precycle stakeholder workshops
- Research to support development of technical standards and qualifying benefits/costs of functional recovery
- Complete EERI's functional recovery policy position by December 2019
- Functional recovery session at National Earthquake Conference
- Continue collaboration and conversation, partner with other organizations, engage in legislation
- Contribute to technical white papers on functional recovery studies
- Begin process of creating voluntary standard appendix in ASCE 7-28
- Talk about idea of functional recovery with building officials and engineers
- Take research data and present in communications geared toward laypeople
- Work within NEHRP to add functional recovery to strategic plan, develop options report to Congress, work with ICC, and keep building relationships
- Work with state and local communities to educate them about the idea of including functional recovery goals and concepts in local HMPs and FEMA risk map process
- Provide local education to council members and socialize the idea
- Make recommendation to CBSC to consider functional recovery provisions
- Stay committed to resilience committees with National Council of Structural Engineers (NCSEA) and SEAOC
- Support bill analysis for potential functional recovery topics
- Work on code development team and facilitate conversation with internal stakeholders
- Facilitate discussion of functional recovery topics in CALBO Committees

SEISMIC ROUNDTABLE NEXT STEPS

A meeting date of October 23, 2019 was set for the Next Steps Forum to discuss results from the Seismic Roundtable and define next steps on the development of a nationally applicable approach to seismic functional recovery for new construction.

A "Seismic Functional Recovery Roadmap" will be presented at the Forum and goals for the Forum are to 1) select the best path from the "Seismic Functional Recovery Roadmap" and 2) identify participants, supporters, and associated roles for the selected path.

The event will take place at the ICC Annual Conference on October 23rd, 8:30 am to Noon, at the Rio Hotel and Convention Center in Las Vegas, NV.

PARTICIPANTS LIST

- Leslie Abrahams, Science and Technology Policy Institute (STPI)
- Shahen Akelyan, City of Los Angeles
- Katie Almand, CALBO
- Ed Almeter, Haselton Baker Risk Group
- Rebecca Atkinson, Planner
- Jesse Batchelder, City of Sacramento
- Hussain Bhatia, CA Office of Statewide Health Planning and Development
- David Bonneville, BSSC PUC Chair
- David Bonowitz, David Bonowitz, S.E.
- Yousef Bozorgnia, UCLA
- Jonathan Buckalew, Nabih Youseff Structural Engineers
- Yolanda Bundy, City of Ventura
- John Bwarie, Stratscope
- Philip Caldwell, National Electrical Manufacturers Association
- Kelly Cobeen, Wiss Janney Elstner Associates
- Kurt Cooknick, CA Division of the State Architect
- Victor Cuevas, City of Los Angeles and CALBO
- Kevin Day, CA Building Standards Commission
- David Jared DeBock, CSU Chico and Haselton Baker Risk Group
- Gregory Deierlein, Stanford University
- Shane Diller, City of Elk Grove and CALBO
- Joyce Fuss, Lionakis and SEAOC
- Sharon Goei, City of Milpitas and CALBO
- Jennifer Goupil, American Society of Civil Engineers
- Curt Haselton, Haselton Baker Risk Group
- Jon Heintz, Applied Technology Council
- Lauren Herman, CALBO
- Gary Ho, City and County of San Francisco
- John Hooper, Magnusson Klemencic Associates
- George Hoyt, City of Palo Alto
- Ryan Huxley, CA Division of the State Architect
- Danis Isho, City of Tracy
- Katherine Johnson, NIST
- Grace Kang, Pacific Earthquake Engineering Research Center
- Ryan Kersting, Buehler
- Shaunt Kojabashian, Haselton Baker Risk Group
- Michael Mahoney, FEMA
- Greg Mahoney, City of Davis
- Mia Marvelli, CA Building Standards Commission
- Steven McCabe, NIST
- Richard McCarthy, CA Seismic Safety Commission
- Mike Mieler, Arup
- Emory Montague, Simpson Strong-Tie
- Kevin Moore, Simpson, Gumpertz & Heger
- Kai Ki Mow, City of Bellevue
- Adrin Nazarian, CA State Assembly
- Ralph Ochoa, ICC Outside Counsel
- Chris Poland, Chris Poland Consulting Engineer
- Ryan Pursley, City of Concord
- Robert Raymer, California Building Industry Association
- Anne Rosinski, FEMA
- Justin Rupley, County of Sacramento
- Zahraa Saiyed, Scyma Design and Consulting
- Don Schinske, SEAOC
- Jon Siu, City of Seattle
- J.G. (Greg) Soules, CB&I Storage Tank Solutions
- Bryan Spain, California Code Check and CALBO
- Nancy Springer, County of Sacramento
- Sally Sproat, Jumpstart Insurance
- Mike Stone, National Electrical Manufacturers Association
- Andrew Stuffler, City of Santa Barbara and CALBO
- Ali Sumer, CA Office of Statewide Health Planning and Development
- Richard Tam, City and County of San Francisco
- Stuart Tom, ICC Board of Director
- Heidi Tremayne, Earthquake Engineering Research Institute
- Fred Turner, CA Seismic Safety Commission
- Matthew Wall, Western States Seismic Policy Council
- Matt Wheeler, CALBO
- Steven Winkel, The Preview Group and CBSC
- Kent Yu, Seft Consulting
- Emellia Zamani, CA State Assembly
- Farzin Zareian, UCI



ICC STAFF

- Ryan Colker
- Susan Dowty
- S. K. Ghosh
- Sandra Hyde
- Jacob Karson
- Madison Neal
- Chris Ochoa
- Michael Pfeiffer
- Dave Walls
- Sara Yerkes

ADDITIONAL INFORMATION

- Videos and slide pdfs of the Seismic Roundtable morning presentations are available [here](#).
- Photos from the event are available [here](#).