HCAI Department of Health Care Access and Information
2020 West El Camino Avenue, Suite 800
Sacramento, CA 95833
hcai.ca.gov

Hospital Building Safety Board
Instrumentation Committee
AGENDA
March 24, 2026
10:00 a.m. – 4:00 p.m.

The Committee may not discuss or act on any matter raised during the public comment section that is not included on this agenda, except to place the matter on a future meeting agenda. (Government Code §§ 11125, 11125.7, subd. (a).)

Locations:
2020 West El Camino Ave, Conference Room 930, Sacramento, CA 95833
355 South Grand Avenue, Conference Room 2000, Los Angeles, CA 90071
Teams Meeting Access; Meeting ID: 227 226 707 372 5; Passcode: Kk7fR6gT
Call in: (916) 535-0978; Phone Conference ID: 505 623 108#

Item #1 Call to Order and Welcome
Facilitator: Martin B. Hudson, PhD, GE, Principal Geotechnical Engineer, Hudson Geotechnics, Inc.; Committee Chair (or designee)

Item #2 Roll Call and Meeting Advisories/Expectations
Facilitator: Veronica Yuke, HCAI; HBSB Executive Director (or designee)

Item #3 Implementing Structural Health Monitoring Programs for Post-Earthquake Response
- Discussion and public input

Facilitators: James O. Malley, Senior Principal, Degenkolb; and Evan Reis, SE, Executive Vice President and Director of Science and Analytics, Safehub, Inc. (or designees)

Item #4 Review of goals for Ad hoc Educational Opportunities to Advance Structural Health Monitoring by Hospitals Subcommittee meeting on January 29, 2026
- Discussion and public input

Facilitator: Courtney Johnson, PG, CEG, Principal Geologist, Slate Geotechnical Consultants; Committee Member

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Implementing Structural Health Monitoring Programs for Post-Earthquake Response

Evan Reis, EVP & Director of Science

Challenges with traditional post earthquake response

Observations: First 15 Minutes

- **Decisions to evacuate hospitals were often made quickly** in the first 15 minutes.
- **Fear** played an unexpected role in these decisions (i.e., cracks in partitions made patients and staff afraid to stay or return) and led to some evacuations.
- These decisions are **difficult to reverse** once they are made.

57

EERI

Challenges with traditional post earthquake response

Relying solely on visual inspections (even by structural engineers)

- Structural damage is often hidden
- Based on engineering judgement

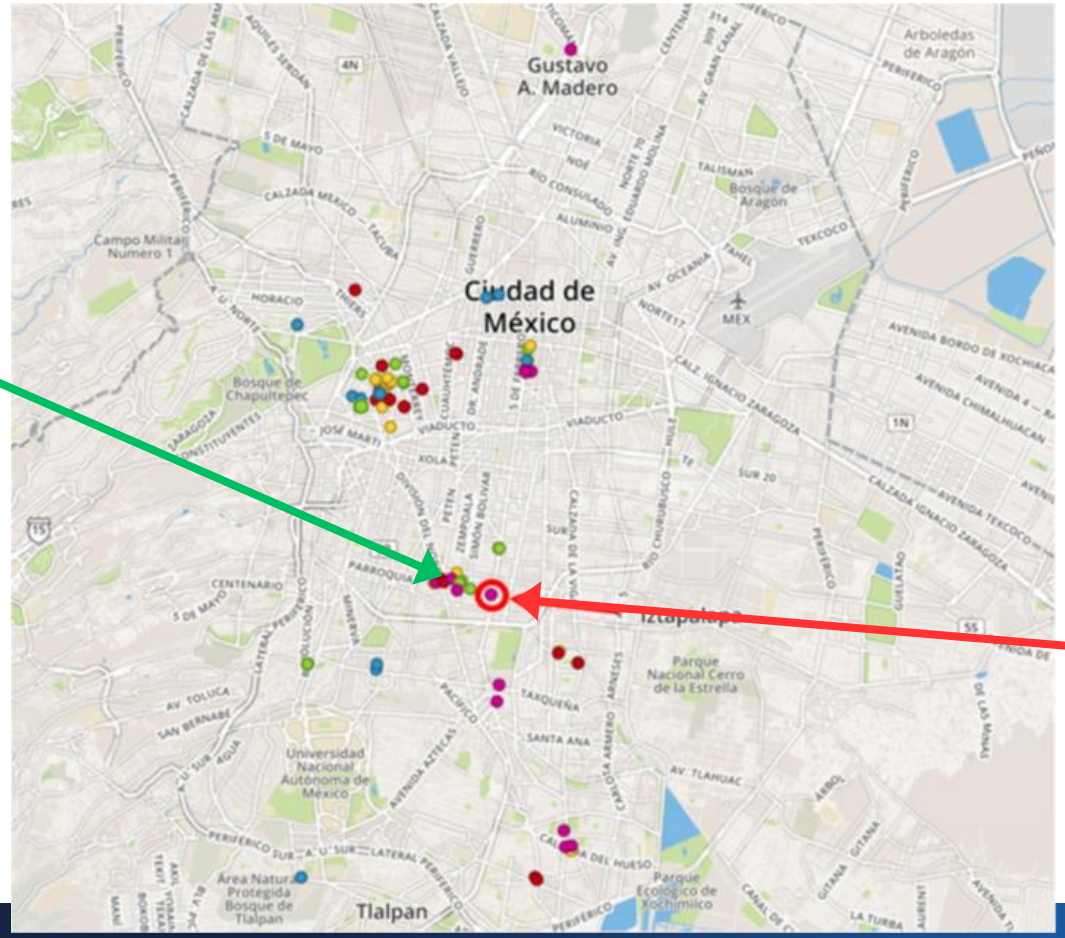
Northridge, 1994

Ridgecrest, 2019

Challenges with traditional post earthquake response

Buildings within a block of each other affected by the M7.1 2017 Puebla Earthquake. Similar year & type of construction.

Green = No damage
Ground shaking per USGS: 20.08%g



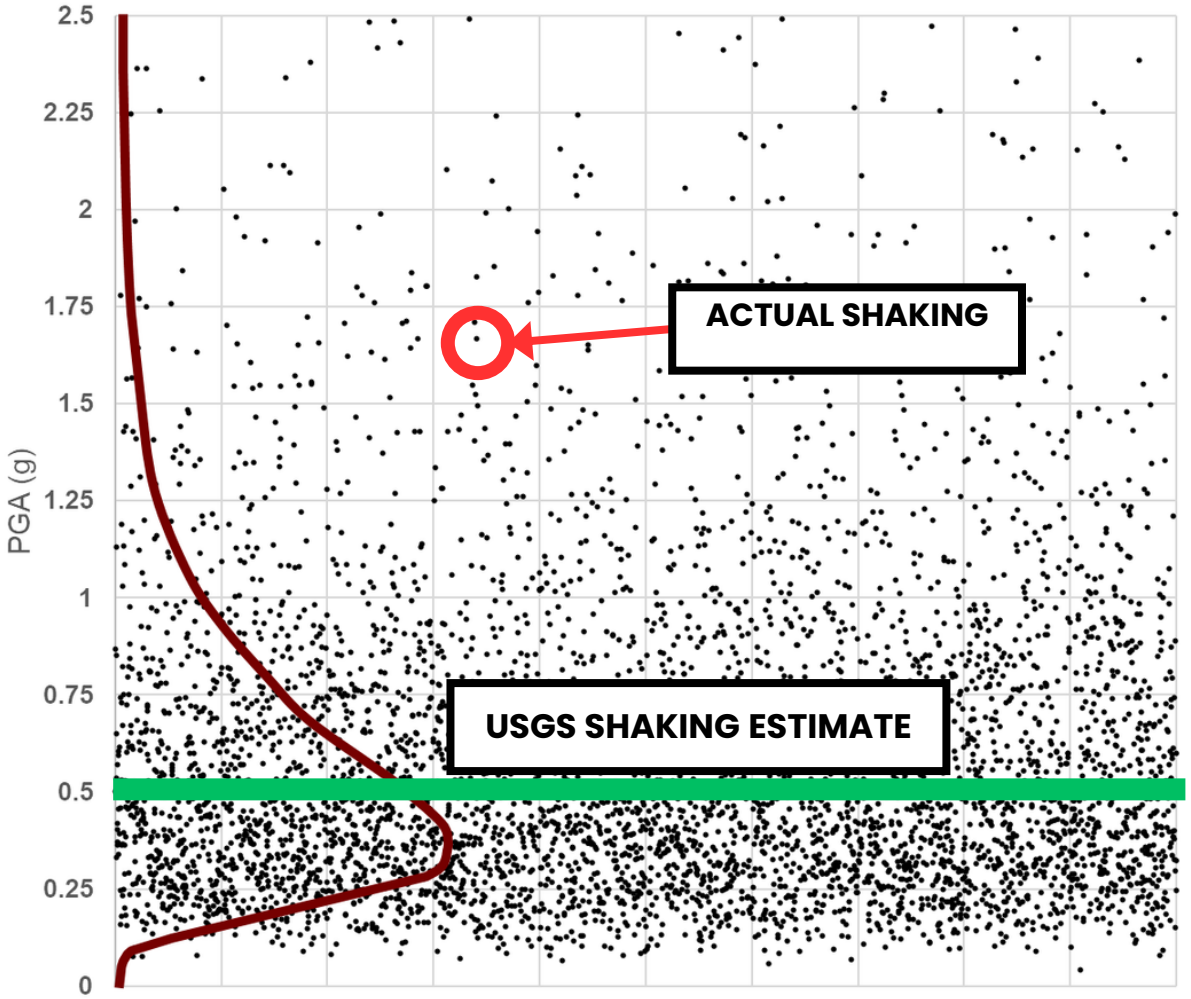
Red = major damage
Ground shaking per USGS: 20.12%g

Source – Applied Technology Council

Instrumentation At Location Eliminates GMPE Variability...

...and empirically accounts for soil structure interaction

USGS ShakeMap-estimated PGA for a specific location associated with a shallow-crust earthquake in California



safehub

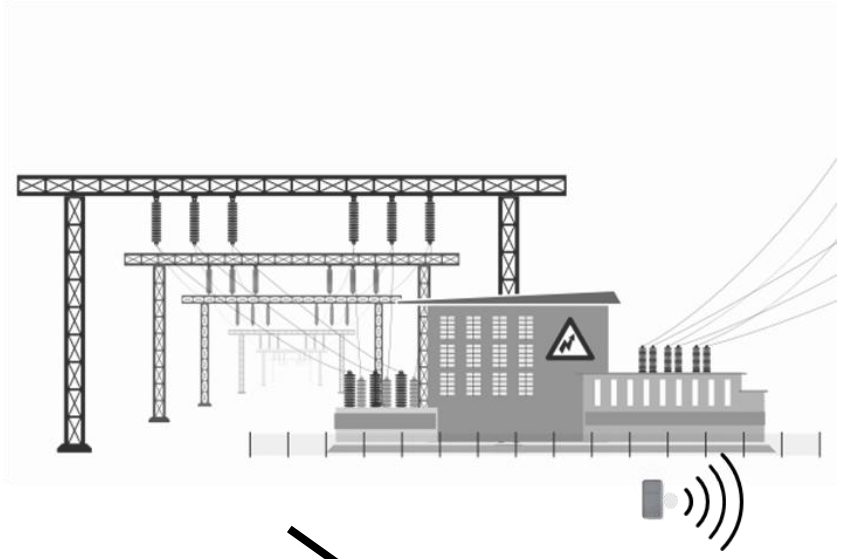
safehub

Sensor Technology

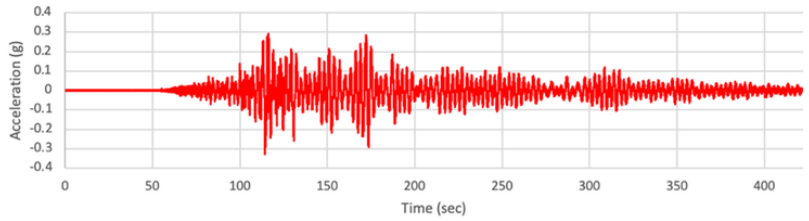
State of the Art MEMS Accelerometer Technology

- Scalable: Low-cost, cellphone-sized sensors
- Easy install & pairing process
- Cellular connectivity avoids network concerns
- Automatic mobile network failover, back-up battery, local data storage
- No calibration necessary, no maintenance and remote updating

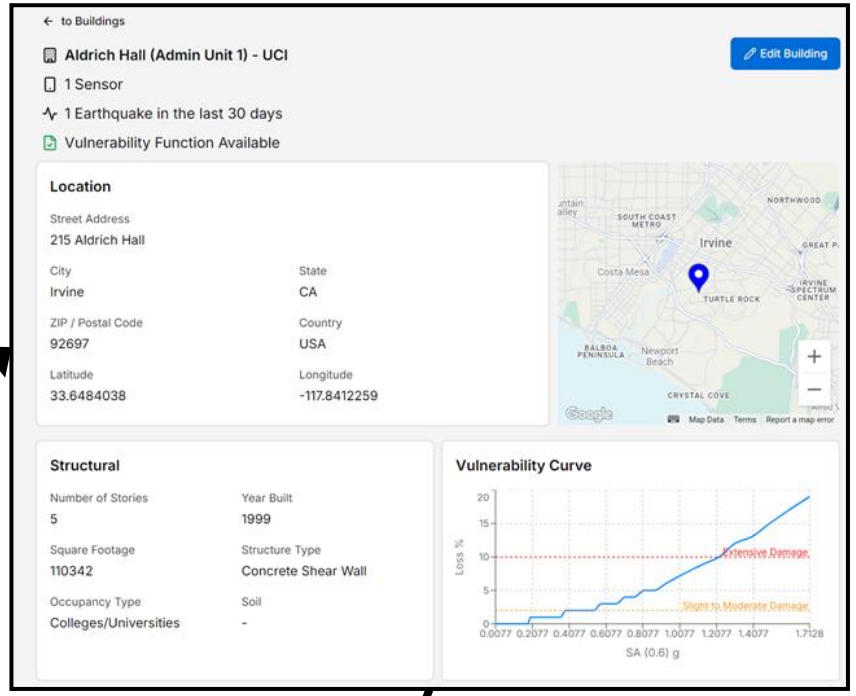
Building Specific Data for Situational Awareness



Triaxial acceleration record



Transformation to PSA at 0.3 or 1.0 seconds



Damage Indicators	
Damage	% Loss
Cost	$ Loss
Downtime	Days

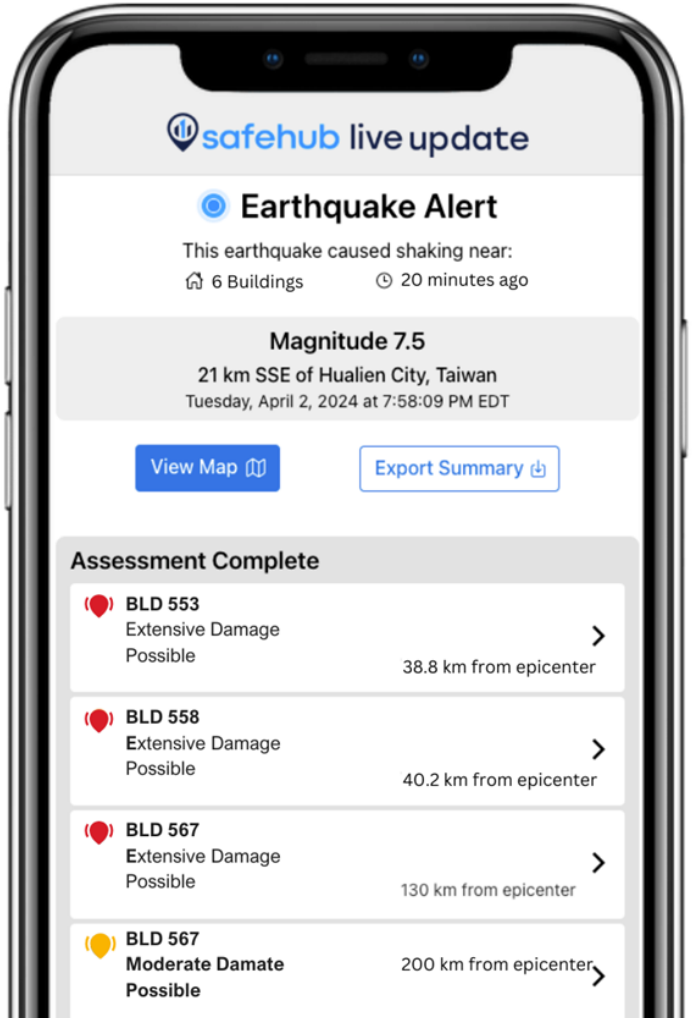
Rapid Damage Alerts

Text & email alerts, along with
live updates on damage estimates:

Extensive damage expected

Slight-to-Moderate damage expected

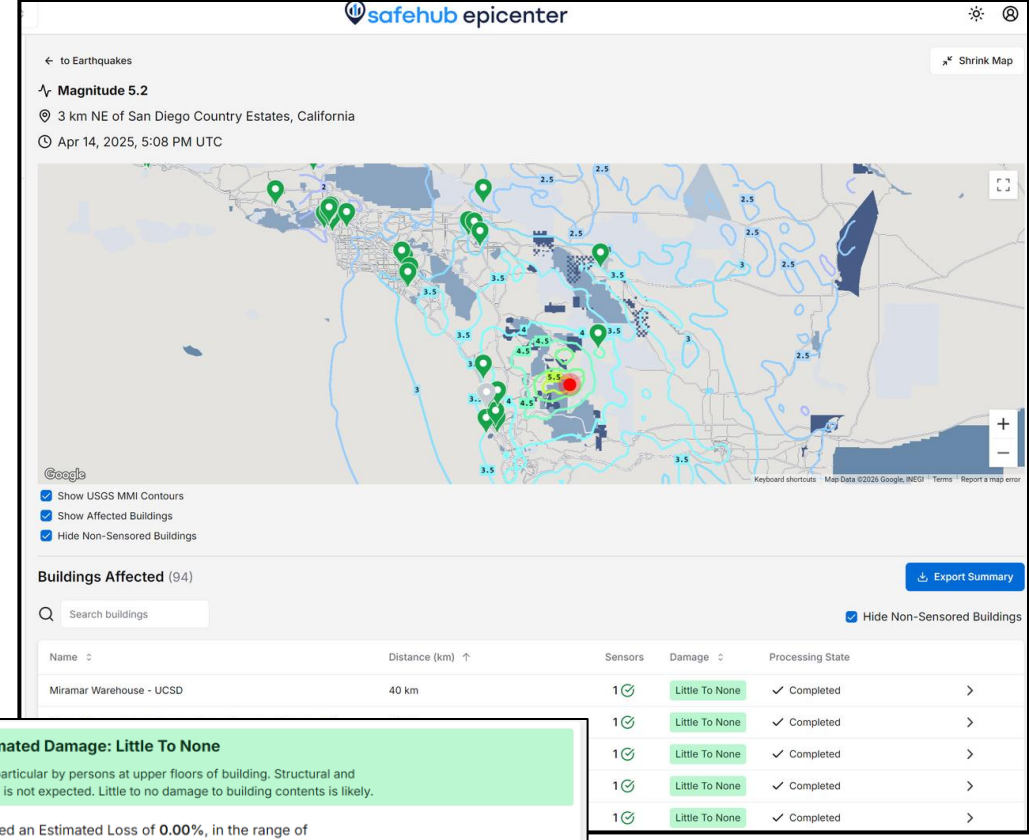
Little-to-No damage expected

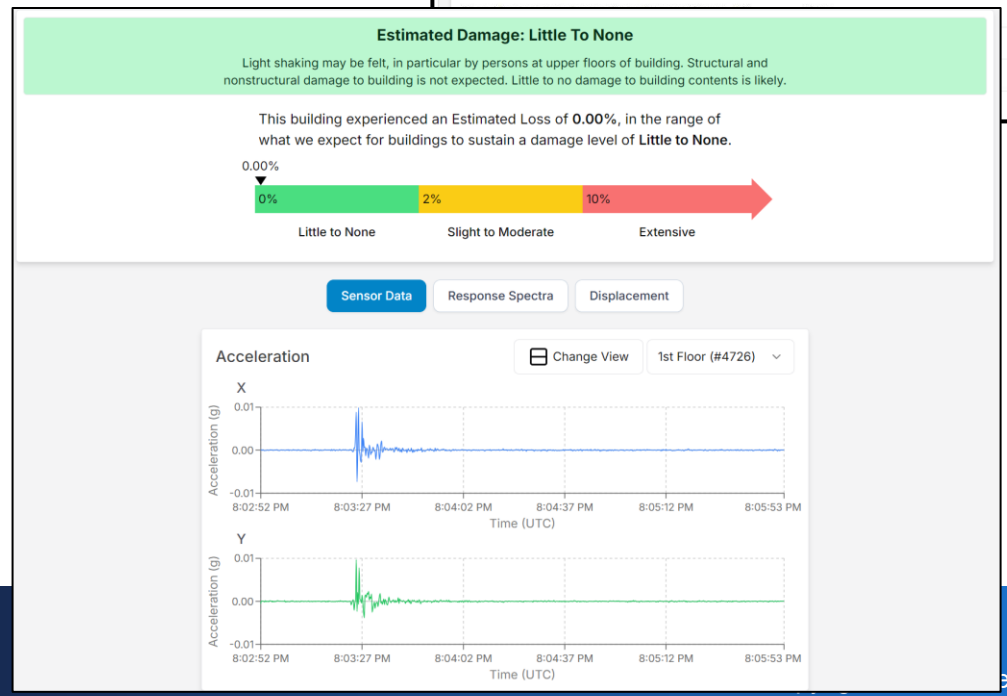


of USGS initial EQ ID

Data in one place

- Maps of impacted assets
- Higher fidelity and accuracy than regional intensity maps
- Rapid triage of inspection priorities
- Building specific acceleration data
- Integration with existing EOC programs

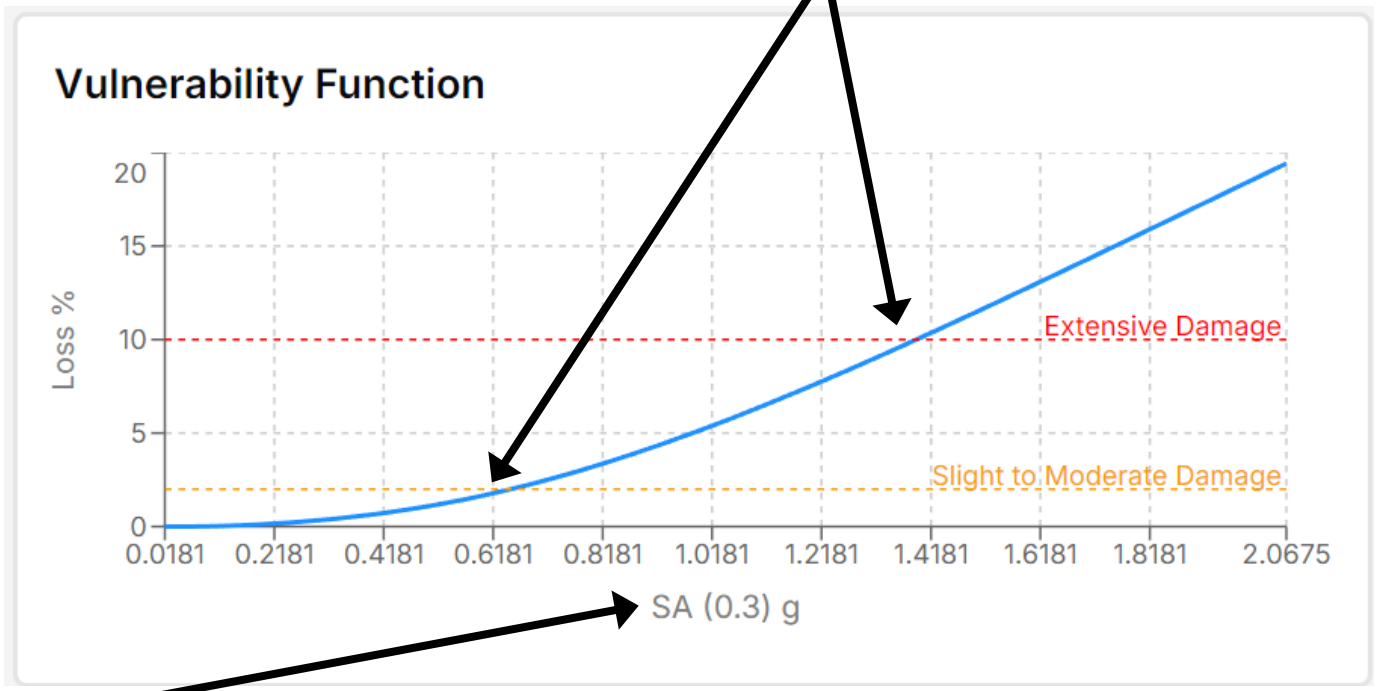




Building Specific Vulnerability Functions Improve Damage Estimates

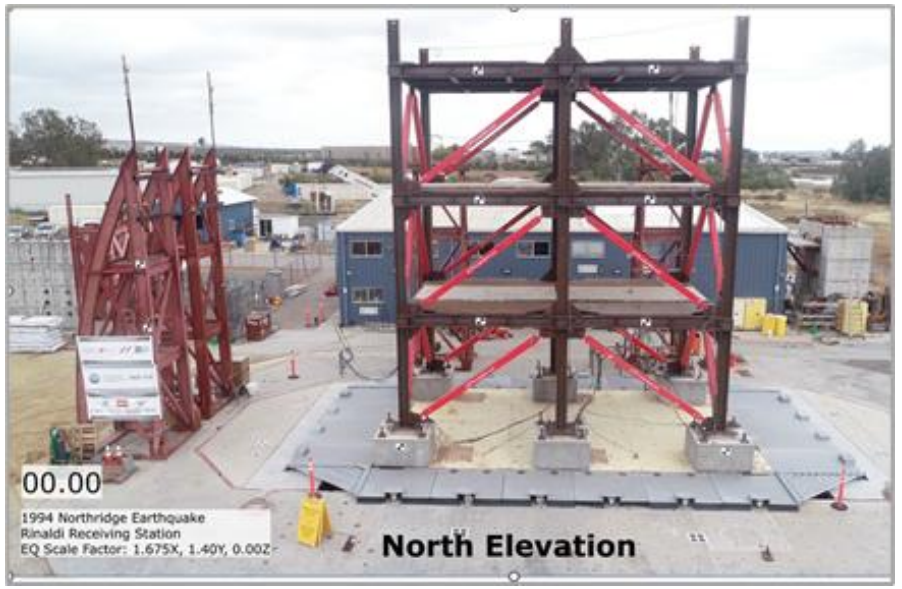
Vulnerability functions based on standard or custom evaluation methodologies

- HAZUS
- FEMA 154
- ASCE 41
- FEMA P58
- FEMA E74 - for equipment
- Custom based on testing



Sensor Testing

Berkeley
UNIVERSITY OF CALIFORNIA



*"The measurements are **nearly identical** within the range most important to most civil infrastructure...Overall we also observed that the wireless sensors are simple to attach and robust to remove and reattached, while retaining power for several days in the outdoor environment."*

– Dr. Tara Hutchinson, UC San Diego

*"The measurements were **virtually indistinguishable** from [force balanced sensors used by CSMIP]. "*

– Dr. Amarnath Kasalanati, PEER Associate Director

UC San Diego
JACOBS SCHOOL OF ENGINEERING

STRUCTURAL SYSTEMS
RESEARCH PROJECT

Report No.
SSRP–24/06

Comparing the Performance of a Compact Wireless Vibration Sensor to Conventional Wired Vibration Sensors in the TallWood Shake Table Test Program

by

Shokrullah Sorosh and Tara Hutchinson
(University of California San Diego)

November 2024

Department of Structural Engineering
University of California San Diego
La Jolla, California 92093-0085

safehub

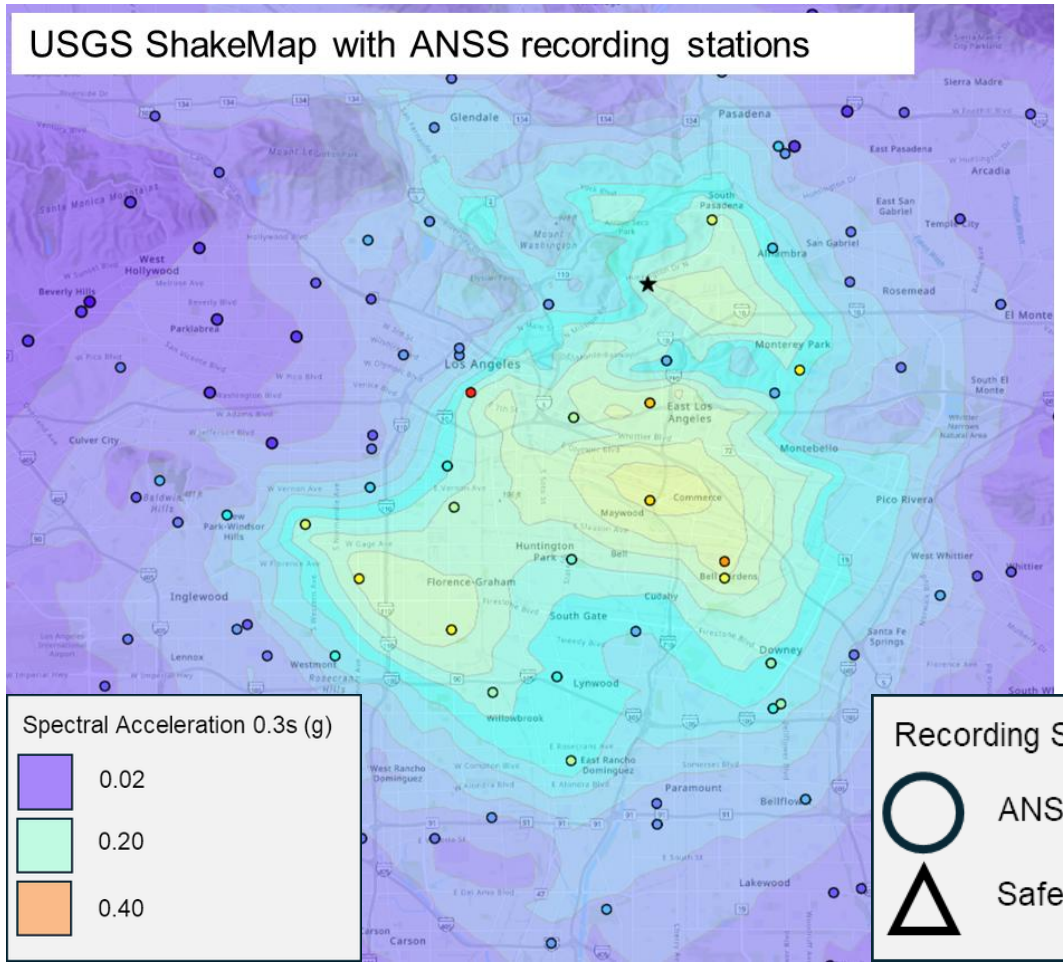
Parametric Earthquake Insurance

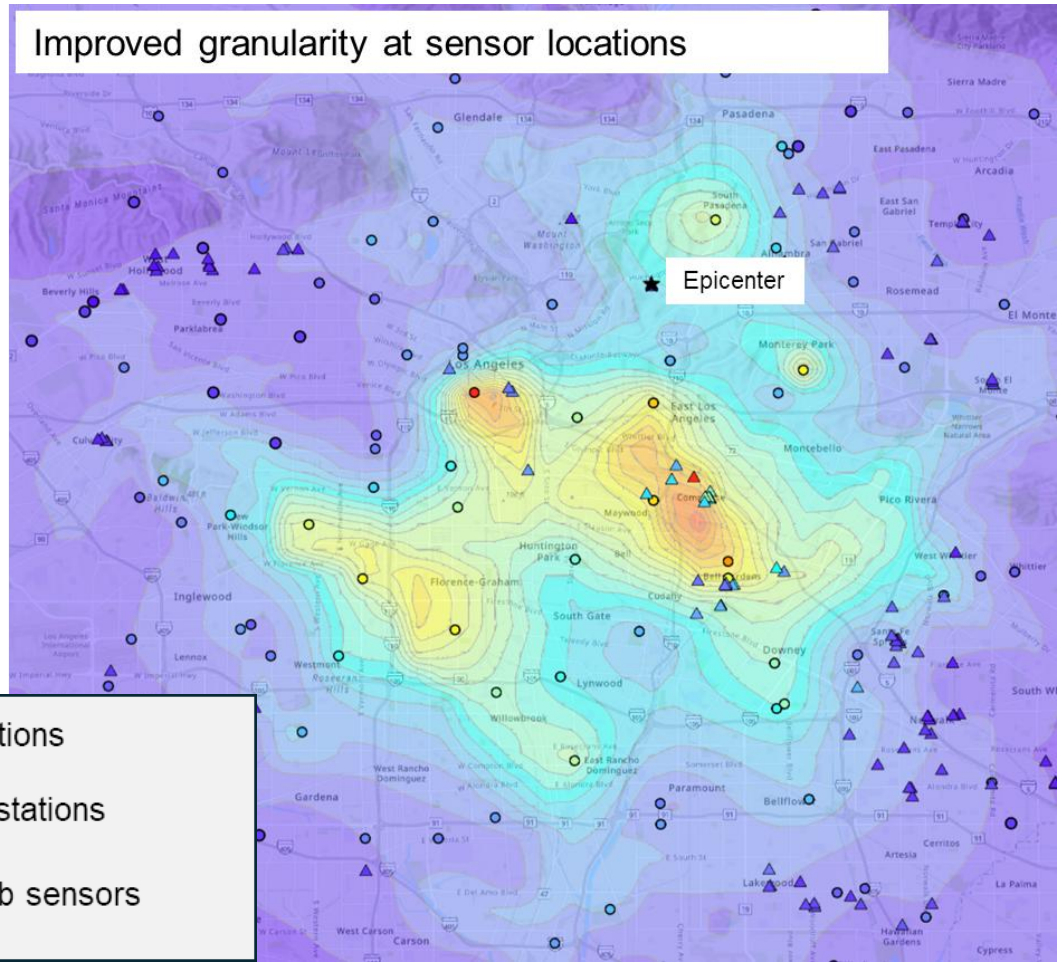
Parametric Insurance: Pros & Cons Compared to Traditional Insurance

- Immediate payment based on pre-defined trigger levels
- Flexible use of proceeds for any earthquake related costs
- High basis risk if policy uses only regional shaking intensity maps

Asset Specific Data vs USGS ShakeMap

M4.4 Highland Park Earthquake; August 12, 2024

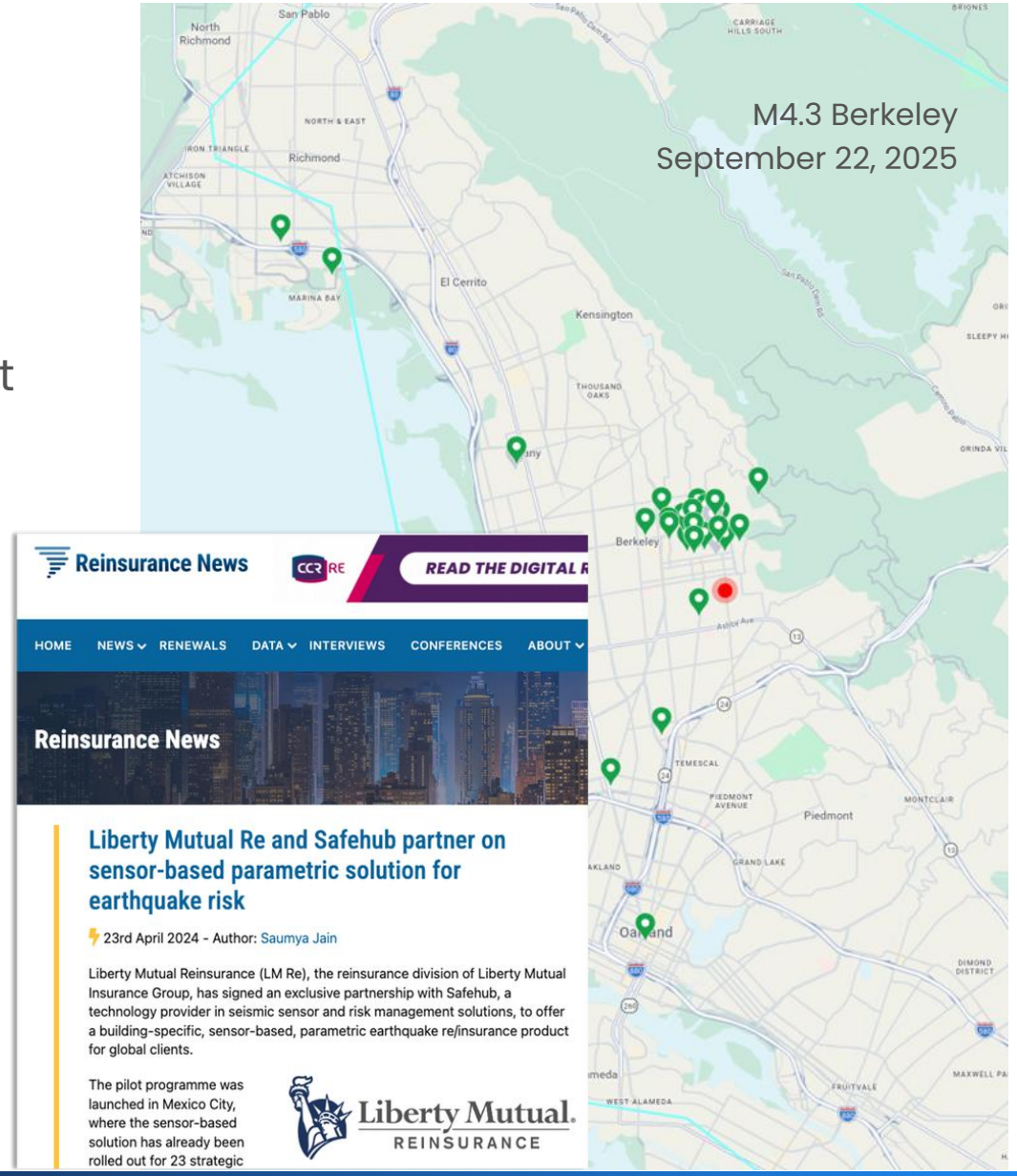




University of California

World's first sensor based parametric earthquake program

- $55 million policy across UC system
- Also includes post-earthquake damage assessment
- 198 sensors installed across all 10 UC campuses
- 190 earthquakes captured as of February 01, 2026




safehub
Thank You

Item #4 California Strong Motion Instrumentation Program (CSMIP) update on Notification for Structural Response Monitoring

- Discussion and public input

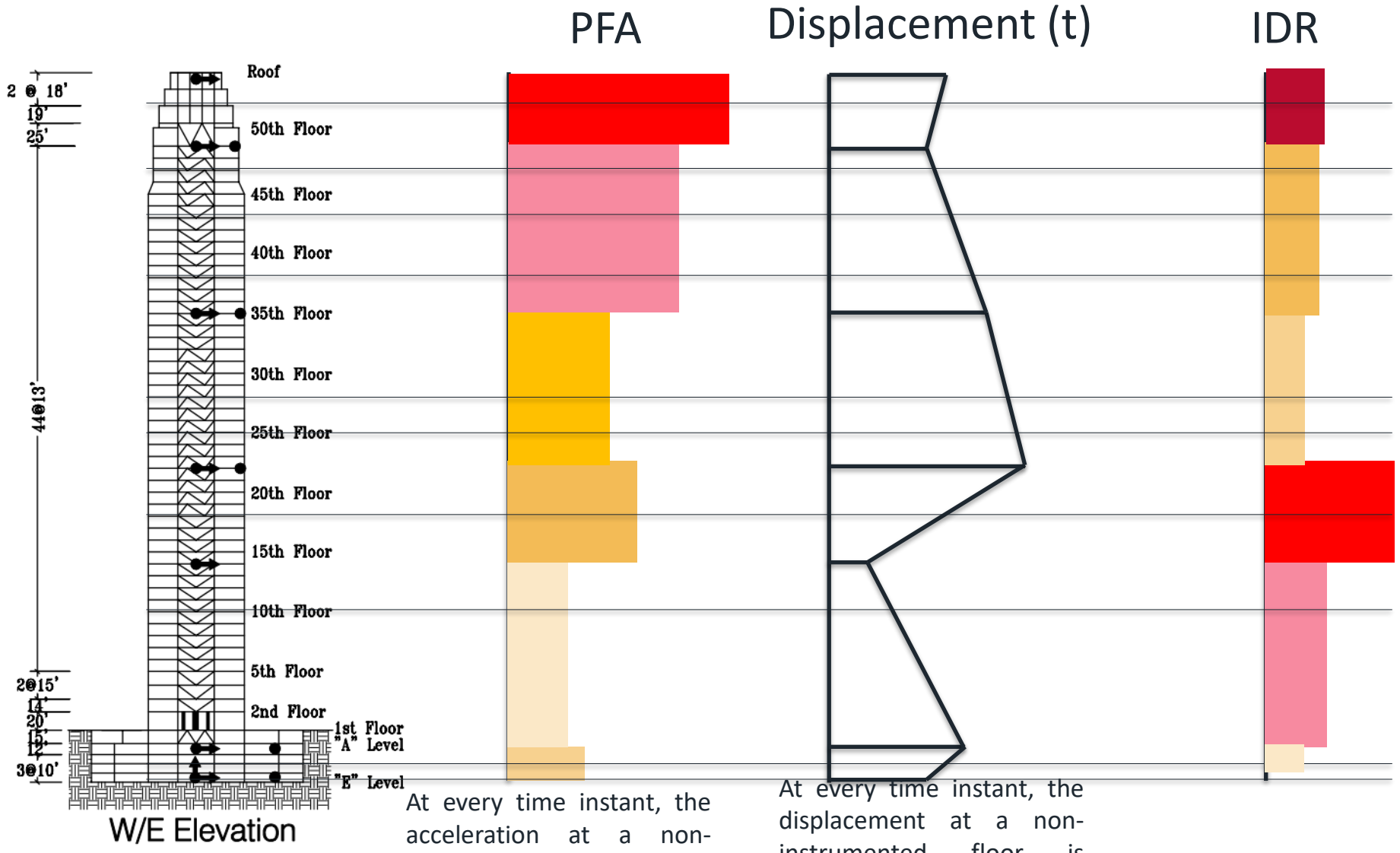
Facilitator: Hamid Haddadi, PhD GP, Program Manager, CSMIP, California Geological Survey (or designee)

California
Department of
Conservation
California Geological Survey

Earthquake Notification System for Hospitals

HBSB Strong Motion Instrumentation Committee Meeting – 24 March 2026

PFA & IDR Interpolation (Basic)



At every time instant, the acceleration at a non-instrumented floor is assumed to be equal to that of the lower floor.

At every time instant, the displacement at a non-instrumented floor is calculated as a linear interpolation between two instrumented floors.

Notification Template

Last update (PDT/PST): 11/17/25, 12:30:56

Record Start Time (PDT/PST): 12:25:15 on 3/23/26

PGA: EW = 0.XYZg; NS = 0.XYZg; UP = 0.XYZg;

Maximum IDR: EW = 0.XYZ% (F1th/F2th); NS = 0.XYZ% (F1th/F2th);

Maximum PFA: EW = 0.XYZg (@ F?); NS = 0.XYZg (@ F?)

Candidate Hospitals

California Department of Conservation

Facility Number/Name	Building Name	No. of Stories above/below ground	Lateral System	Links	Station No.	No. of Recorders	Recorder Type	Recorded Events
11810 Los Angeles General Medical Center	Inpatient Tower	9/0	Steel eccentrically-braced frames	Instrumented Building Link	24248	1	KMI	23
10537 Desert Regional Medical Center	East Tower	4/1	Steel moment frames	Instrumented Building Link	12299	1	KMI	15
18173 Palomar Medical Center	Hospital	11/1	Steel moment frames with SidePlate connections in both directions, located at both interior and perimeter.	Instrumented Building Link	13473	1	KMI	1
11659 UC San Diego Health La Jolla - Jacobs Medical Center & Sulpizio Cardiovascular Center	Bed Tower	10/2	Special steel moment resisting frames with SidePlate connections in each direction and concrete shearwalls below Level 1.	Instrumented Building Link	03593	1	KMI	1
17905 Kaiser Foundation Hospital - Ontario	Main Hospital	5/partial	Steel buckling restrained braced frames distributed in both directions, and concrete shear walls at basement level.	Instrumented Building Link	23416	1	KMI	8
12476 UCSF Medical Center	Long Hospital	15/1	Composite steel plate shear walls with a 25% moment resisting steel frame. The composite shear walls consists of steel plates encased in concrete on both sides.	Instrumented Building Link	58257	1	KMI	4
10273 Marinhealth Medical Center	06-West Wing	5/partial	Perimeter steel moment frames along the three sides of the building.	Instrumented Building Link	58755	1	KMI	3
17668 Kaiser Foundation Hospital-Santa Clara	Hospital- Phase 1	3/1	Chevron braced steel frames with unbonded braces (steel buckling-restrained braced frames)on perimeter and central core, concrete sheer walls below grade.	Instrumented Building Link	57251	1	KMI	9
10184 Providence St. Joseph Hospital	Phase III Addition Building	4/1	10" thick concrete shear walls along the perimeter and inside the building. Shear walls terminate at various levels. 12" thick flat slab serves as the horizontal diaphragm.	Instrumented Building Link	89770	1	KMI	33
18180 Eden Medical Center	Replacement Hospital	6/1	Reinforced concrete shear walls at interior and perimeter from Basement to Level 3. Concentrically braced steel frames from Level 3 to Roof.	Instrumented Building Link	58494	1	KMI	4

Drift Pairs

EW direction
NS direction
45 degrees
Fully instrumented

California Department of Conservation

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9
24248	1 4	2 6	2 5	4 7	6 9	5 8	7 10	9 12	8 11
Height (ft)	68	68	68	59	59	59	20	21	22

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6
12299	12 11	7 5	8 6	11 10	5 3	6 4
Height (ft)	13	14	15	25	25	25

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9	Pair 10	Pair 11	Pair 12	Pair 13	Pair 14	Pair 15	Pair 16	Pair 17	Pair 18
3593	5 8	2 6	4 7	8 11	6 9	7 10	11 14	9 12	10 13	14 17	12 15	13 16	15 19	16 20	17 21	21 24	19 22	20 23
Height (ft)	38	38	38	38	38	38	36	36	36	34	34	34	40	40	40	36	36	36

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9
13473	2 5	1 6	1 4	5 8	6 9	4 7	8 11	9 12	7 10
Height (ft)	54	54	54	66	66	66	80	80	80

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9
23416	3 6	4 7	5 8	6 9	7 10	8 11	9 13	10 14	11 15
Height (ft)	32	32	32	15	15	15	30	30	30

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9
58257	5 8	4 7	3 6	8 12	7 11	6 10	12 15	11 14	10 13
Height (ft)	95	95	95	65	65	65	52	52	52

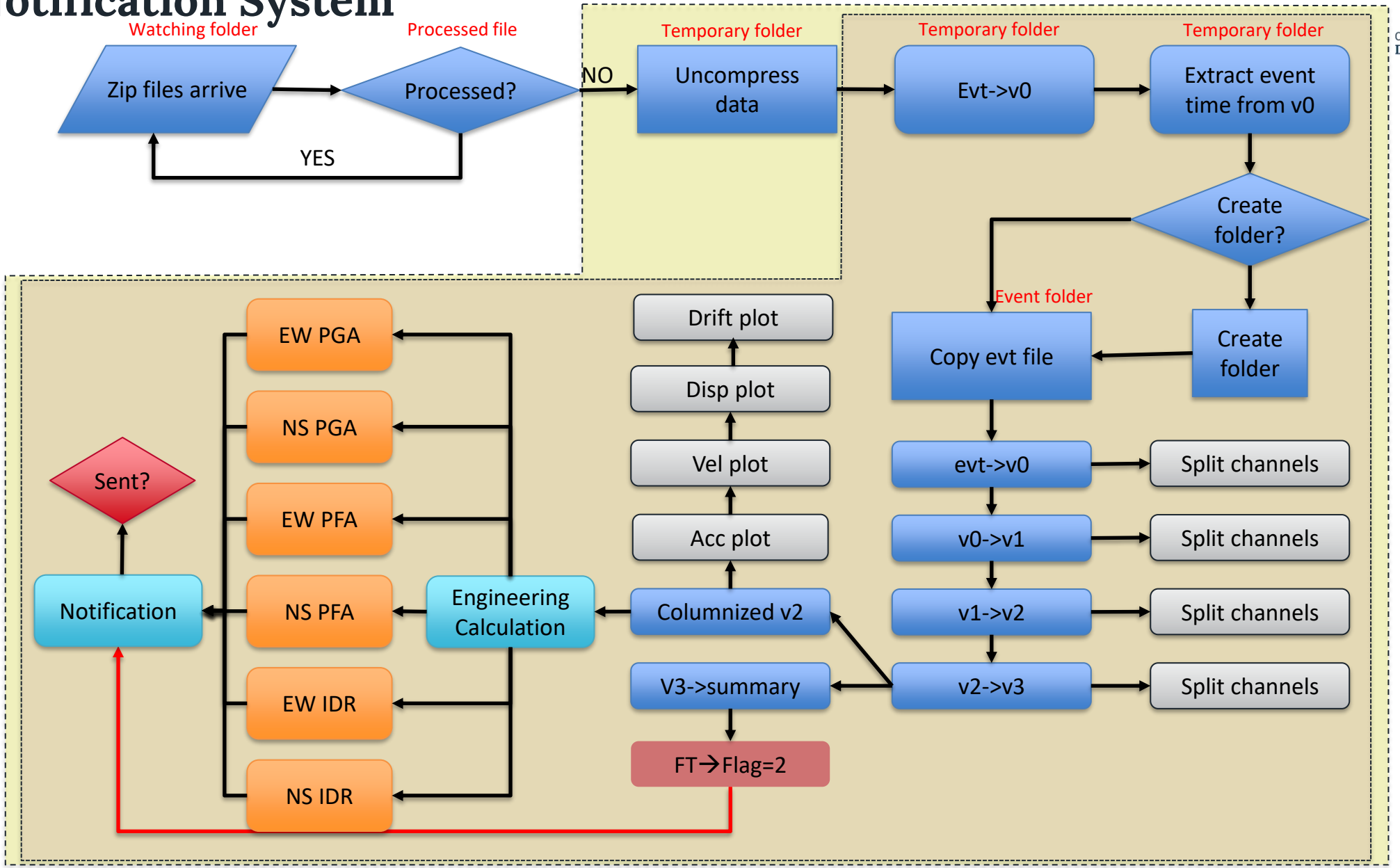
Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8
58755	1 3	2 4	4 6	5 7	6 9	7 10	8 12	9 11
Height (ft)	17	17	25	25	24	24	12	12

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9	Pair 10	Pair 11
57251	2 4	3 5	4 7	5 8	6 9	7 10	8 11	9 12	10 13	11 14	12 15
Height (ft)	15	15	15	15	15	15	15	15	15	15	15

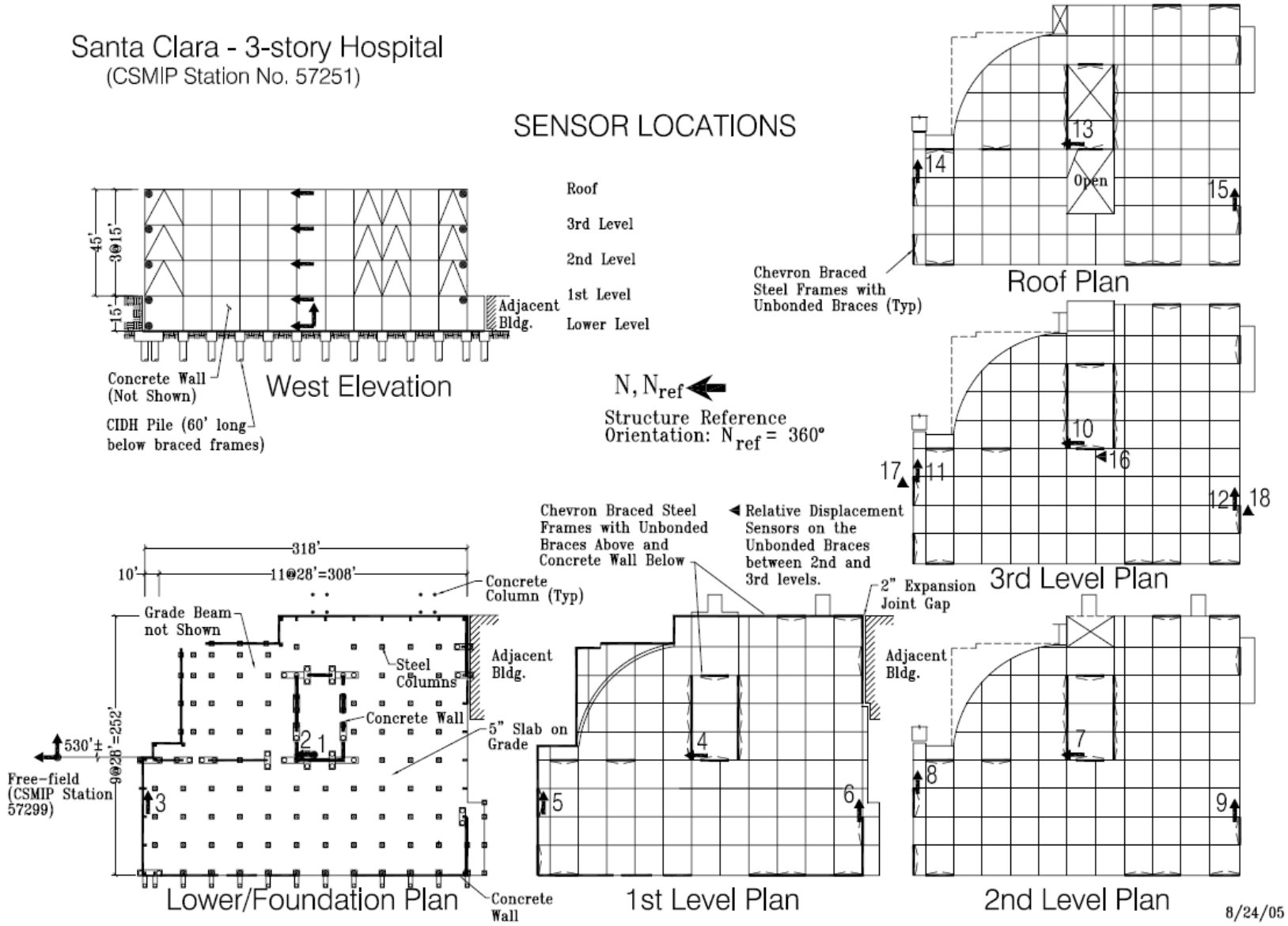
Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6
89770	4 6	3 5	6 9	5 7	9 10	7 11
Height (ft)	24	24	25	25	13	13

Station	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9	Pair 10	Pair 11	Pair 12	Pair 13
58494	5 11	4 10	3 9	2 7	6 8	10 15	9 14	7 12	8 13	15 19	14 18	12 16	13 17
Height (ft)	53	53	53	53	36	31	31	31	31	34	34	34	34

Notification System



Case Study

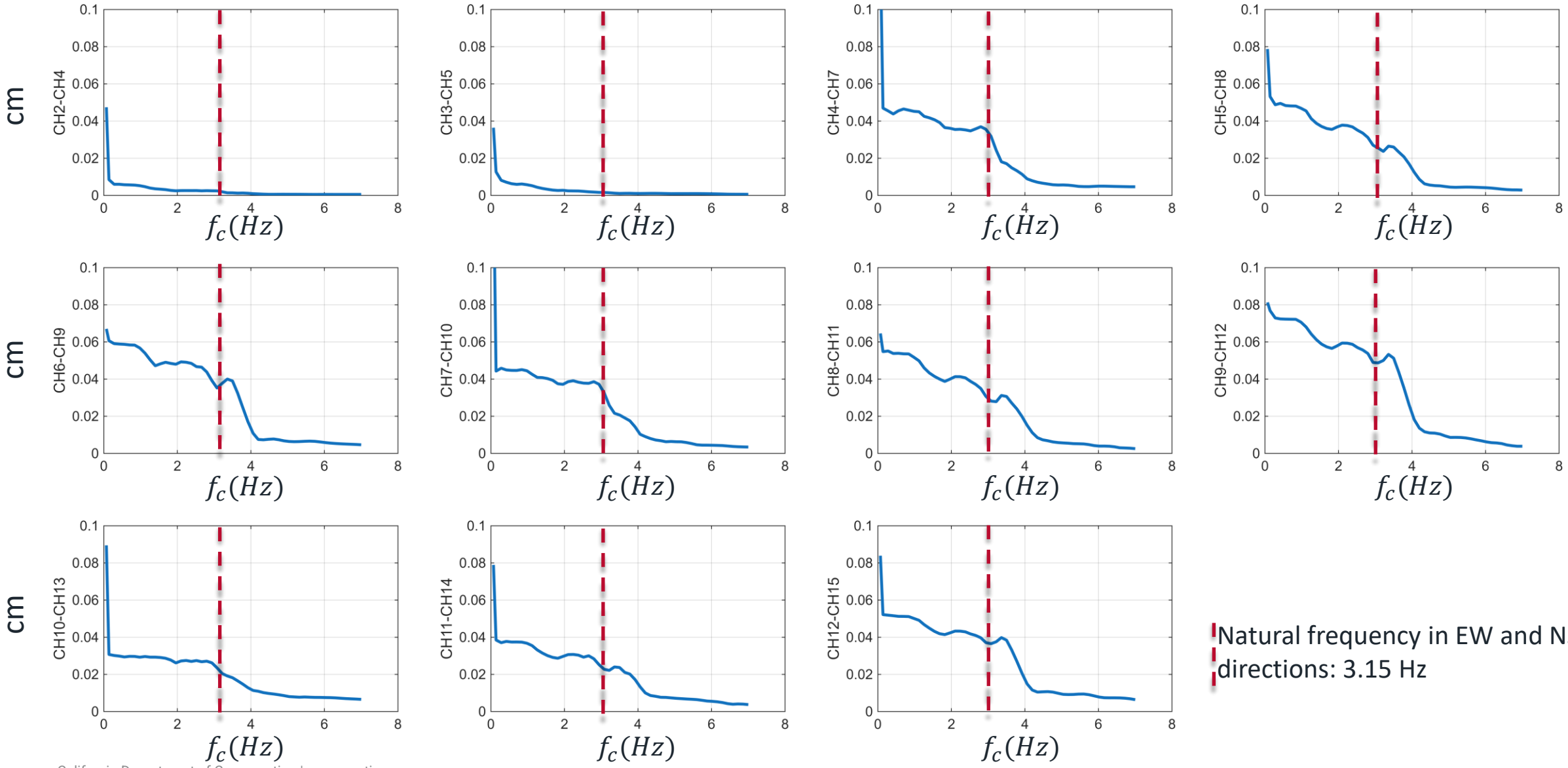

Santa Clara - 3-story Hospital
(CSMIP Station No. 57251)
SENSOR LOCATIONS
Roof
3rd Level
2nd Level
1st Level
Lower Level
45'
3@15'
15'
Adjacent Bldg.
Concrete Wall (Not Shown)
CIDH Pile (60' long below braced frames)
West Elevation
N, N_ref
Structure Reference Orientation: N_ref = 360°
Chevron Braced Steel Frames with Unbonded Braces (Typ)
13
14
Open
15
Roof Plan
10
16
17
11
12
18
3rd Level Plan
Chevron Braced Steel Frames with Unbonded Braces Above and Concrete Wall Below
Relative Displacement Sensors on the Unbonded Braces between 2nd and 3rd levels.
2" Expansion Joint Gap
318'
10'
11@28'=308'
Concrete Column (Typ)
Grade Beam not Shown
Steel Columns
Concrete Wall
5" Slab on Grade
Adjacent Bldg.
530'±
9@28'=252'
Free-field (CSMIP Station 57299)
1
2
3
Lower/Foundation Plan
Concrete Wall
4
5
6
1st Level Plan
7
8
9
2nd Level Plan
8/24/05

9 Earthquakes Recorded at Santa Clara – 3-story Hospital

California Department of Conservation

StaNo ▼	Station	Network	Epicentral Distance (km)	Fault Distance (km)	Ground pga (g)	Struct pga (g)	Earthquake Name	Magnitude	Earthquake Origin Time(UTC)	Event ID	View	Download
57251	Santa Clara - 3-story Hospital	CGS	63.4	--	--	0.027	Lafayette	4.2ML	2007-03-02 04:40:00	nc40194055	○	☐
57251	Santa Clara - 3-story Hospital	CGS	22.5	--	0.026	0.084	AlumRock	5.4Mw	2007-10-31 03:04:54	nc40204628	○	☐
57251	Santa Clara - 3-story Hospital	CGS	23.8	--	0.003	0.013	milpitas	4.1ML	2010-01-07 18:09:35	nc71336726	○	☐
57251	Santa Clara - 3-story Hospital	CGS	62.0	--	0.009	0.022	Berkeley	4.4MW	2018-01-04 10:39:37	nc72948801	○	☐
57251	Santa Clara - 3-story Hospital	CGS	22.9	--	0.003	0.013	AlumRock	3.8MW	2018-04-16 16:39:26	nc73000196	○	☐
57251	Santa Clara - 3-story Hospital	CGS	67.1	--	0.004	0.018	PleasantHill	4.5MW	2019-10-15 05:33:42	nc73291880	○	☐
57251	Santa Clara - 3-story Hospital	CGS	62.4	--	0.006	0.018	Aromas	4.2MW	2021-01-17 04:01:27	nc73512355	○	☐
57251	Santa Clara - 3-story Hospital	CGS	29.1	--	0.006	0.018	AlumRock	5.1MW	2022-10-25 18:42:02	nc73799091	○	☐
57251	Santa Clara - 3-story Hospital	CGS	84.4	--	0.005	0.026	TresPinos	4.4MW	2023-04-04 22:23:17	nc73866925	○	☐

M5.4 AlumRock Earthquake, 2007 Recorded at Sta 57251

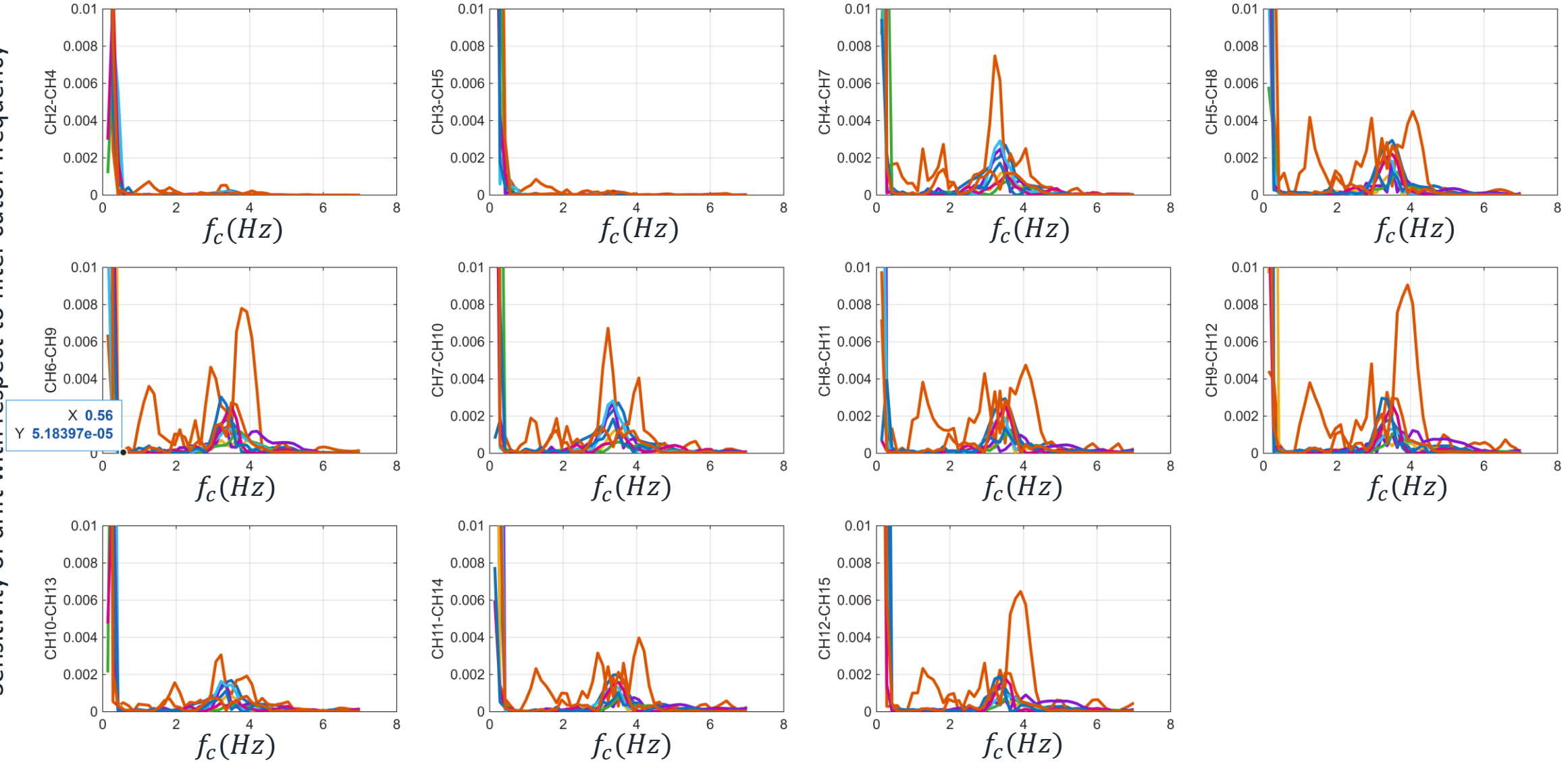


Natural frequency in EW and NS directions: 3.15 Hz

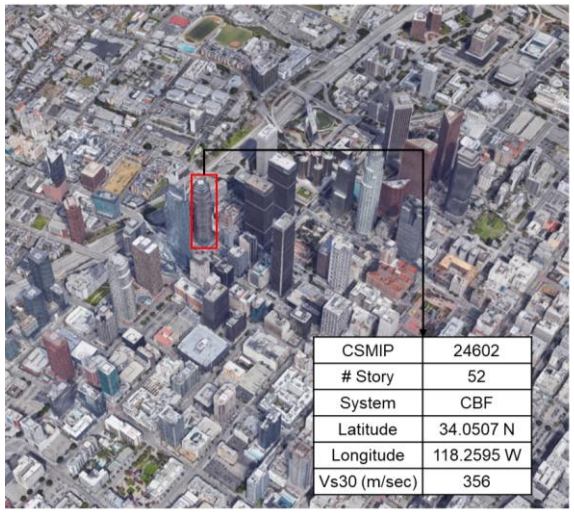
Drift Sensitivity For All Earthquakes Recorded at Sta 57251

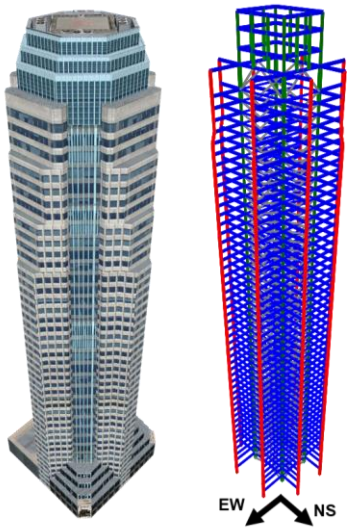
California Department of Conservation

Sensitivity of drift with respect to filter cutoff frequency



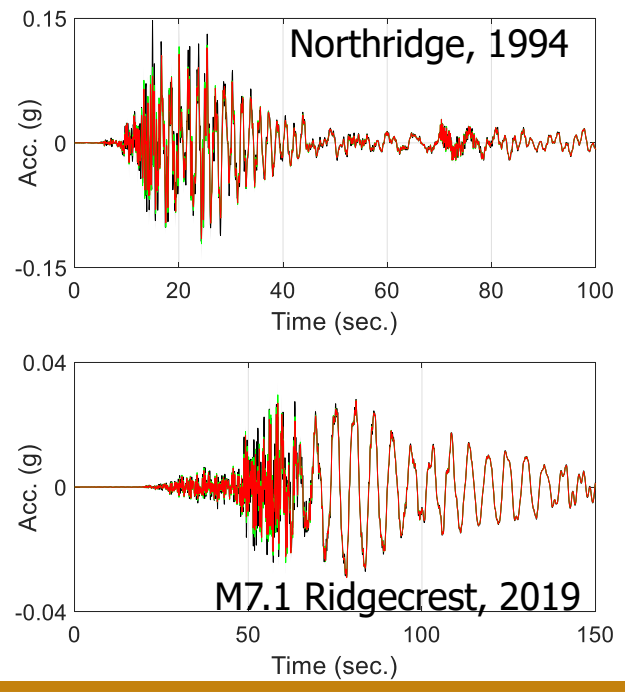
Response Reconstruction: Simulated Data

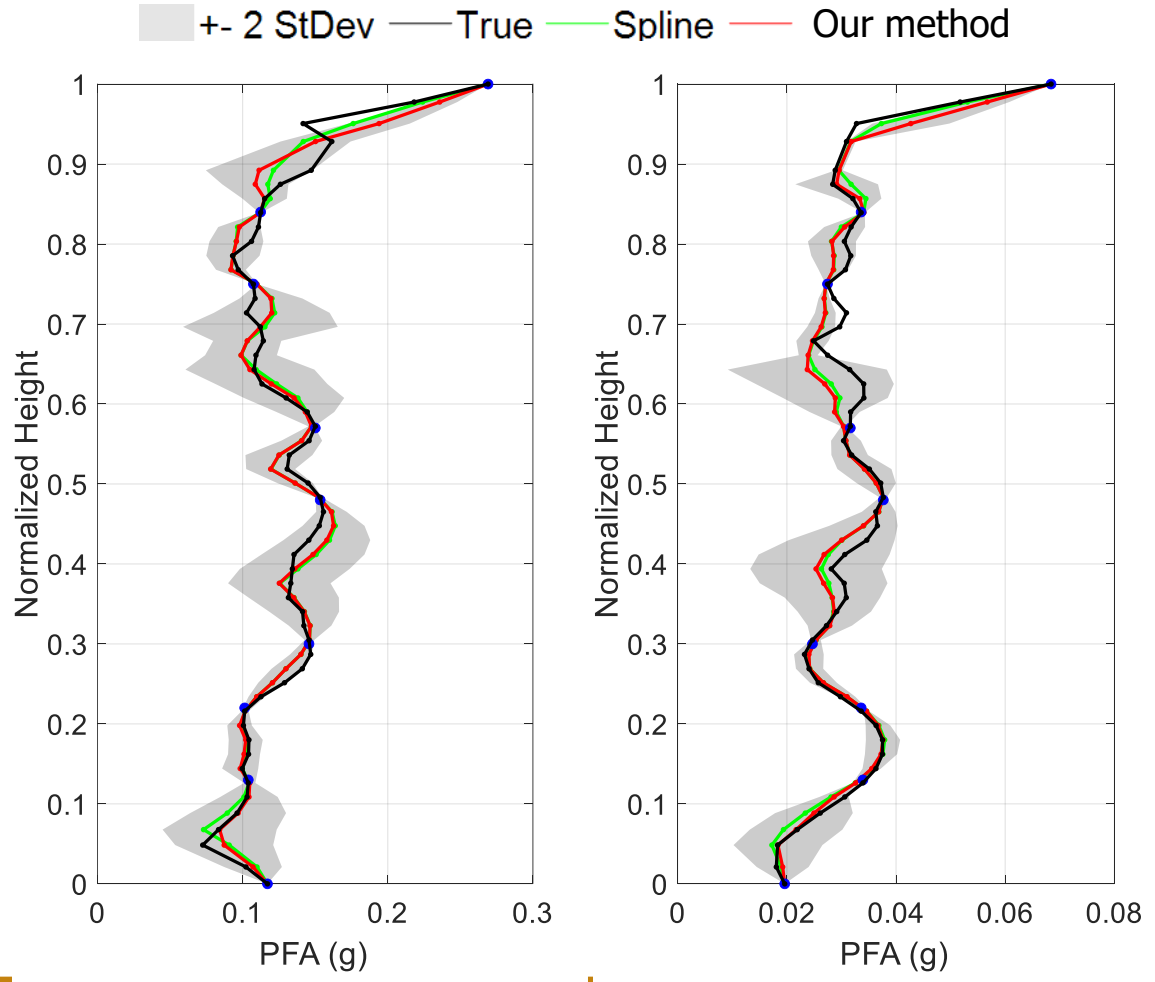




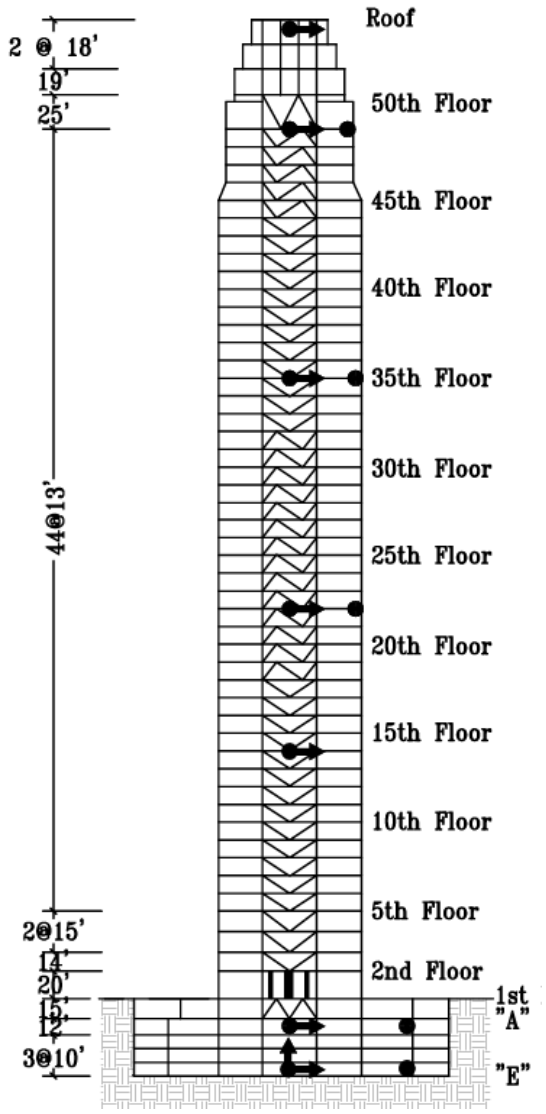
No.	Earthquake	Date/Time	Magnitude	Epicentral Distance (km)
1	Landers	6/28/1992 11:57	7.3 Ml	169
2	BigBear	6/28/1992 15:05	6.5 Ml	133
3	Northridge	1/17/1994 12:30	6.4 Ml	31
4	Chino Hills	7/29/2008 18:42	5.4 Mw	47
5	Ridgecrest	7/4/2019 17:33	6.4 MW	196
6	Ridgecrest	7/6/2019 3:19	7.1 MW	200

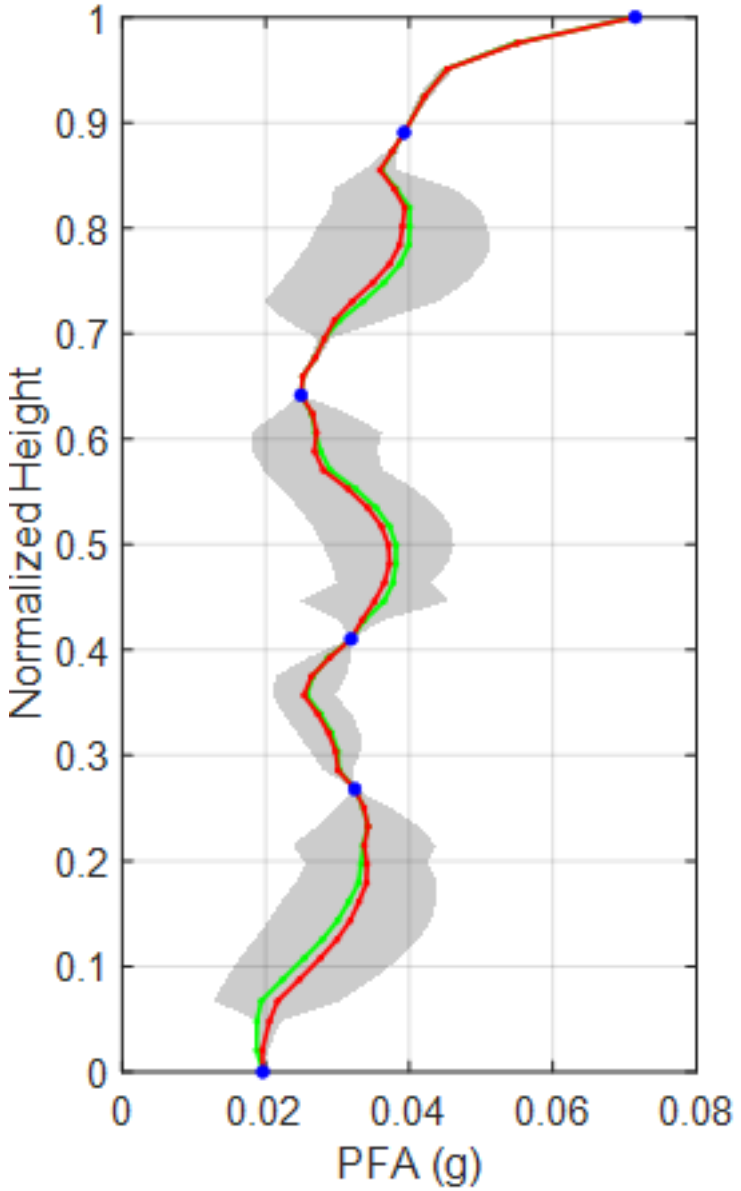
Examples of the reconstructed responses

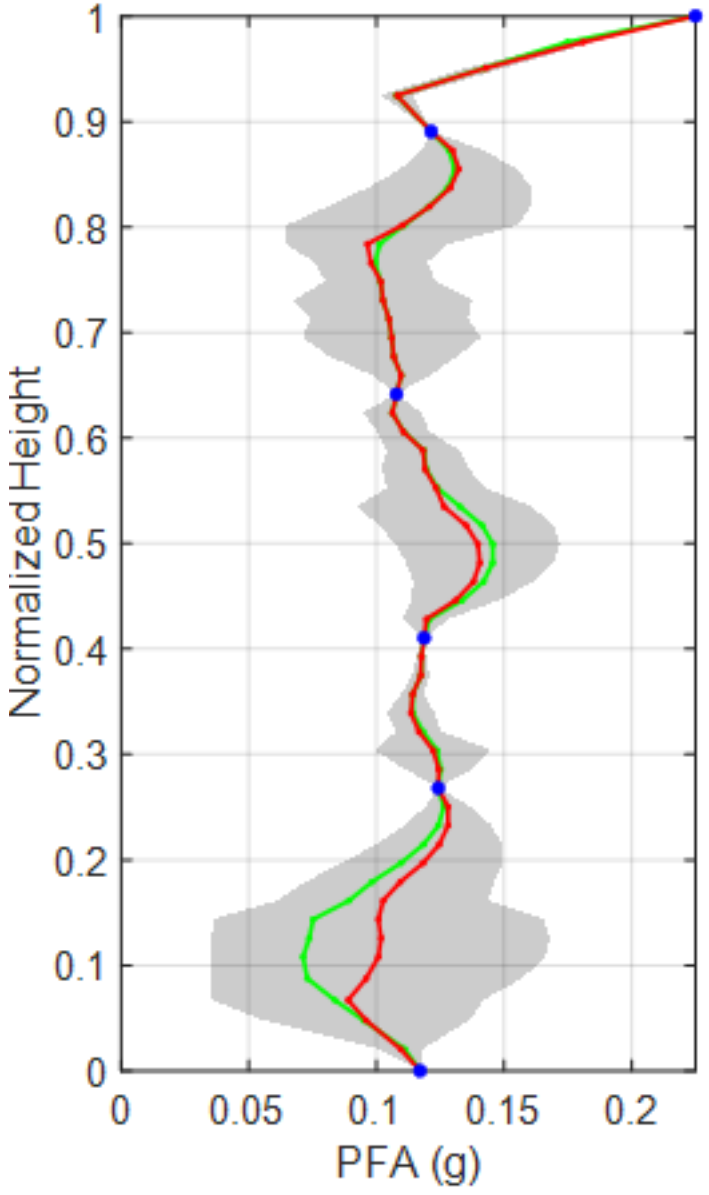


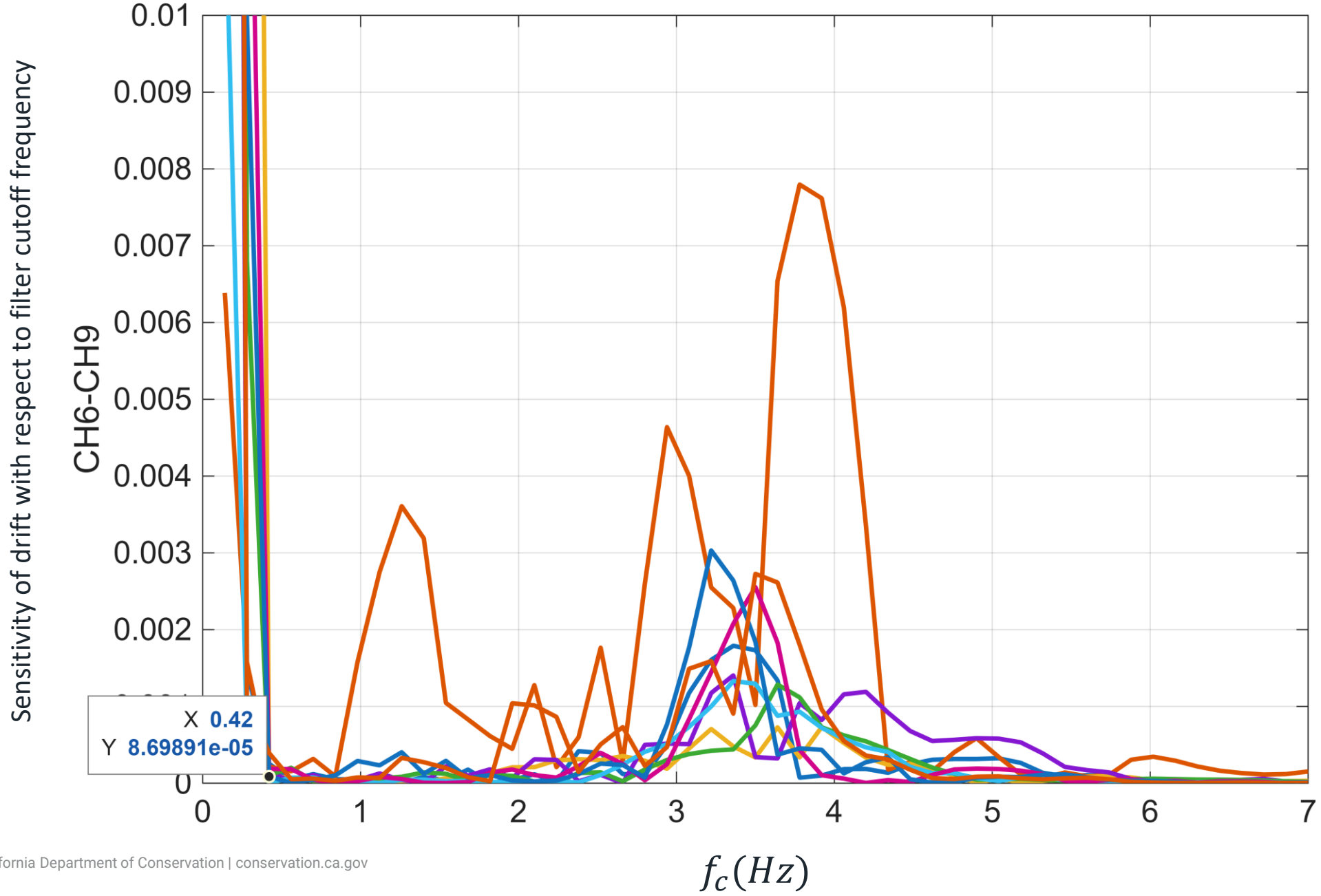


Response Reconstruction by Cubic Spline

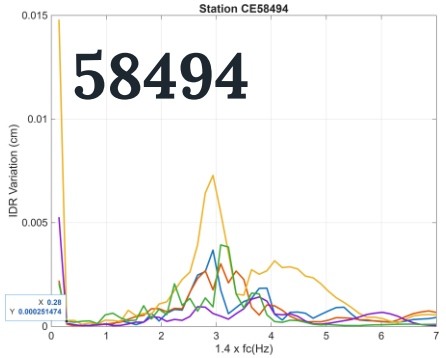


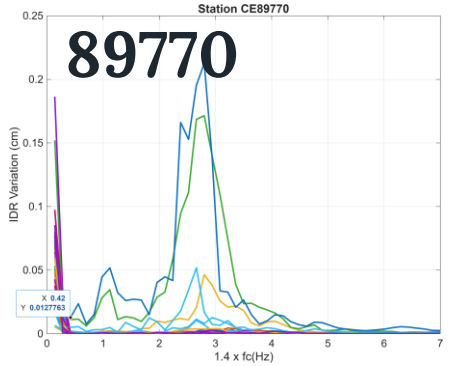


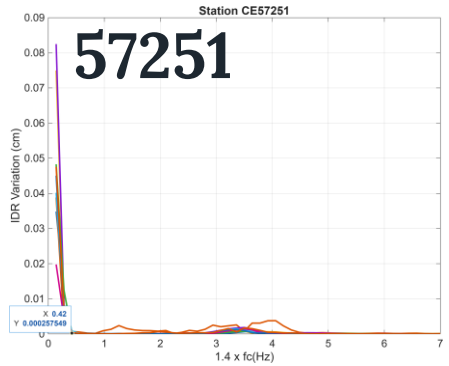


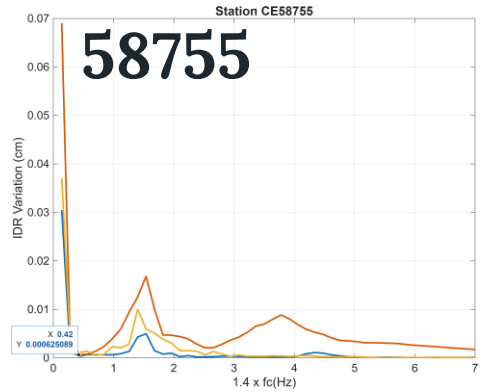

Sensitivity of drift with respect to filter cutoff frequency
CH6-CH9
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0
X 0.42
Y 8.69891e-05
0
1
2
3
4
5
6
7
$f_c(Hz)$

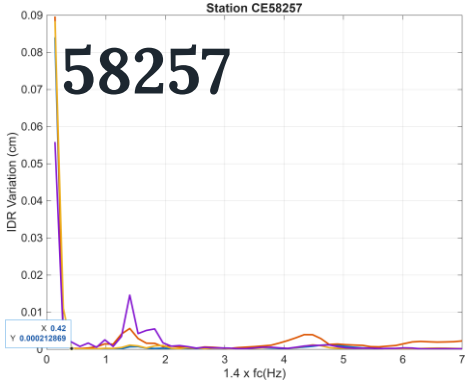
Drift Sensitivity for All Stations - Results are averaged across pairs/channels.

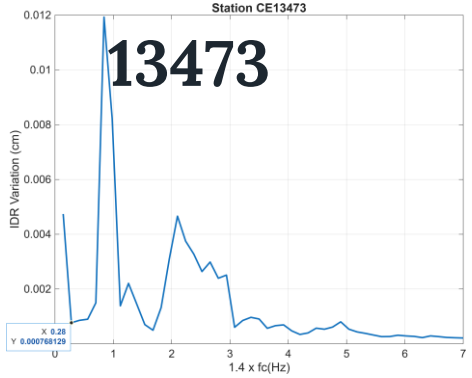


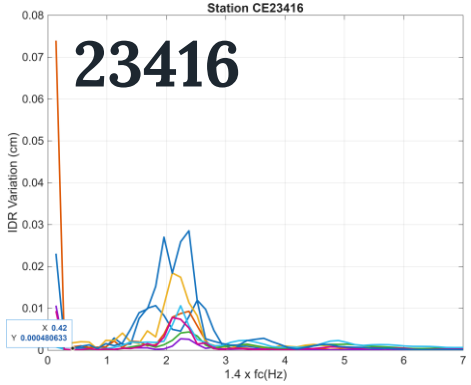


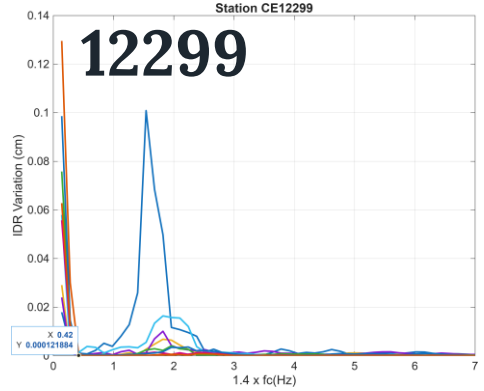


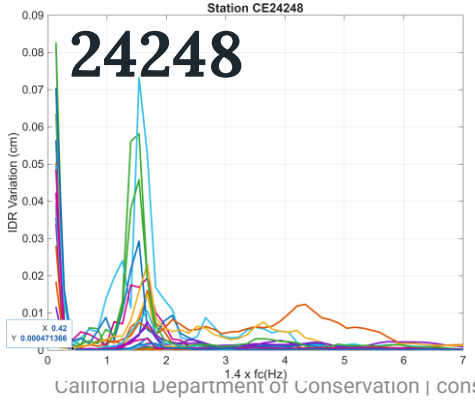












Item #5 Review of goals for Ad hoc Educational Opportunities to Advance Structural Health Monitoring by Hospitals Subcommittee meeting on January 29, 2026

- Discussion and public input

Facilitator: Courtney Johnson, PG, CEG, Principal Geologist, Slate Geotechnical Consultants; Committee Vice-Chair (or designee)

Ad hoc Educational Opportunities to Advance Structural Health Monitoring by Hospitals (ASHMH) Subcommittee

- First meeting held January 29, 2026
- Reaffirmed overarching subcommittee goal: Develop educational opportunities to advance utilization of structural health monitoring by hospitals using seismic instrumentation
- Towards achieving the goal, the subcommittee identified the following target deliverables:
  - Two-page summary – outreach document summarizing key findings in the Seismic Instrumentation of Healthcare Facilities white paper
  - How-to implementation guide for hospital owners and administrators
  - Webinar series outline, as a first step

Ad hoc Educational Opportunities to ASHMH Subcommittee

- Subcommittee identified the need for additional education:
  - Available systems and current technologies
  - Owner's factors such as operational needs and decision making for hospital administrators or emergency response planners
- These are necessary before attempting any modifications to the Seismic Instrumentation of Healthcare Facilities white paper – the earlier agenda item was part of that effort
- Subcommittee will incorporate the additional information in the target deliverables and will use it to evaluate the need for white paper modification, addendum, etc.

Item #5 Comments from the Public/Committee Members on Issues not on this Agenda

The Committee will receive comments from the Public/Committee Members. Matters raised at this time may be taken under consideration for placement on a subsequent agenda.

Facilitator: Martin Hudson (or designee)

Item #6 Adjournment

The next Instrumentation Committee meeting is scheduled for October 29, 2026.