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
Structural and Nonstructural Regulations Committee

AGENDA
March 12, 2025
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 1901, Los Angeles, CA 90071
Teams Meeting Access; Meeting ID: 298 749 800 623; Passcode: pD7kd9wC
Call in: (916) 535-0978; Phone Conference ID: 328 449 534#

Item #1 Call to Order and Welcome
Facilitator: Jim Malley, SE, Senior Principal, Degenkolb Engineers; Committee Chair (or designee)

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

Item #3 Triennial Code Cycle update and timelines on proposed amendments to the 2025 California Building Standards Code Title 24, Part 1, Part 2, and Part 10
- Discussion and public input.

Facilitator: Mia Marvelli, Architect, Supervisor; HCAI (or designee)

Item #4 Streamlining the use of existing OSHPD Preapproval Programs to align with the new nonstructural component force equation in ASCE 7-22.
- Discuss upcoming webinar
- Discussion and public input

Facilitator: Timothy Piland, SE, Senior Structural Engineer; HCAI (or designee)

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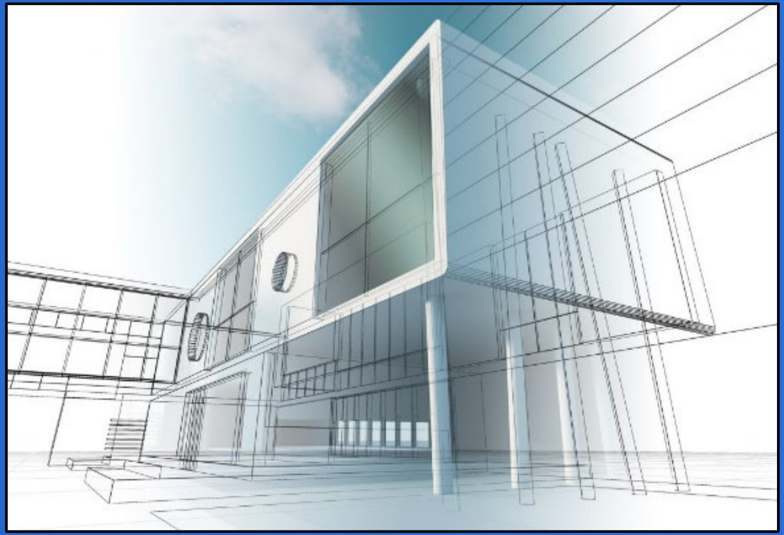
HBSB Structural and Nonstructural Regulations Committee

2025 Triennial Code Cycle update and timeline

March 12, 2025



2025 edition of Title 24

December 2024 & February 2025, CBSC approved the 2025 T-24 Code changes

July 2025, Publication of the 2025 Title 24

January 2026, Effective date of the 2025 Title 24

OSHPD has already started new code changes for the 2025 Supplement

OSHPD 2025 Timeline and HBSB Meetings

DUE TO CBSC

May 2025 CBSC Coordinating Council meeting

December 1, 2025 Submit all Parts of T-24

January – June 2025 identify code changes

July 2025 OSHPD DD & DDC review/approve

REVIEW BY HBSB/COMMITTEES

Sept. 10, 2025 (Codes and Process) CAC, CBC Vol. 1, CEC, CMC and CPC

Oct. 22, 2025 Struct & Non-Struct) CAC, CBC Vol. 2 and CEBC

Dec. 10, 2025 HBSB Full Board meeting

HCAi Department of Health Care Access and Information

ACTION ITEMS

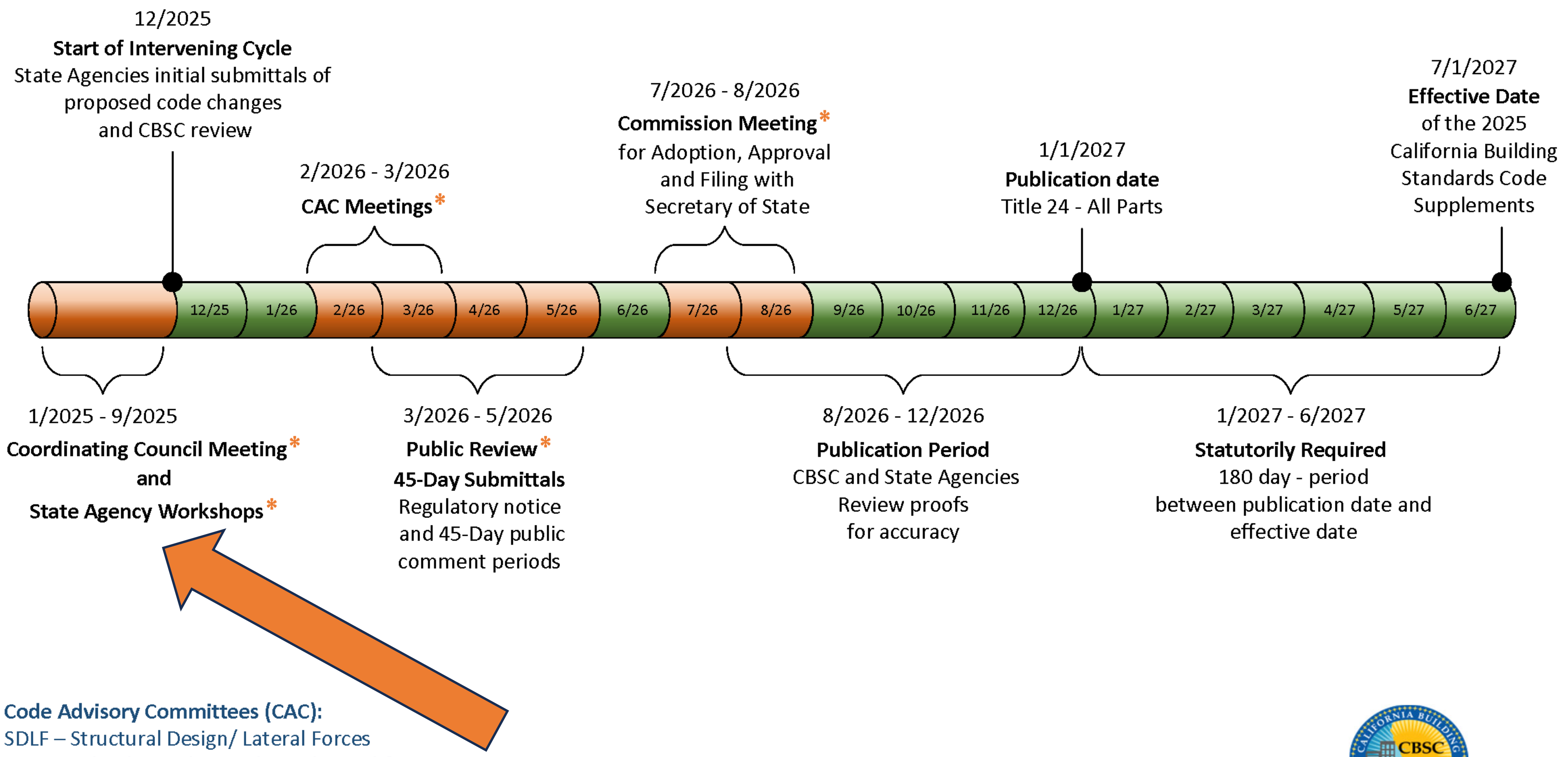
- Review TIA's
- Review updated reference standards
- Attend National codes and standards committees
- Assess new recent Legislation
- Ongoing list of T-24 questions, clarifications
- Stakeholder outreach/workshop
- Coordinate with state agencies (DSA & SFM)

2025 Intervening Code Adoption Cycle

California Building Standards Commission

Amendments to the 2025 California Building Standards Code, Title 24 Supplement July 1, 2027 Effective Date

* Public Participation Opportunity



Code Advisory Committees (CAC):
SDLF – Structural Design/ Lateral Forces
PEME – Plumbing, Electrical, Mechanical & Energy
HF – Health Facilities
GREEN – Green Building
BFO – Building, Fire & Other
ACCESS – Accessibility

dgs.ca.gov/BSC
(916) 263-0916

Rev. 01/2025
All dates are subject to change

- **2025 Title 24 Supplement**
- **December 2025 Submit all Parts to CBSC**
- **Supplement Publication Jan. 1, 2027**
- **Effective Date: July 1, 2028**
- [2025 Intervening Cycle]

2024-26 CODE ADVISORY COMMITTEES [Code Advisory Committees (ca.gov)]

Expand All

- ACCESSIBILITY COMMITTEE — ACCESS +
- BUILDING, FIRE & OTHER COMMITTEE — BFO +
- GREEN BUILDING COMMITTEE—GREEN +
- HEALTH FACILITIES COMMITTEE—HF +
- PLUMBING, ELECTRICAL, MECHANICAL & ENERGY COMMITTEE—PEME +
- STRUCTURAL DESIGN/LATERAL FORCES COMMITTEE—SD/LF +

Familiar faces:

Connie Christensen-HF Ex-Officio

Gary Dunger-HF

Belinda Young-HF

Bill Zellmer-HF & ACCESS

SUBSCRIBE TO CBSC'S MAILING LIST

Stay in touch with CBSC and receive meeting and public comment period notices, information bulletins, quarterly newsletters and more! Add your email address to our mailing list by visiting DGS' govDelivery Subscription Service webpage. After submitting your email, be sure to select the "CBSC Communications" topic on the next page. View our Privacy Policy for more information.

www.dgs.ca.gov/BSC/Contact

CBSC Rulemaking page

https://www.dgs.ca.gov/BSC/Rulemaking/2025-Intervening-Cycle

Item #4

Streamlining the use of existing OSHPD Preapproval Programs to align with the new nonstructural component force equation in ASCE 7-22

- Discuss upcoming webinar
- Discussion and public input

Facilitator: Timothy Piland, SE, Senior Structural Engineer; HCAI (or designee)

Upcoming Webinar: Streamlining OSHPD Preapproval Programs to ASCE 7-22

ASCE 7-22 will be incorporated into the 2025 CBC, with significant changes to the seismic horizontal nonstructural component lateral forces within Chapter 13.

Specifically, Eqn 13.3-1 (F_P), Table 13.5-1 Architectural Components and Table 13.6-1 Mechanical and Electrical Components.

The changes reflect a more refined approach to the behavioral response of nonstructural components in a major seismic events, via testing and the collaborative efforts of the ASCE 7-22 Seismic Committee.

DEPARTMENT OF HEALTH CARE ACCESS AND INFORMATION
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR HCAI PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM)	OFFICE USE ONLY APPLICATION #: OPM-0669

HCAI Preapproval of Manufacturer's Certification (OPM)

Type: [X] New [ ] Renewal/Update

OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)	OFFICE USE ONLY APPLICATION #: OSP-0699

OSHPD Special Seismic Certification Preapproval (OSP)

Type: [X] New [ ] Renewal

Adaptation of New ASCE 7-22 to OSHPD Preapproval Programs

Confused?

Need assistance?

Webinar

Wednesday, April 9th, 2025

HCAI
Department of Health Care Access and Information

CBC 2025 Changes to HCAI Preapprovals (ASCE 7-22 Chapter 13)

Wednesday, April 9, 2025
10:00 – 11:30 a.m., Pacific Time

This webinar will focus on the application of the revised *Fp* used in the design of nonstructural components within ASCE 7-22 Chapter 13, for both new and existing HCAI preapprovals:

- **Changes to the seismic design force, *Fp* from ASCE 7-16 to 7-22.**
- **Review of new variables introduced in Chapter 13, Equation 13.3-1.**
- **Application of the horizontal seismic design force *Fp* to both existing and new preapprovals.**
- **OPM and OSP Preapproval examples and new requirements.**

HCAI SPEAKER

Timothy J. Piland
Sr. Structural Engineer
Structural Support Unit
HCAI/OSHPD

For more information or questions, contact kelie.zimmer@HCAI.ca.gov

REGISTRATION AND INSTRUCTIONS

Fee: *Complimentary*

To Register: Click here if you would like to attend. Upon registration, you will receive a confirmation email with Login Instructions.

Note: Multiple staff members from one office should register INDIVIDUALLY to receive separate log-ins.

A *certificate of completion* will be emailed from GoToWebinar to registered attendees who log-in and attend the day-of webinar. Certificates ***will not*** be available from HCAI.

AIA 1.5 HSW Learning Unit (LU) (pending AIA approval).

The presentation is accessed through GoToWebinar. If necessary, it is suggested that you download the app and install in advance of the webinar.

Who Should Attend?

Architects, Structural and Mechanical Engineers, Inspectors of Record, Manufacturers, and others interested or involved in HCAI nonstructural component preapprovals.

Item #5 Proposed Policy Intent Notice (PIN) 77 for Steel Quality Assurance (QA) and Quality Control (QC)

- Discussion and public input

Facilitator: Mohammad Karim, PhD, SE, Supervisor, HCAI (or designee)

Item #6 New automated Seismic Compliance Project portal to facilitate submittals of updated compliance plans

- Discussion and public input

Facilitator: Ali Sumer, PhD, SE, Supervisor, HCAI (or designee)

Seismic Compliance Plan Application

- All general acute care facilities shall submit a compliance plan by January 1, 2026 (2025 California Administrative Code Chapter 6, Section 1.4.5)
- The 2030 compliant facilities (all general acute care buildings in a facility having SPC 3/4/4D/5 and NPC 5 ratings) are not required to submit a compliance plan application.

Seismic Compliance Plan Application

- Seismic Compliance Plan is **NOT** a drawing or calculations or an evaluation.
- Seismic compliance plans **outline** the details for how each building in the facility will achieve seismic compliance by the proposed completion date.
- The information includes types of compliance solutions, such as retrofitting a building or removing acute care services, with associated timelines and related project numbers, if any, for each building.

Seismic Compliance Plan – Change in Plans

California Administrative Code Part 1 Chapter 6 Section 1.4.5 requires:

> *A change to an approved Compliance Plan shall be submitted by a hospital owner when the method or schedule to achieve compliance changes.*

HCAI has not received compliance plan updates from many facilities in the last 24 years.

Seismic Compliance Plan

- First submittals were due 2001.
- The required info is still the same, just different submittal process.
- 2001 → paper submittal → pdf submittal → 2025 automated submittal

1.4 Compliance plans. A compliance plan shall be prepared and submitted for each building subject to these regulations. All general acute care hospital owners shall formulate a compliance plan which shall indicate the facility's intent to do any of the following:

1. Building retrofit for compliance with these regulations for continued acute care operation beyond 2030;
2. Partial retrofit for initial compliance, with closure or replacement expected by 2002, 2008, 2013 or 2030;
3. Removal from acute care service with conversion to nonacute care health facility use; or
4. No action, building to be closed, demolished or replaced.

This plan must clearly indicate the actions to be taken by the facility and must be in accordance with the timeframes set forth in Article 2 (Structural Performance Category-"SPC") and Article 11 (Nonstructural Performance Category-"NPC") of the Seismic Evaluation Procedure regulations.

2. All site, architectural, and engineering plans shall be formatted on 11- by 17-inch sheets (folded to 8½ by 11 inches);
3. Larger sheets, if required to clearly describe the requested information, shall be appended to the compliance plan; and
4. Other supporting documents in addition to those meeting the minimum requirements of Section 1.4.4 may be appended to the compliance plan.

1.4.2 Compliance plan submittal. Hospital owners shall submit the compliance plan to the Office by January 1, 2001, unless the owner requests an extension pursuant to Section 1.4.3. The hospital owners shall submit the compliance plan in accordance with Section 7-113, "Application for Plan or Report Review" and Section 7-133, "Fees" of Article 3, Chapter 7, Part 1, Title 24.

1.4.3 Compliance plan submittal extension. Hospital owners may request an extension from the Office for submission of the compliance plan. Any hospital owner requesting an extension for submittal of the compliance plan shall make such request in writing to the Office up to 180 days prior to, but no later than January 1, 2001. The compliance plan must be submitted no later than January 1, 2002. All hospital owners requesting an extension for submittal of the compliance plan shall certify to OSHPD that all hospital buildings continuing acute care operation beyond January 1, 2002 meet the standards of NPC 2 by January 1, 2002.

1.4.4 Compliance plan requirements. Each compliance plan shall contain the following elements:

1. An Existing Site/Campus Description;
2. A Compliance Plan Description;
3. A Compliance Site Plan;
4. A Compliance Plan Schedule; and
5. An Existing and Planned Buildings Matrix.

1.4.4.1 Existing site/campus description. If the compliance plan is submitted separately from the seismic evaluation, it will be necessary to resubmit the information as specified in Section 1.3.4.5, of the Nonstructural Evaluation Report.

1.4.4.2 Compliance plan description. Provide a comprehensive narrative description of the Compliance Plan, including the projected schedule for compliance.

1.4.4.3 Compliance site plan. Provide Compliance Site Plans, indicating the configuration of the facility at the 2008 and 2030 milestones. The plans shall indicate conforming and nonconforming buildings and identify the final configuration of the facility at each milestone, after completion of compliance measures.

1.4.4.4 Compliance plan schedule. Provide a bar graph schedule which describes the schedule for compliance with the SPC and NPC seismic performance categories, indicating the schedule of the following major phases of the plan:

1. Obtain a geotechnical report (if necessary);
2. Architecture and engineering design/construction document preparation;
3. Local approvals;
4. Office review, approval and permitting;

BUILDING NAME/ DESIGNATION	BUILDING TYPE (per Section 2.2.3)	SPC existing	SPC planned	NPC existing	NPC planned

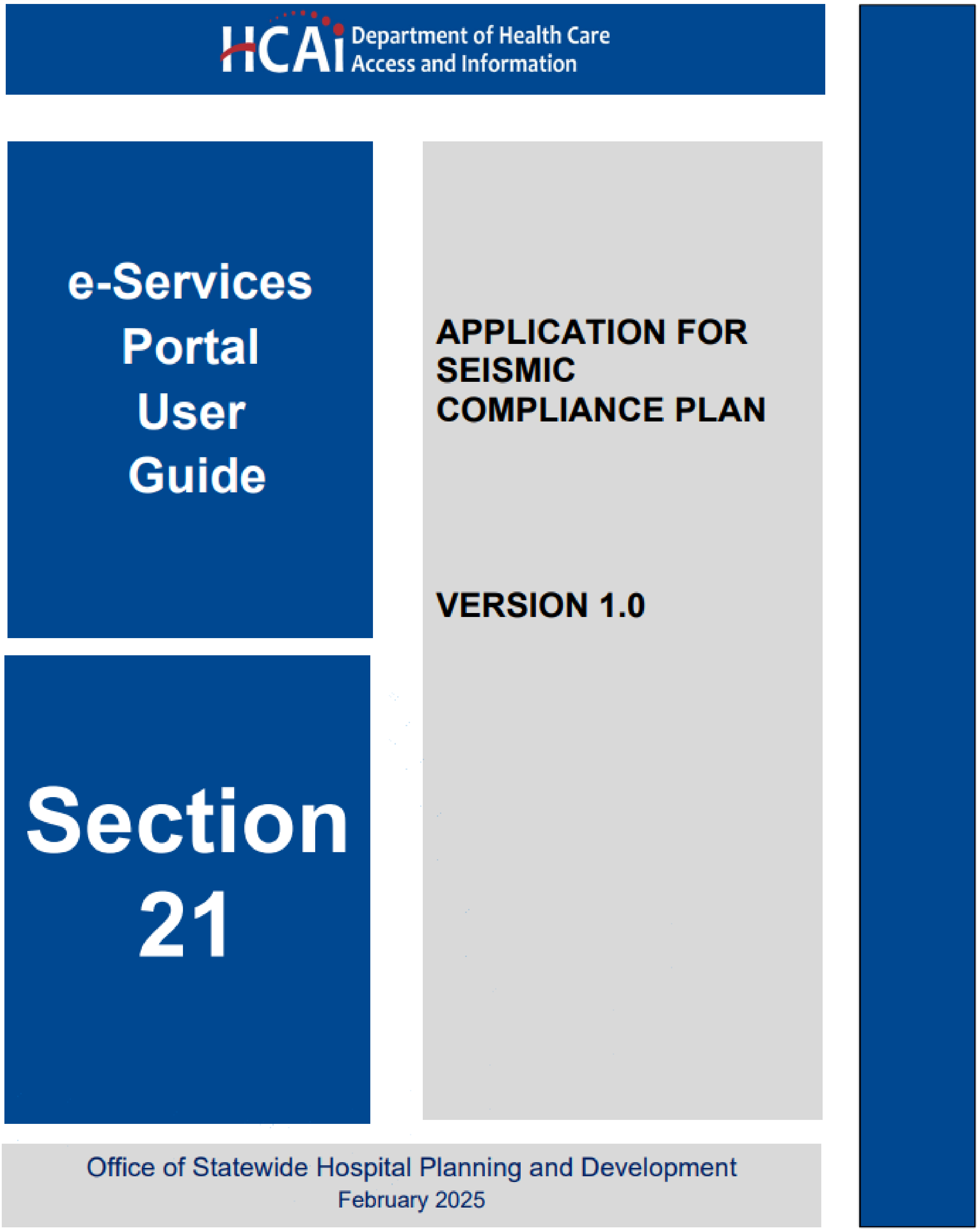
5. Approval of Department of Health Services Licensing and Certification, and any other required licensing;
6. Permanent relocation of acute care services to other buildings or facilities (identify services affected);
7. Temporary/interim relocation of acute care services to other buildings including the duration of the approved program flexibility plan pursuant to Health and Safety Code Section 1276.05;
8. Construction period; and
9. Beneficial occupancy.

BUILDING NAME/ DESIGNATION	OSHPD (or local building) permit date/ number	GOVERNING BUILDING CODE	CONSTRUCTION COMPLETION DATE	BUILDING TYPE (per Section 2.2.3)	SPC	NPC

Seismic Compliance Plan Application

- Seismic compliance plan applications are projects which are submitted to HCAI via the *eServices Portal (eSP)*.

- For step-by-step instructions on how to submit a seismic compliance plan application see User Guide 21 Application for Seismic Compliance Plan Review.



Overview of Seismic Compliance Plan

There are two main tables

- **Compliance Method**: Outlines method of compliance for each building
- **Building Milestones**: Outlines critical and regular milestones for each building

The rest of the application is about facility ownership, applicant contact info, etc.

Overview of Seismic Compliance Plan: **Compliance Method**

- Compliant
- Demolish building
- Relocate services to other existing compliant building
- Replace services to NEW building
- SPC retrofit
- NPC retrofit
- SPC and NPC retrofit

Facility will see HCAI comments here

		Building No.	Building Name	Current SPC Rating	Current NPC Rating	Compliance Type	Narrative	Seismic Compliance Related Project Numbers	HCAI Note	
☐	⚠	BLD-00317	Cancer Research Institute (Ezralow Tower)	3	3					Actions ▾ Edit
☐	⚠	BLD-03689	Topping Tower	5	2					Actions ▾

Edit Selected

Overview of Seismic Compliance Plan: **Building Milestones (max 10 per bldg)**

- Compliant Building
- Evaluation Report Submittal
- Material Testing Report Submittal
- Construction Project Submittal
- Permit Issuance
- Construction Commencement
- Construction Milestone
- Construction Final
- NPC 4/4D Construction Document Submittal
- NPC 4/4D Permit Issuance
- NPC 5 Construction Document Submittal
- NPC 5 Permit Issuance
- N/A

i. Completed

ii. In Progress

iii. Not Started

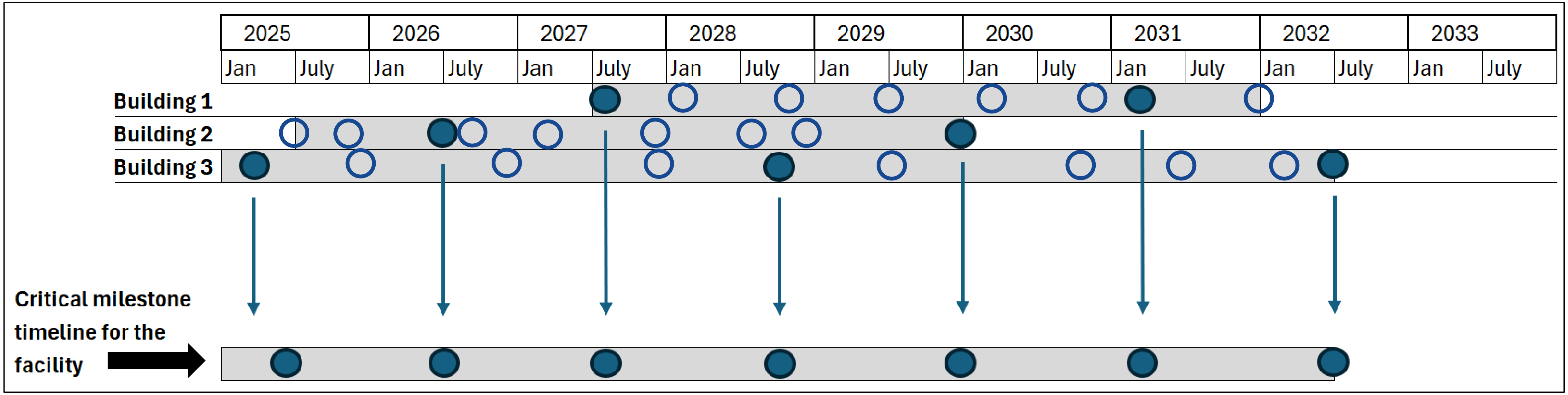
Facility will see HCAI comments here

BUILDING MILESTONES

Edit

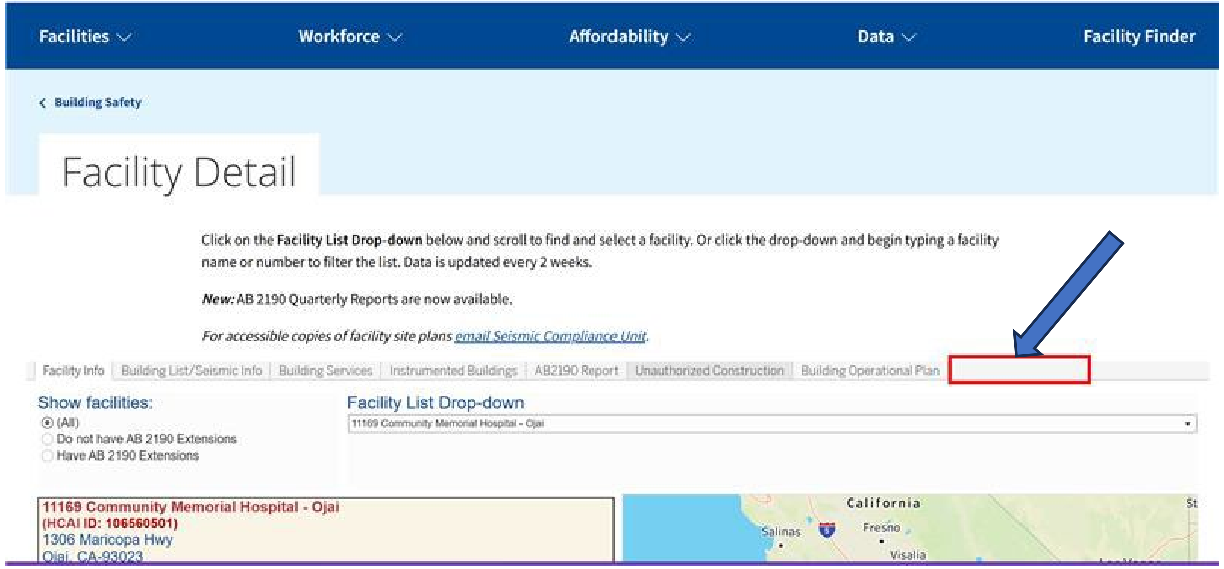
Building No.	Milestone Type	Description	Critical Milestone	Completion Date	Status	Related Project Numbers	HCAI Note	HCAI Determination
BLD-00317	Evaluation Report Submittal	NPC 5 Evaluation report submitted in December 21, 2023	No	12/22/2023	Completed	SRU-2023-00863		

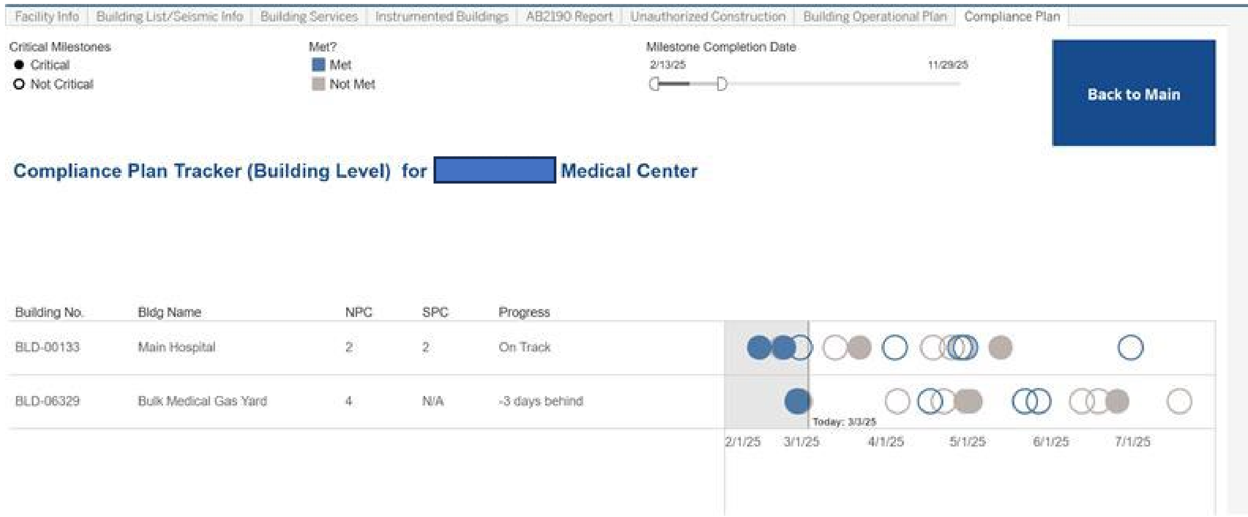
Critical vs Regular Milestones



Publication of Compliance Plans on HCAI Website

When approved, remarked or denied, compliance plan will be published on the HCAI Facility Detail page for each facility





Item #7 Advisory Guide: A13 – NPC Upgrade Construction Process for Existing Ceilings and Above Ceiling Utilities

- Discussion and public input

Facilitator: Ali Sumer (or designee)

HCAI
Department of Health Care Access and Information

Advisory Guide

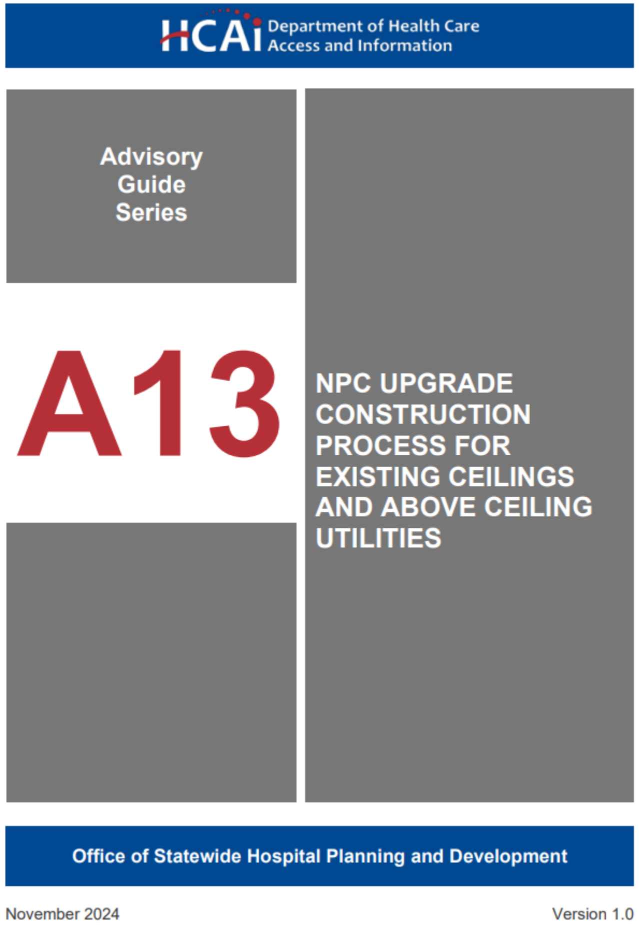
A13

NPC UPGRADE CONSTRUCTION PROCESS FOR EXISTING CEILINGS AND ABOVE CEILING UTILITIES

HBSB SNSR

03/12/2025

Purpose


HCAi Department of Health Care Access and Information

Advisory Guide Series

A13

NPC UPGRADE CONSTRUCTION PROCESS FOR EXISTING CEILINGS AND ABOVE CEILING UTILITIES

Office of Statewide Hospital Planning and Development

November 2024 Version 1.0

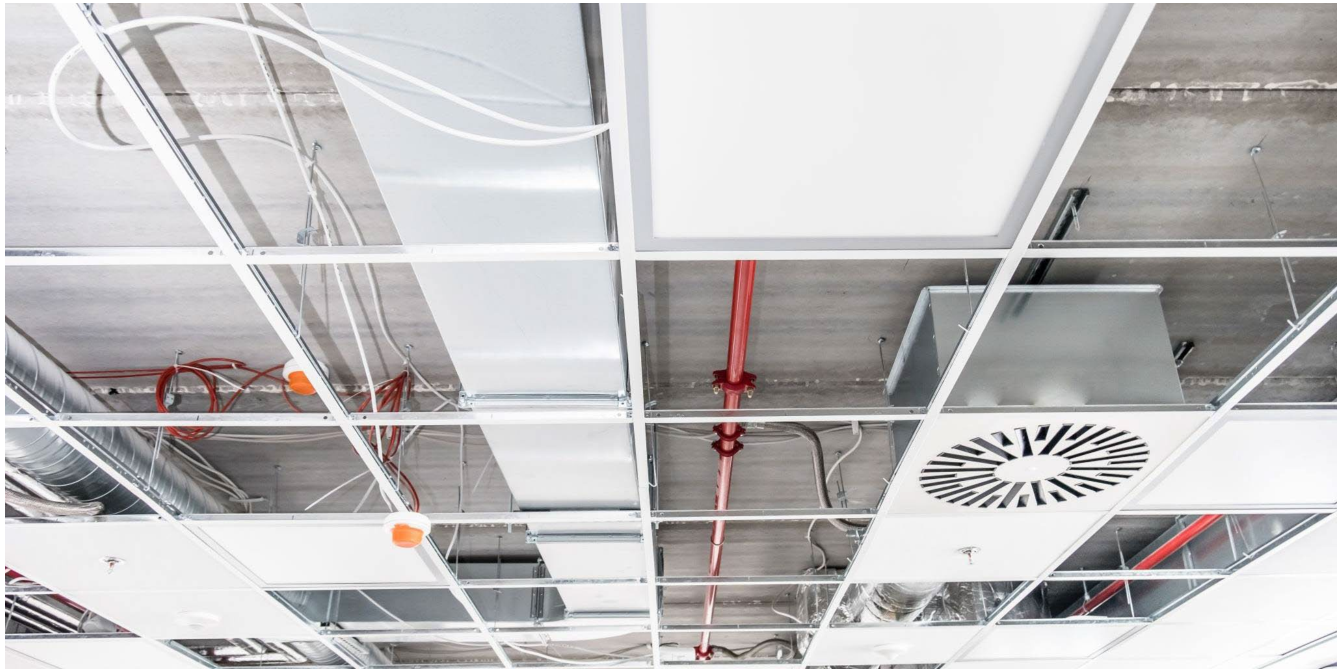
- For buildings not constructed under an OSHPD permit (or pre-1982/83, information regarding the layout and bracing conditions of utilities above ceilings is limited or incorrect.
- Surveying these utilities disrupts hospital operations
- Advisory Guide is to minimize disruption and expedite NPC upgrade construction for components at or above ceilings.

Click here: A13 Guide

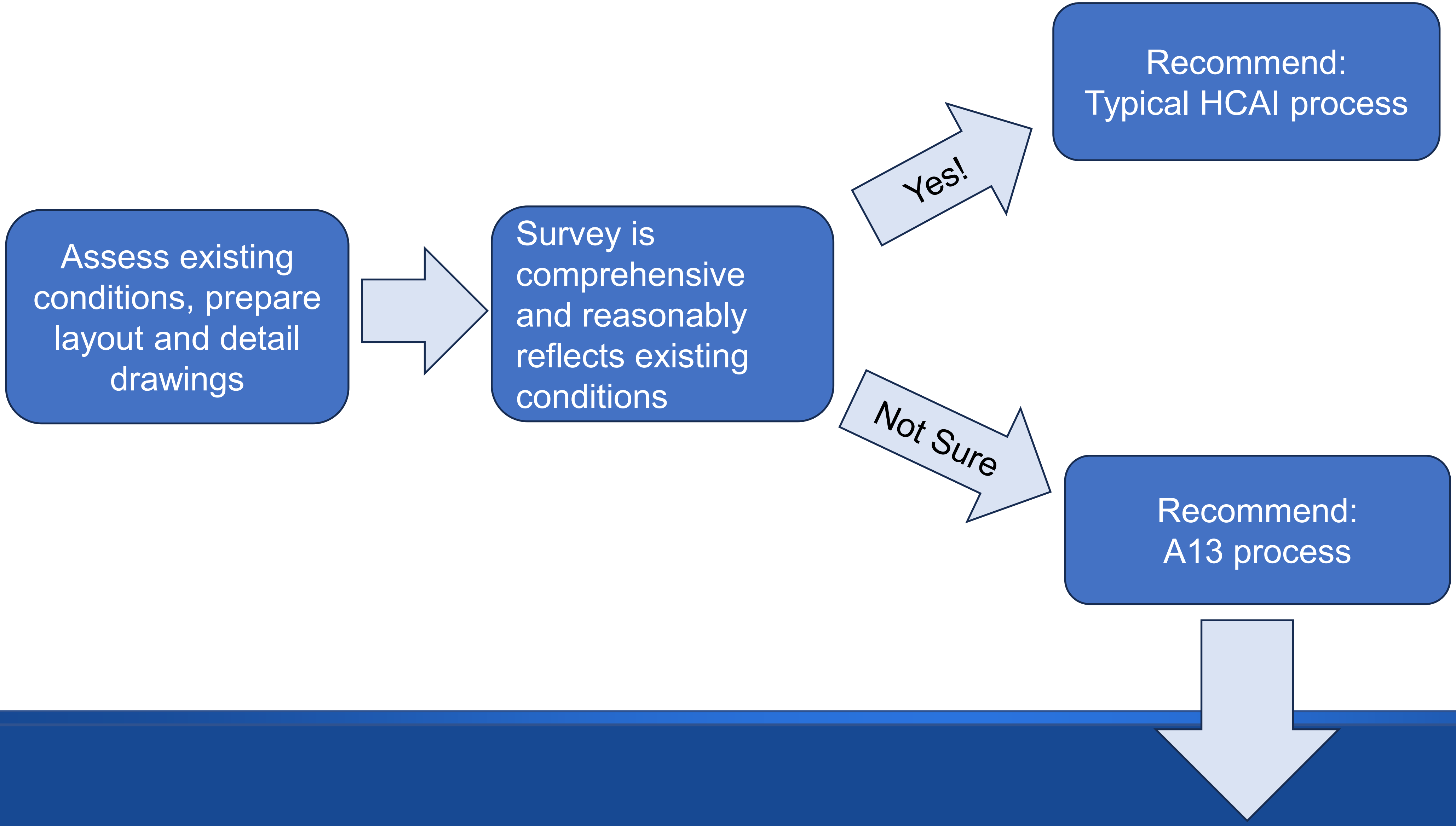
Scope

- Advisory Guide is solely on the NPC upgrade of existing components and systems at or above ceilings.

- Advisory Guide does not apply to wall-mounted equipment, floor-mounted equipment, new equipment, systems and utilities, or deferred submittals.



DPOR Question: When should I use A13?



Gather existing drawings, prepare typical details specific to the building.

Split scope area into several areas for each milestone. Put it in TIO.

HCAI region approval and permit. Project is set T&M.

On-Site First Assessment (Milestone 1): DPOR, contractor, IOR - First area observation with HCAI DSE or CO.

Every step, take lots of photos. DPOR maintains the record. As-builts (record set) shall be up to date.

DPOR makes bracing decisions. NMA or ACD

Prepare as-built of the area, may close the ceiling.

Milestone 1+n: HCAI staff may spot check bracing decisions of previous areas, photos, as-builts.

Finish all work. Upload the as-builts (record set) to the region project. No approval required.

Construction Final

Item #8 Seismic compliance update on recently signed legislation: AB 869 (Chapter 801), and PIN development

- Discussion and public input

Facilitator: Ali Sumer (or designee)

Department of Health Care Access and Information

Seismic Compliance Plan and Delays Beyond the 2030 Deadline

Ali Sumer, Seismic Compliance Unit Supervisor

March 12th, 2025

Recent / Upcoming HCAI Seismic Webinars

- February 20, 2025 - Seismic Grant: Small and Rural Hospital Relief Program
- March 4, 2025 - Seismic compliance plan and delays beyond the 2030 deadline
- March 18, 2025 - NPC compliance
- March 27, 2025 - Water rationing plan
- April 2, 2025 - SPC compliance

What is the overall summary?

- Seismic Compliance Plan Application (new interface, old requirement)
  - Two brief tables that identifies seismic scope and schedule to achieve compliance
  - Required for ALL hospitals, deadline to submit 1/1/2026.

- Delay application (AB 869)
  - A final compliance date between 1/1/2030 and 1/1/2033 (matching Seismic Compliance Plan application final date on the schedule)
  - Verifies eligibility with required documentation
  - Only eligible hospitals can apply, deadline to submit 1/1/2026

Submit a seismic compliance plan & a delay application by 1/1/2026.

HSC Section	AB 869 High-Level Summary
130065.1(b)	Authorizes an up to 3-year delay of the 2030 seismic compliance deadline for a **Distressed Hospital Loan Program Recipient**, a **small hospital**, a **rural hospital**, a **critical access hospital** or a health care **district hospital** (with some exceptions) and subject to securing HCAI approval of a seismic compliance plan and if necessary, an NPC-5 evaluation report.
130065.1(d)(1)	To secure a delay, if necessary, the hospital must have submitted the **NPC-5 evaluation report** no latter than January 1, 2025, for each noncompliant building.
130065.1(d)(2)	To secure a delay, the hospital must submit a **seismic compliance plan** no later than 1/1/26 with steps (and milestones) to achieve compliance at the earliest reasonable date, but no later than 1/1/33. HCAI must approve or deny the compliance plan within 120 days. If denied, hospitals can remedy the deficiencies.
130065.1(d)(3)	Hospital and HCAI-identified **milestones** will be used as the basis for determining whether the hospital is making adequate progress toward the compliance deadline.
130065.1(e)	HCAI has the **discretion** to delay compliance with seismic safety standards for an **additional 2-years** for eligible hospitals that continue to experience financial distress or for circumstances beyond their control.
130065.1(g)&(i)	If a hospital misses a milestone or the deadline, HCAI has the authority to assess **fines** and **delay issuing permits** for non-seismic related construction.

HCAI's Efforts to Implement AB 869

- Upon chaptering, HCAI began to develop regulations to implement AB 869.
- Regulations issued for public comment in early November as Part of the Triennial Code Cycle update to the 2025 California Building Standards Code.
- Proposed changes to the administrative code reviewed during the December Hospital Building Safety Board meeting.
- HCAI sent letters to potential eligible facilities (about 130 facilities) for awareness.

HCAI’s Efforts to Implement AB 869

- The California Building Standards Commission gave final approval (February).
- Final Express Terms were filed with the Secretary of State on February 27, 2025
- Regulations will become effective (30-days after filing) March 29, 2025.
- **HCAI PIN 80** published March 4, 2025 outlining implementation.
- Streamlined seismic compliance plan application opened
- New seismic delay application opened

PIN 80 - Seismic Compliance Plan, and AB 869 Delays Beyond 2030 Deadline

- PIN 80 outlines the implementation of the regulations for seismic compliance delay as required by Assembly Bill 869.
- A streamlined seismic compliance plan application has been introduced in PIN 80.
- The rollout of this automated seismic compliance plan is done in conjunction with the AB 869 delay application, since the delay to the 2030 deadline requires close monitoring of the seismic compliance progress.
- Tracking of progress is now centralized through the seismic compliance plan application.

PIN 80 - Policy

- All general acute care facilities shall submit a compliance plan by January 1, 2026 (2025 California Administrative Code Chapter 6, Section 1.4.5)
- Hospitals seeking a delay shall **submit a seismic compliance plan and a delay application to HCAI no later than January 1, 2026**.
- The 2030 compliant facilities (all general acute care buildings in a facility having SPC 3/4/4D/5 and NPC 5 ratings) are not required to submit a compliance plan application.
- If a delay is approved, the additional time is valid for the entire facility provided that the approved schedule for each building is reasonably achieved over the course of the compliance plan timeline.

Check Facility Status

- There are several ways to check facility types individually on HCAI website. However, to see the entire list please visit Report Center – HCAI [report.hcai.ca.gov]
  - Choose Office of Statewide Hospital Planning and Development & AB 869 Eligibility Summary list and press “Go” [Wait 5-10 seconds to generate]

HCAI Report Center

Office of Statewide Hospital | AB 869 Eligibility Summary | Go

Select Facility(s) 10006 - Orchard Hospital,10009 -

Select One From Below: All

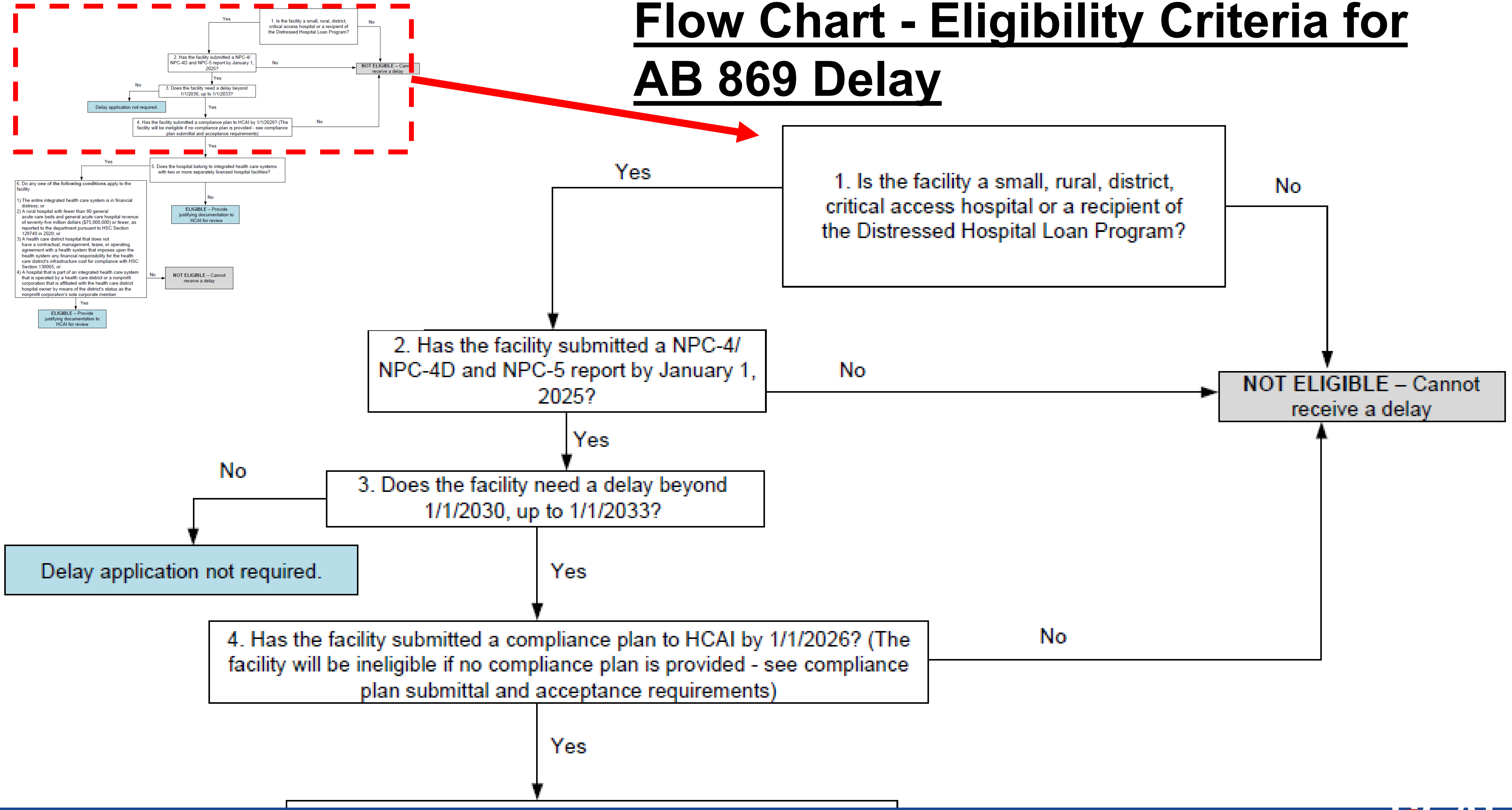
1 of 1 | 100% | Find | Next

AB 869 Eligibility Summary

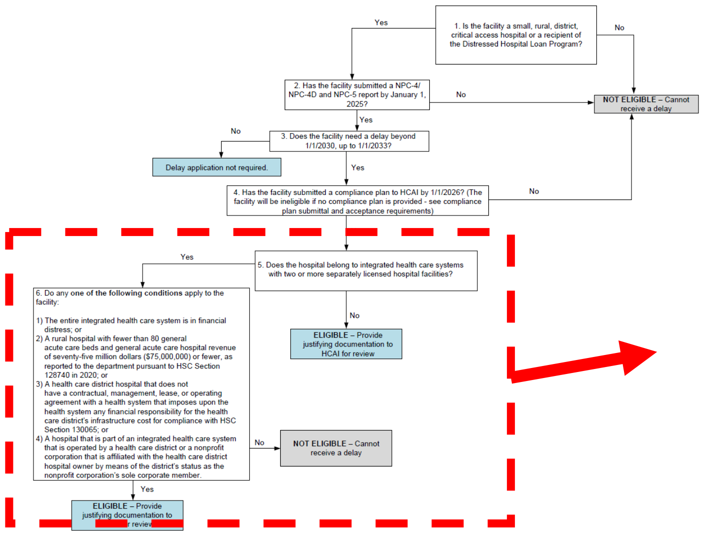
HSC - Health & Safety Code
MSSA - Medical Service Study Areas
DHLP - Distressed Hospital Loan Program

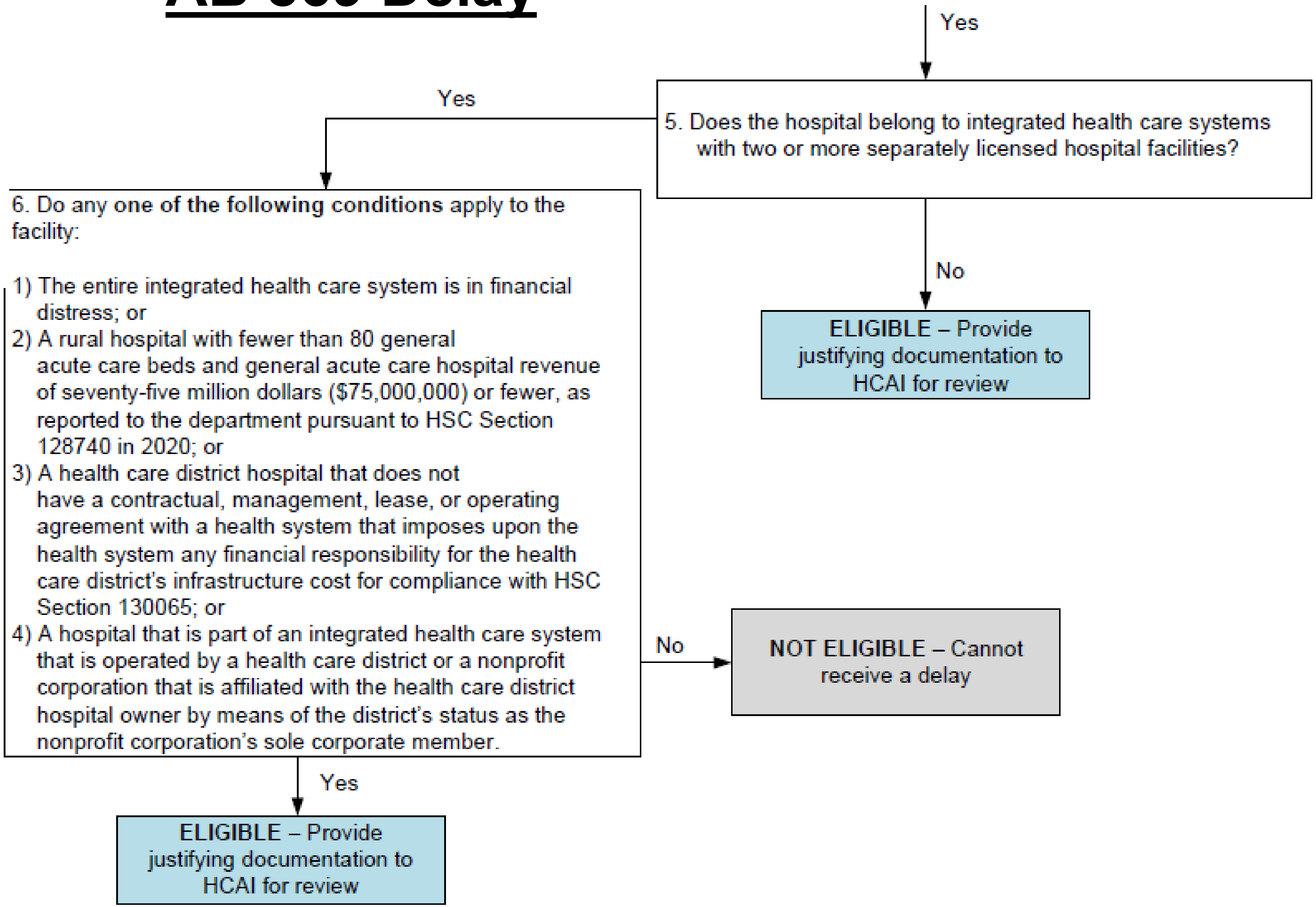
Facility	County Code	MSSA Rural Frontier	Rural 80 Beds under 75 Million	Beds 50 or Less	HSC 1250 Rural	DHLP	Compliant 2030	NPC Submittal	District
10019 - Oroville Hospital	04 - Butte	Yes						Submitted	
10029 - Mark Twain Medical Center	05 - Calaveras	Yes	Yes	Small	Yes			Submitted	District
10032 - Colusa Medical Center	06 - Colusa	Yes	Yes	Small	Yes			Not Submitted	
10109 - Barton Memorial Hospital	09 - El Dorado	Yes			Yes			Submitted	
10112 - Marshall Medical Center	09 - El Dorado	Yes			Yes			Submitted	

Flow Chart - Eligibility Criteria for AB 869 Delay

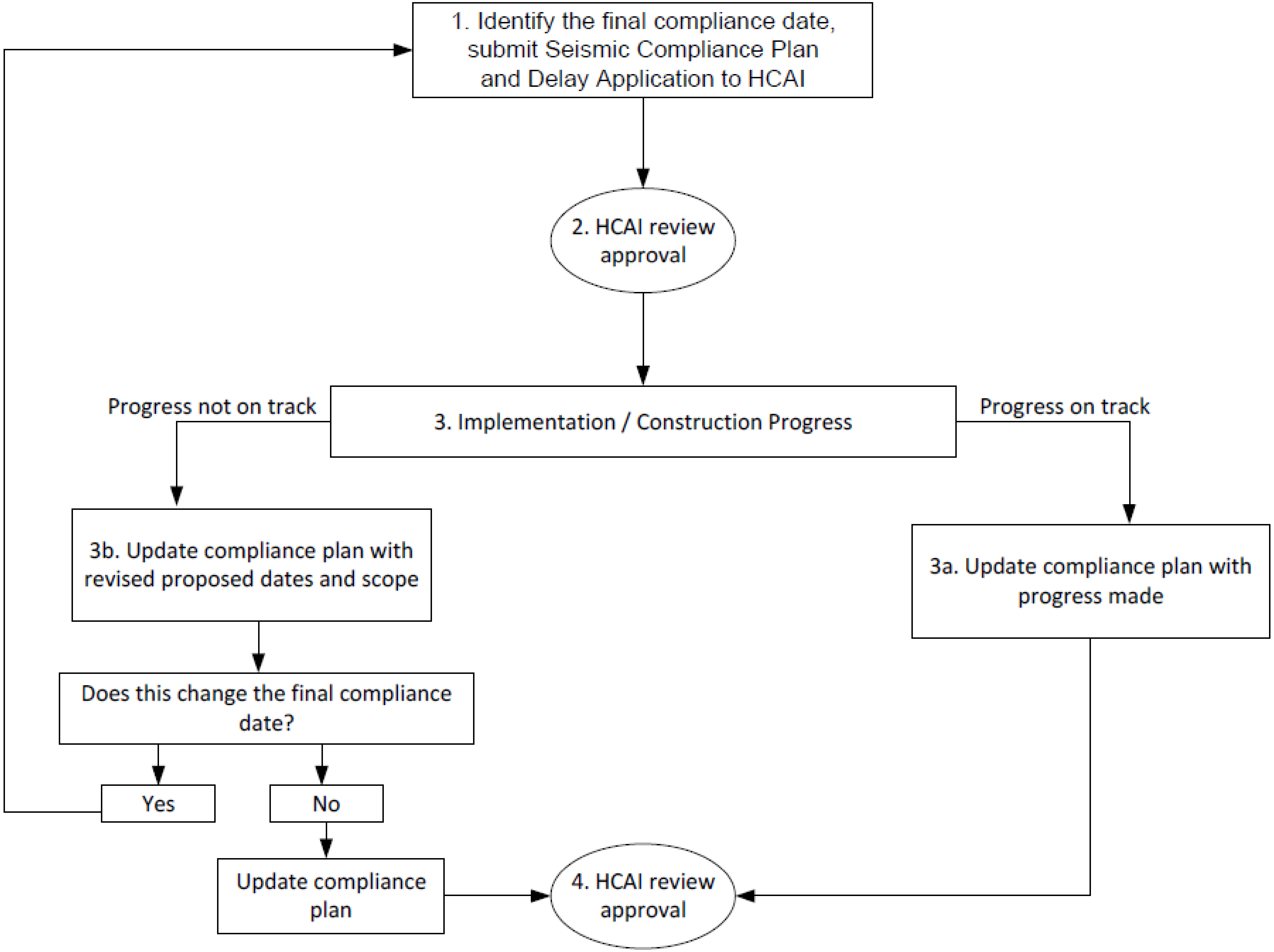


Flow Chart - Eligibility Criteria for AB 869 Delay





Flow Chart - submitting and updating seismic compliance plan and delay applications



Seismic Compliance Delay (AB 869) Application

Overview of Delay Application (AB 869)

There is one critical info asked:

- **Requested delay deadline date**

There is required documentation at the attachment step

The rest of the application is about facility ownership, applicant contact info, etc.

Seismic Compliance Delay (AB 869) Application

- Submitted to HCAI's Seismic Compliance Unit via the *eServices Portal (eSP)*.
- For step-by-step instructions on how to submit a delay application see User Guide 13A Applications for Seismic Delays for AB 869.
- The Department will review submittals within 120 days, and comment, approve or deny the hospital's seismic compliance plan and related delay request.
- The 120-day approval period will restart each time the facility resubmits the compliance plan for backcheck. "Approved", "Denied" and "HCAI commented/remarked" applications will be posted on the HCAI website, including reasons for denial or details of comments.

Additional 2-year Delay (up to 1/1/2035)

- May be granted when factors beyond the hospital's control make it impossible for the hospital to meet the deadline.
- Factors beyond the hospital's control include, financial distress, supply chain interruptions (contractor, labor, or material delays), acts of God (fire, earthquake, extended periods of severe weather etc.), government entitlements, and other circumstances beyond the hospital’s control.

Additional 2-year Delay (up to 1/1/2035)

Consideration for the additional up to two-years delay will depend on **the future status** of the facility and the compliance progress achieved. Therefore, this additional up to two-year **delay will not be considered before January 1st, 2030**.

Applications may be submitted after January 1st, 2030 with related justifying documentation.

To establish factors beyond the hospital's control, each hospital shall provide the following:

a) A description of the factors beyond their control which are delaying construction, and their influence on meeting the critical milestones for the project,

b) A revised seismic compliance plan, updating the existing application, indicating the length of delay needed to complete the project.

NPC Deadlines for facilities with AB 869 delay

- By January 1, 2025, the hospital owner shall submit a complete nonstructural evaluation up to NPC 4 or 4D and NPC 5, for each building
- By March 1, 2026, the hospital owner shall submit construction documents.
- By March 1, 2028, the hospital owner shall obtain a building permit
- By the approved delay date (between 1/1/2030 and 1/1/2033) – finish construction, obtain certificate of occupancy.

Please note that there is one year of time allowed between the plan approval and the start of construction, with an optional extension of one additional year provided there is justification (CAC, Chapter 7, Section 7-129 c).

SPC Deadline for facilities with AB 869 delay

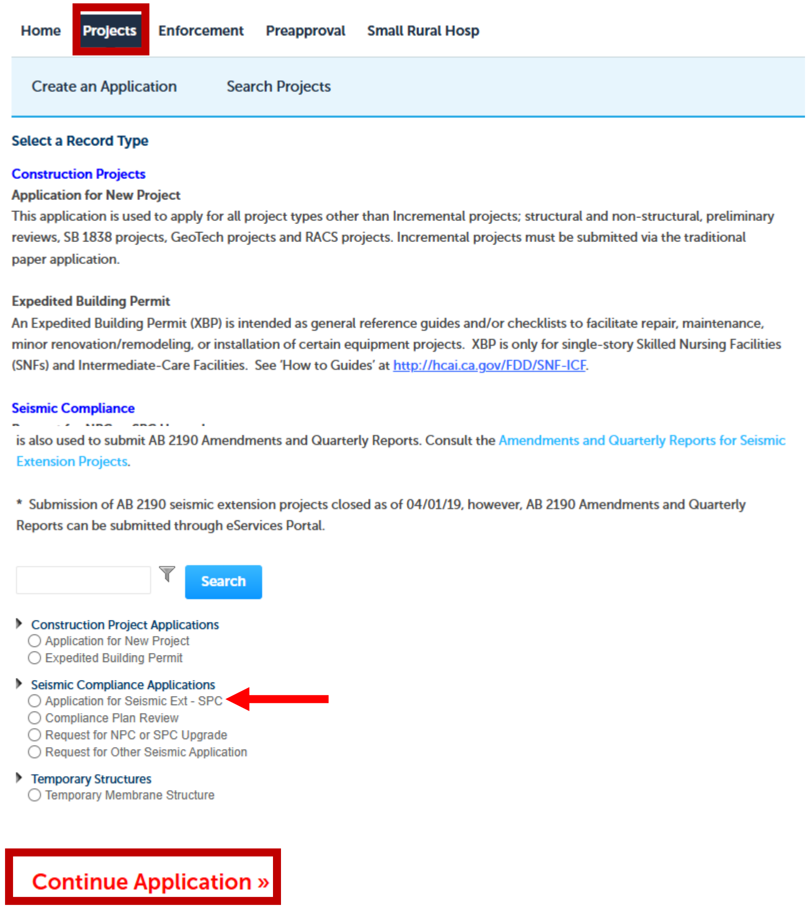
- There is no interim deadline for SPC
- The SPC related milestones in the approved seismic compliance plan are enforceable deadlines
- Final deadline is the final delay date in the approved application.

Small and Rural Hospital Relief Program Changes in AB 869

- AB 869 has also expanded eligibility requirements for the Small and Rural Hospital Relief Program (SRHRP).
- Eligibility for the SRHRP program will now include any Distressed Hospital Loan Program recipient and any Health Care District hospital that seeks delay under Section 1.5.2 Item 3, beyond the January 1, 2030 deadline.
- These hospitals are now able to apply for SRHRP grants under this change.
- Please see 2025 California Administrative Code Chapter 6 Section 1.9.2 Grant Requirements (or Appendix B in PIN 80) for more information.

AB869 Delay – New Application

- Click - Projects
  - Create a new application or search existing
  - Select “Application for Seismic Ext – SPC” under Seismic Compliance Applications
  - Agree to terms and continue application



Adjustments to Schedules (AB 869)

- The Department may grant an adjustment as necessary to deal with contractor, labor, material delays, with acts of God, or with governmental entitlements, experienced by the hospital.
- The hospital shall submit the reason for the delay along with substantiating documents, a revised construction schedule, and new milestones consistent with the adjustment.
- Requests for adjustments shall be made with the Department as soon as the reasons for delay are known, but no less than 30 calendar days before any upcoming delay schedule or construction milestone dates.

Accountability Measures for Seismic Compliance Plan Violations

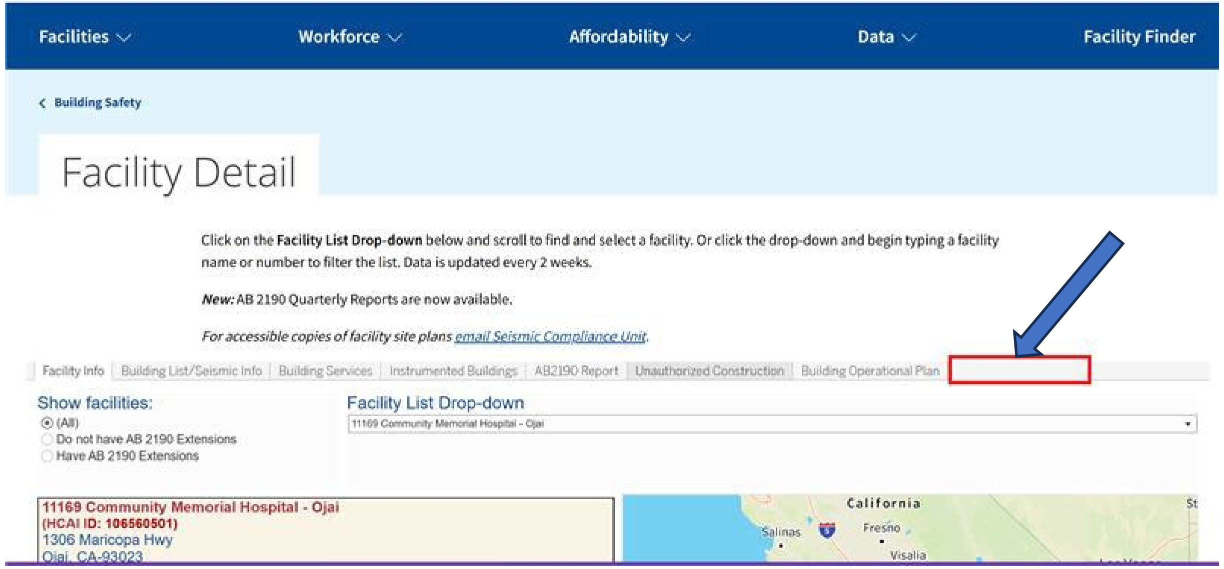
- Failure to comply with the construction schedule or meet any critical milestone established by the Department and the hospital shall result in the assessment of a fine of $5,000 per calendar day per facility until the requirements or milestones, respectively, are met.

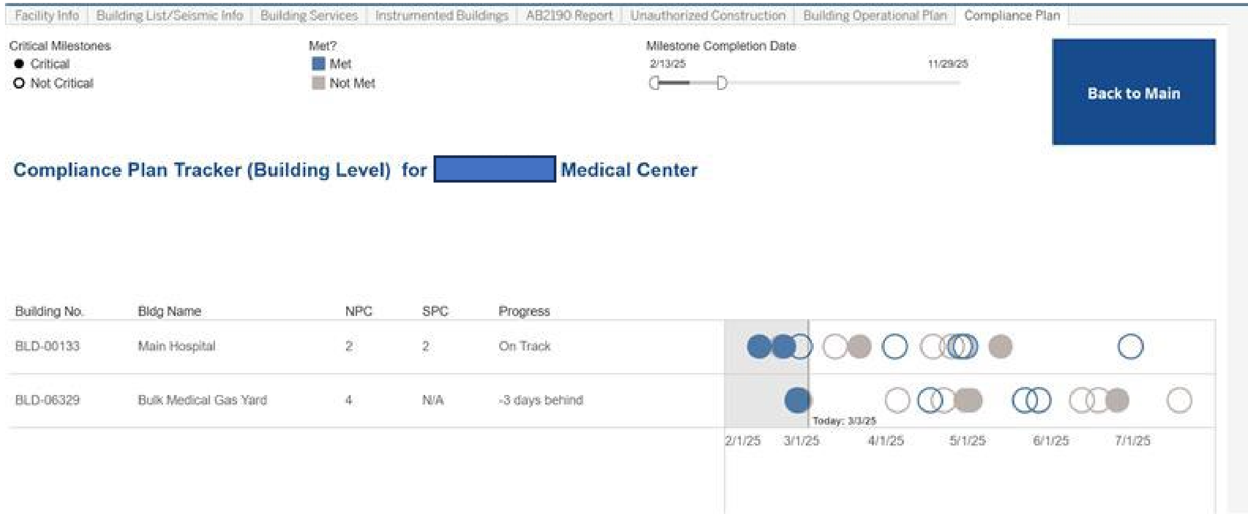
- These fines apply to critical milestones and do not extend to regular milestones.

- Hospitals that fail to meet any milestone or seismic compliance deadline approved in its compliance plan shall <u>**not be issued a building permit for any building in the facility**</u> except those required for seismic compliance, maintenance, and emergency repairs until the milestone is met and the hospital is adequately progressing toward meeting the subject hospital's seismic compliance, as determined by HCAI.

Publication of Compliance Plans on HCAI Website

When approved, remarked or denied, compliance plan will be published on the HCAI Facility Detail page for each facility





Thank You!

Questions?
Please email
SeismicComplianceUnit@hcai.ca.gov

Item #9

Proposed requirement for amplification of diaphragm transfer shears by W_0 and R_{upper}/R_{Lower} in building when a Type 4 out-of-plane irregularity is triggered by a stiffness irregularity, using the Two-stage analysis procedure in ASCE 7

- Discussion and public input

Facilitator: Roy Lobo, PhD, SE, Principal Structural Engineer, HCAI (or designee)

Do transfer forces in the podium need to be amplified by Ω_0 and R_{Upper}/R_{Lower} in a two-stage analysis?

Roy Lobo

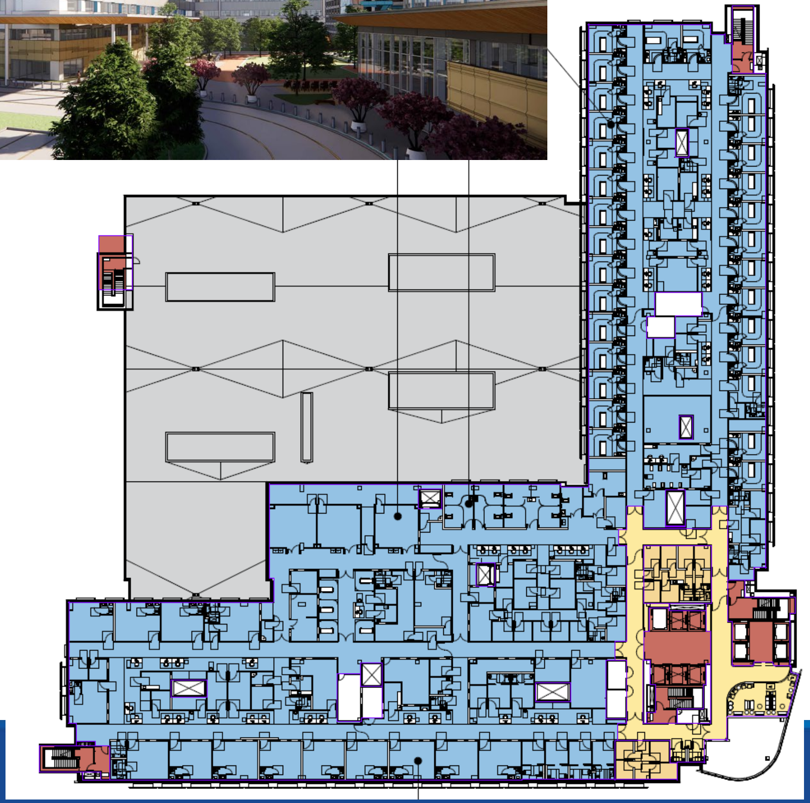
to SNSR Committee

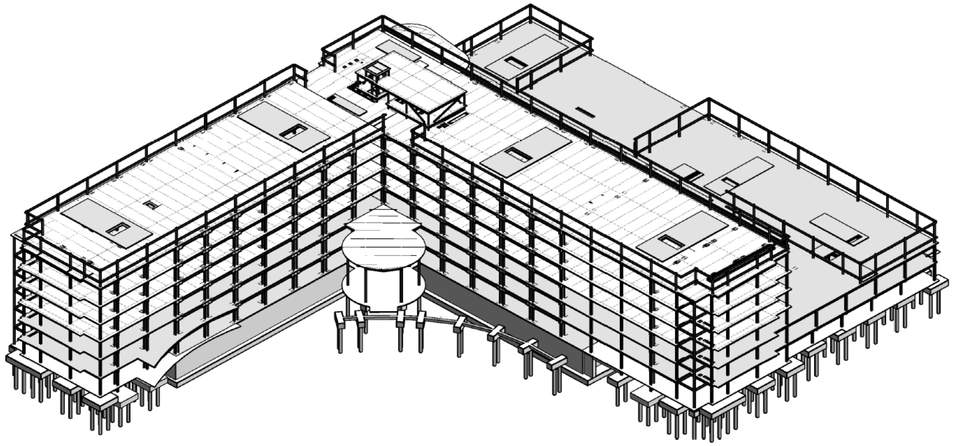
3/12/2025

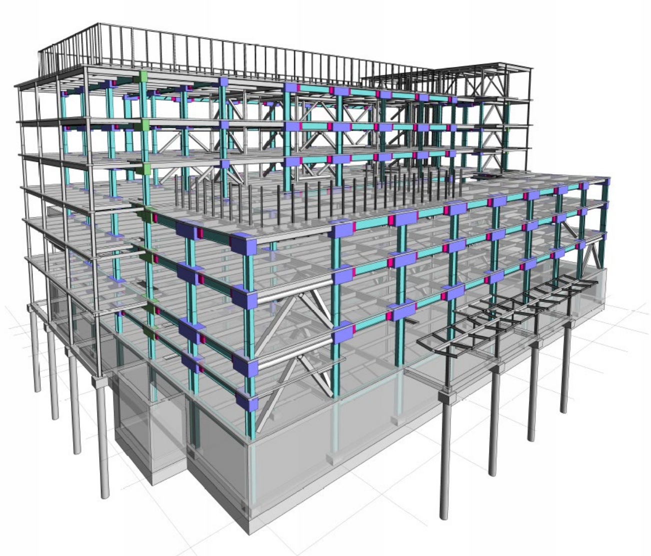
Outline

- *Examples of hospital buildings with transfer diaphragms*
- *Code requirements for vertical combination of forces*
- *Code requirements for design of the transfer diaphragm when a two-stage analysis is used*
- *Horizontal irregularity Type 4 triggered by a stiffness discontinuity at the stiff podium in buildings that qualify for a two-stage analysis*
- *Results from a nonlinear time history analysis of 7-story RC SMF on a 1-story podium*
- *Observations and code change recommendations*

Examples of Hospital Buildings with Transfer Diaphragms





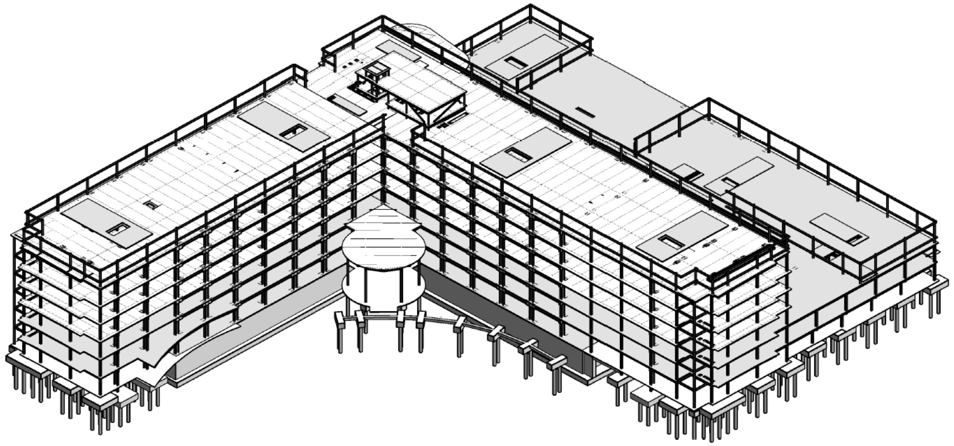


Vertical Combinations (ASCE 7-22)

- **Section 12.2.3: Combination of framing systems in the same direction**

12.2.3.1 R, C_d, and Ω_0 Values for Vertical Combinations Where a structure has a vertical combination in the same direction, the following requirements shall apply.

1. Where the lower system has a lower response modification coefficient, R, the design coefficients (R, Ω_0, and C_d) for the upper system are permitted to be used to calculate the forces and drifts of the upper system. For the design of the lower system, the design coefficients (R, Ω_0, and C_d) for the lower system shall be used. Forces transferred from the upper system to the lower system shall be increased by multiplying by the ratio of the higher response modification coefficient to the lower response modification coefficient.
2. Where the upper system has a lower response modification coefficient, the design coefficients (R, Ω_0, and C_d) for the upper system shall be used for both systems.

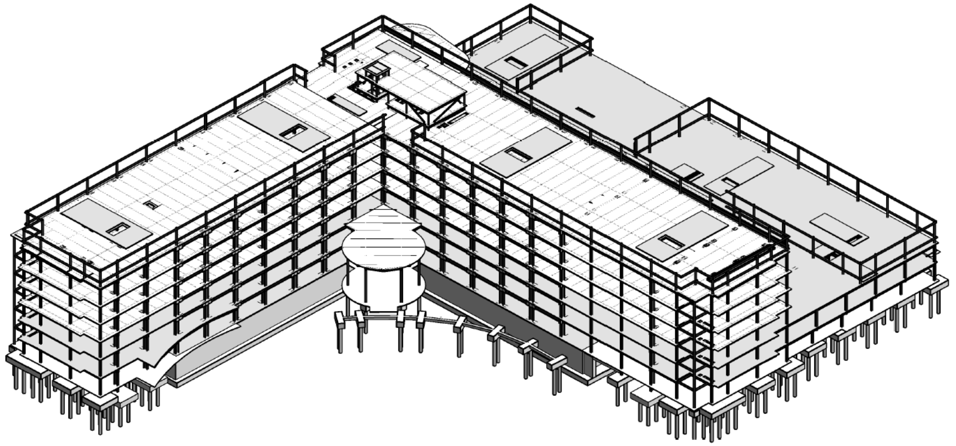


Vertical Combinations (ASCE 7-22)

- **Section 12.2.3.2 : Two Stage Analysis**

12.2.3.2 Two-Stage Analysis Procedure for Vertical Combinations of Systems A two-stage equivalent lateral force procedure is permitted to be used for structures that have a flexible upper portion above a rigid lower portion, provided the design of the structure complies with all of the following.

(a) The stiffness of the lower portion shall be at least 10 times the stiffness of the upper portion. For purposes of determining this ratio, the base shear shall be computed and distributed vertically according to Section 12.8. Using these forces, the stiffness for each portion shall be computed as the ratio of the base shear for that portion to the elastic displacement, δ_e, computed at the top of that portion, considering the portion fixed at its base. For the lower portion, the applied forces shall include the reactions from the upper portion, modified as required in Item (d).



Code Context: Vertical Combinations (ASCE 7-22)

- **Section 12.2.3.2 : Two Stage Analysis**

(b) The period of the entire structure shall not be greater than 1.1 times the period of the upper portion considered as a separate structure supported at the transition from the upper to the lower portion.

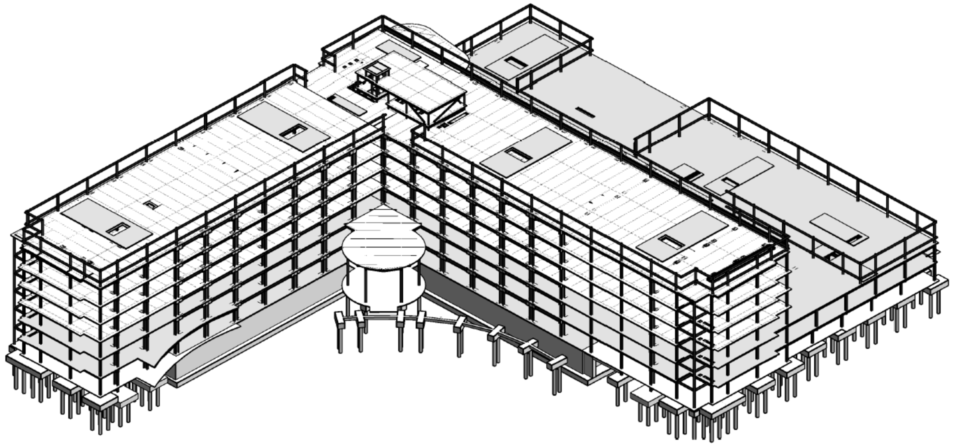
(c) The upper portion shall be designed as a separate structure using the appropriate values of R and ρ.

(d) The lower portion shall be designed as a separate structure using the appropriate values of R and ρ while meeting the requirements of Section 12.2.3.1. The reactions from the upper portion shall be those determined from the analysis of the upper portion, where the effects of the horizontal seismic load, E_h, are amplified by the ratio of the R/ρ of the upper portion over R/ρ of the lower portion. This ratio shall not be less than 1.0.

(e) The upper portion is analyzed with the equivalent lateral force or modal response spectrum procedure, and the lower portion is analyzed with the equivalent lateral force procedure.

(f) The structural height of the upper portion shall not exceed the height limits of Table 12.2-1 for the seismic force-resisting system used, where the height is measured from the base of the upper portion.

(g) Where Horizontal Irregularity Type 4 or Vertical Irregularity Type 3 exists at the transition from the upper to the lower portion, the reactions from the upper portion shall be amplified in accordance with Sections 12.3.3.4, 12.10.1.1, and 12.10.3.3, in addition to amplification required by Item (d).



12.3.3.4 Elements Supporting Discontinuous Walls or Frames Structural elements supporting discontinuous walls or frames of structures that have horizontal irregularity Type 4 of Table 12.3-1 or vertical irregularity Type 3 of Table 12.3-2 shall be designed to resist the seismic load effects, including overstrength of Section 12.4.3. The connections of such discontinuous walls or frames to the supporting members shall be adequate to transmit the forces for which the discontinuous walls or frames were required to be designed.

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Transfer Forces in Diaphragms (7-22)

12.10.3.3 Transfer Forces in Diaphragms Diaphragms designed in accordance with this section shall be designed for the inertial forces determined from Equations (12.10-4) and (12.10-5) and for applicable transfer forces acting through the diaphragm between vertical seismic force-resisting elements. For structures that have a horizontal structural irregularity of Type 4 in Table 12.3-1, the transfer forces between horizontally offset vertical seismic force-resisting elements shall be increased by the overstrength factor of Section 12.4.3 before being added to the diaphragm inertial forces. For structures that have other horizontal or vertical structural irregularities of the types indicated in Section 12.3.3.5, the requirements of that section shall also apply.

EXCEPTION: One- and two-family dwellings of light-frame construction shall be permitted to use $\Omega_0 = 1.0$.

12.3.3.5 Increase in Forces Caused by Irregularities for Seismic Design Categories D through F For structures assigned to Seismic Design Category D, E, or F and having a horizontal structural irregularity of Type 1, 2, 3, or 4 in Table 12.3-1 or a vertical structural irregularity of Type 3 in Table 12.3-2, the design forces determined from Section 12.10.1.1 shall be increased 25% at each diaphragm level where the irregularity occurs for the following elements of the seismic force-resisting system:

1. Connections of diaphragms to vertical elements and to collectors, and
2. Collectors and their connections, including connections to vertical elements of the seismic force-resisting system.

EXCEPTION: Forces calculated using the seismic load effects including overstrength of Section 12.4.3 need not be increased.

12.10.3.2 Seismic Design Forces for Diaphragms, Including Chords and Collectors Diaphragms, including chords, collectors, and their connections to the vertical elements, shall be designed to resist in-plane seismic design forces given by Equation (12.10-4):

$$F_{px} = \frac{C_{px}}{R_s} w_{px} \qquad (12.10\text{-}4)$$

The force F_{px} determined from Equation (12.10-4) shall not be less than:

$$F_{px} = 0.2 S_{DS} I_e w_{px} \qquad (12.10\text{-}5)$$

C_{px} shall be determined as illustrated in Figure 12.10-2.

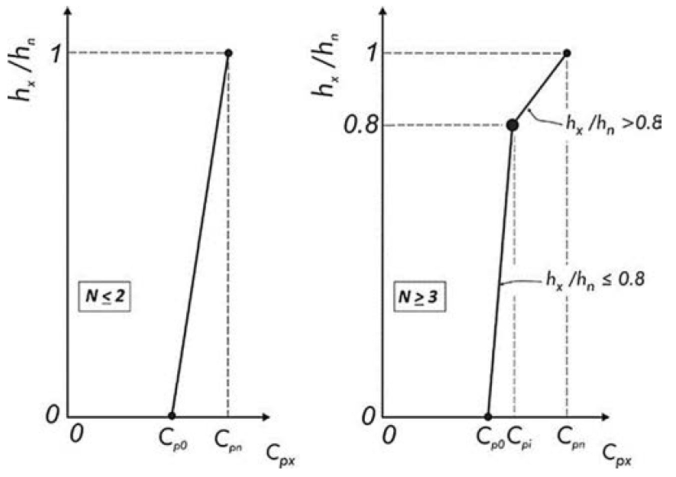


Figure 12.10-2. Calculating the design acceleration coefficient, C_{px}, in buildings with $N \le 2$ and in buildings with $N \ge 3$.

and

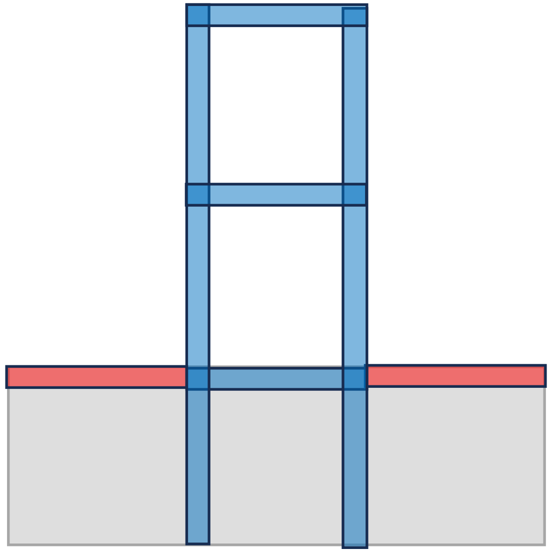
$$C_{pn} = \sqrt{(\Gamma_{m1}\Omega_0 C_s)^2 + (\Gamma_{m2} C_{s2})^2} \ge C_{pi} \qquad (12.10\text{-}7)$$

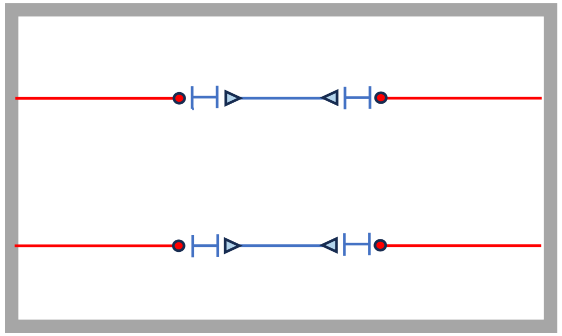
Design acceleration coefficient, C_{pi}, shall be the greater of the values given by Equations (12.10-8) and (12.10-9):

$$C_{pi} = 0.8 C_{p0} \qquad (12.10\text{-}8)$$

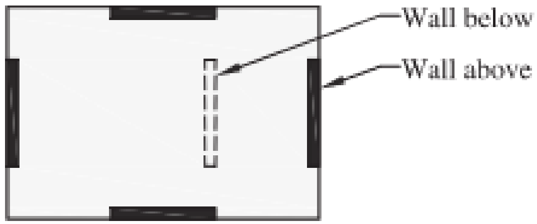
$$C_{pi} = 0.9 \Gamma_{m1} \Omega_0 C_s \qquad (12.10\text{-}9)$$

Are these irregularities present (7-22)?





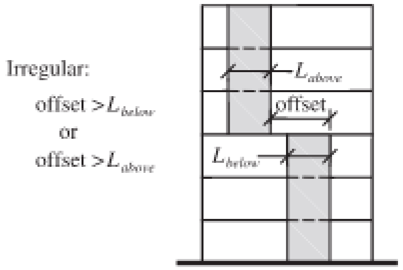
- Table 12.3-1 Horizontal Structural Irregularity
  - **Type 4 Out-of-Plan Offset Irregularity**: Out-of-plane offset irregularity, defined to exist where there is a discontinuity in a lateral force-resistance path, such as an out-of-plane offset of at least one of the vertical elements.



Type 4. Out-of-plane offset

Figure is from ASCE 7-16 since ASCE 7-22 has a typo

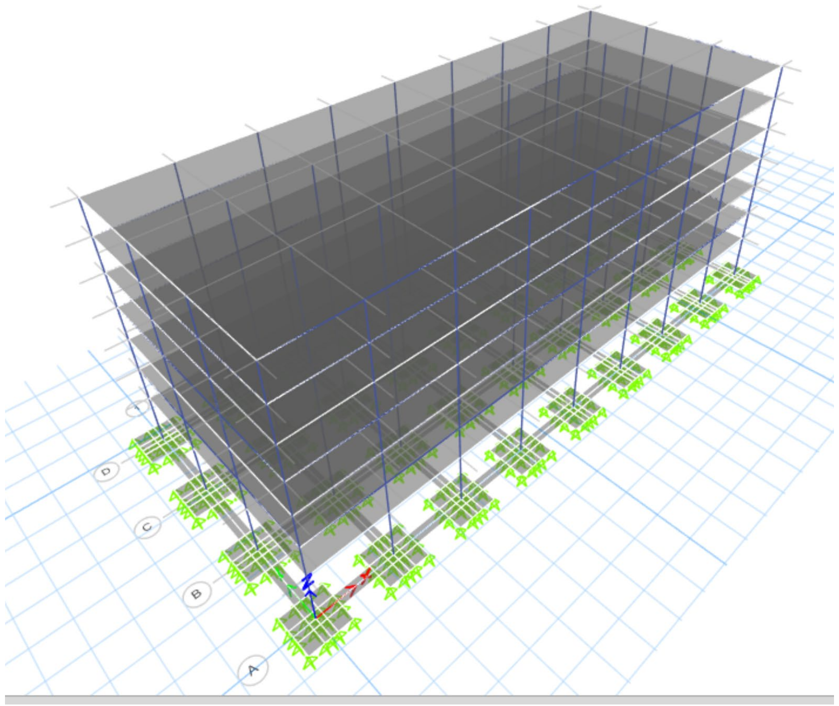
- Table 12.3-2 Vertical Structural Irregularity
  - **Type 3 In-Plane Discontinuity in Vertical Lateral Force-Resisting Irregularity** is defined to exist where there is an in-plane offset of a vertical seismic force-resisting element resulting in overturning demands on supporting structural elements.



Case Study Example: 7 - Story Concrete SMF over 1 Story Podium

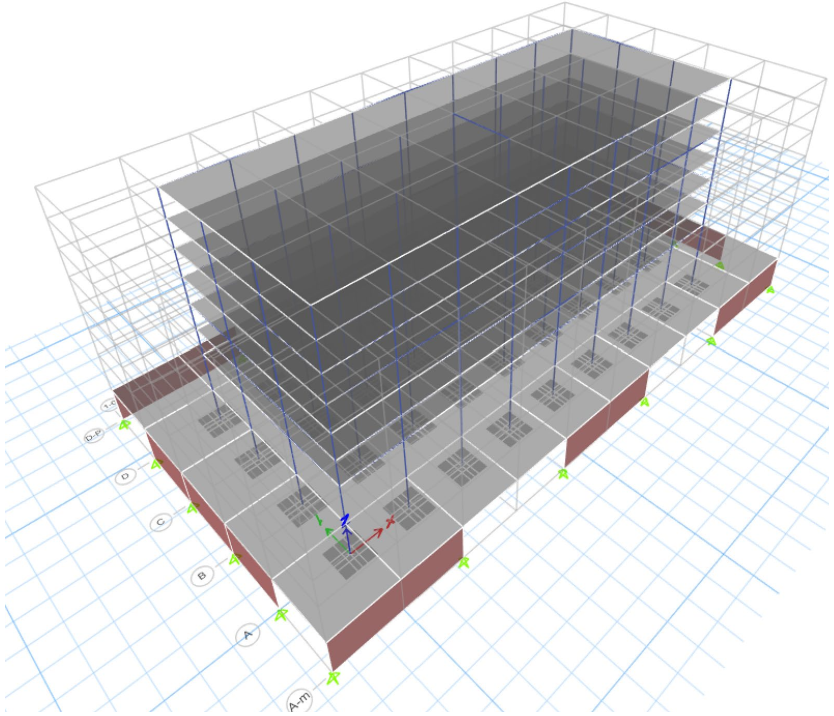
Models and analysis are intended to simulate design for a Special Moment Frame RC-II Building

Example: 7 - Story Concrete Special Moment Frame + Podium



Model 1

Fixed Base Model, No Podium



Model 2

Podium Model

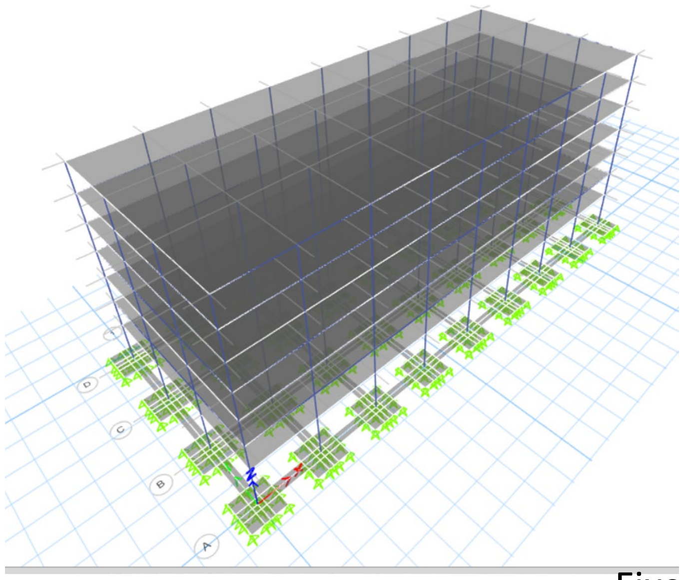
Example: 7-story Concrete MF + SW@1st floor

Example: 7 - Story Concrete Special Moment Frame

- *Building is a modified version of the 7-story Van Nuys building with the following modifications*

- *General Assumptions - Linear Elastic Properties*
  - *Building modeled on shallow foundations*
  - *Beam and column dimensions modified to satisfy ACI and ASCE 7 strength and drift requirements*
  - *Only Longitudinal direction considered.*
  - *Beam Stiffness = 0.3 EI*
  - *Column Stiffness = 0.3 – 0.5 EI*
  - *No shear failures*
  - *Strong column weak beam satisfied*
  - *Fixed Base assumptions*

  - *Building Periods Longitudinal Direction*
    - *Mode 1 = 1.45 second*
    - *Mode 2 = 0.54 seconds*
    - *Mode 3 = 0.28 seconds*



Model 1

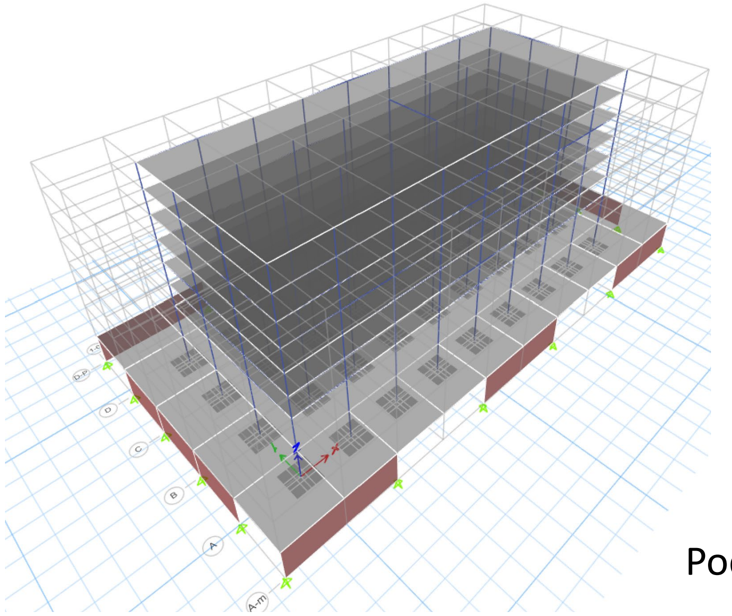
Fixed Base Model, No Podium

Example: 7 - Story Concrete Special Moment Frame on a 1 Story Podium

- *Building is a modified version of the 7-story Van Nuys building with the following modifications*

- ***General Assumptions - Linear Elastic Properties***
  - ***Building modeled on shallow foundations***
  - ***Beam and column dimensions modified to satisfy ACI and ASCE 7 strength and drift requirements***
  - ***Only Longitudinal direction considered.***
  - ***Beam Stiffness = 0.3 EI***
  - ***Column Stiffness = 0.3 – 0.5 EI***
  - ***No shear failures***
  - ***Strong column weak beam satisfied***
  - ***Stiff diaphragm and shear walls at first floor***

  - ***Building Periods Longitudinal Direction***
    - ***Mode 1 = 1.55 second***
    - ***Mode 2 = 0.58 seconds***
    - ***Mode 3 = 0.32 seconds***



Model 2
Podium Model

Example: 7-story Concrete MF + SW@1st floor

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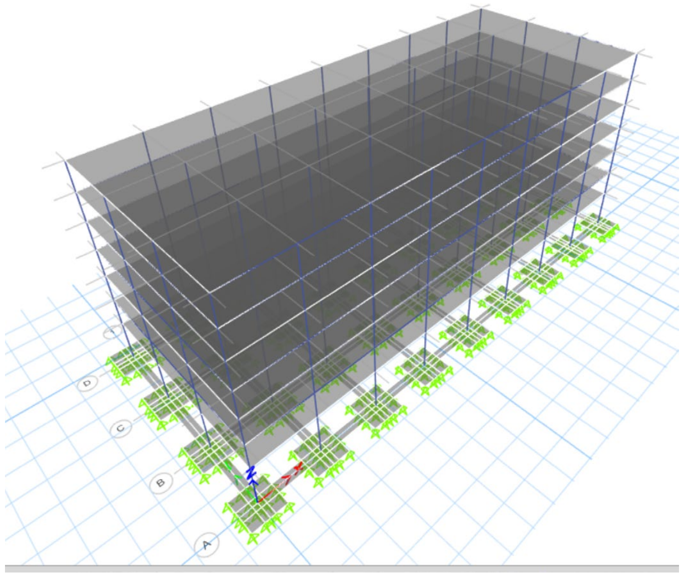
Example: 7 - Story Concrete Special Moment Frame

- ***Ground motion data***
  - $S_{DS} = 1.62$
  - $S_{D1} = 0.64g$

Base Shear Calculation – Upper structure Only

S_{DS}	1.620	g
S_{D1}	0.640	g
C_t	0.016	
h_n	65.7	ft
x	0.9	
C_u	1.40	S_{D1} > 0.4 s
R	8.0	Reinforced Concrete SMRF
I_e	1.0	Risk Category II
$T_{Building}$	1.450	Fixed based period
T_0	0.079	sec
T_s	0.395	sec
T_a	0.69	sec
T	0.97	sec
C_s	**0.08**	
V=	**826**	kips



Model 1

Fixed Base Model, No Podium

Example 7-Story Building (Concrete MF)

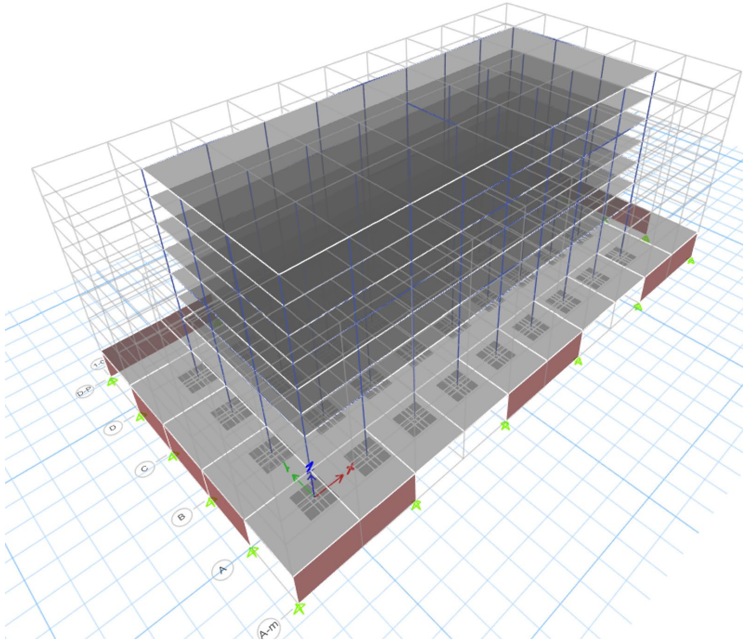
Example: 7 - Story Concrete Special Moment Frame

- ***Ground motion data***
  - $S_{DS} = 1.62$
  - $S_{D1} = 0.64g$

Base Shear Calculation – R_{upper} Combined model

S_{DS}	1.620	g
S_{D1}	0.640	g
C_t	0.016	
h_n	77.7	ft
x	0.9	
C_u	1.40	S_{D1} > 0.4 s
R	8.0	Reinforced Concrete SMRF
I_e	1.0	Risk Category II
$T_{Building}$	1.540	Fixed based period
T_0	0.079	sec
T_s	0.395	sec
T_a	0.80	sec
T	1.13	sec
$\mathbf{C_s}$	**0.07**	

V = **955**



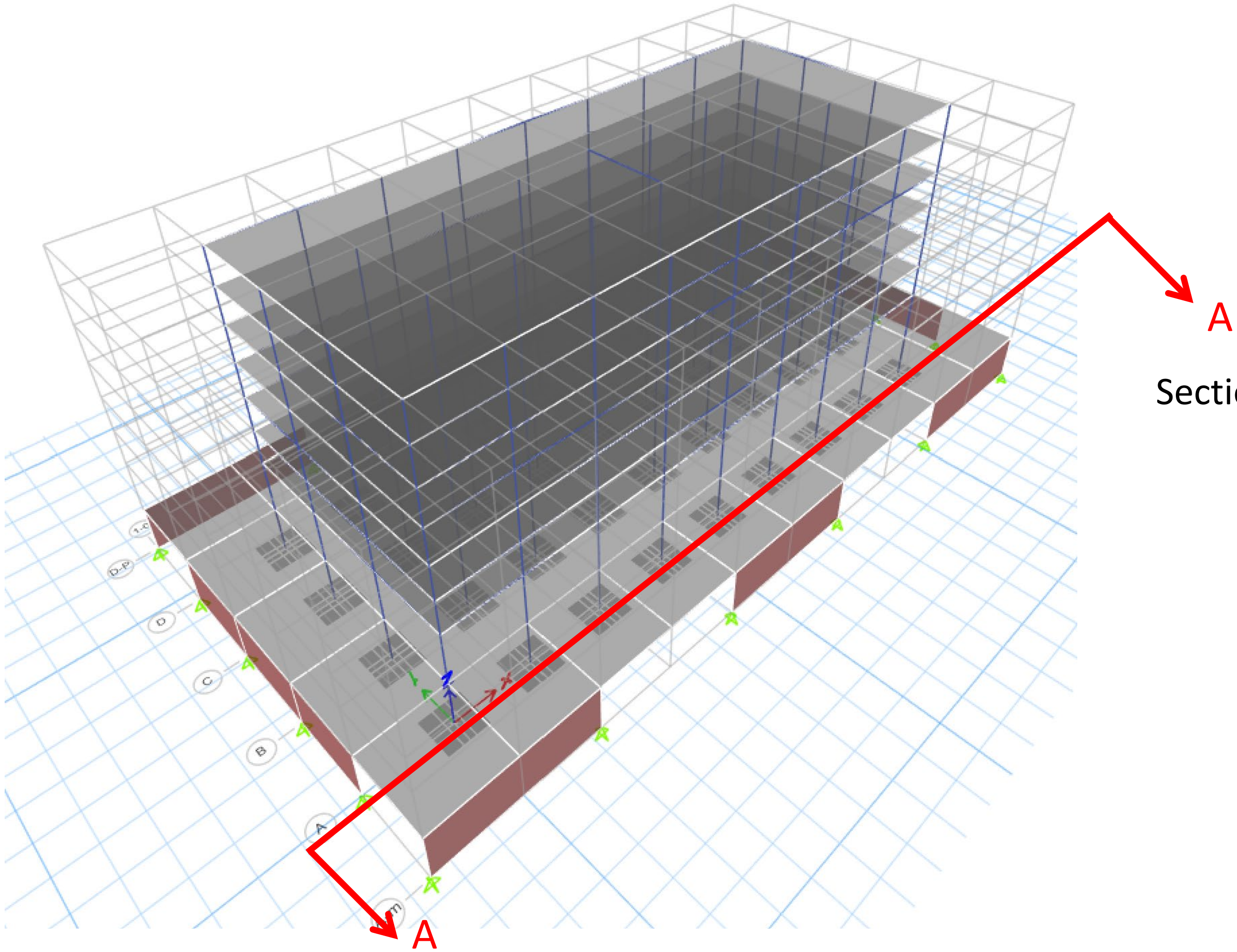
Model 2

Podium Model

Example: 7-story Concrete MF + SW@1st floor

HCAI Department of Health Care Access and Information

Example: 7 - Story Concrete Special Moment Frame + Podium



Section Cut A-A at Transfer Diaphragm

Model 2
Podium Model

Example: 7-story Concrete MF + SW@1st floor

Example: 7 - Story Concrete Special Moment Frame + Podium

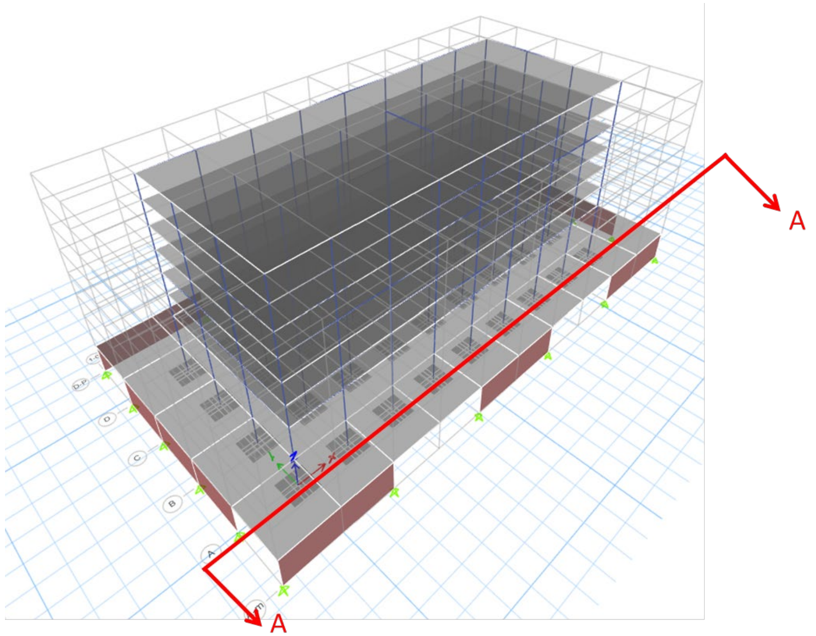
Distribution of Forces – R_{Upper}

Floor	Weight	H_x	$w_x h^k$	C_{vx}	F_x	F_{px}	Max F_{px}	Min F_{px}
7	1341	77.7	407163	0.22	209	209	869	434
6	1381	69	358768	0.19	184	200	895	447
5	1381	60.33	300773	0.16	155	184	895	447
4	1381	51.6	244962	0.13	126	170	895	447
3	1381	42.9	192220	0.10	99	155	895	447
2	1381	34.2	142740	0.08	73	142	895	447
1	1751	25.5	123093	0.07	63	159	1135	567
0	3454	12	90243	0.05	46	245	2238	1119
	13451		1859962		955			

V = **955**

Transfer Force = 909 kips

Podium Inertia Force = 1119 kips



Transfer Diaphragm forces @ A-A

Transfer Dispahragm Shear Without Ω_0	1014 kips
Transfer Diaphragm Shear with R_{upper}/R_{lower}	1166 kips
Transfer Dispahragm Shear With Ω_0	1923 kips
Transfer Diaphragm Shear with R_{upper}/R_{lower} & Ω_0	2378 kips

$R_{upper} = 8$
$R_{lower} = 6$
$\Omega = 3$

Model 2
Podium Model

Example: 7-story Concrete MF + SW@1st floor

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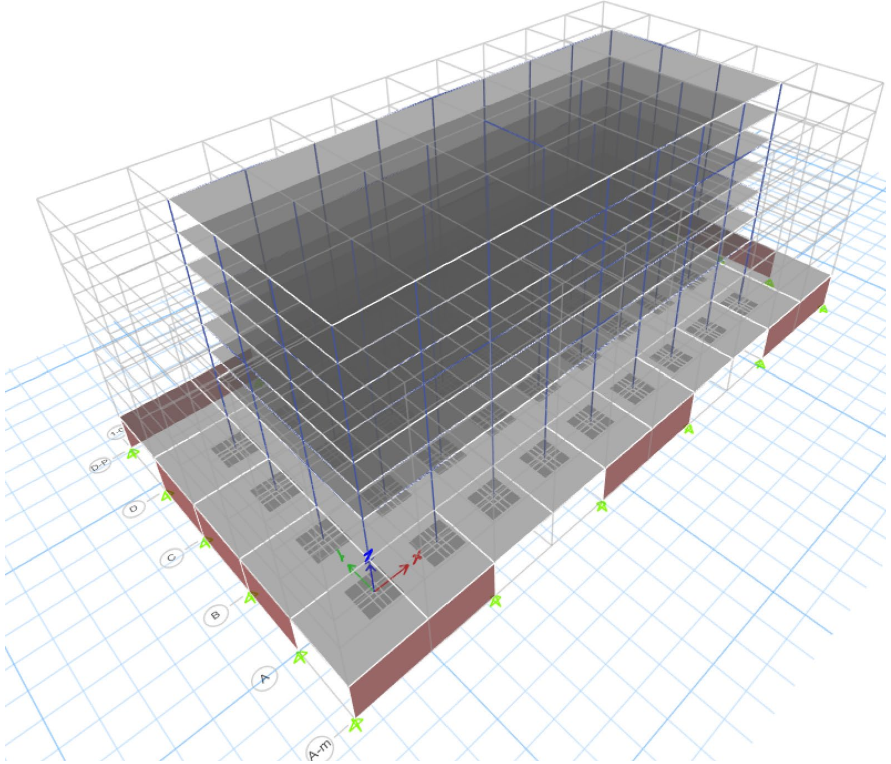
Example: 7 - Story Concrete Special Moment Frame + Podium

- ***Ground motion data***
  - $S_{DS} = 1.62$
  - $S_{D1} = 0.64g$

Base Shear Calculation – R_{lower}

S_{DS}	1.620	g
S_{D1}	0.640	g
C_t	0.020	
h_n	77.7	ft
x	0.8	
C_u	1.40	S_{D1} > 0.4 s
R	6.0	Reinforced Concrete Shear Wall
I_e	1.0	Risk Category II
$T_{Building}$	1.540	Fixed based period
T_0	0.079	sec
T_s	0.395	sec
T_a	0.52	sec
T	0.73	sec
C_s	**0.15**	

V = **1958**



Model 2
Podium Model

Example: 7-story Concrete MF + SW@1st floor

HCAi Department of Health Care Access and Information

Example: 7 - Story Concrete Special Moment Frame + Podium

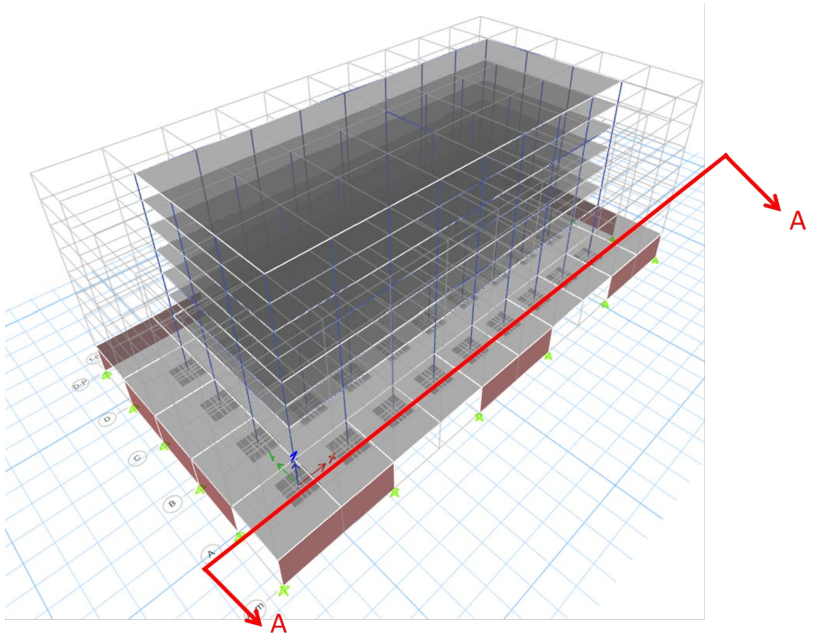
Distribution of Forces – R_{Lower}

Floor	Weight	H_x	$w_x h^k$	C_{vx}	F_x	F_{px}	Max F_{px}	Min F_{px}
7	1341	77.7	172932	0.20	394	394	869	434
6	1381	69	155979	0.18	355	380	895	447
5	1381	60.33	134265	0.16	306	355	895	447
4	1381	51.6	112766	0.13	257	330	895	447
3	1381	42.9	91760	0.11	209	306	895	447
2	1381	34.2	71247	0.08	162	282	895	447
1	1751	25.5	65093	0.08	148	321	1135	567
0	3454	12	55349	0.06	126	503	2238	1119
	13451		859392		1958			

V = **1958**

Transfer Force = 1832 kips

Podium Inertia Force = 1119 kips



Model 2

Podium Model

Transfer Diaphragm forces @ A-A

Transfer Dispahragm Shear Without Ω_0	1475 kips
Transfer Diaphragm Shear with R_{upper}/R_{lower}	1475 kips
Transfer Dispahragm Shear With Ω_0	2849 kips
Transfer Diaphragm Shear with R_{upper}/R_{lower} & Ω_0	2849 kips

$R_{upper} = 6$
$R_{lower} = 6$
$\Omega = 2.5$

Example: 7-story Concrete MF + SW@1st floor

Example: 7 - Story Concrete Special Moment Frame + Podium

- ***Ground motion data***

  - ***$S_{DS} = 1.62$***
  - ***$S_{D1} = 0.64g$***

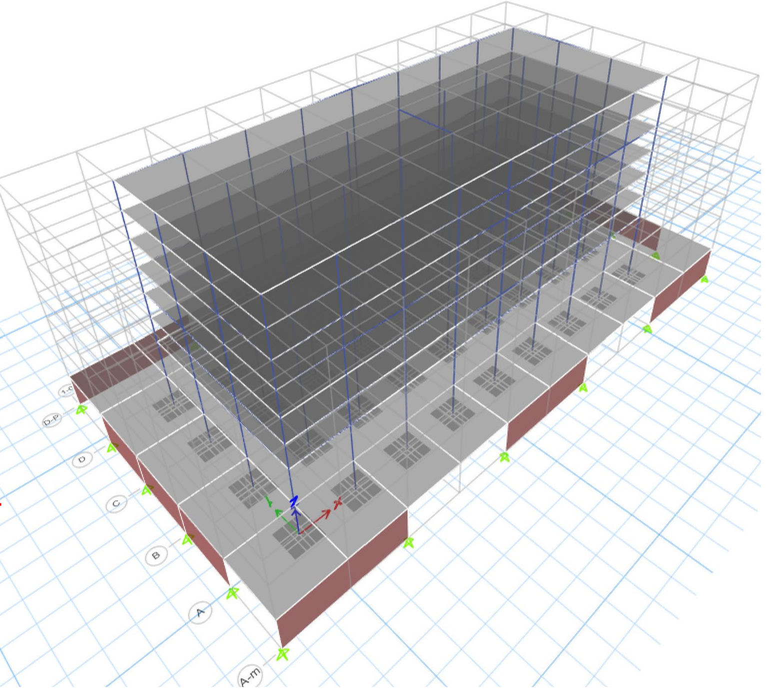
  - ***Total Base Shear Lower***

    = 826 x (8/6) + 933 = 2034 kips

Base Shear Calculation – $R_{\text{lower Only}}$

S_{DS}	1.620	g
S_{D1}	0.640	g
C_t	0.020	
h_n	12.0	ft
x	0.75	
C_u	1.40	S_{D1} > 0.4 s
R	6.0	Reinforced Concrete SMRF
I_e	1.0	Risk Category II
$T_{Building}$	1.540	Fixed based period
Ω_o	2.5	Omega of Upper Structure
T_0	0.079	sec
T_s	0.395	sec
T_a	0.13	sec
T	0.18	sec
C_s	**0.270**	

V = **933**



Model 2

Podium Model

Example: 7-story Concrete MF + SW@1st floor

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Example: 7 - Story Concrete Special Moment Frame + Podium

Diaphragm Force @ Transfer Diaphragm Eq. 12.10-4

Design Parameter		7-story Example + Podium RCMF	7-story Example + Podium RCSW	7-story Example + Podium
Lateral Resisting System		RCMF	RCSW	RCSW
n =		8	8	1
Ω_o =		3	2.5	2.5
S_{DS} =		1.63	1.63	1.63
S_{D1} =		0.64	0.64	0.64
I_e =		1	1	1
h_n =		77	77	12
C_t =		0.016	0.02	0.02
x		0.9	0.75	0.75
T =		0.80	0.52	0.13
C_u =		1.4	1.4	1.4
T_{max} =		1.12	0.73	0.18
R =		8	6	6
Cs =		0.20	0.27	0.27
Cs =		0.07	0.15	0.59
C_s min =		0.07	0.07	0.07
C_s (design) =		0.07	0.15	0.27
$C_{s2}(1)$ =	$(0.15n + 0.25)I_eS_{DS}$ =	2.36	2.36	0.65
$C_{s2}(2)$ =	I_eS_{DS} =	1.63	1.63	1.63
$C_{S2}(3)$ =	$I_eS_{D1}/0.03(n-1) >= 2$	3.05	3.05	0.00
C_{s2} (design) =		1.63	1.63	0.00
z_s =		0.7	1	1
Γ_{m1} =	$1 + z_s/2(1 - 1/n)$ =	1.31	1.44	1.00
Γ_{m2} =	$0.9z_s(1 - 1/n)^2$ =	0.48	0.69	0.00
C_{pn} =	$\sqrt{(\Gamma_{m1}\Omega_0 C_s)^2+(\Gamma_{m2}C_{s2})^2}$	0.83	1.24	0.679

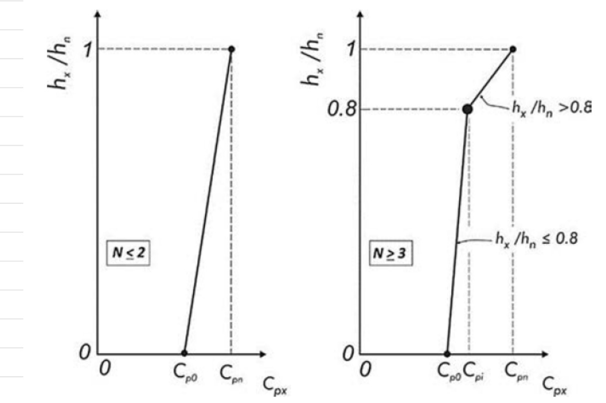


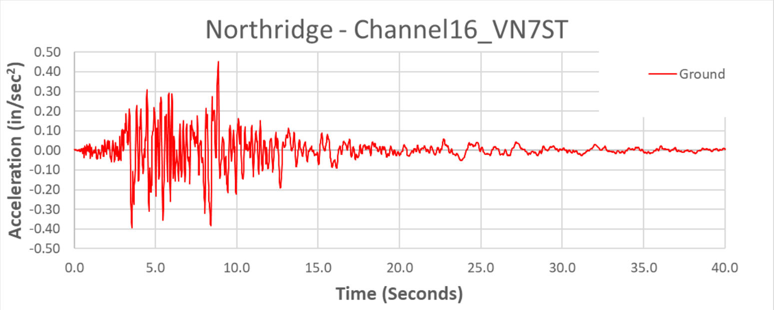
Figure 12.10-2. Calculating the design acceleration coefficient, C_{px}, in buildings with $N \le 2$ and in buildings with $N \ge 3$.

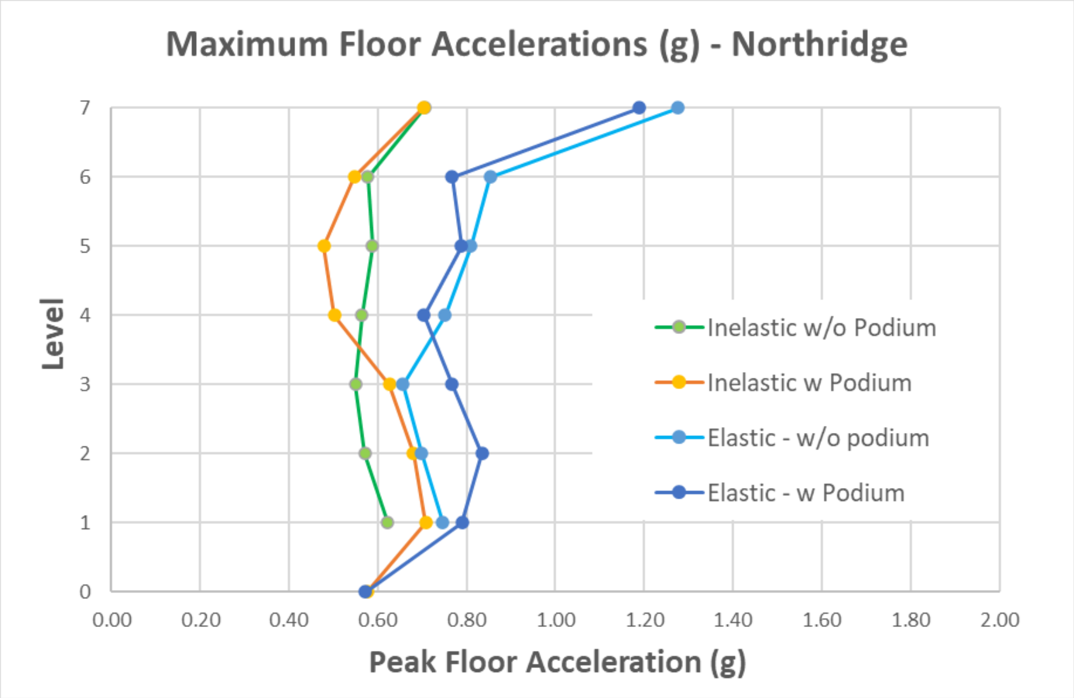
Design Parameter		7-story Example + Podium RCMF	7-story Example + Podium RCSW	7-story Example + Podium
C_{p0} =	$0.4S_{DS}I_e$	0.648	0.648	0.648
C_{pi} =	$0.8C_{p0}$	0.66	0.99	0.54
C_{pi} =	$C_{pi} = 0.9\Gamma_{m1}\Omega_0 C_s$	0.25	0.47	0.61
$C_{pi\ (Design)}$ =	Fig. 12.10-2	0.66	0.99	0.61
Ht of Diap. (ft)		12	12	12
$C_{px\ (Design@L1)}$ =	Design Accel Coefficient	0.651	0.714	0.675
R_s	Table 12.10-1	1.5	1.5	1.5
W_{px}	Weight of Diaphragm	3454	3454	3454
F_{px} (kips)	Diap. Seismic Design Force	1499	1644	1554
F_{px_min} =	$0.2S_{DS}I_eW_{px}$	1119.1	1119.1	1119.1

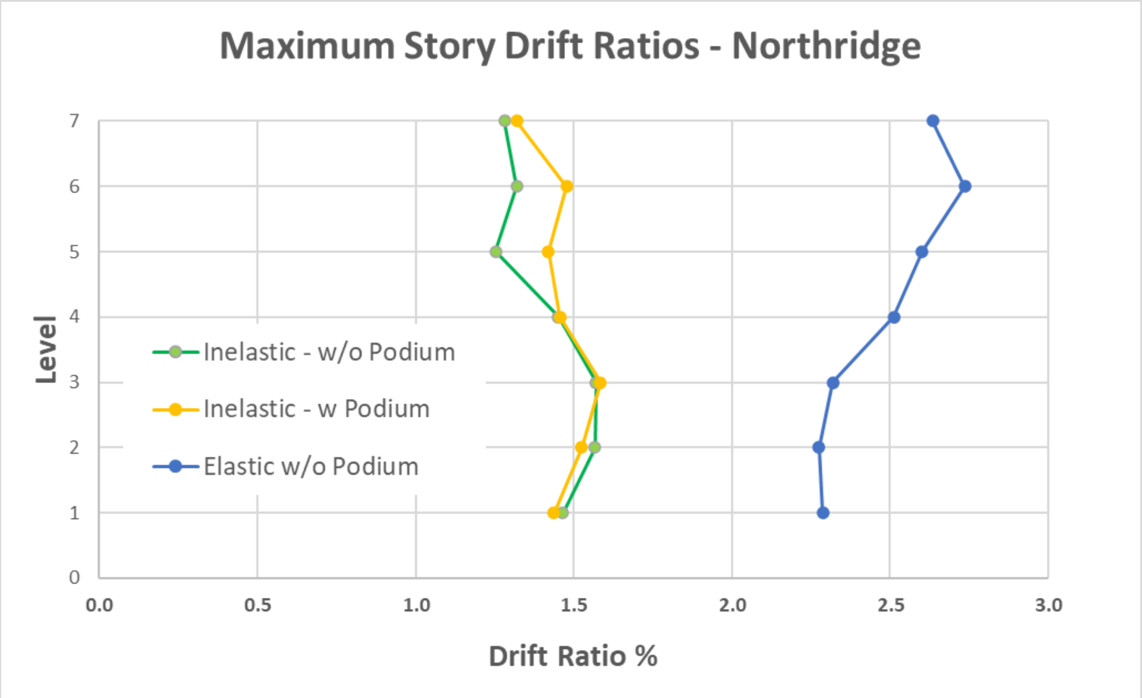
Example: 7-story Concrete MF + SW@1st floor

Comparison of Maximum Responses – Northridge (Van Nuys)

- ***PGA – 0.453 g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)







Example: 7-story Concrete MF + SW@1st floor

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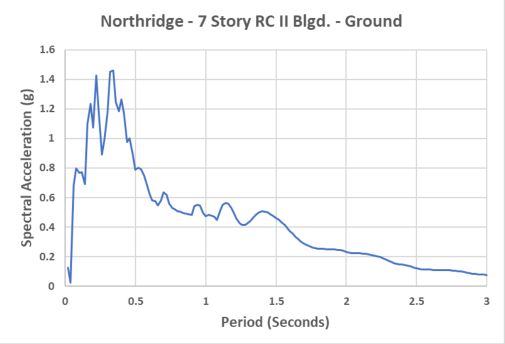
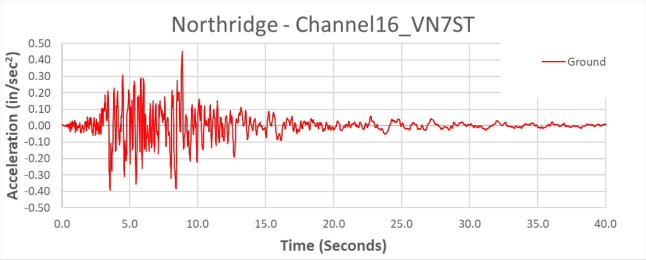
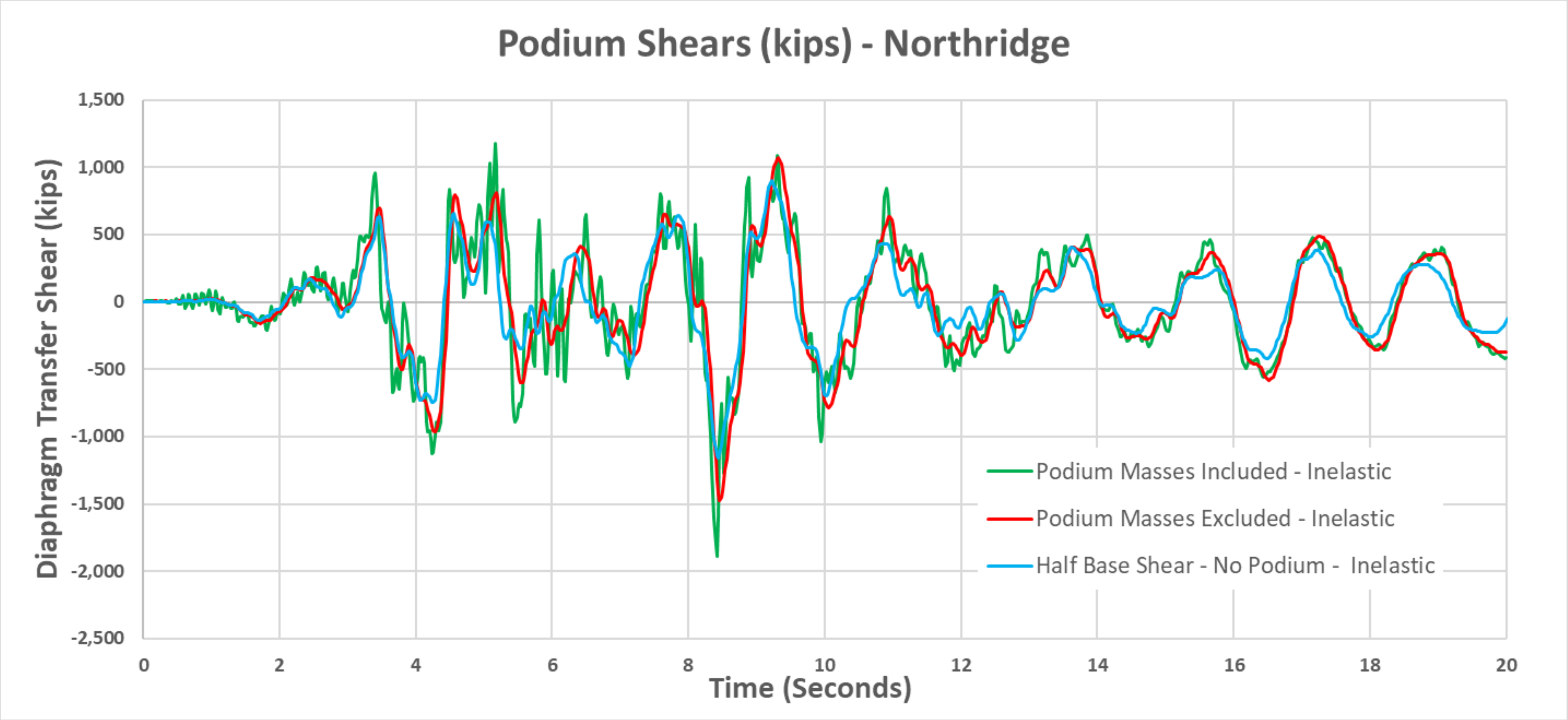
Podium Shear Time History Comparisons – Northridge (Van Nuys)

- ***PGA – 0.453g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)







Example: 7-story Concrete MF + SW@1st floor

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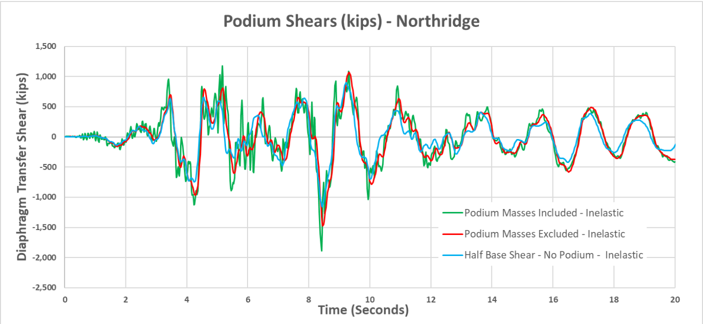
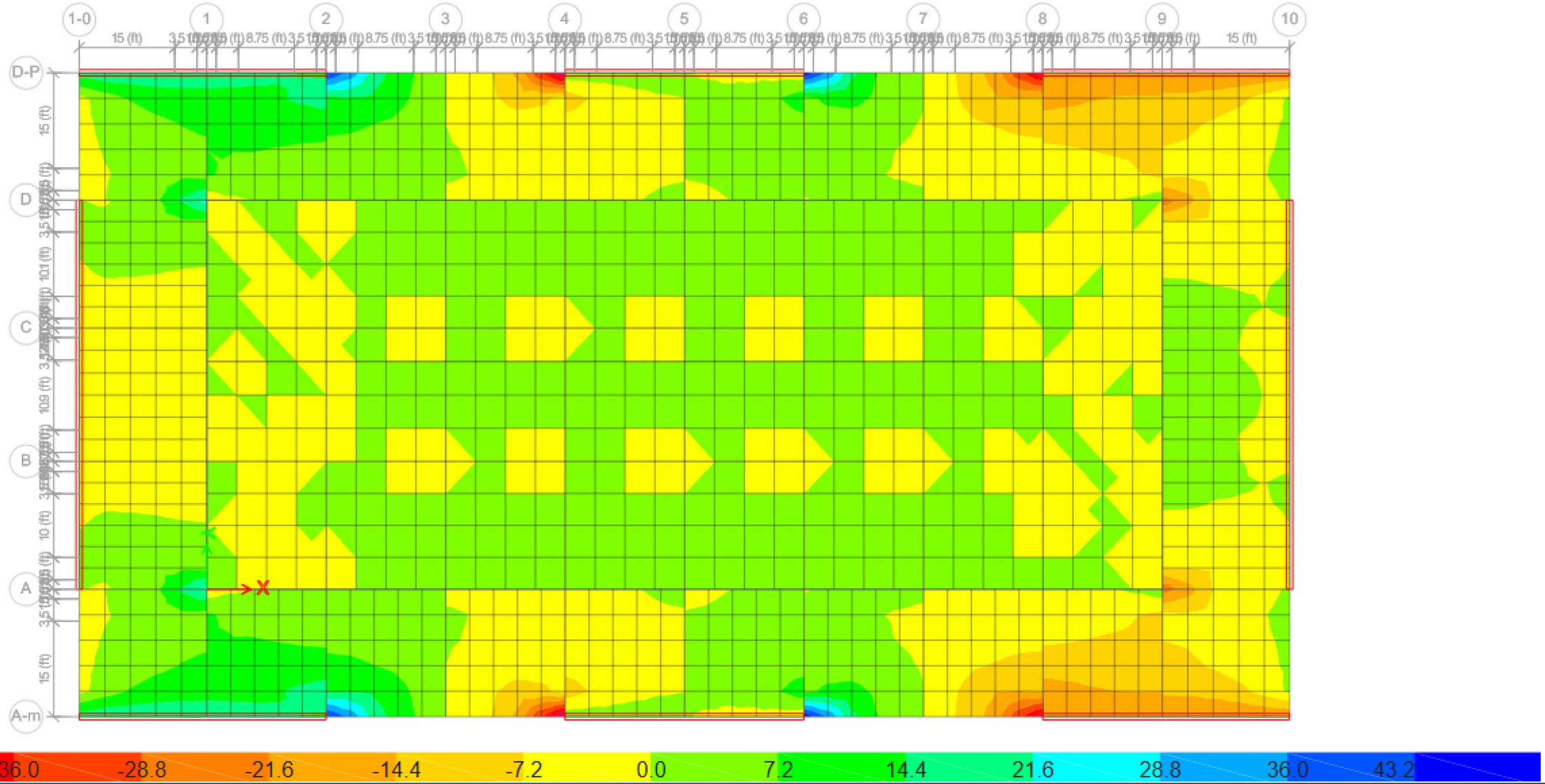
Diaphragm F11 Stresses at Max. Shear 8.42 seconds





Example: 7-story Concrete MF + SW@1st floor

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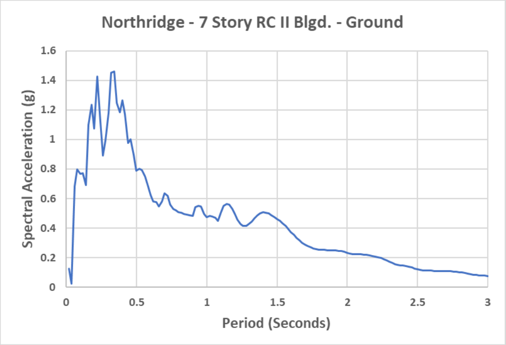
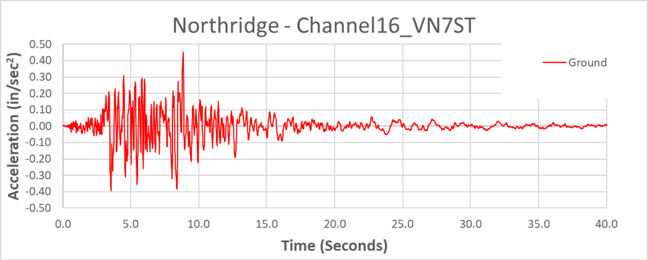
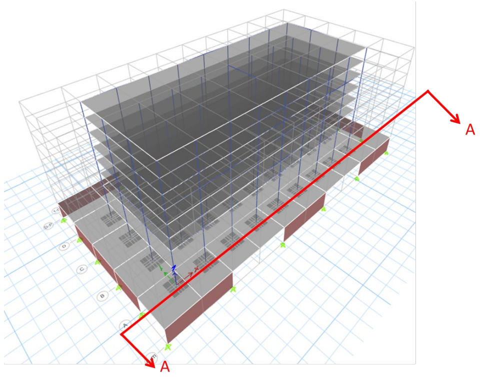
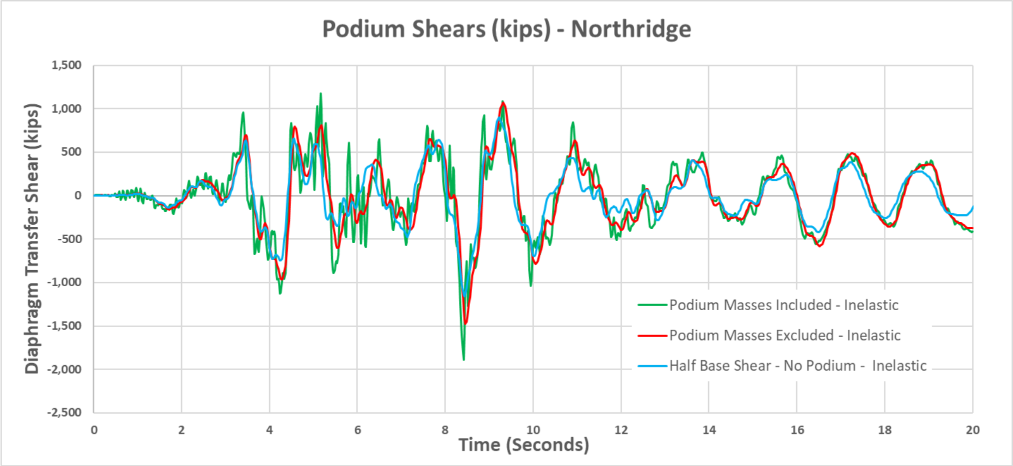
Podium Shear Time History Comparisons – Northridge (Van Nuys)

- ***PGA – 0.453g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)









Maximum Podium Shears (Northridge) - Kips	
Podium Mass Included (Time History)	1889
Podium Mass Excluded (Time History)	1472
Podium Mass Excluded Discontinuous Columns (Time History)	1092
Half Base Shear Fixed Base - Inelastic(No Podium) (Time History)	1157
Half Base Shear Fixed Base - Elastic(No Podium) (Time History)	2532
Shear corresponding to Upper Structure Properties from model (ELF)	520
Half base shear corresponding to FB Upper Structure (ELF)	413

Example: 7-story Concrete MF + SW@1st floor

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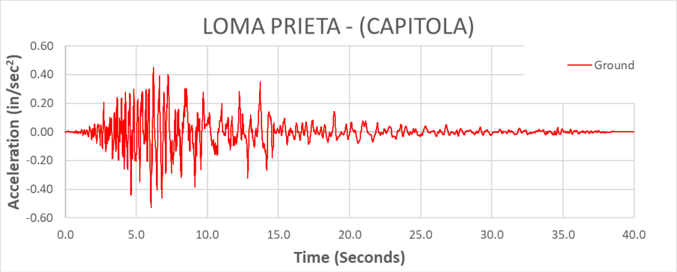
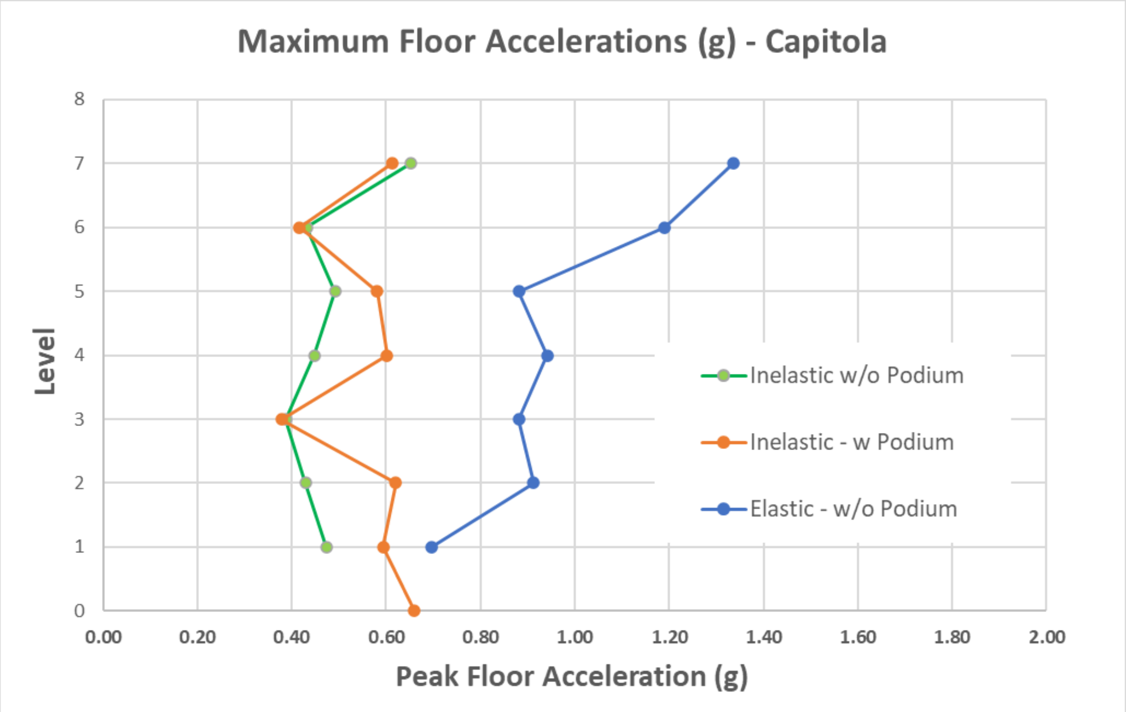
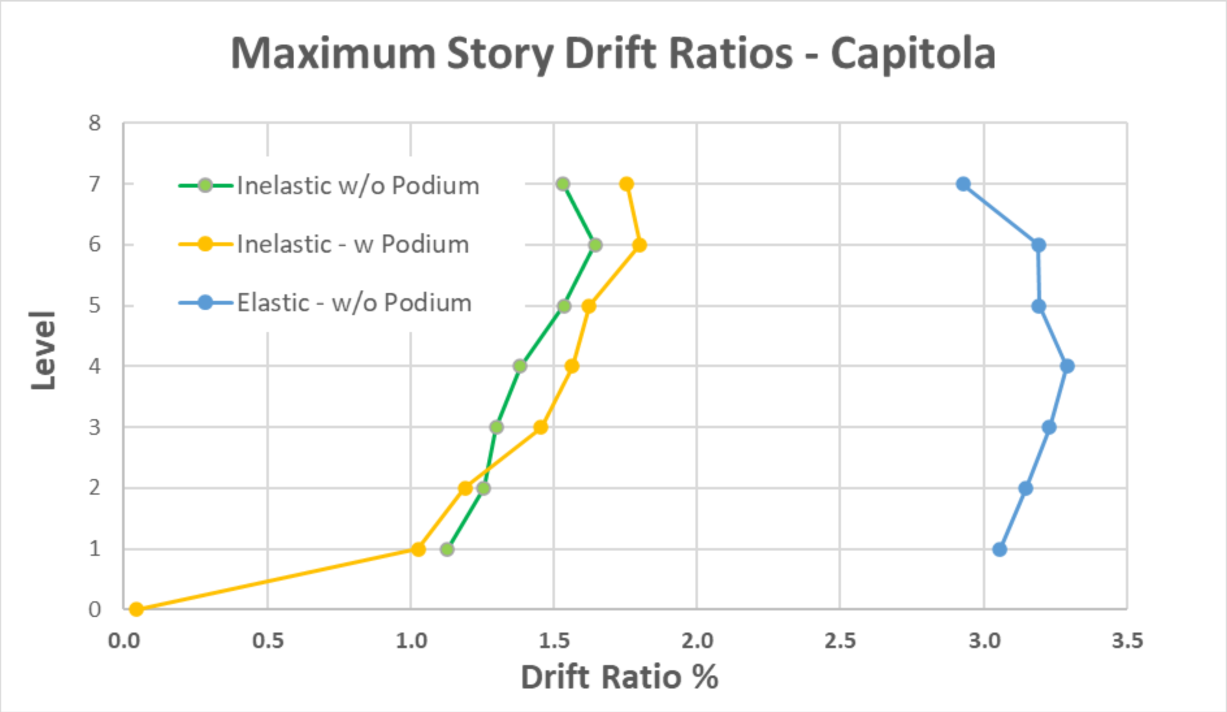
Comparison of Maximum Responses – Loma Prieta (Capitola)

- ***PGA – 0.529 g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)



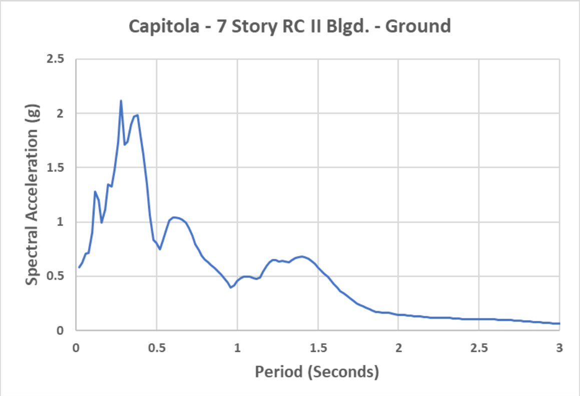


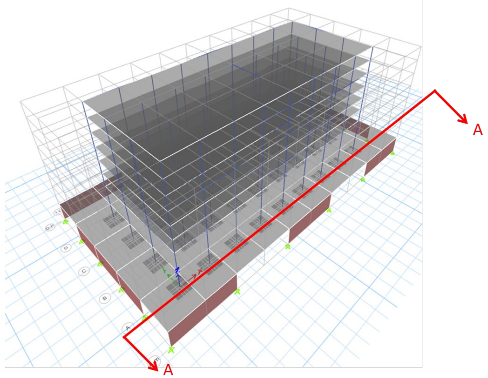


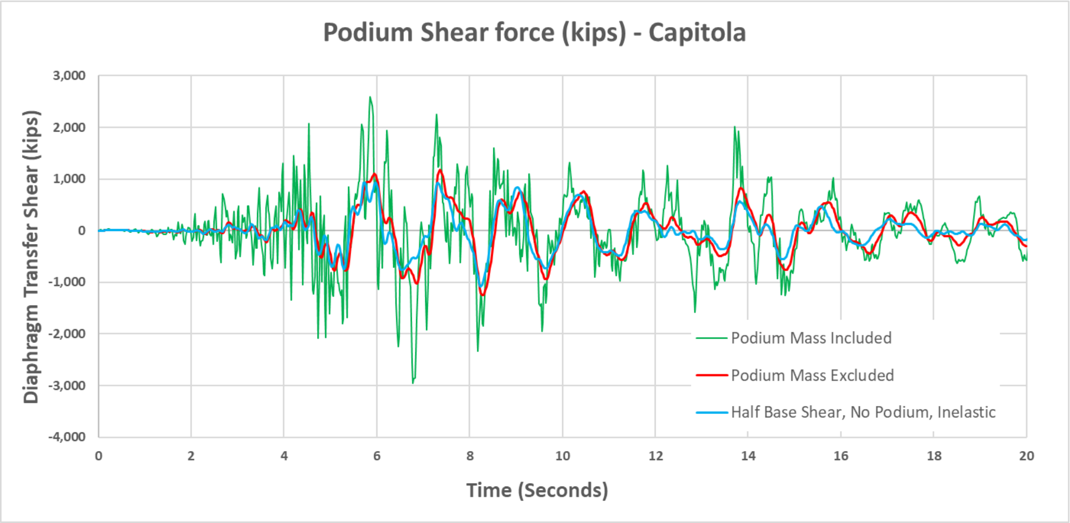
Example: 7-story Concrete MF + SW@1st floor

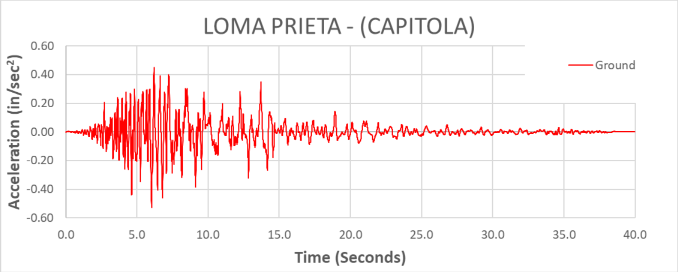
Podium Shear Time History Comparisons – Loma Prieta (Capitola)

- ***PGA – 0.529g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)







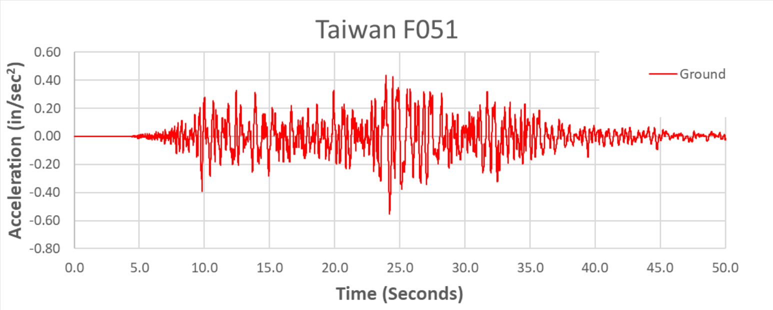


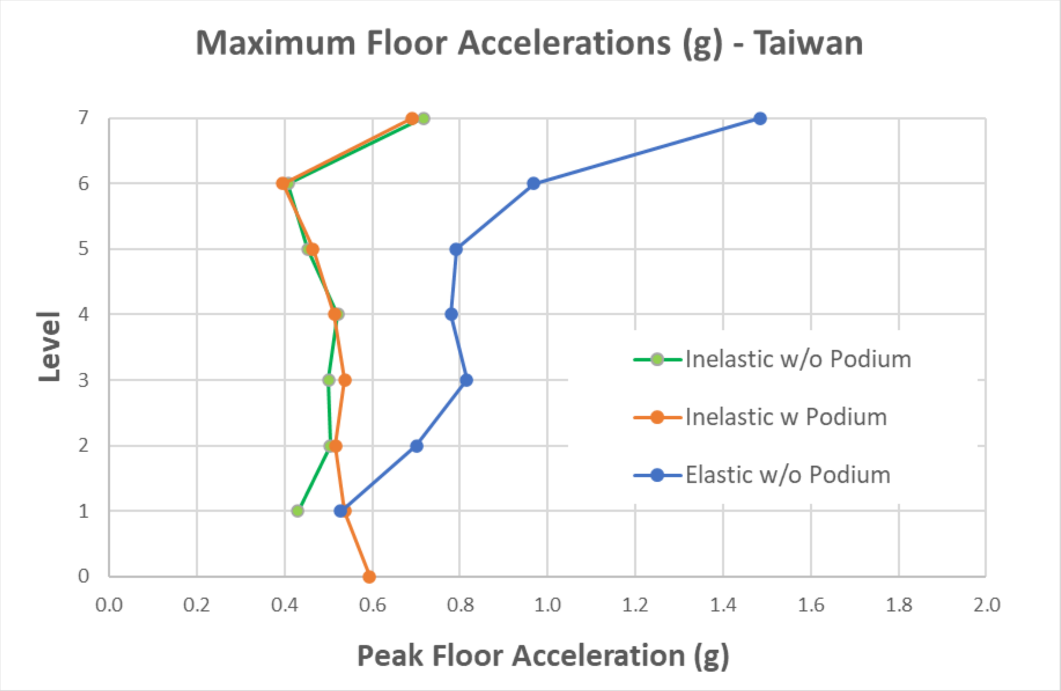
Maximum Podium Shears (Capitola) - Kips	
Podium Mass Included	1611
Podium Mass Excluded	1253
Podium Mass Excluded Discontinuous Columns	954
Half Base Shear Fixed Base - Inelastic(No Podium)	1085
Half Base Shear Fixed Base - Elastic(No Podium)	2750

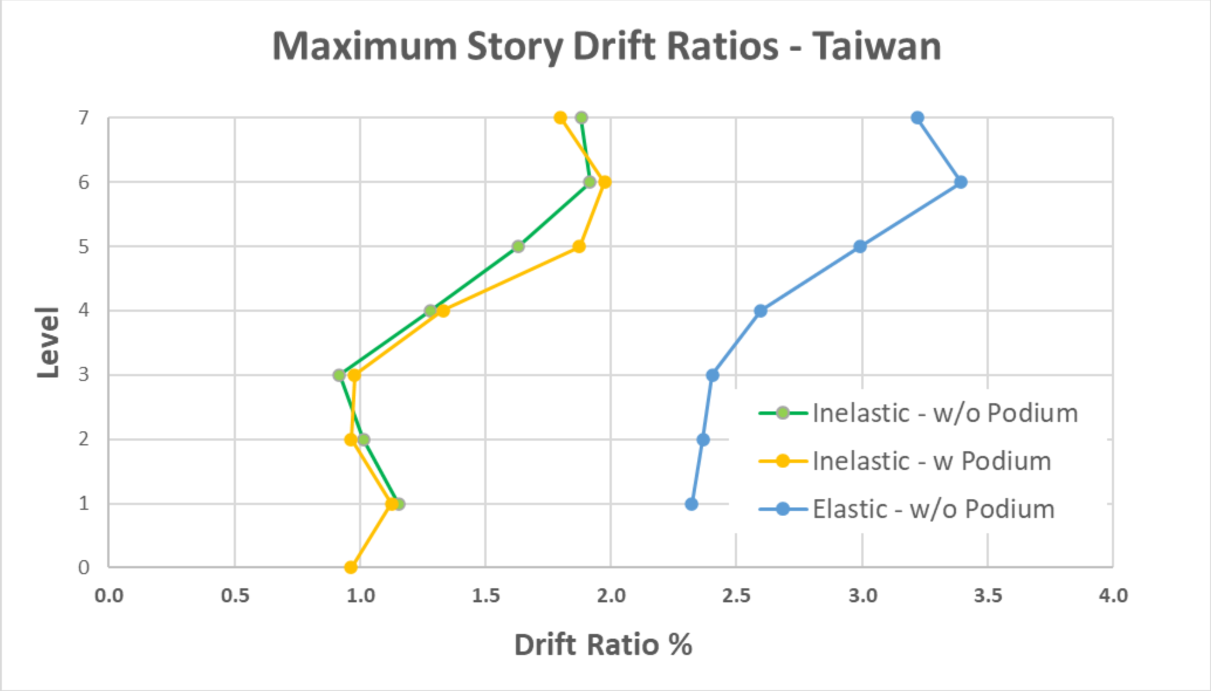
Example: 7-story Concrete MF + SW@1st floor

Comparison of Maximum Responses – Taiwan

- ***PGA – 0.552 g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)



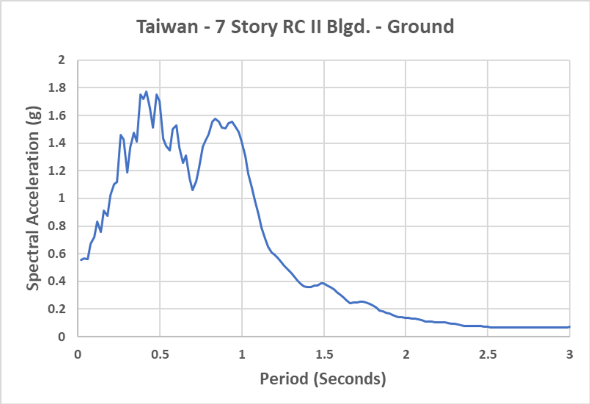


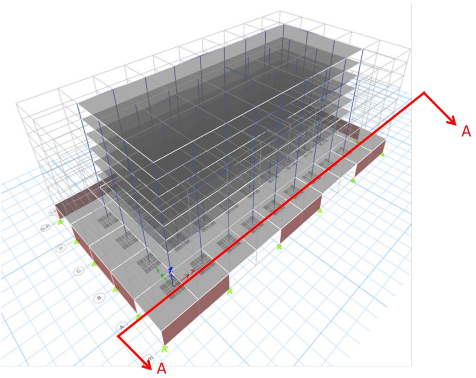


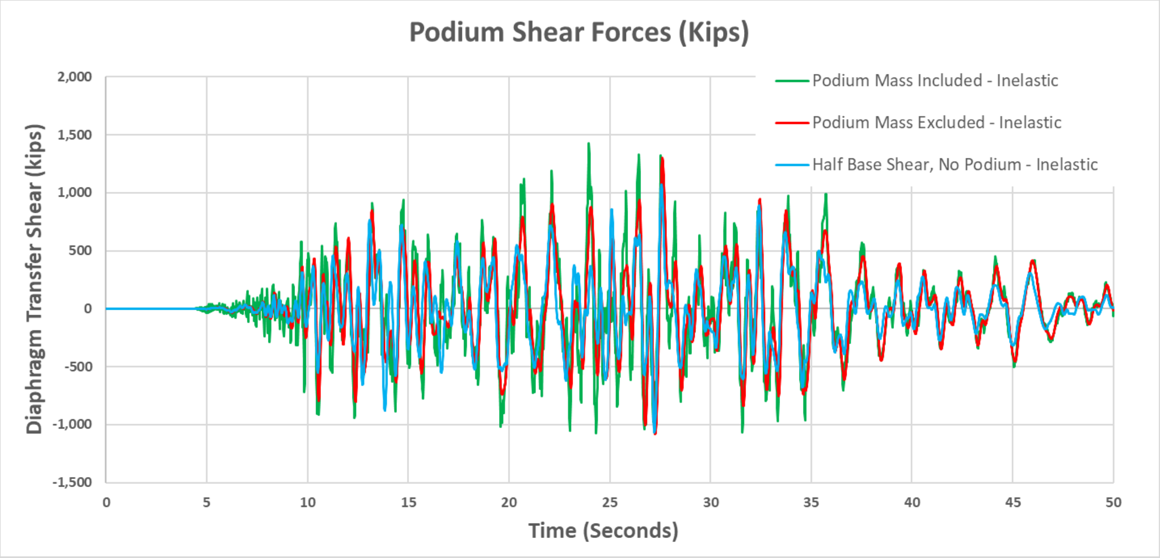
Example: 7-story Concrete MF + SW@1st floor

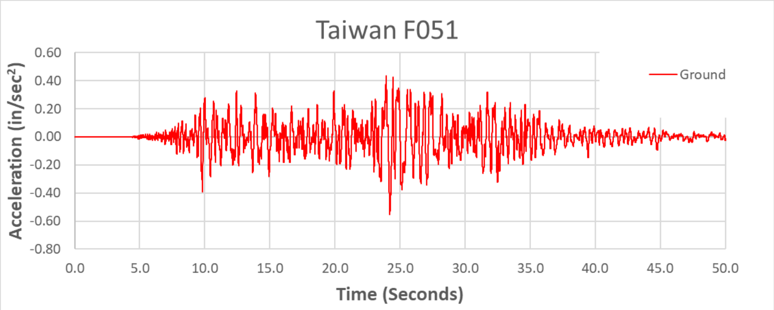
Podium Shear Time History Comparisons – Taiwan

- ***PGA – 0.552g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)









Maximum Podium Shears (Taiwan) - Kips	
Podium Mass Included	1425
Podium Mass Excluded	1300
Podium Mass Excluded Discontinuous Columns	976
Half Base Shear Fixed Base - Inelastic(No Podium)	1073
Half Base Shear Fixed Base - Elastic(No Podium)	2554

Example: 7-story Concrete MF + SW@1st floor

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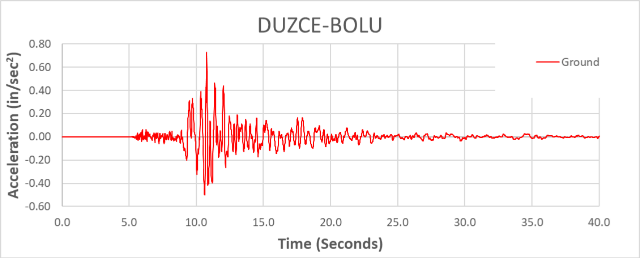
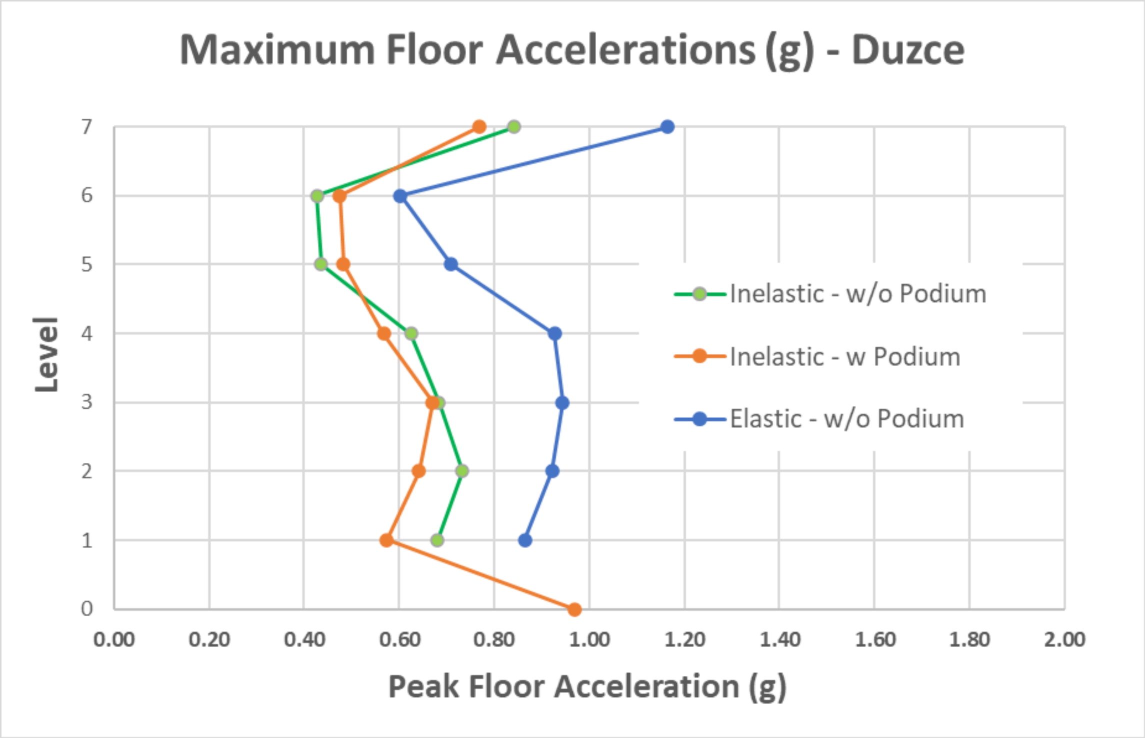
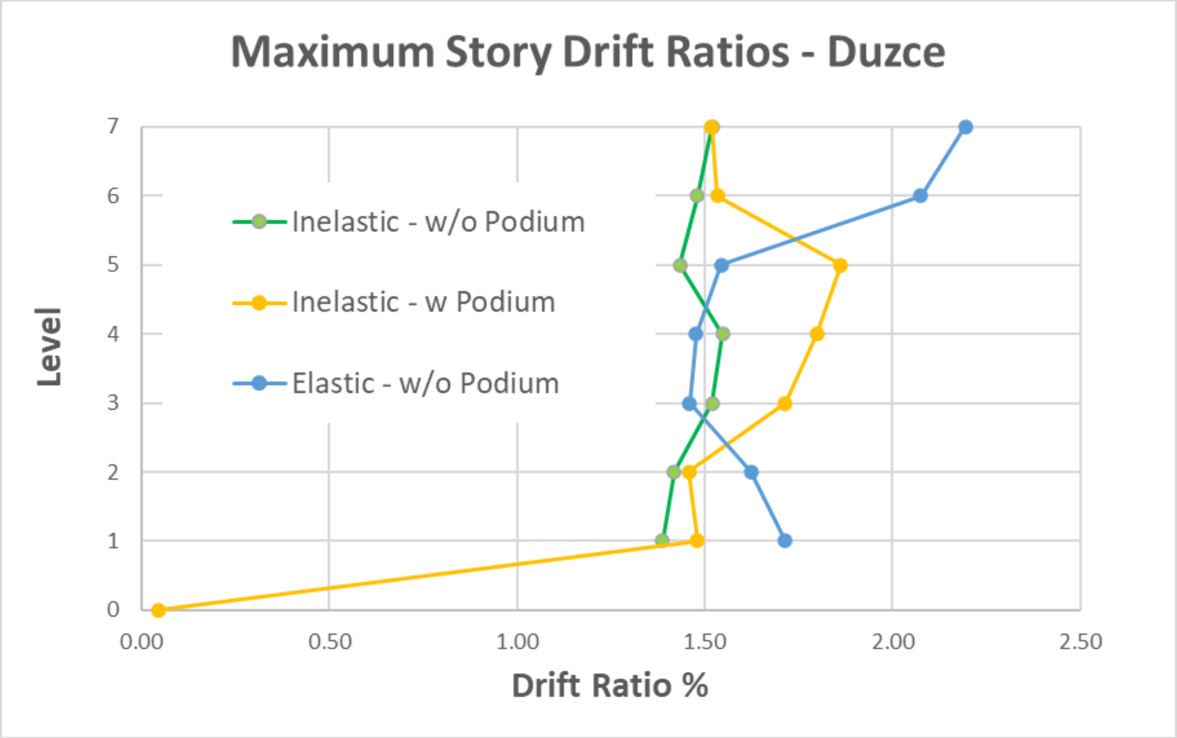
Comparison of Maximum Responses – Duzce Bolu

- ***PGA – 0.726 g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)





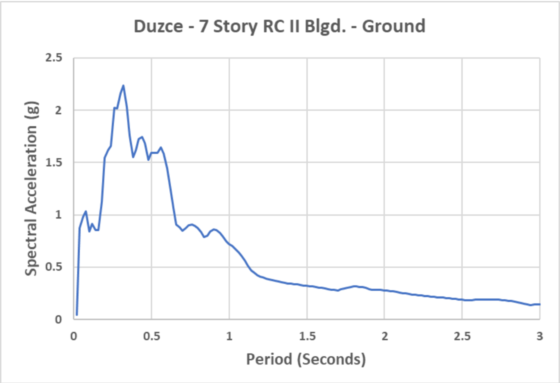


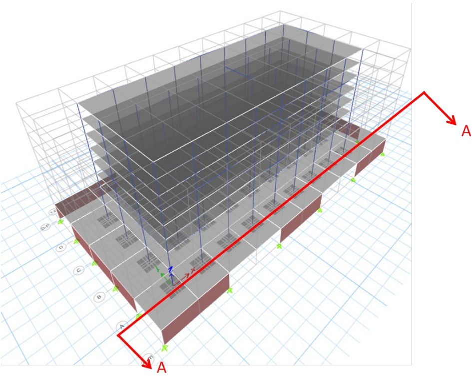
Example: 7-story Concrete MF + SW@1st floor

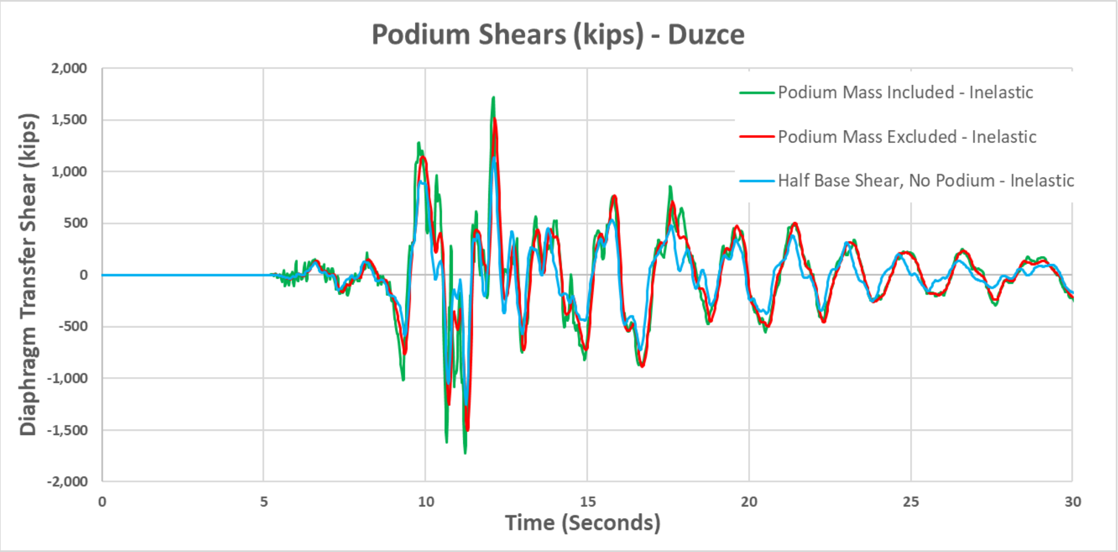
HCAi Department of Health Care Access and Information

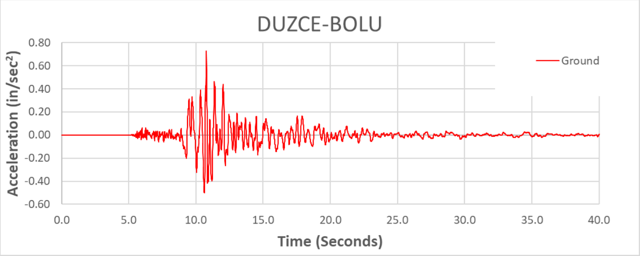
Podium Shear Time History Comparisons – Duzce Bolu

- ***PGA – 0.726g***
- Model 1 (7 Story Fixed Base, No Podium)
- Model 2(Podium at 1st Floor)









Maximum Podium Shears (Duzce) - Kips	
Podium Mass Included	1725
Podium Mass Excluded	1515
Podium Mass Excluded Discontinuous Columns	1115
Half Base Shear Fixed Base - Inelastic(No Podium)	1255
Half Base Shear Fixed Base - Elastic(No Podium)	1933

Example: 7-story Concrete MF + SW@1st floor

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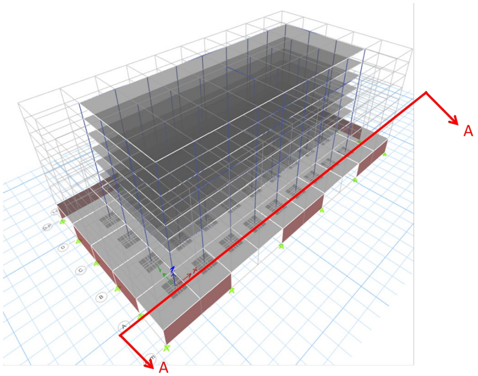
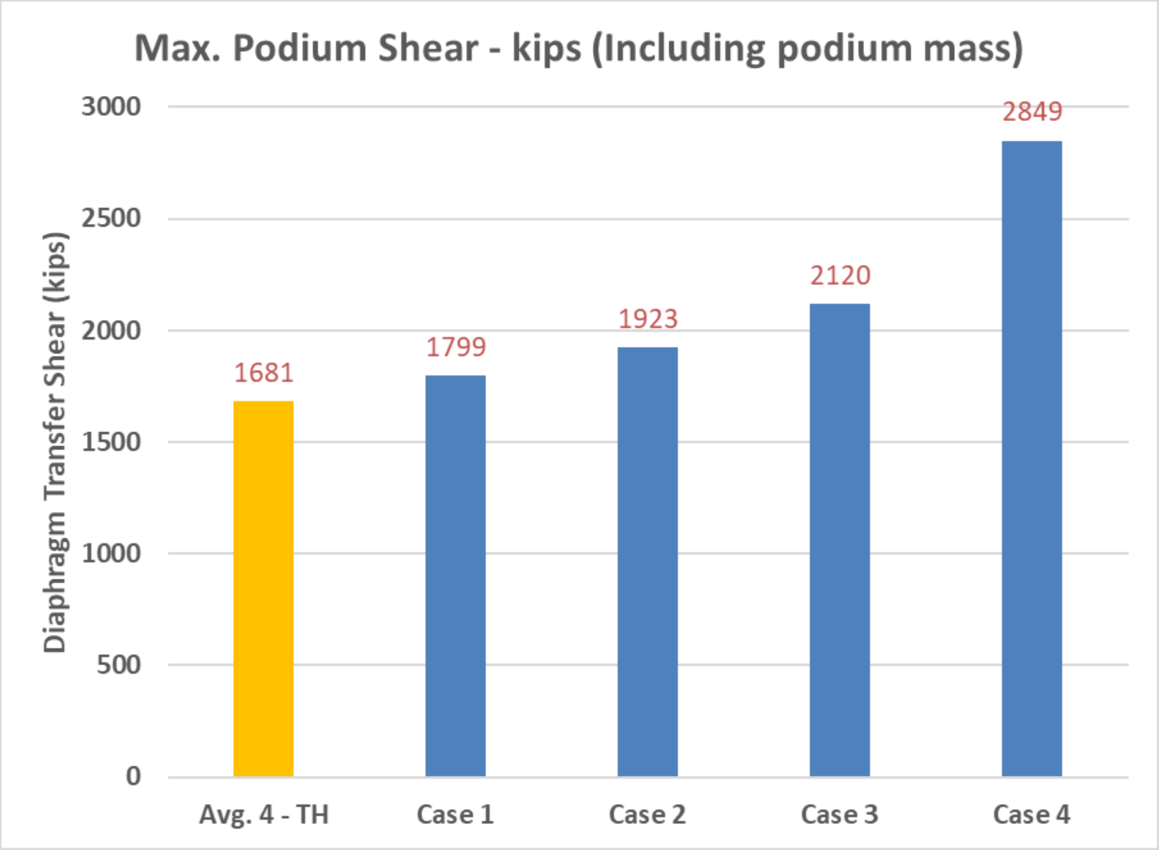
Summary of Diaphragm Transfer Forces, w/Podium Masses

- Model 2(Podium at 1st Floor)





Avg. 4-TH: Average Max Diaph shears from the 4 eqk TH w/podium mass inc.

Case 1: R, Ω & Period from Upper (ELF: Fixed Base no podium)

826/2*3 + 1119/2 = 1799

Case 2: R, Ω & Period from Upper (ELF: Fixed Base with Podium)

909/2*3 + 1119/2 = 1923

Case 3: R, Ω & Period from Upper (Forces: Massless Podium Model)

520*3 + 1119/2 = 2120

Case 4: R, Ω & Period from Lower (ELF: Fixed Base Lower)

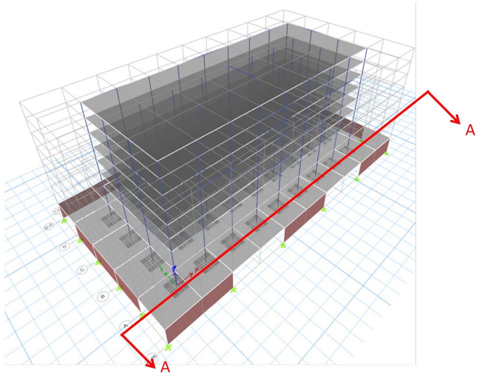
1832/2*2.5 + 1119/2 = 2849

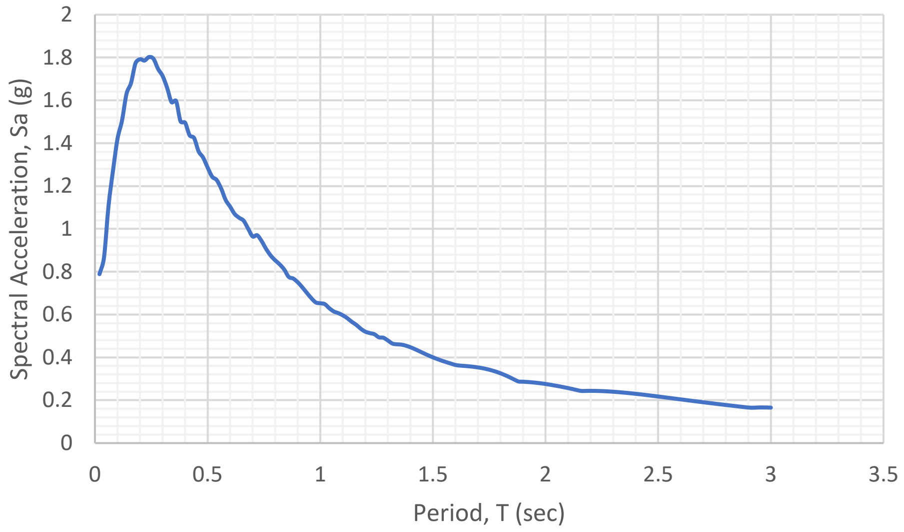
Podium Shear Time History Summary

- *7 Spectrally Matched Time Histories*

Max Podium Shears (Spectrally Match 7 TH) - Kips	
Christchurch	1806
Loma Prieta Sratoga Station	2131
Duzce	1968
Tabas	1971
Elcentro Imp Valley	2073
Darfield	2093
ChiChi	1825.1

Average = 1981 k





Example: 7-story Concrete MF + SW@1st floor

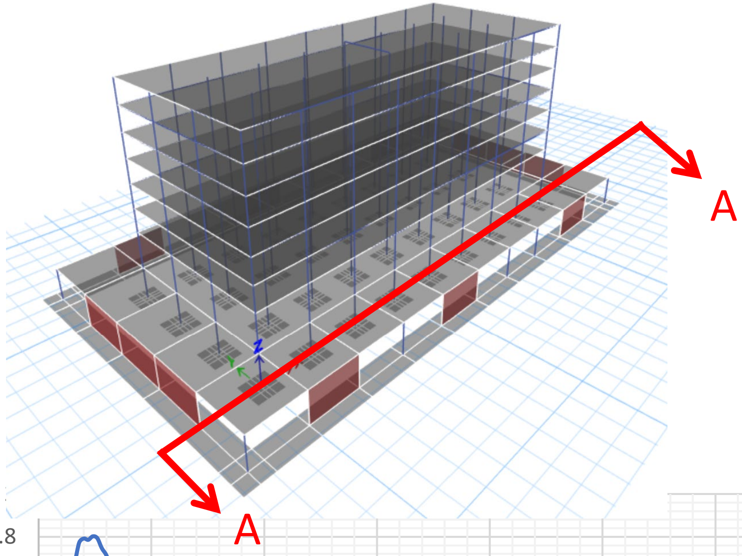
Podium Shear Time History Summary (Soil spring supports)

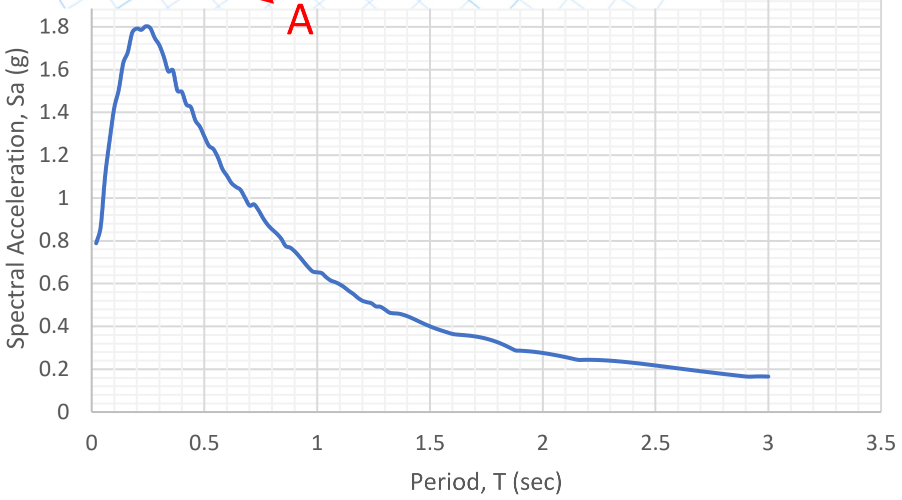
- *7 Spectrally Matched Time Histories*

Max Podium Shears (Spectrally Match 7 TH) - Kips Area Spring supports all elements	
Christchurch	1642
Loma Prieta Sratoga Station	1959
Duzce	1879
Tabas	1962
Elcentro Imp Valley	1974
Darfield	2014
ChiChi	1611

Average = 1863 k

About a 6% reduction in podium transfer shears with nonlinear soil flexibility.





Example: 7-story Concrete MF + SW@1st floor

Example: 7 - Story Concrete Special Moment Frame + Podium

Diaphragm Force @ Transfer Diaphragm Eq. 12.10-4

Design Parameter		7-story Example + Podium RCMF	7-story Example + Podium RCSW	7-story Example + Podium
Lateral Resisting System		RCMF	RCSW	RCSW
n =		8	8	1
Ω_o =		3	2.5	2.5
S_{DS} =		1.63	1.63	1.63
S_{D1} =		0.64	0.64	0.64
I_e =		1	1	1
h_n =		77	77	12
C_t =		0.016	0.02	0.02
x		0.9	0.75	0.75
T =		0.80	0.52	0.13
C_u =		1.4	1.4	1.4
T_{max} =		1.12	0.73	0.18
R =		8	6	6
Cs =		0.20	0.27	0.27
Cs =		0.07	0.15	0.59
C_s min =		0.07	0.07	0.07
C_s (design) =		0.07	0.15	0.27
$C_{s2}(1)$ =	$(0.15n + 0.25)I_eS_{DS}$ =	2.36	2.36	0.65
$C_{s2}(2)$ =	I_eS_{DS} =	1.63	1.63	1.63
$C_{S2}(3)$ =	$I_eS_{D1}/0.03(n-1) >= 2$	3.05	3.05	0.00
C_{s2} (design) =		1.63	1.63	0.00
z_s =		0.7	1	1
Γ_{m1} =	$1 + z_s/2(1 - 1/n)$ =	1.31	1.44	1.00
Γ_{m2} =	$0.9z_s(1 - 1/n)^2$ =	0.48	0.69	0.00
C_{pn} =	$\sqrt{(\Gamma_{m1}\Omega_0 C_s)^2+(\Gamma_{m2}C_{s2})^2}$	0.83	1.24	0.679

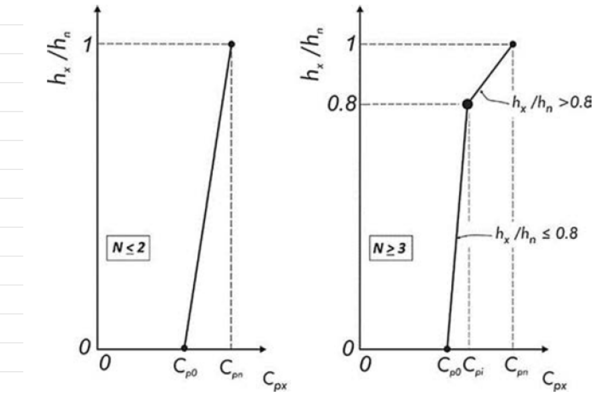


Figure 12.10-2. Calculating the design acceleration coefficient, C_{px}, in buildings with $N \le 2$ and in buildings with $N \ge 3$.

Design Parameter		7-story Example + Podium RCMF	7-story Example + Podium RCSW	7-story Example + Podium
C_{p0} =	$0.4S_{DS}I_e$	0.648	0.648	0.648
C_{pi} =	$0.8C_{p0}$	0.66	0.99	0.54
C_{pi} =	$C_{pi} = 0.9\Gamma_{m1}\Omega_0 C_s$	0.25	0.47	0.61
$C_{pi\,(Design)}$ =	Fig. 12.10-2	0.66	0.99	0.61
Ht of Diap. (ft)		12	12	12
$C_{px\,(Design@L1)}$ =	Design Accel Coefficient	0.651	0.714	0.675
R_s	Table 12.10-1	1.5	1.5	1.5
W_{px}	Weight of Diaphragm	3454	3454	3454
F_{px} (kips)	Diap. Seismic Design Force	1499	1644	1554
F_{px_min} =	$0.2S_{DS}I_eW_{px}$	1119.1	1119.1	1119.1

Example: 7-story Concrete MF + SW@1st floor

Example: 7 - Story Concrete Special Moment Frame + Podium

Diaphragm Force @ Transfer Diaphragm Eq. 12.10-4

Design Parameter		7-story Example + Podium RCMF	7-story Example + Podium RCSW	7-story Example + Podium
Lateral Resisting System		RCMF	RCSW	RCSW
n =		8	8	1
Ω_o =		3	2.5	2.5
S_{DS} =		1.62	1.62	1.62
S_{D1} =		0.64	0.64	0.64
I_e =		1	1	1
h_n =		77	77	12
C_t =		0.016	0.02	0.02
x		0.9	0.75	0.75
T =		0.80	0.52	0.13
C_u =		1.4	1.4	1.4
T_{max} =		1.12	0.73	0.18
R =		8	5	5
Cs =		0.20	0.32	0.32
Cs =		0.07	0.18	0.71
C_s min =		0.07	0.07	0.07
C_s (design) =		0.07	0.18	0.32
$C_{s2}(1)$ =	$(0.15n + 0.25)I_eS_{DS}$ =	2.35	2.35	0.65
$C_{s2}(2)$ =	I_eS_{DS} =	1.62	1.62	1.62
$C_{s2}(3)$ =	$I_eS_{D1}/0.03(n-1)$ >= 2	3.05	3.05	0.00
C_{s2} (design) =		1.62	1.62	0.00
z_s =		0.7	1	1
Γ_{m1} =	$1 + z_s/2(1 - 1/n)$ =	1.31	1.44	1.00
Γ_{m2} =	$0.9z_s(1 - 1/n)^2$ =	0.48	0.69	0.00
C_{pn} =	$\sqrt{(\Gamma_{m1}\Omega_0 C_s)^2 + (\Gamma_{m2} C_{s2})^2}$	0.83	1.28	0.810

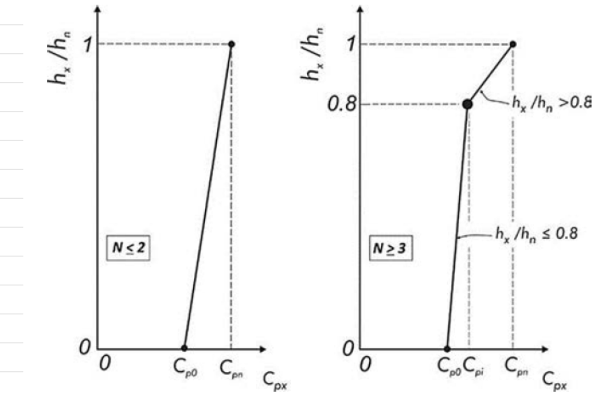


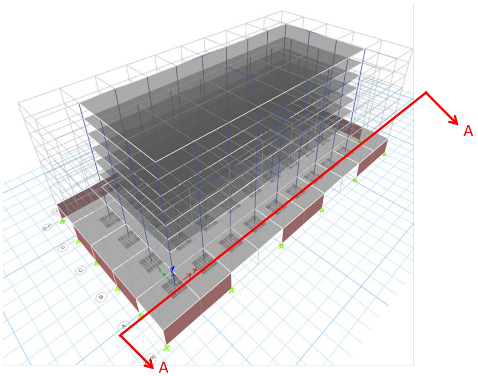
Figure 12.10-2. Calculating the design acceleration coefficient, C_{px}, in buildings with $N \le 2$ and in buildings with $N \ge 3$.

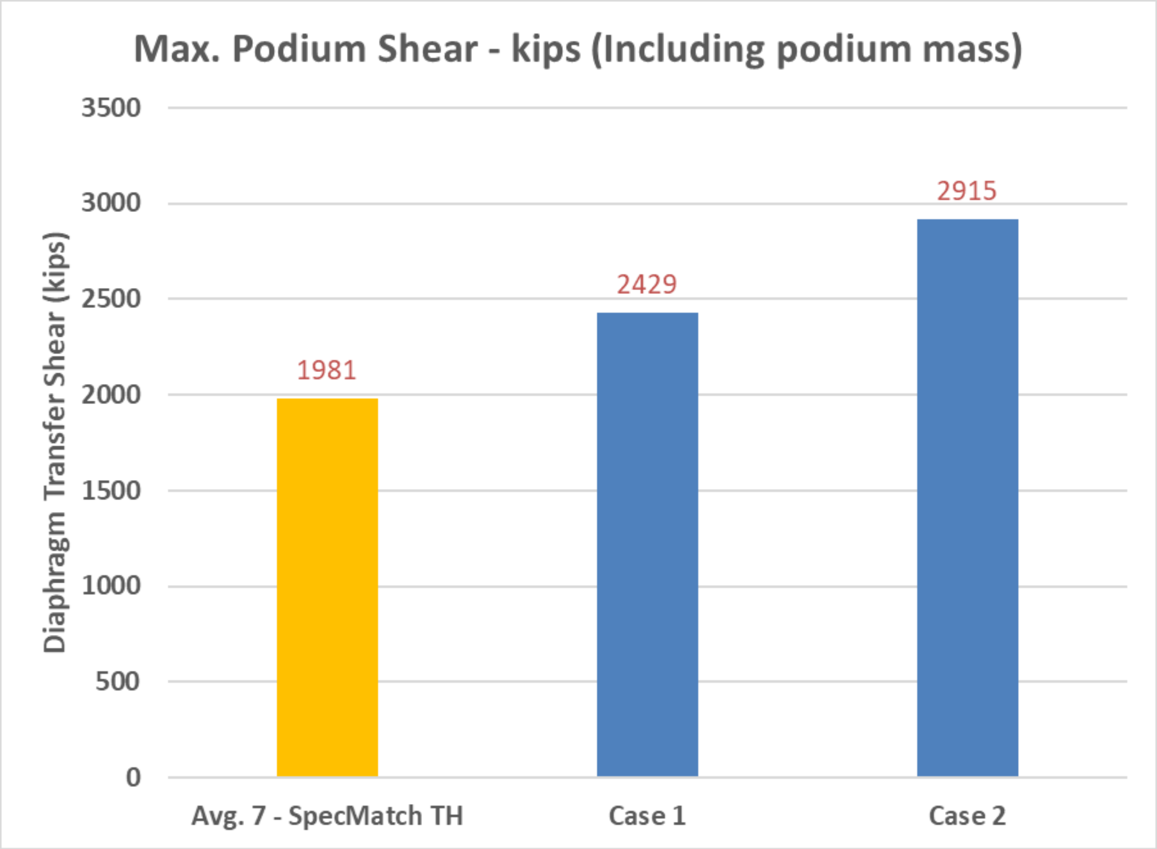
Design Parameter		7-story Example + Podium RCMF	7-story Example + Podium RCSW	7-story Example + Podium
C_{p0} =	$0.4S_{DS}I_e$	0.648	0.648	0.648
C_{pi} =	$0.8C_{pn}$	0.66	1.03	0.65
C_{pi} =	$C_{pi} = 0.9\Gamma_{m1}\Omega_0 C_s$	0.25	0.57	0.73
$C_{pi\ (Design)}$ =	Fig. 12.10-2	0.66	1.03	0.73
Ht of Diap. (ft)		12	12	12
$C_{px\ (Design@L1)}$ =	Design Accel Coefficient	0.651	0.722	0.810
R_s	Table 12.10-1	1.5	1.5	1.5
W_{px}	Weight of Diaphragm	3454	3454	3454
F_{px} (kips)	Diap. Seismic Design Force	1499	1662	1865
F_{px_min} =	$0.2S_{DS}I_eW_{px}$	1119.1	1119.1	1119.1

Example: 7-story Concrete MF + SW@1st floor

Summary of Diaphragm Transfer Forces, w/Podium Masses

- Model 2(Podium at 1st Floor)





Avg. 7-Spec. Matched TH: Average Max Diaph shears w/podium mass inc.

Case 1: R, Ω & Period from Upper x R_{upper}/R_{lower}(ELF: Fixed Base no podium)

826/2*3*(8/6) + 1554/2 = 2429

Case 2: R, Ω & Period from Upper x R_{upper}/R_{lower}(ELF: Fixed Base no podium)

826/2*3*(8/5) + 1865/2 = 2915

Example: 7-story Concrete MF + SW@1st floor

Observations

- *Inherent diaphragm shears were earthquake dependent*
- *Transfer forces at the diaphragm exceeded the maximum base shear delivered by the superstructure even when the mass at the diaphragm level was excluded*
- *Transfer forces were lower than the maximum base shear from a fixed base superstructure when the columns were discontinued at the transfer diaphragm level. No backstay effect*
- *The assumption that there is an amplification of R_{upper}/R_{lower} in addition to the maximum force delivered by the superstructure is not substantiated.*
- *Two stage analysis is a reasonable assumption, for the design of the upper structure if two stage criteria is satisfied.*

Recommendations

- *Transfer force amplification by Omega appears to be warranted (Analysis assumed an elastic lower structure which is conservative).*

- *Transfer diaphragms need not be designed for transfer forces greater than the upper bound capacity of the vertical elements of the lower structure.*

- *Analytical model should include all gravity and lateral forces resisting vertical elements in a combined model, upper and lower structure and transfer diaphragms should be designed to accommodate the shear amplification due to load reversals at the transfer diaphragm level.*

- *Collectors and connections should be designed stronger than the body of the diaphragm.*

Item #10 Proposed reduction of the Lower bound F_p force requirement for design of nonstructural components in base isolated hospital buildings

- Discussion and public input

Facilitator: Roy Lobo, PhD, SE, Principal Structural Engineer, HCAI (or designee)

Justification for Lowering the Lower Bound F_p Force for Nonstructural Components in Base Isolated Structures

Roy Lobo

3/12/2025

Outline of Presentation

- *Current requirements in ASCE 7-22*
- *Comparison of PGA to derived S_{DS} input demands for non-isolated and isolated instrumented buildings*
- *Floor spectral accelerations at the level above the isolators relative to input acceleration for two instrumented base isolated buildings*
- *Building response parameters from a case study model of a seven-story reinforced concrete moment frame building on a one-story podium with and without base isolator supports*
- *Evaluation of proposed lower bound $F_{p,min}$ from the base isolation committee of ASCE 7-28 with the current $F_{p,min}$* for design of nonstructural components
- *Observations and code change recommendations*

Current requirements in ASCE 7-22

- *Design force F_p from a Nonlinear Response History Analysis Section 13.3.1.5*

$$F_p = I_p W_p a_i \left[\frac{C_{AR}}{R_{po}}\right] \qquad (13.3\text{-}7)$$

- *Upper and lower limits shall apply*

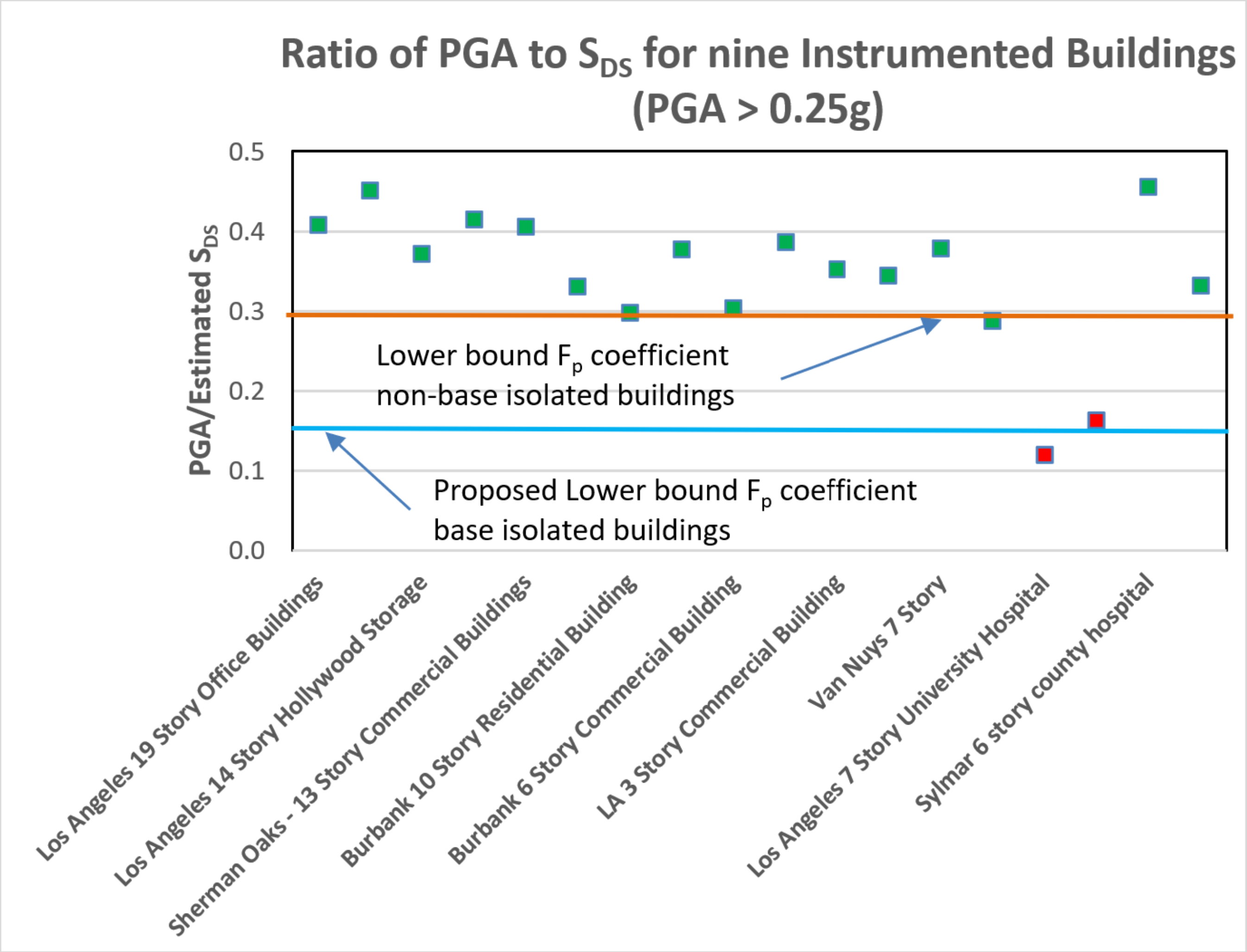
F_p is not required to be taken as greater than

$$F_p = 1.6 S_{DS} I_p W_p \qquad (13.3\text{-}2)$$

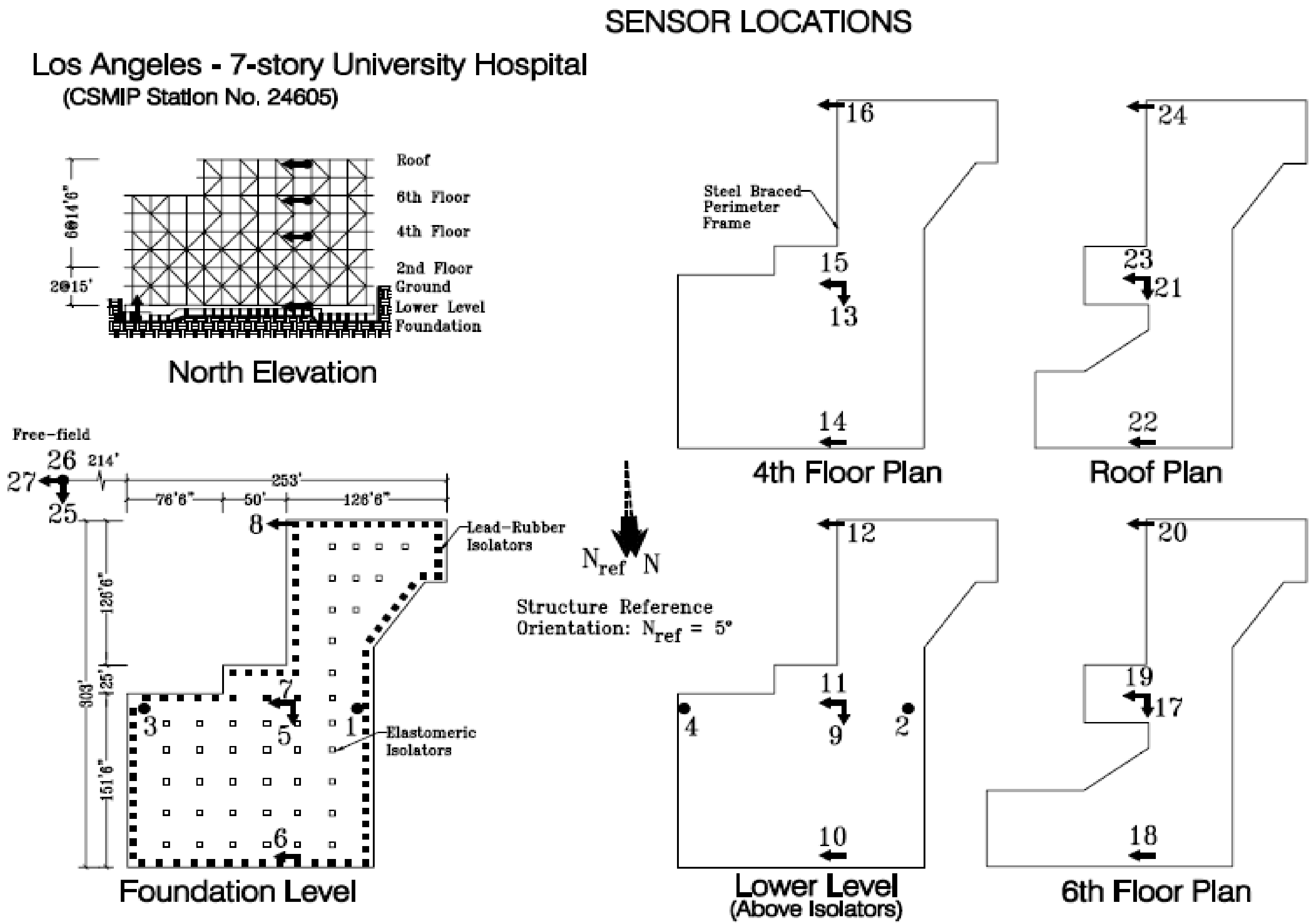
and shall not be taken as less than

$$\boxed{F_p = 0.3 S_{DS} I_p W_p \qquad (13.3\text{-}3)}$$

Ratio of PGA to S_{DS} from Instrumented Buildings where PGA > 0.25g



Ratio of PGA to S_{DS} from Instrumented Buildings where PGA > 0.25g



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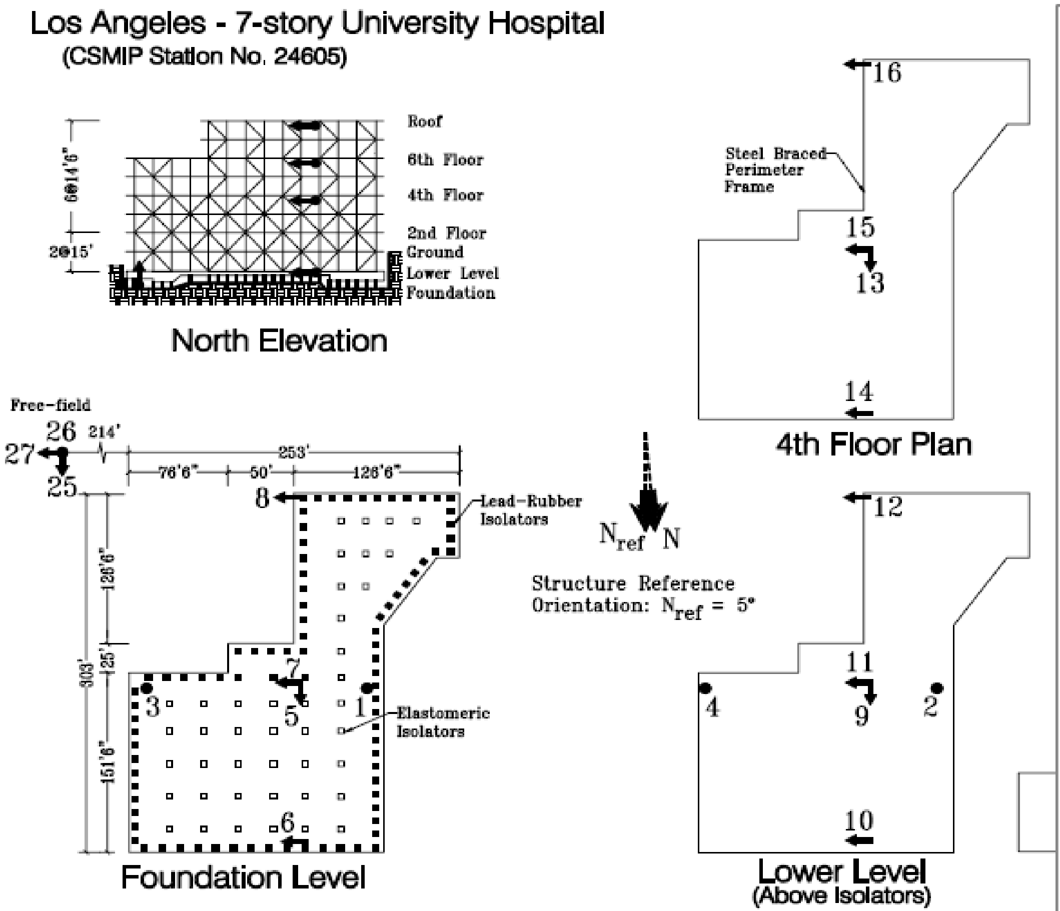
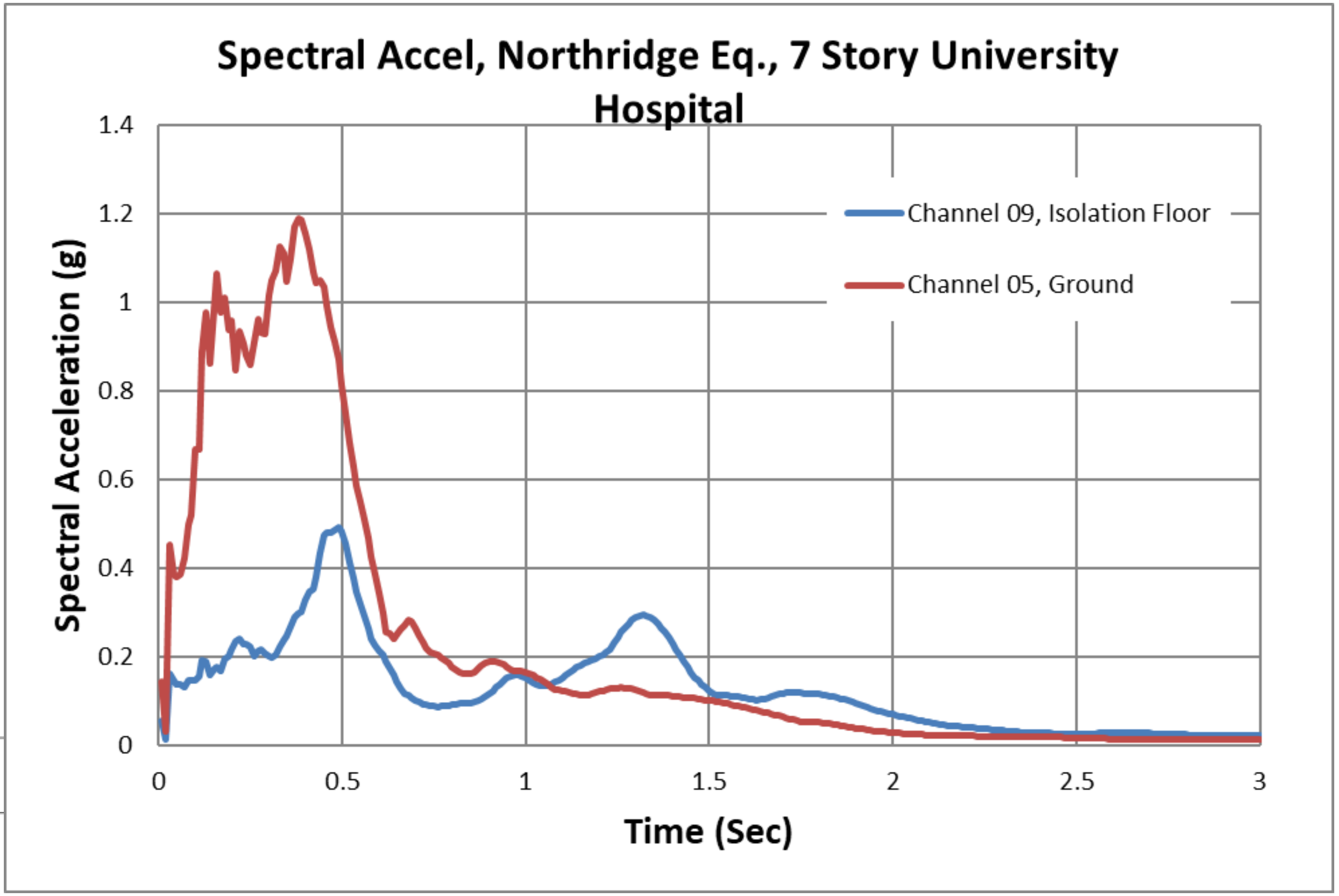
Spectral Acceleration at Ground vs Isolation Floor

SENSOR LOCATIONS





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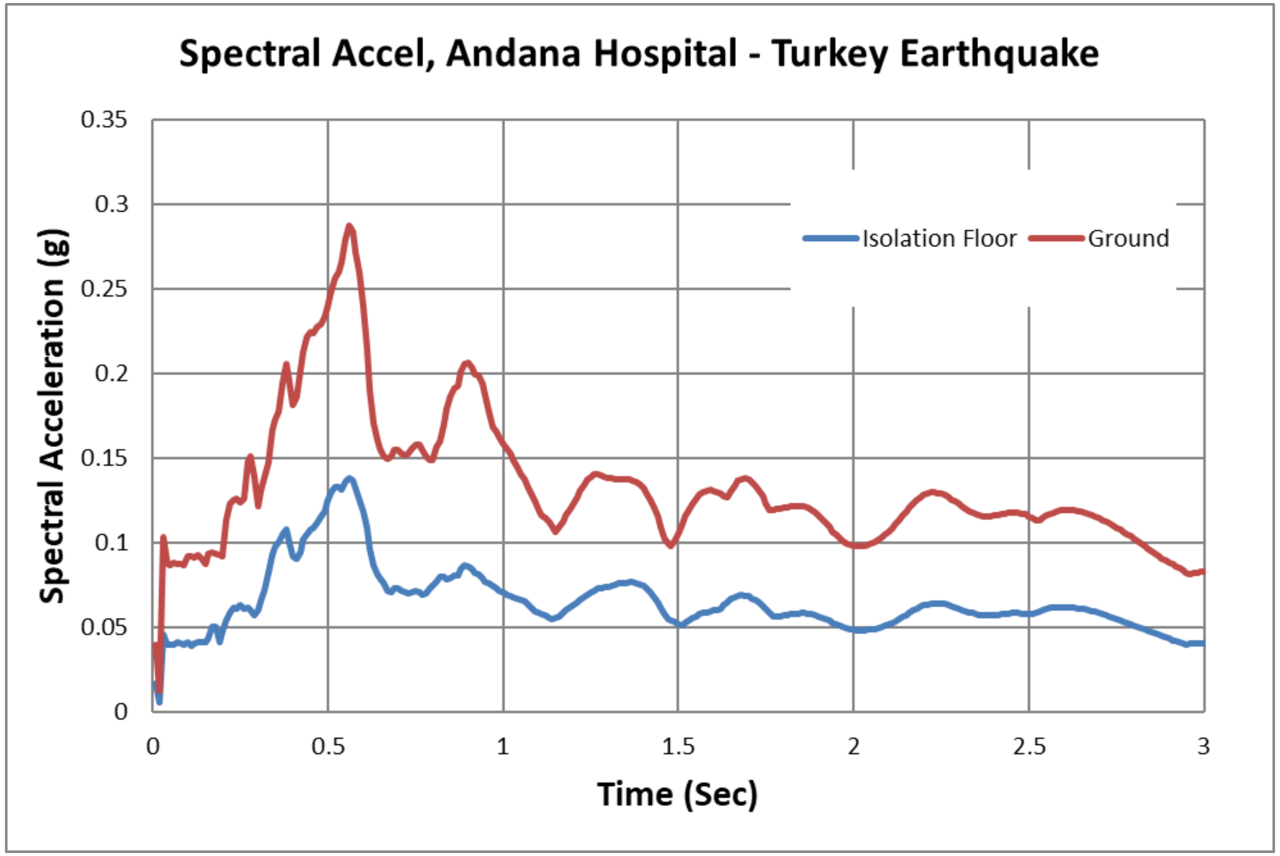
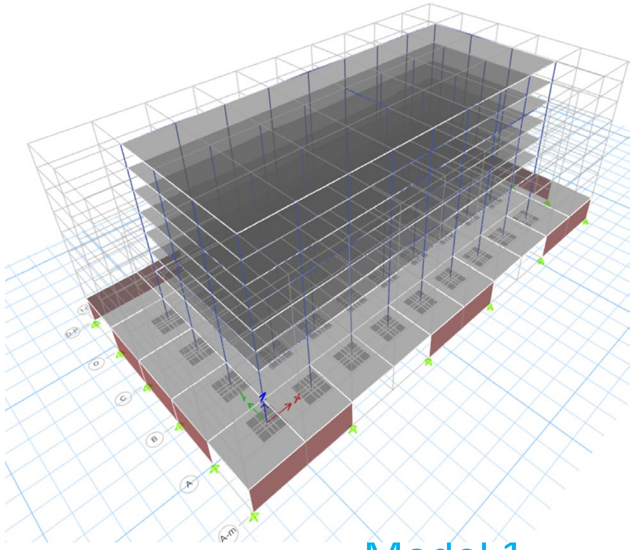
Spectral Acceleration at Ground vs Isolation Floor



Example: 7 - Story Concrete Special Moment Frame on a Stiff Podium

- *Building is a modified version of the 7-story Van Nuys building that satisfies the requirement of a Risk Category II building with the following modifications*
- ***General Assumptions - Linear Elastic Properties***
  - *Building modeled on shallow foundations*
  - *Beam and column dimensions modified to satisfy ACI and ASCE 7 strength and drift requirements for an RC II buildings*
  - *Only Longitudinal direction considered.*
  - *Beam Stiffness = 0.3 EI*
  - *Column Stiffness = 0.3 – 0.5 EI*
  - *No shear failures*
  - *Strong column weak beam satisfied*
  - *Stiff diaphragm and elastic shear walls, pin based at first floor*

  - *Non isolated Building Periods Longitudinal Direction*
    - *Mode 1 = 1.55 second*
    - *Mode 2 = 0.58 seconds*
    - *Mode 3 = 0.32 seconds*



Model 1

Model with Podium at 1st Floor, Pin Base Walls

Example: 7-story Concrete MF + SW@1st floor

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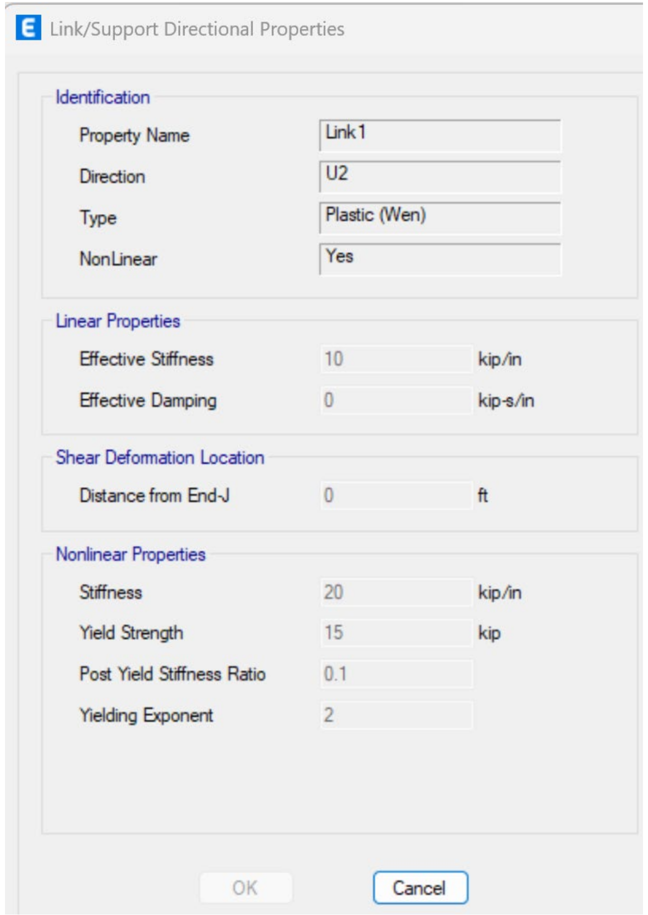
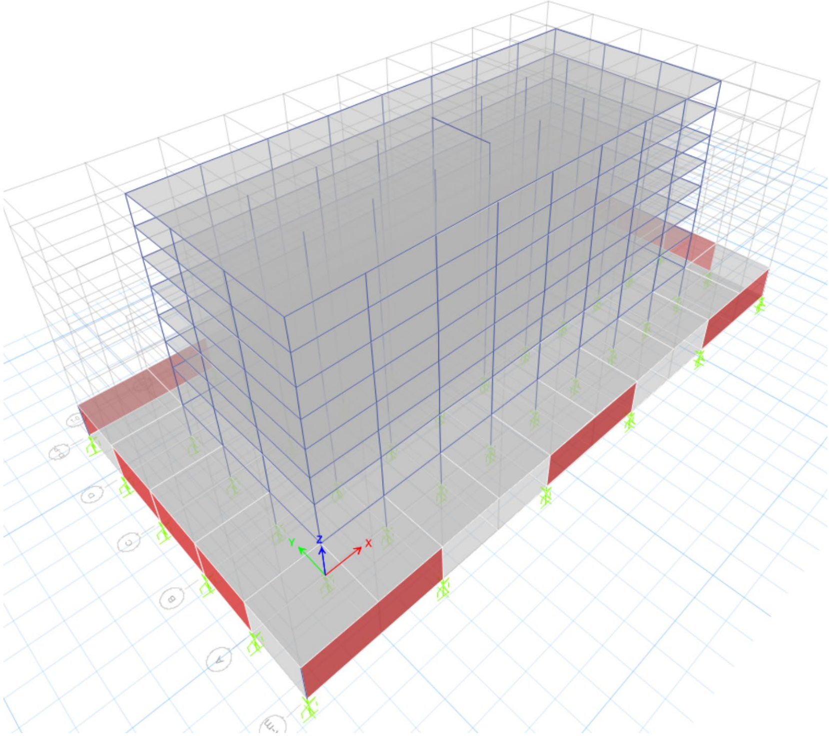
Example: 7 - Story Concrete Special Moment Frame on a Stiff Podium with Base Isolators modeled with a Bouc-Wen hysteretic model

- *All foundation column and pin based wall supports are replaced with nonlinear isolators of the type Plastic (Wen) in ETABS*
- *Lateral Isolator Properties*
- *Building Periods*
  - *Mode 1 = 2.25 second*
  - *Mode 2 = 0.84 seconds*
  - *Mode 3 = 0.47 seconds*



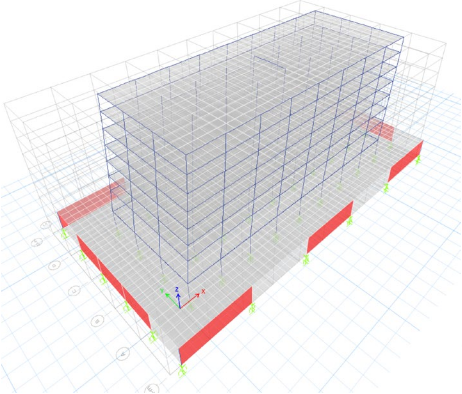


Model 2

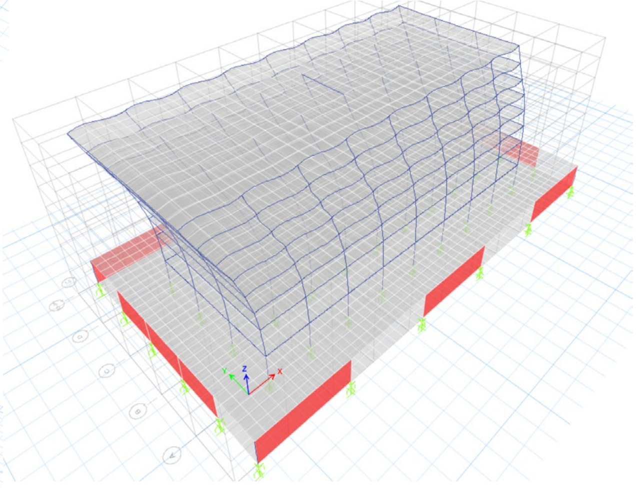
Model with Podium at 1st Floor on Isolators

Example: 7 - Story Concrete Special Moment Frame on a Podium with Base Isolators modeled with a Bouc-Wen hysteretic model

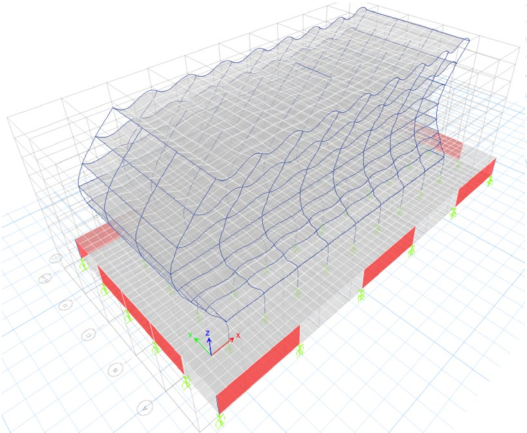
- *Building Periods translational longitudinal direction*
  - *Mode 1 = 2.25 seconds*



  - *Mode 2 = 0.84 seconds*



  - *Mode 3 = 0.47 seconds*



Model 2
Model with Podium at 1st Floor on Isolators

Example: 7-story Concrete MF + SW@1st floor

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Analyses Performed

- ***Linear elastic and nonlinear direct time history analyses were performed on the Non-Isolated model and nonlinear direct time history analysis was performed on the model with isolators.***

- ***ETABS Model – Nonlinear direct integration***
  - *Newmark Direct Integration Method – Rayleigh Damping 2% Nonlinear and 5% Linear Elastic*
  - *Hysteretic model beams and columns – Takeda*
  - *Post yield stiffness ≈ 10 – 15%*

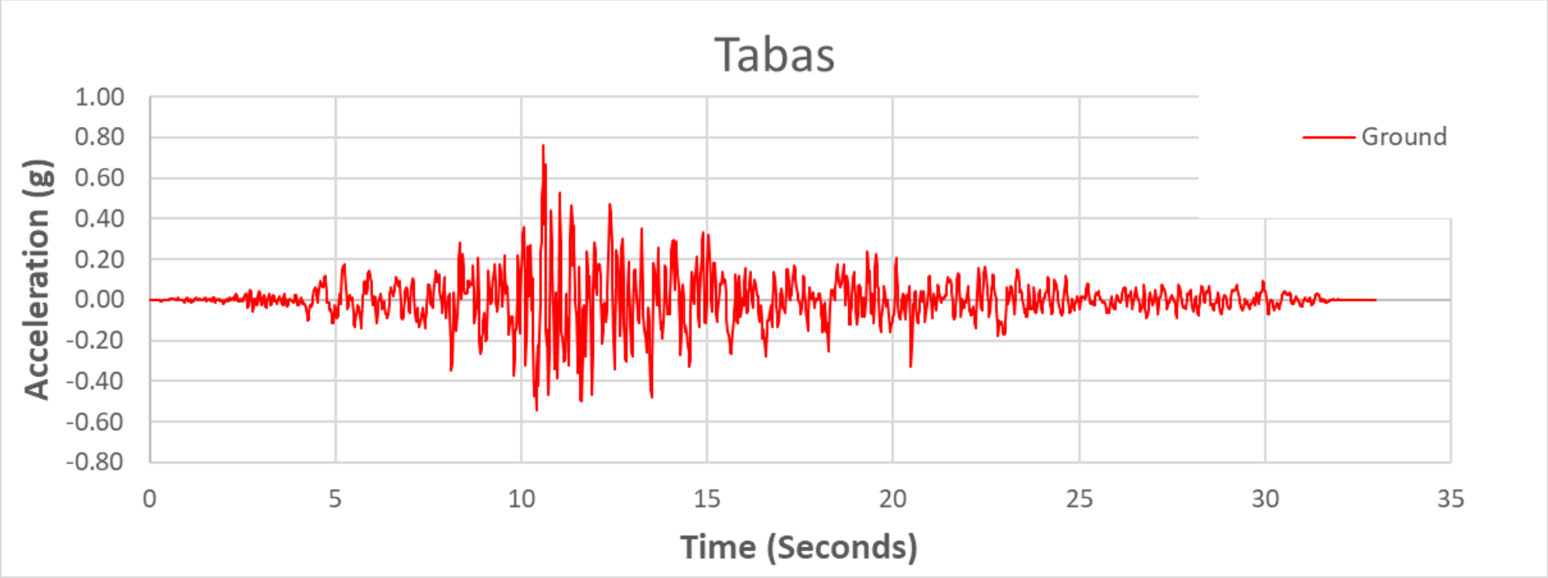
- ***Isolator properties were selected to limit the base shear to approximately the half the inelastic base shear***

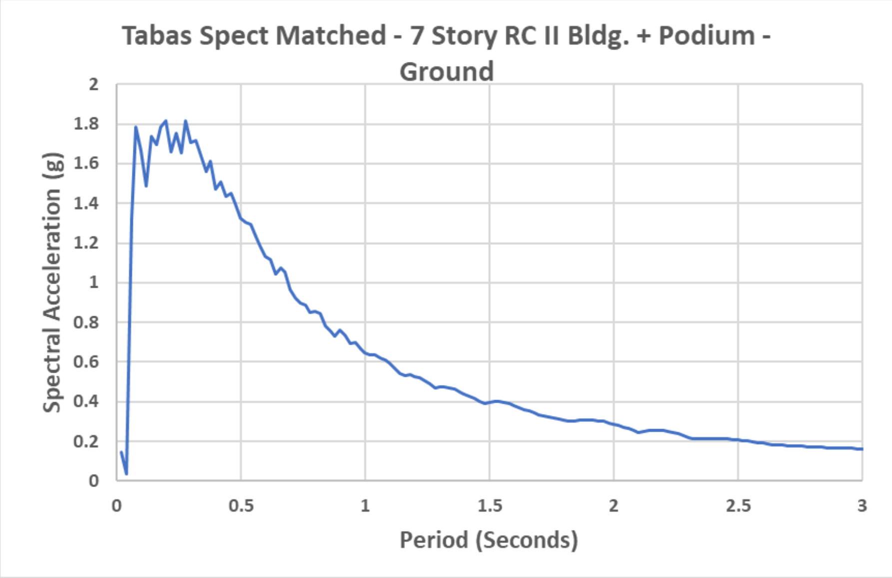
Nonlinear Time History Ground Motion Selection

- ***Earthquake ground motion selection was random but based a DE and MCE level earthquakes that would introduce significant nonlinearity in the structure.***
- ***Nonlinear Direct Integration Time Histories Run***
  - ***Tabas Earthquake Spectrally Matched***
  - ***ChiChi Earthquake Spectrally Matched***
  - ***Loma Prieta Capitola Station***
  - ***Chuetsu-Oki –Kashiwazaki City – EW***
  - ***Kobe – Tak000***

Response Comparisons for – Tabas Eqk. Spectrally Matched (SM)

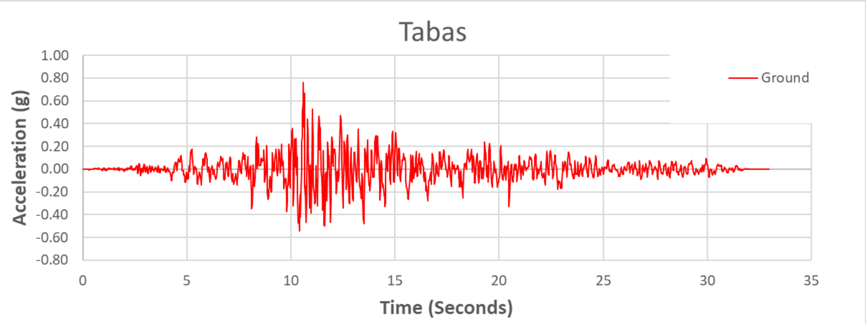
- *PGA – 0.76g*

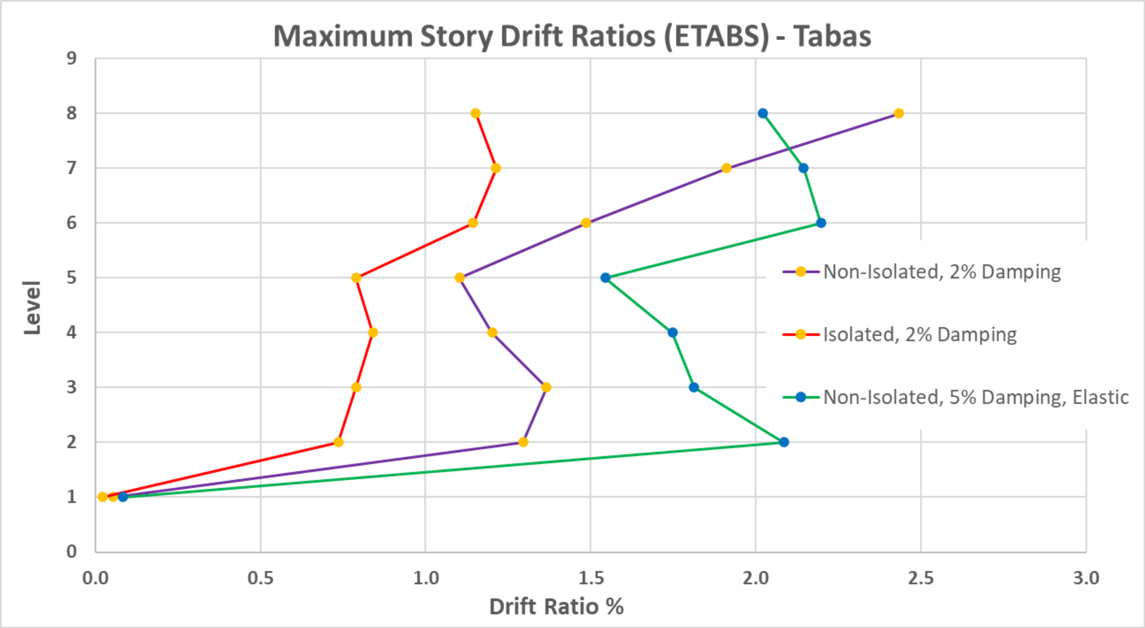


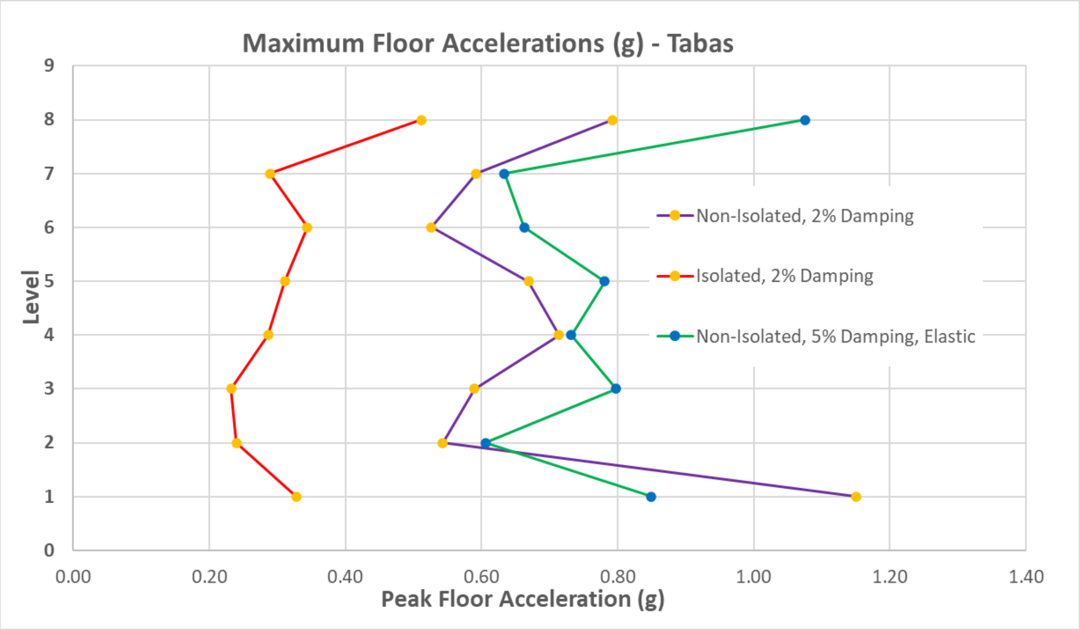


Comparison of Maximum Responses – Tabas Eqk. (SM)

- ***PGA – 0.76 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)







Example: 7-story Concrete MF + SW@1st floor

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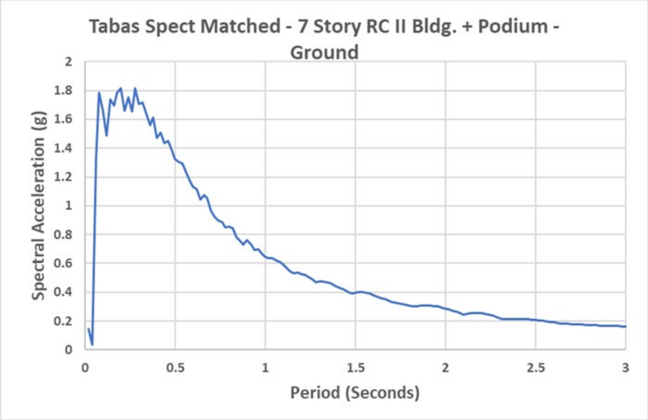
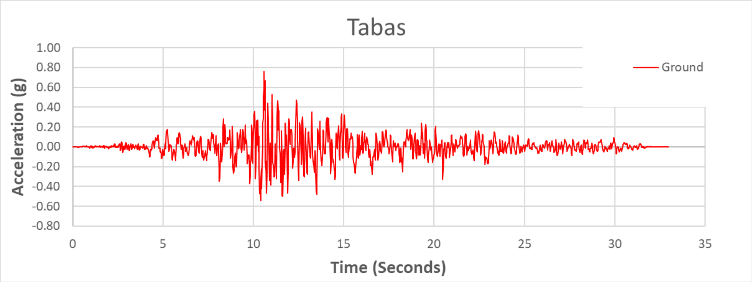
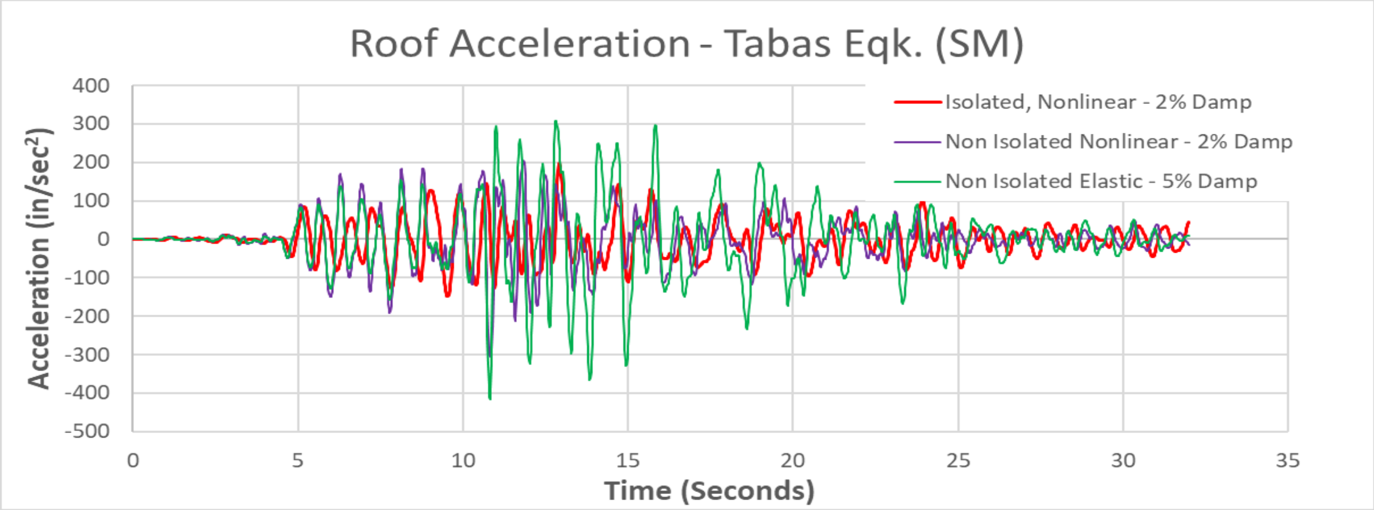
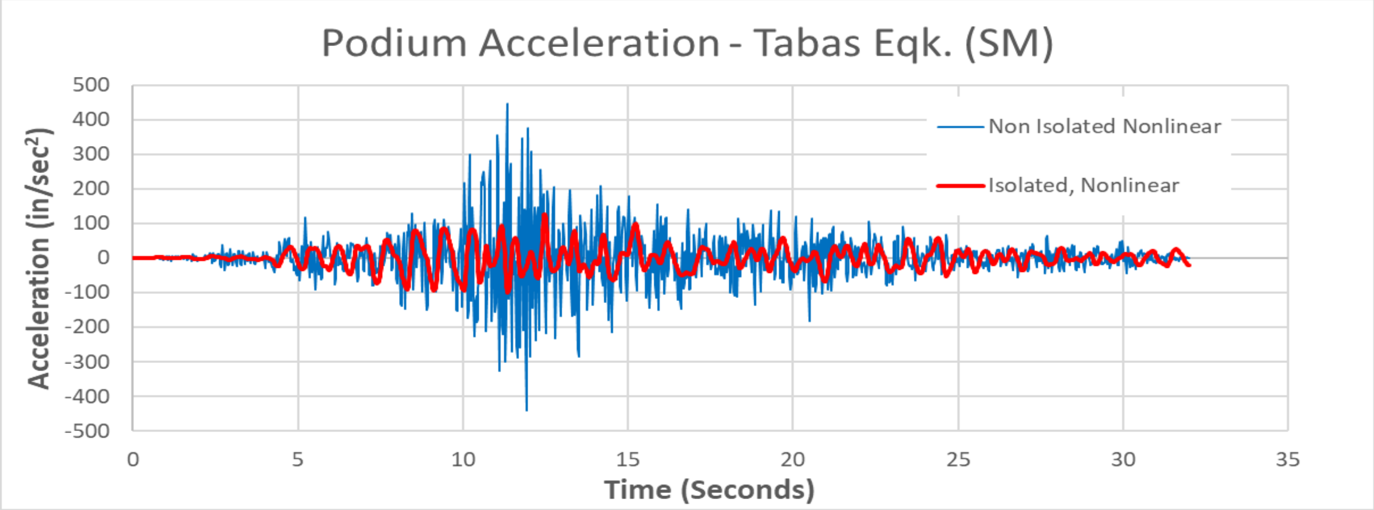
Time History Comparisons – Tabas Eqk. (SM)

- ***PGA – 0.76 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)





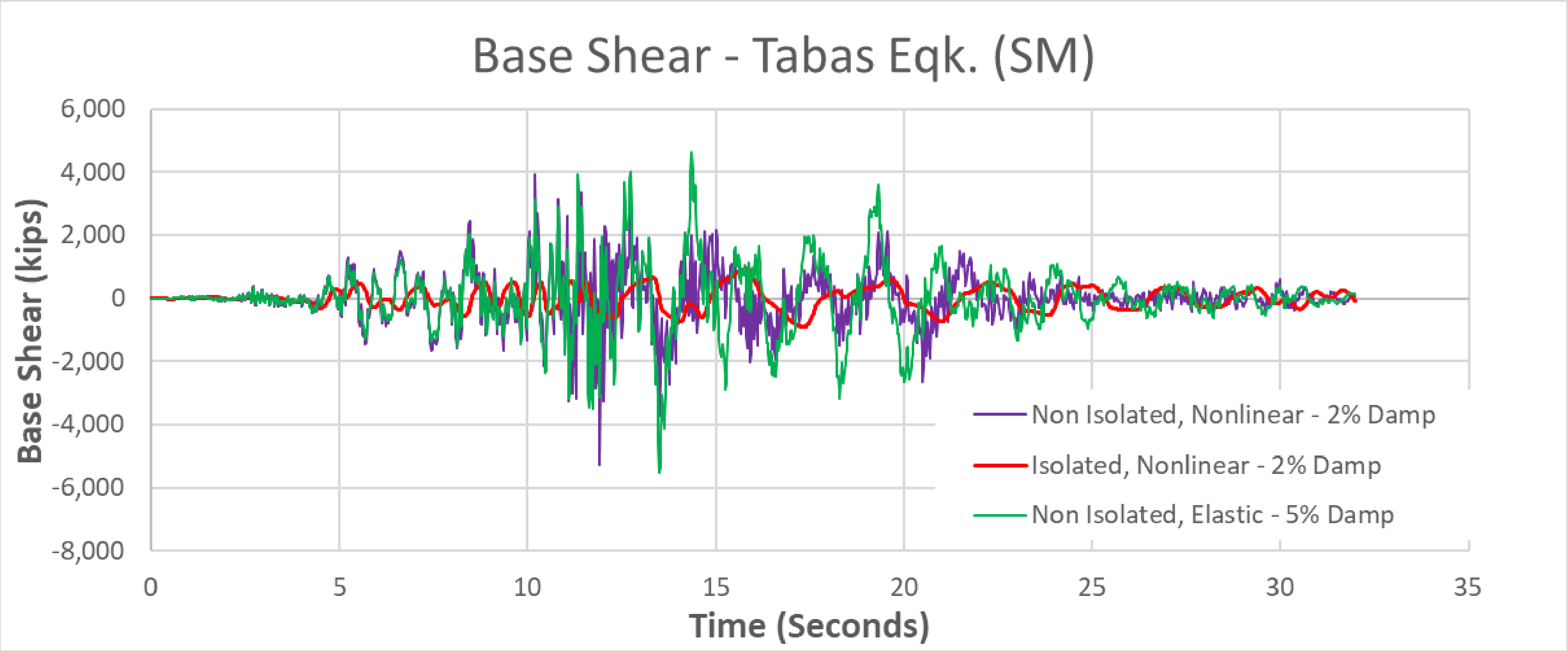




Example: 7-story Concrete MF + SW@1st floor

Base Shear Time History Comparisons – Tabas Eqk. (SM)

- ***PGA – 0.76g***



Example: 7-story Concrete MF + SW@1st floor

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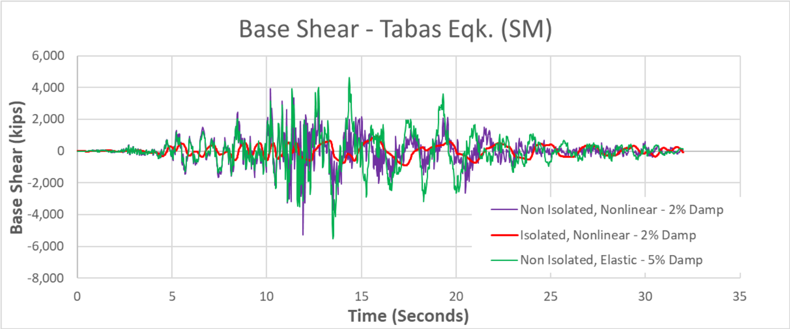
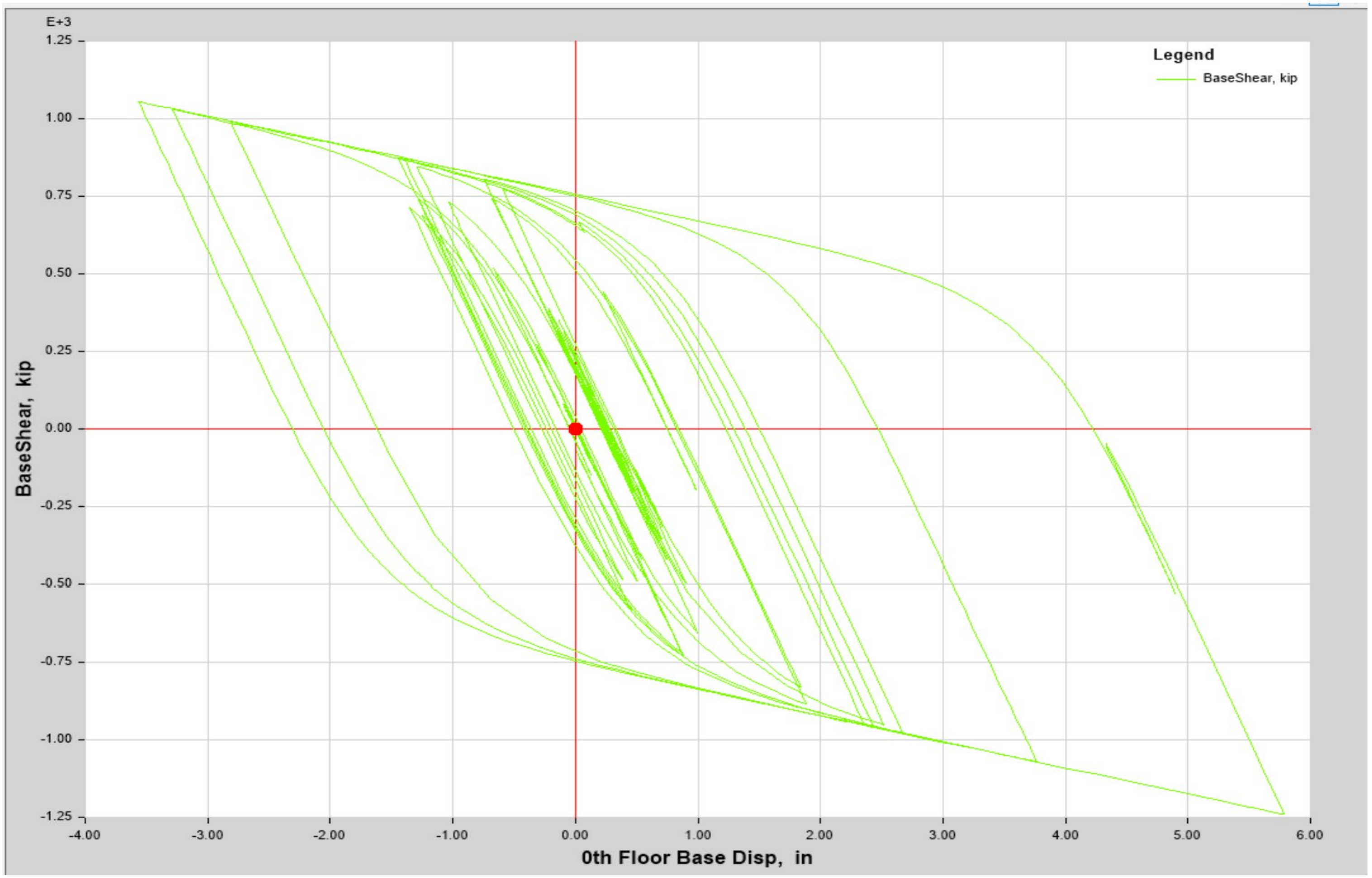
Base Shear vs Isolator Displacement – Tabas Eqk. (SM)

- *PGA – 0.76g*





Example: 7-story Concrete MF + SW@1st floor

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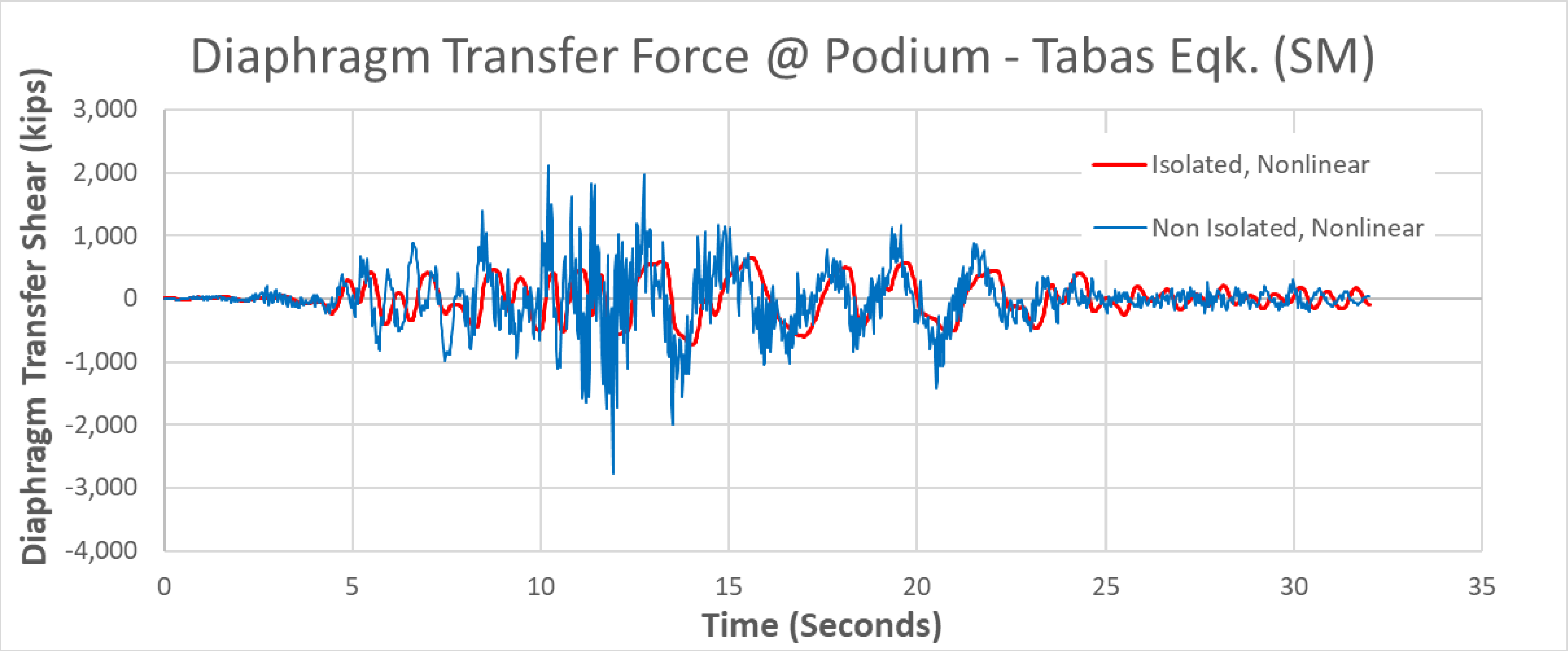
Podium Shear Time History Comparisons – Tabas Eqk. (SM)

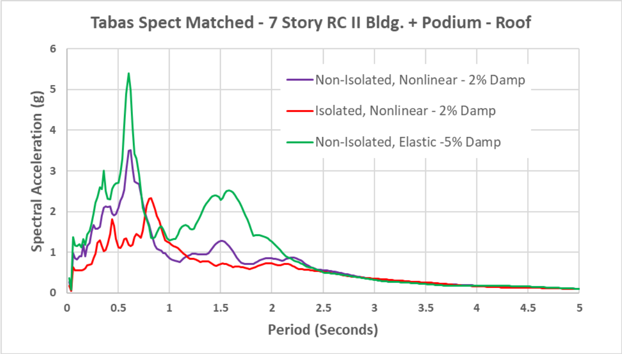
- *PGA – 0.76g*

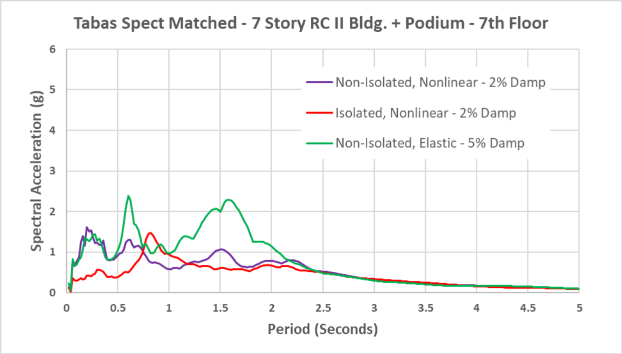


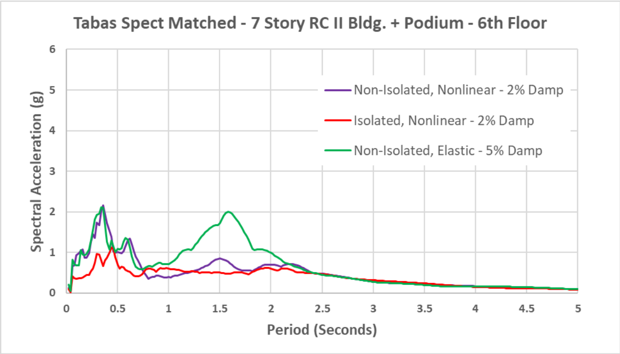
Example: 7-story Concrete MF + SW@1st floor

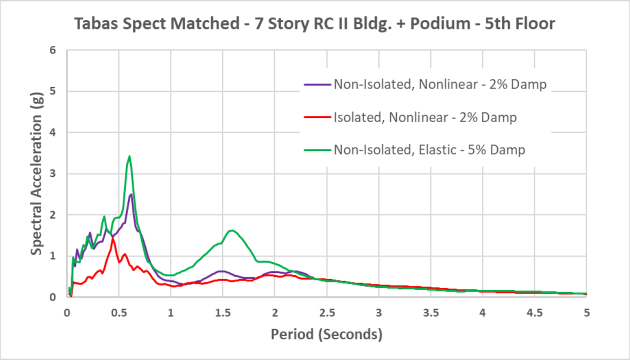
Spectral Response Comparisons for – Tabas – (Spectrally Matched)

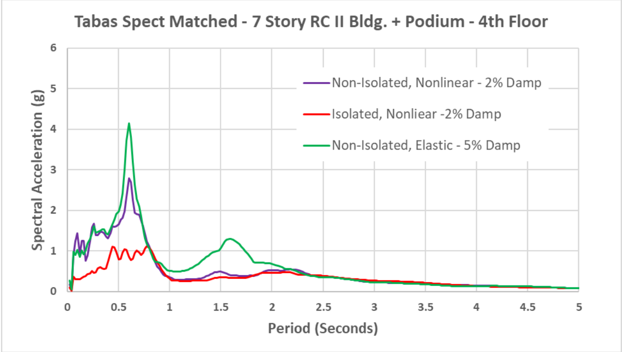
- ***PGA – 0.76g***

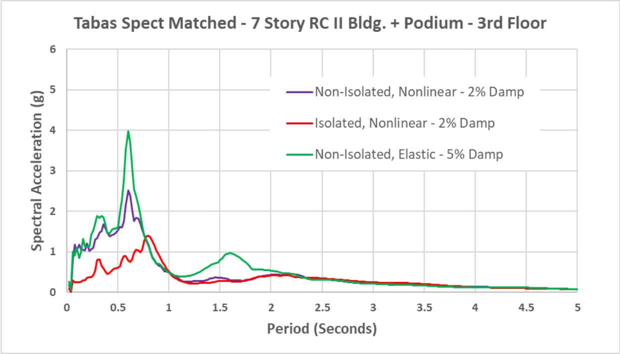


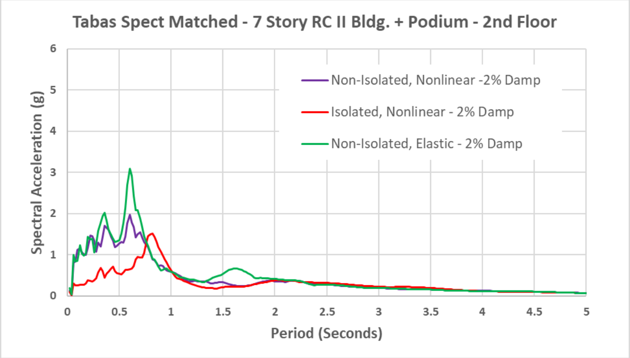


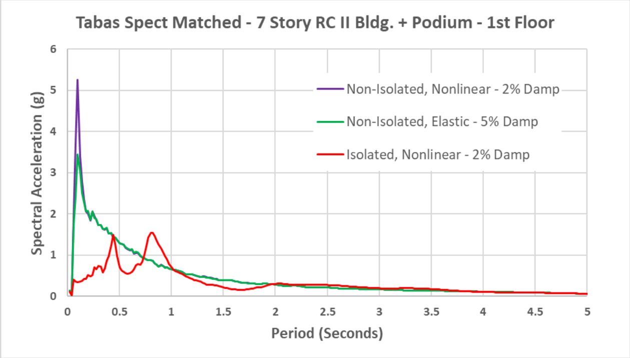












Example: 7-story Concrete MF + SW@1st floor

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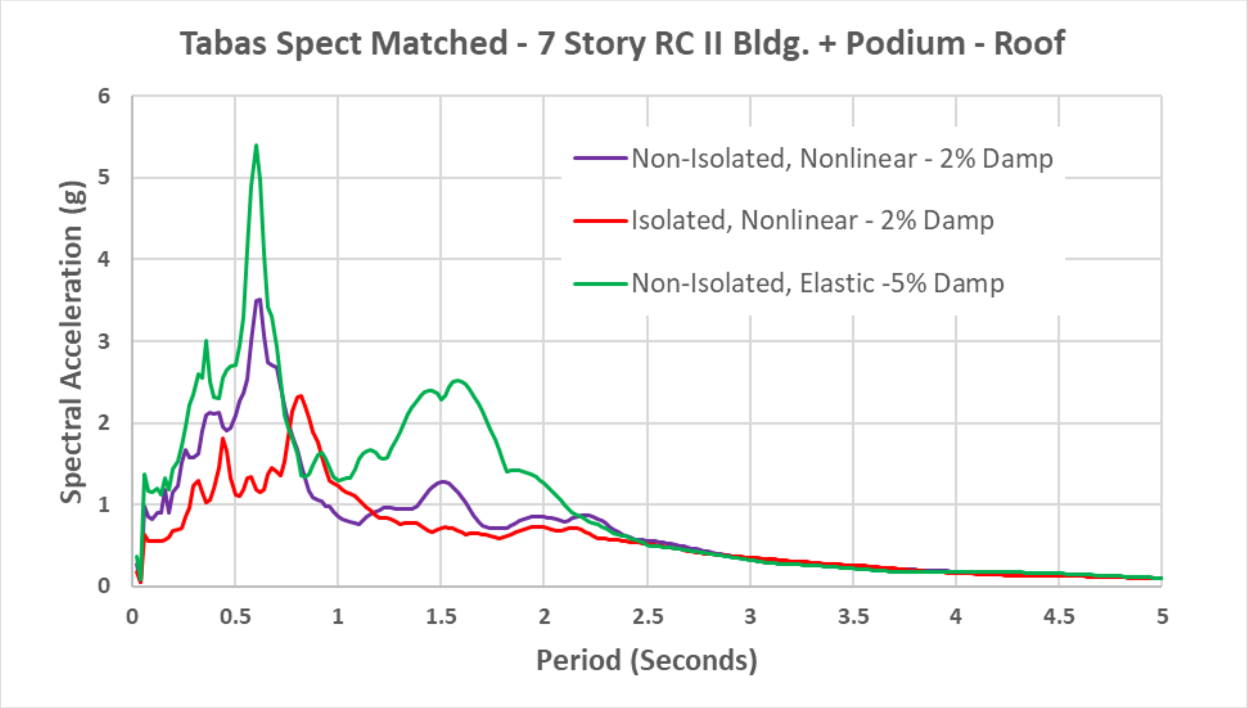
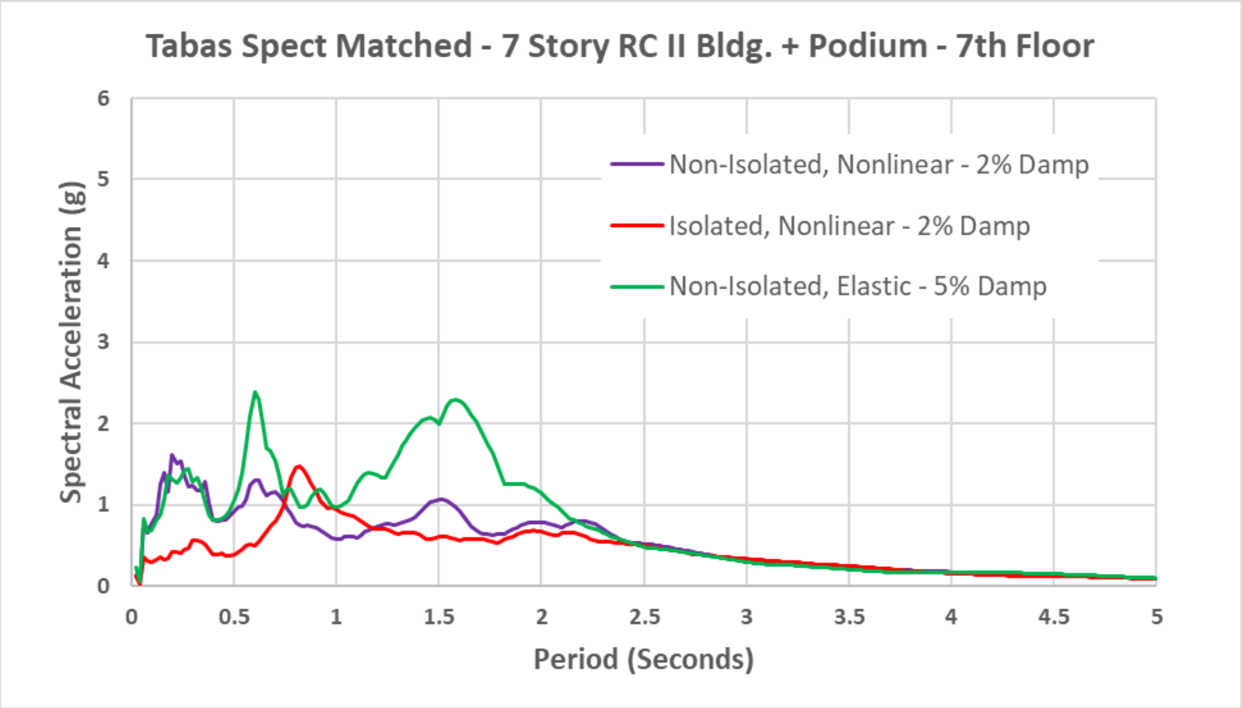
Spectral Response Comparisons for – Tabas – (Spectrally Matched)

- *PGA – 0.76g*

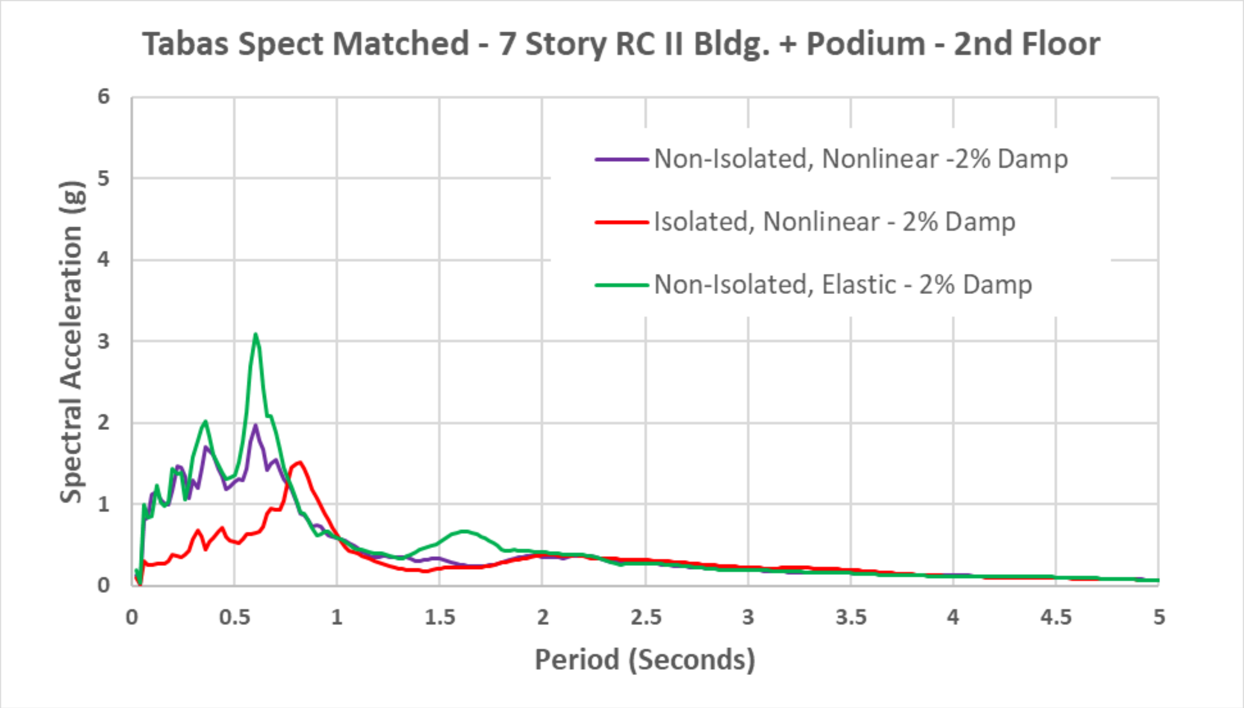


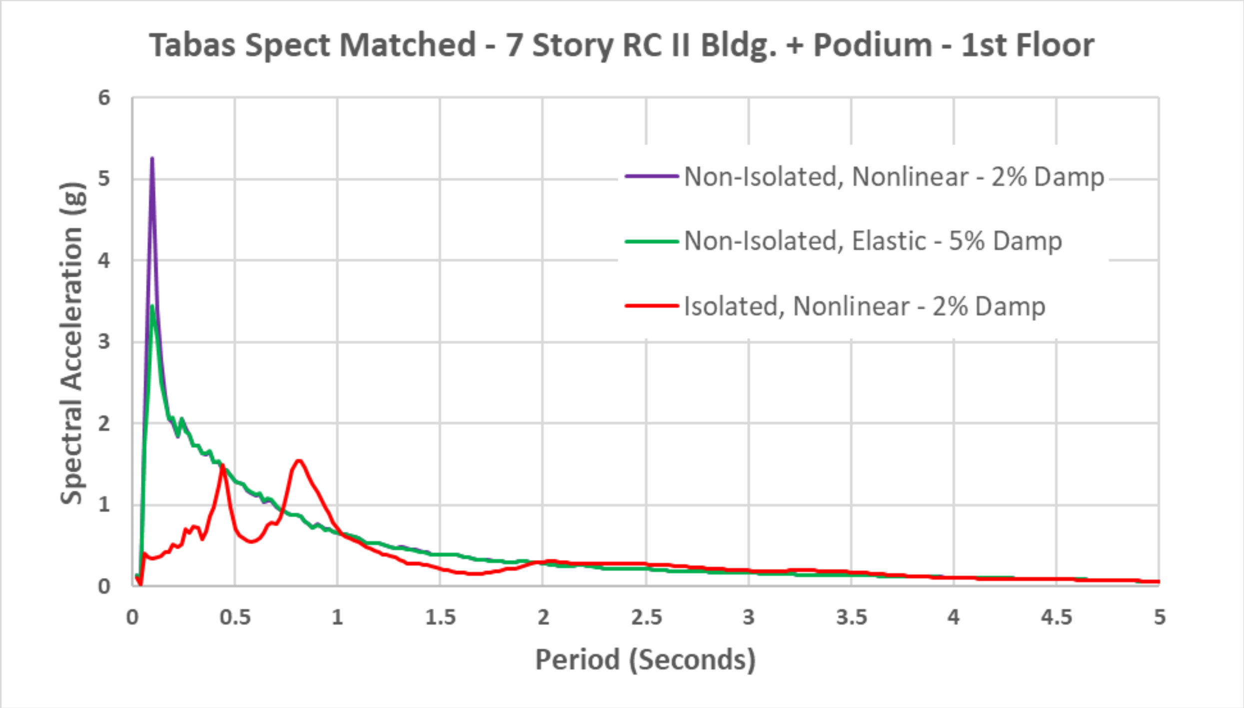


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – Tabas – (Spectrally Matched)

- *PGA – 0.76g*





Example: 7-story Concrete MF + SW@1st floor

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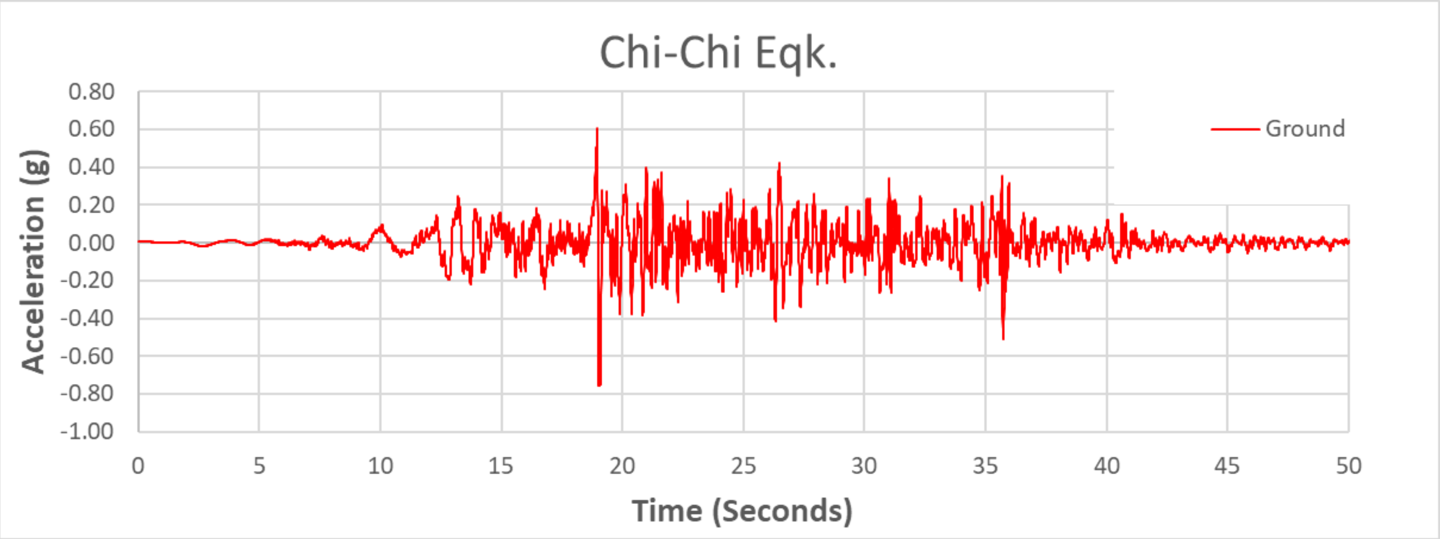
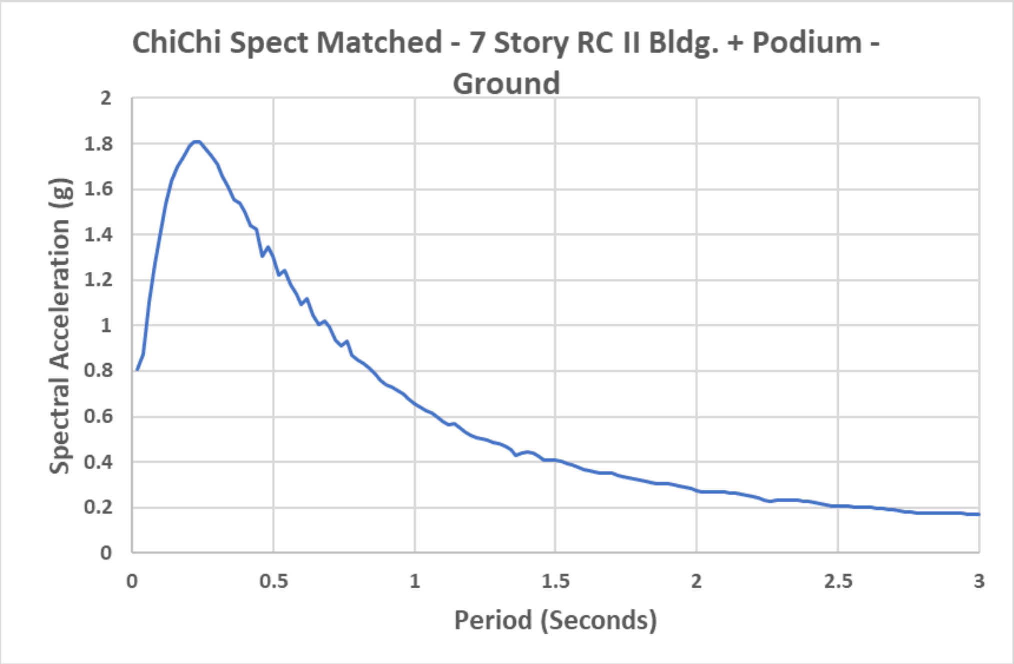
Response Comparisons for – ChiChi Eqk. Spectrally Matched

- ***PGA – 0.76g***

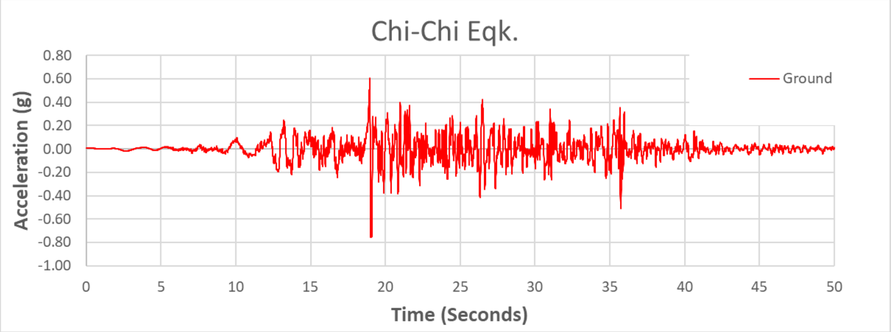


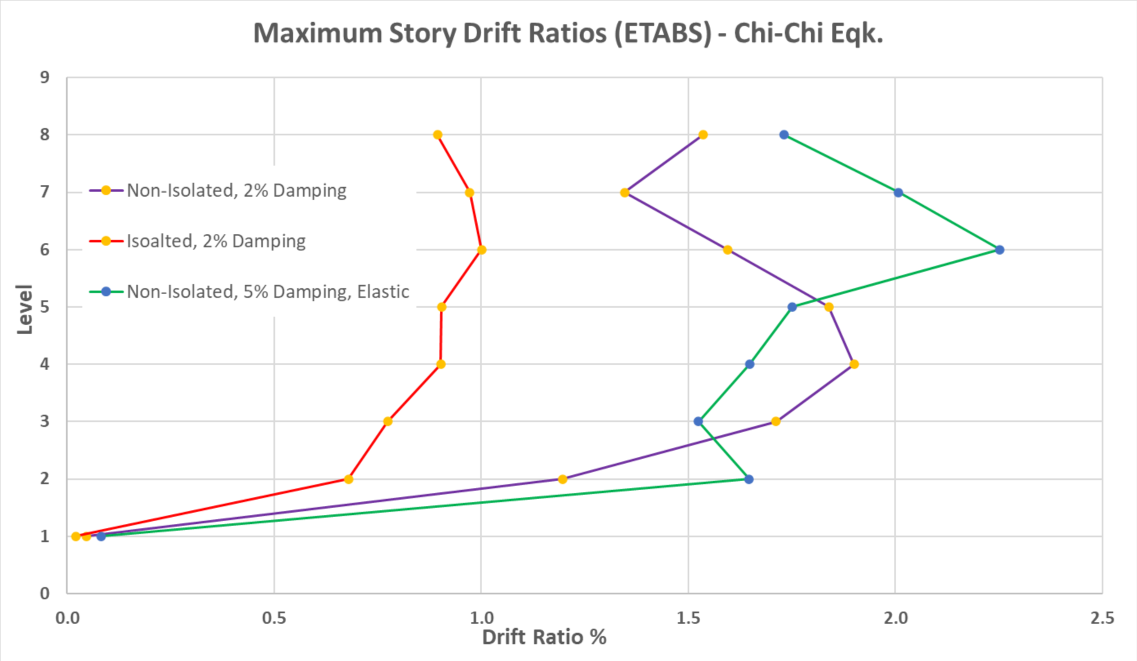


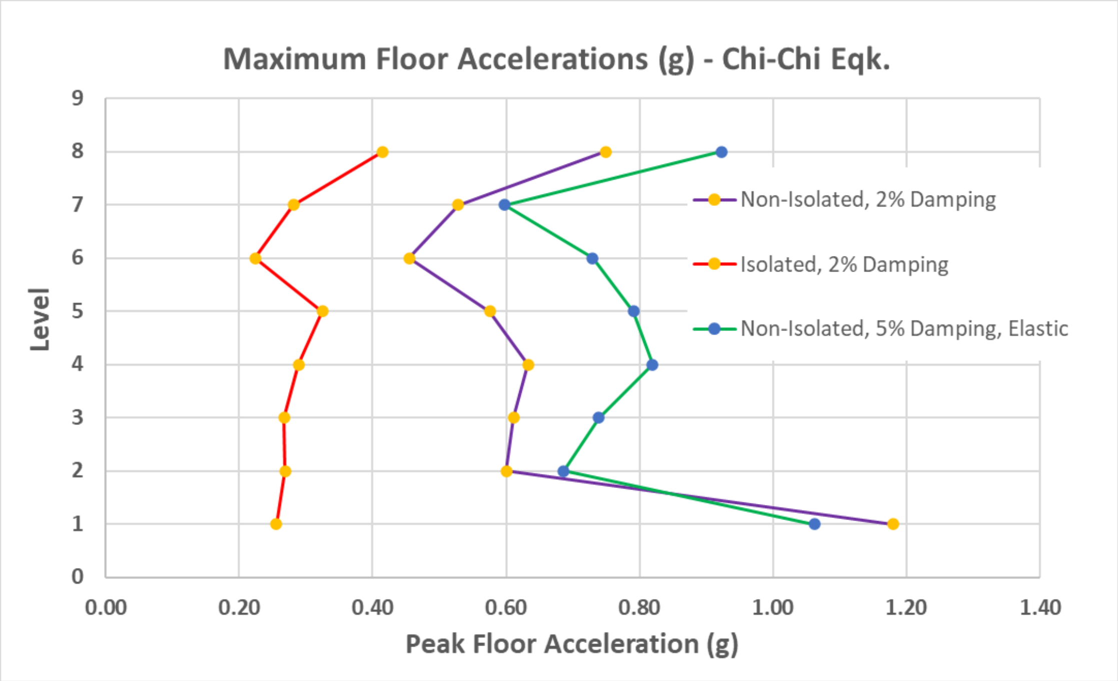
Example: 7-story Concrete MF + SW@1st floor

Comparison of Maximum Responses – Chi-Chi Eqk. Spectrally Matched

- ***PGA – 0.76 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)





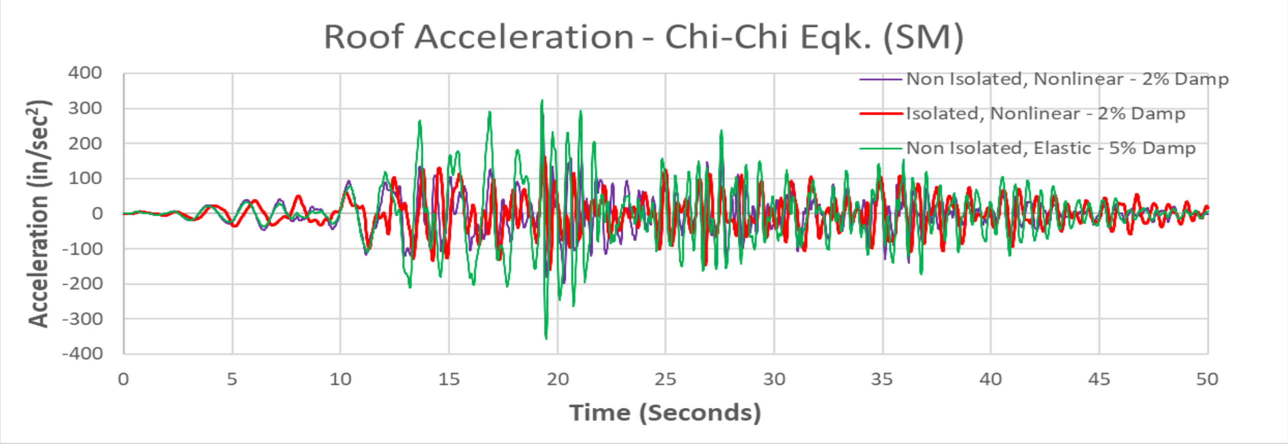


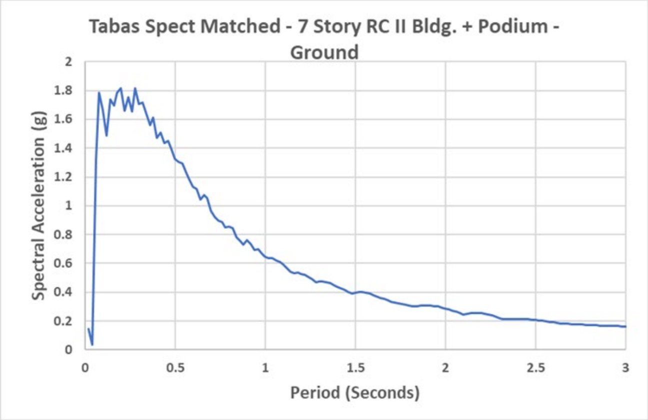
Example: 7-story Concrete MF + SW@1st floor

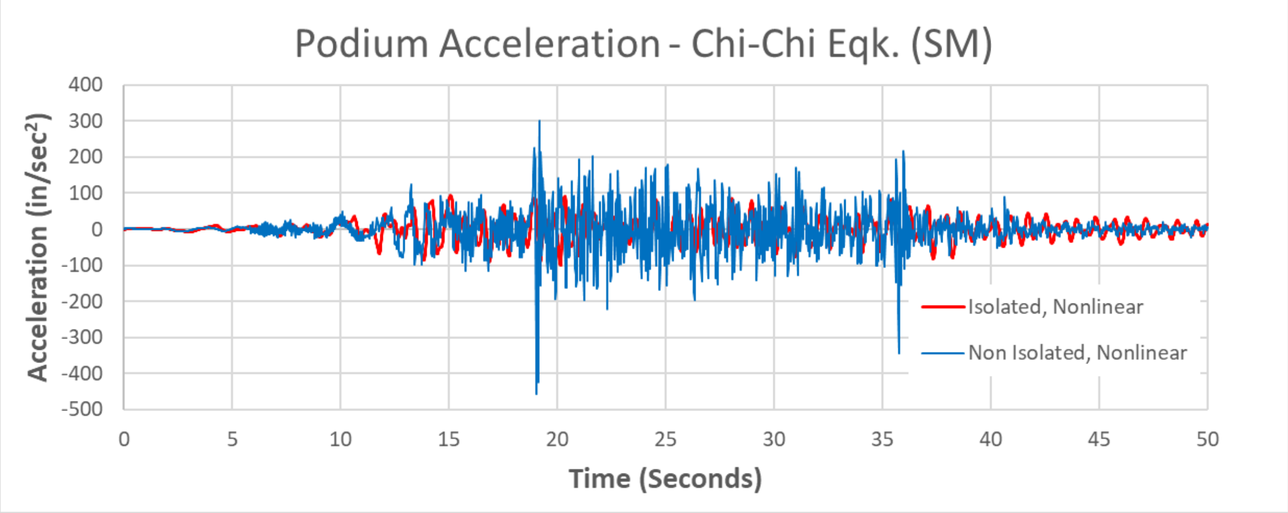
HCAI Department of Health Care Access and Information

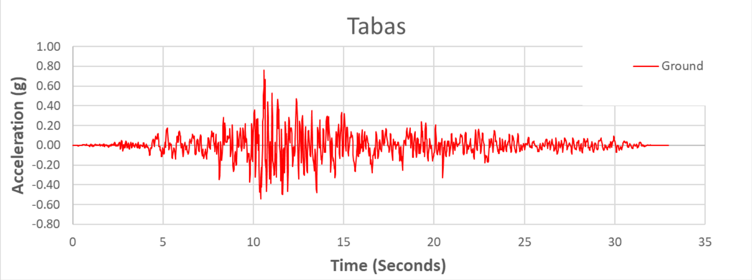
Time History Comparisons – Chi-Chi Eqk. Spectrally Matched

- ***PGA – 0.76 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)





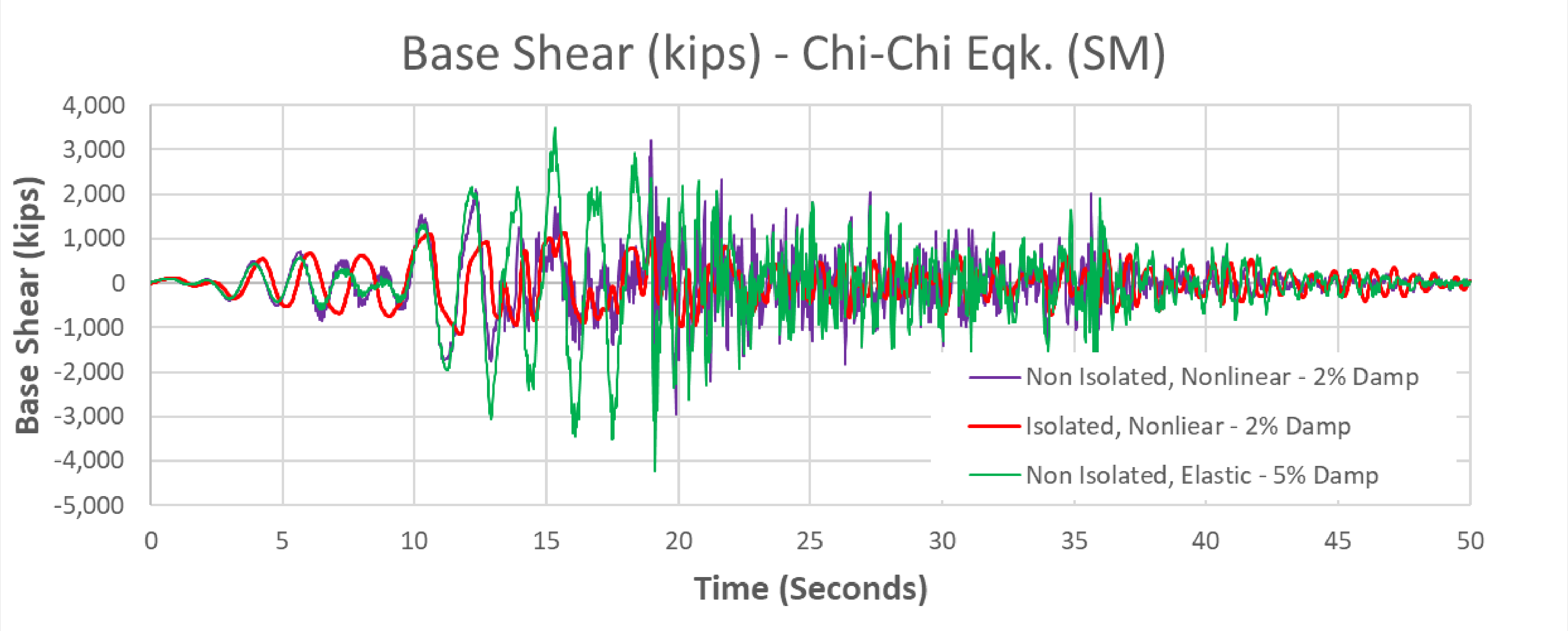




Example: 7-story Concrete MF + SW@1st floor

Base Shear Time History Comparisons – Chi-Chi Eqk. (SM)

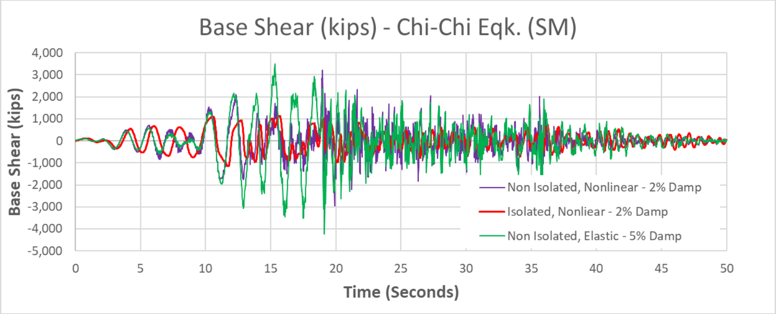
- *PGA – 0.76g*

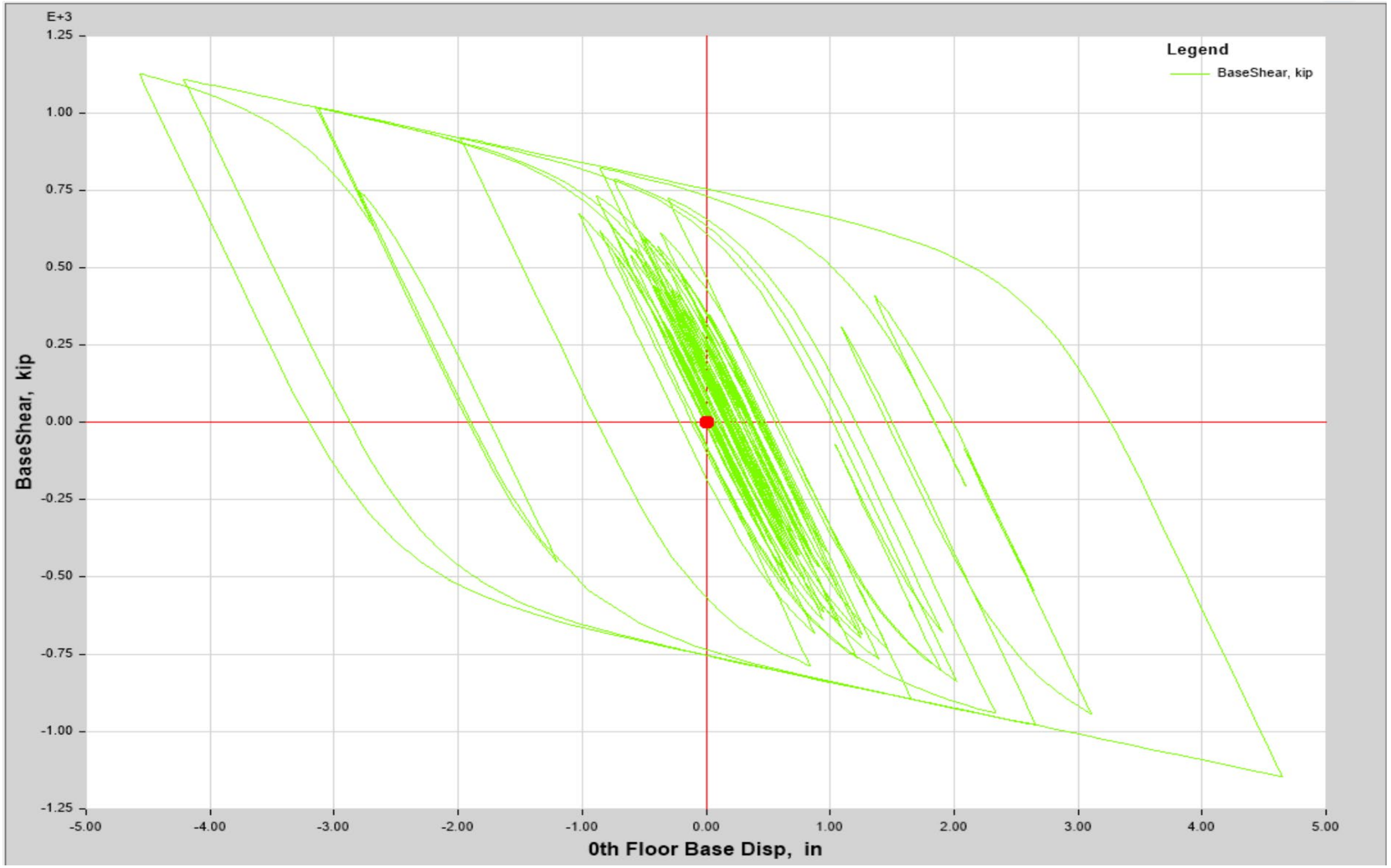


Example: 7-story Concrete MF + SW@1st floor

Base Shear vs Isolator Displacment – Chi-Chi Eqk. (SM)

- *PGA – 0.76g*

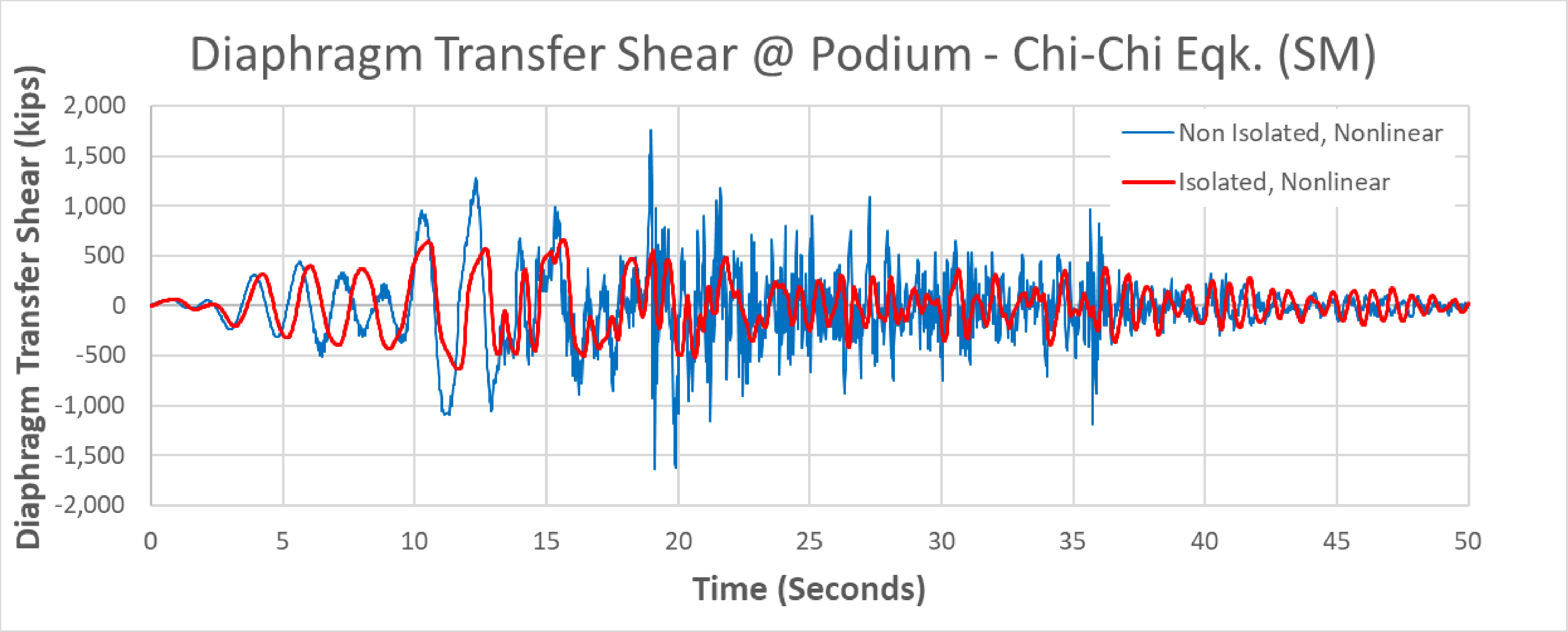




Example: 7-story Concrete MF + SW@1st floor

Podium Shear Time History Comparisons – Chi-Chi Eqk. (SM)

- *PGA – 0.76g*

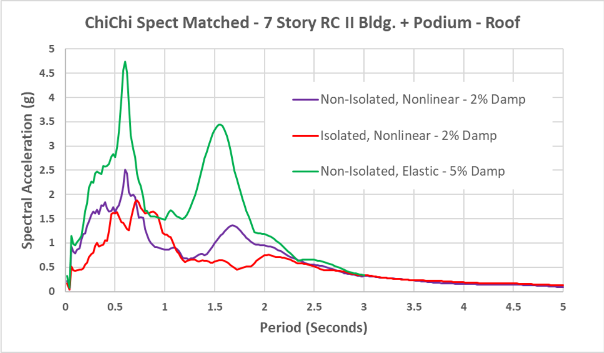


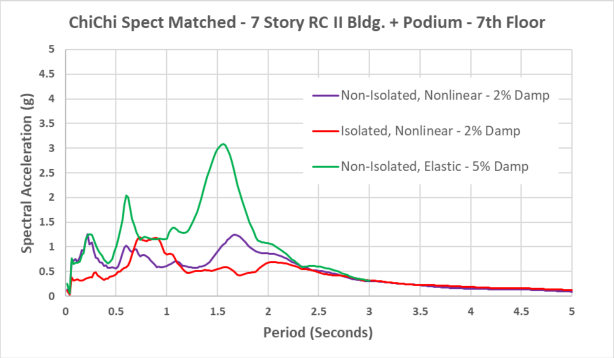
Example: 7-story Concrete MF + SW@1st floor

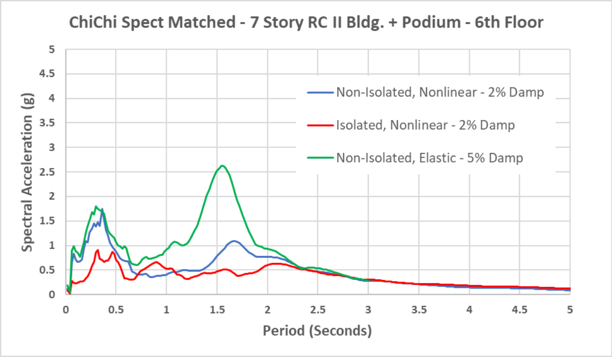
HCAi Department of Health Care Access and Information

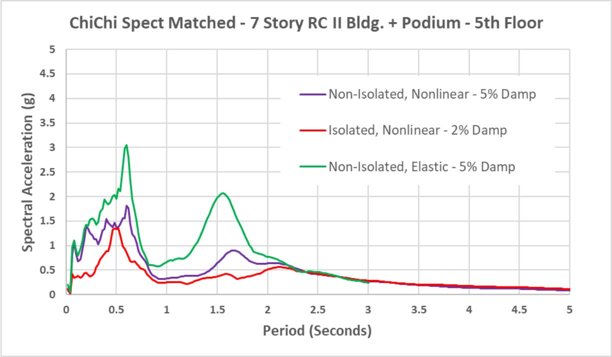
Spectral Response Comparisons for – ChiChi – (Spectrally Matched)

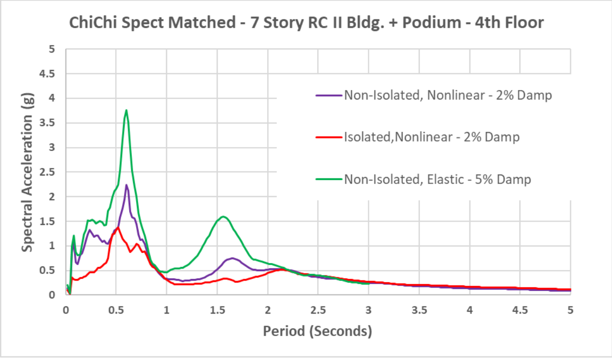
- ***PGA – 0.76g***

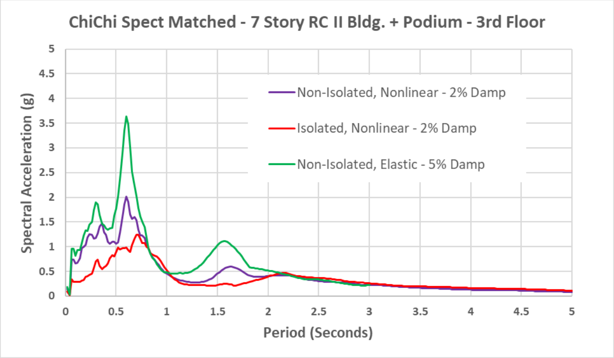


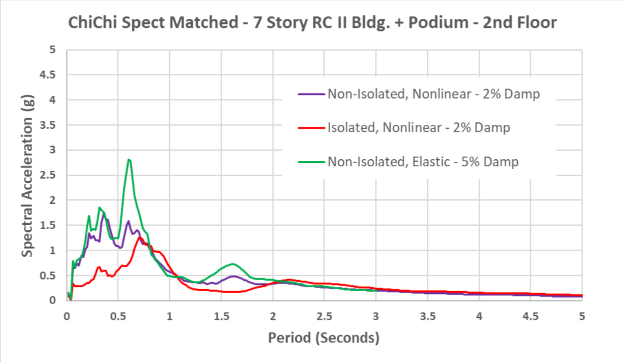


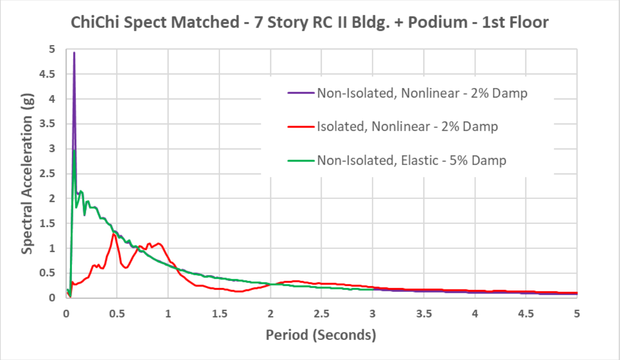








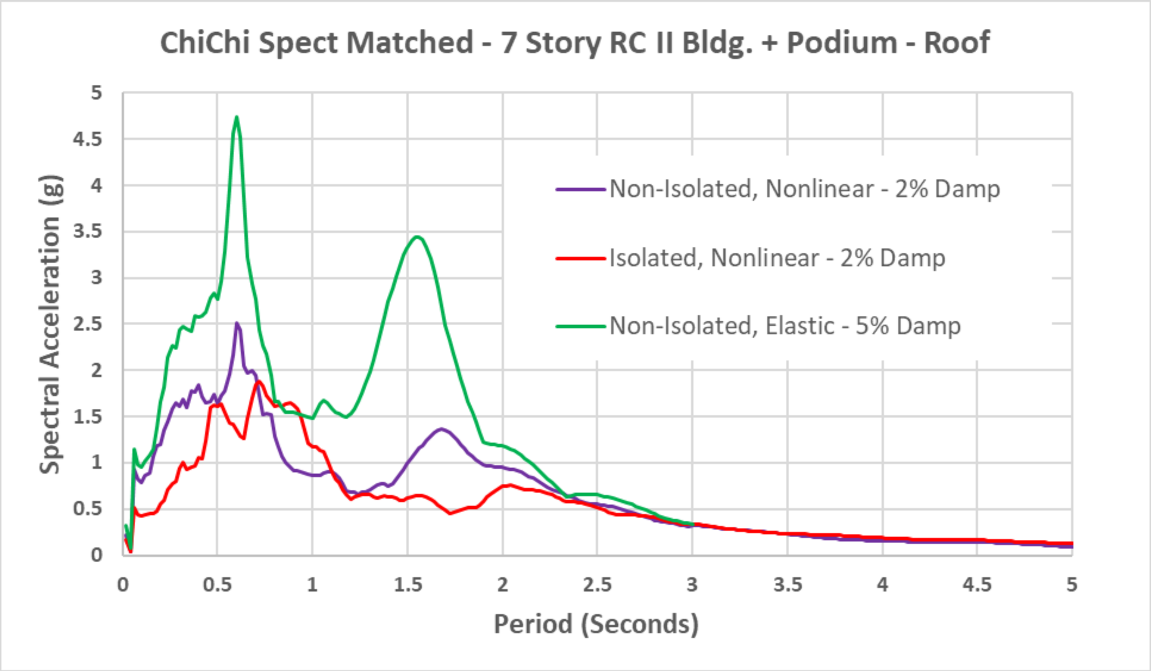


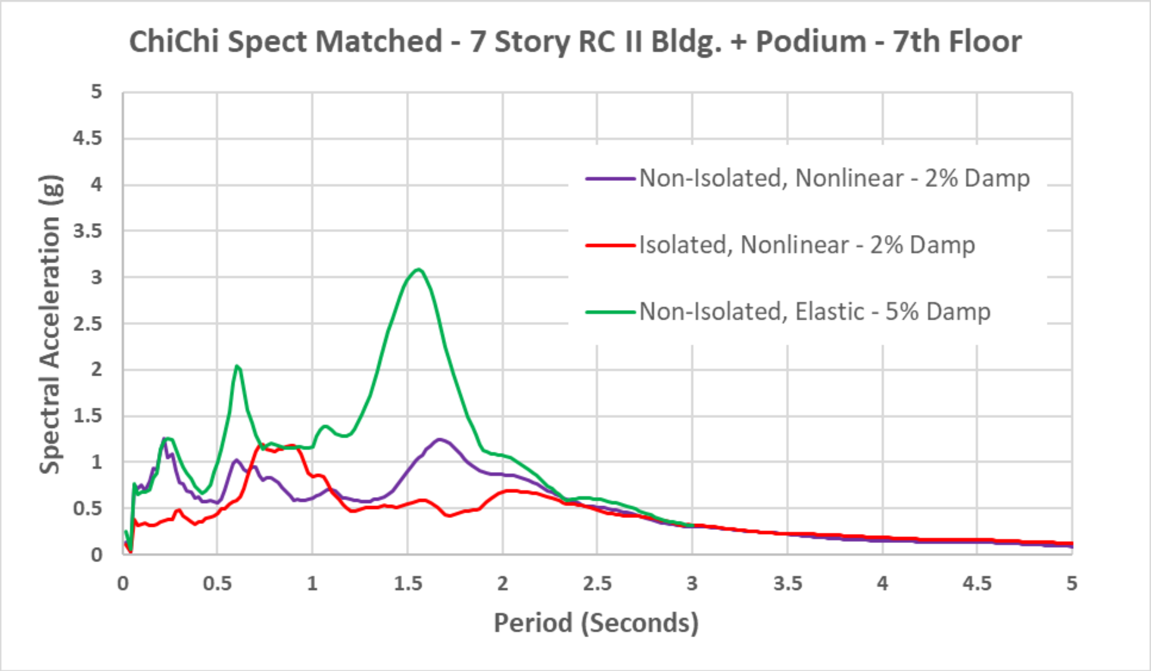


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – ChiChi – (Spectrally Matched)

- *PGA – 0.76g*

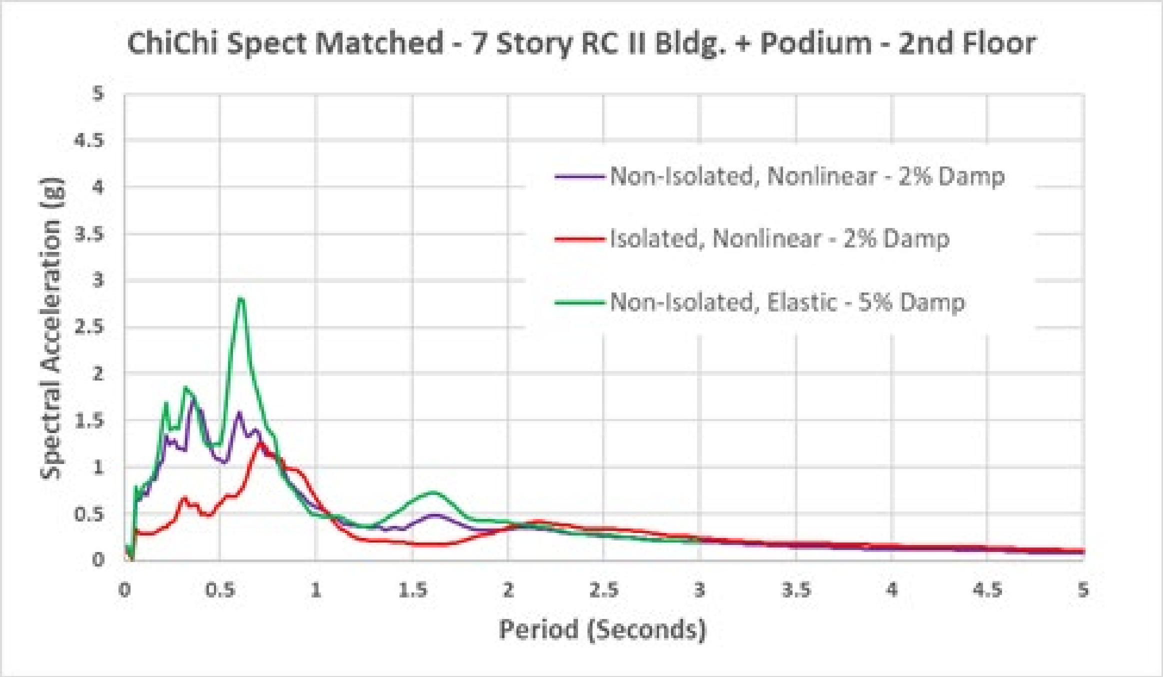


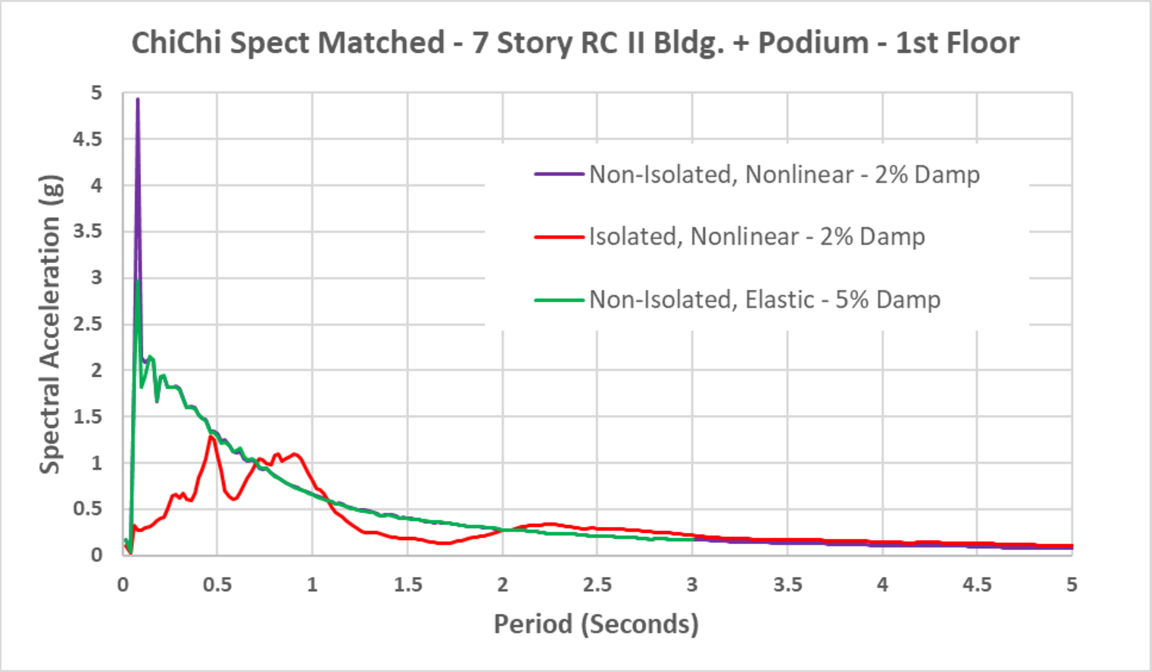


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – ChiChi – (Spectrally Matched)

- ***PGA – 0.76g***

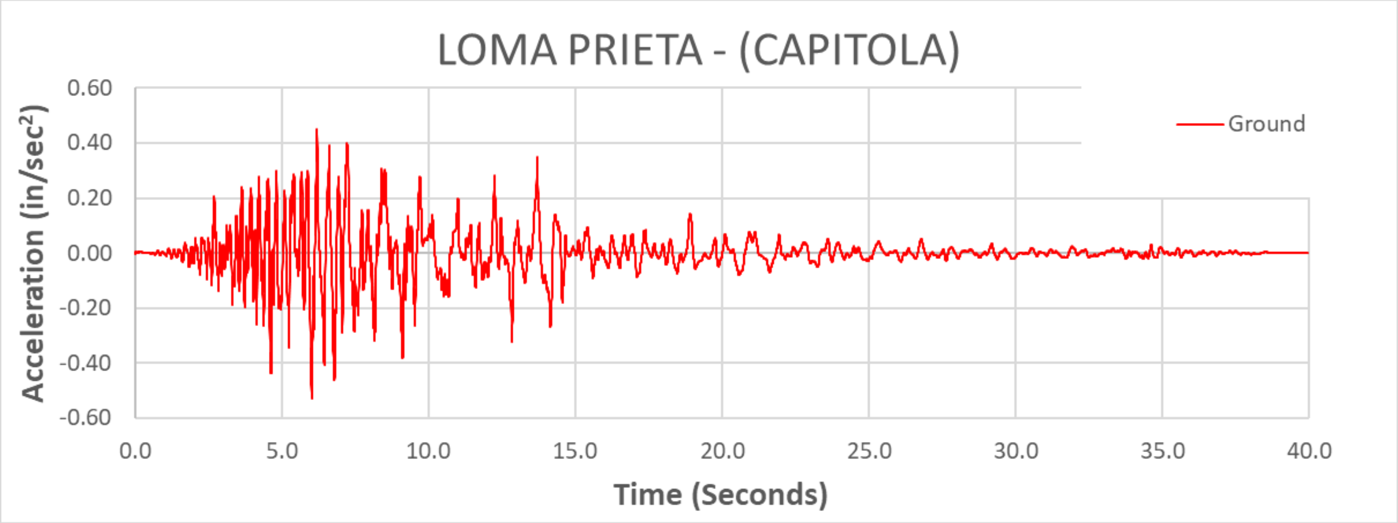


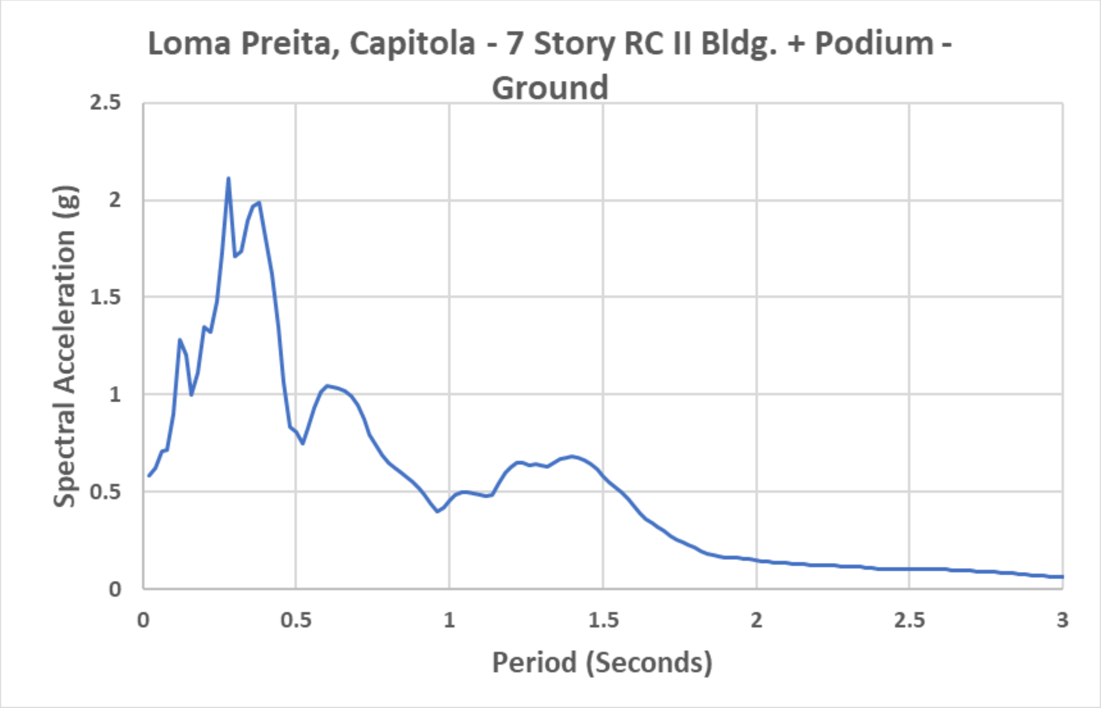


Example: 7-story Concrete MF + SW@1st floor

Response Comparisons for – Loma Prieta, Capitola Station

- ***PGA – 0.529g***



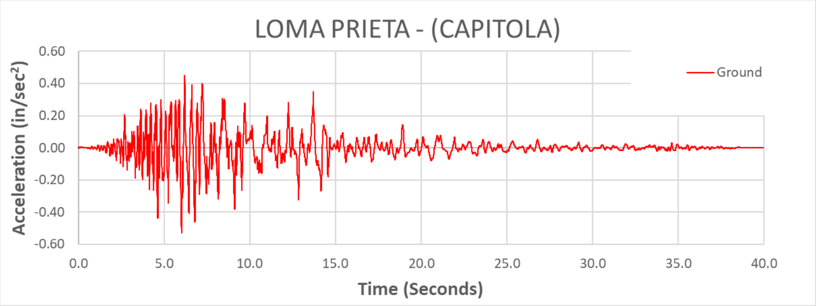


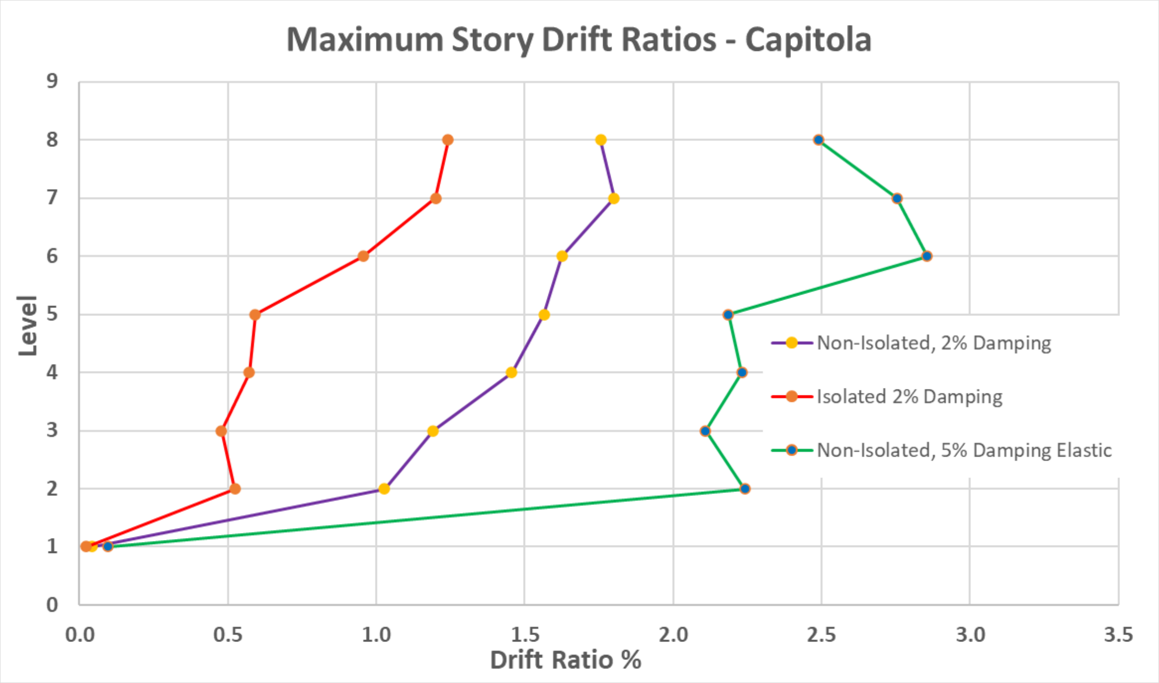
Example: 7-story Concrete MF + SW@1st floor

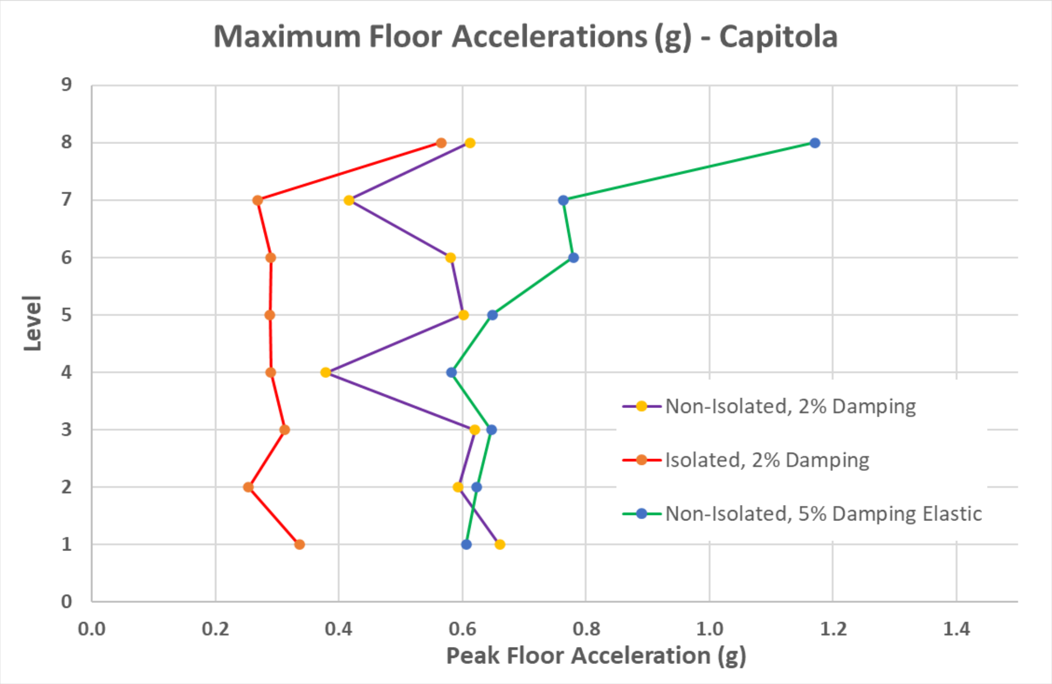
HCAi Department of Health Care Access and Information

Comparison of Maximum Responses – Loma Prieta Capitola Sta.

- ***PGA – 0.529 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)



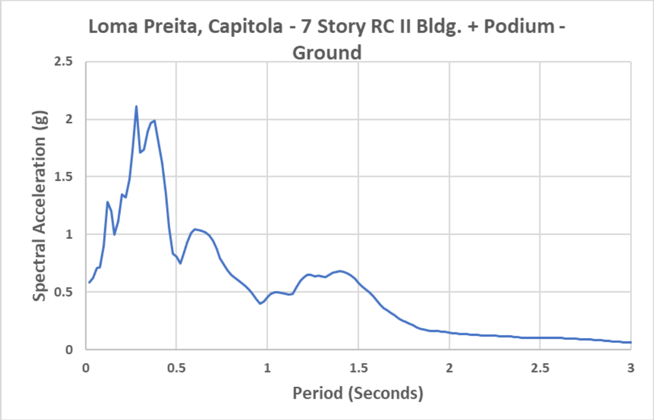


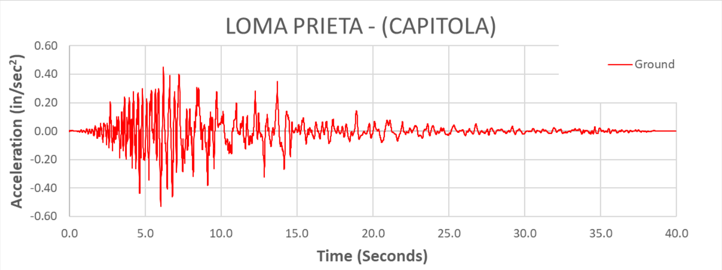


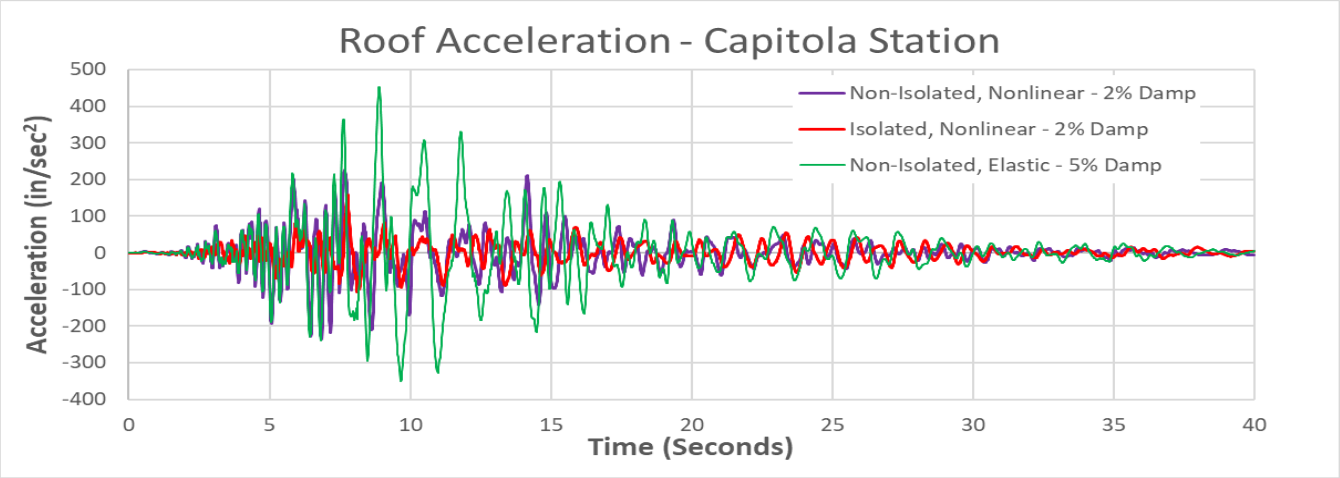
Example: 7-story Concrete MF + SW@1st floor

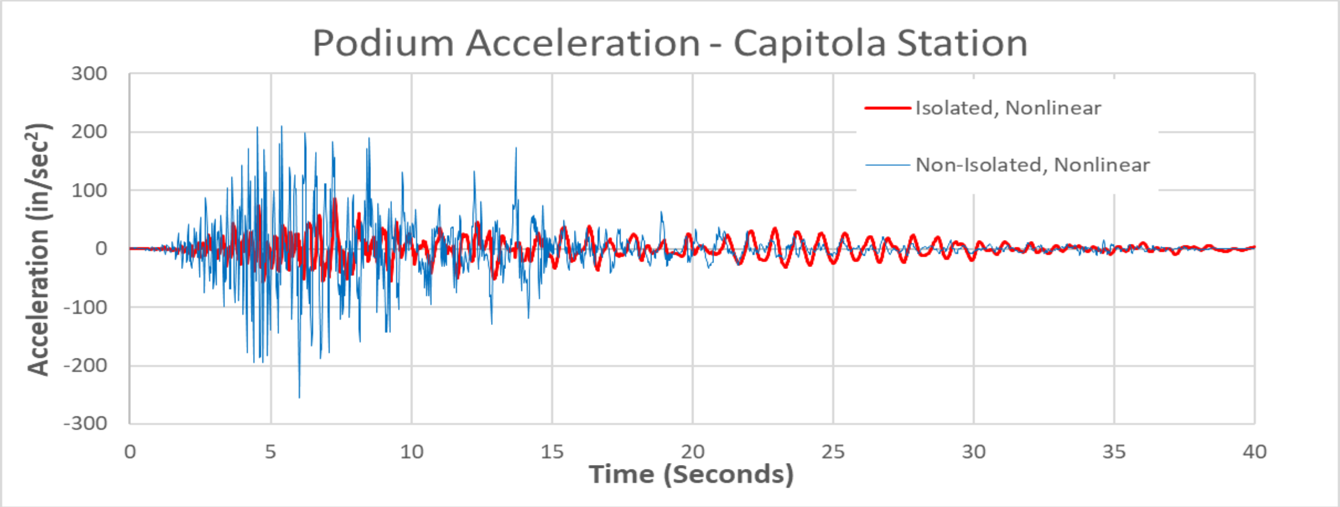
Time History Comparisons – Loma Prieta Capitola Sta.

- ***PGA – 0,592 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)









Example: 7-story Concrete MF + SW@1st floor

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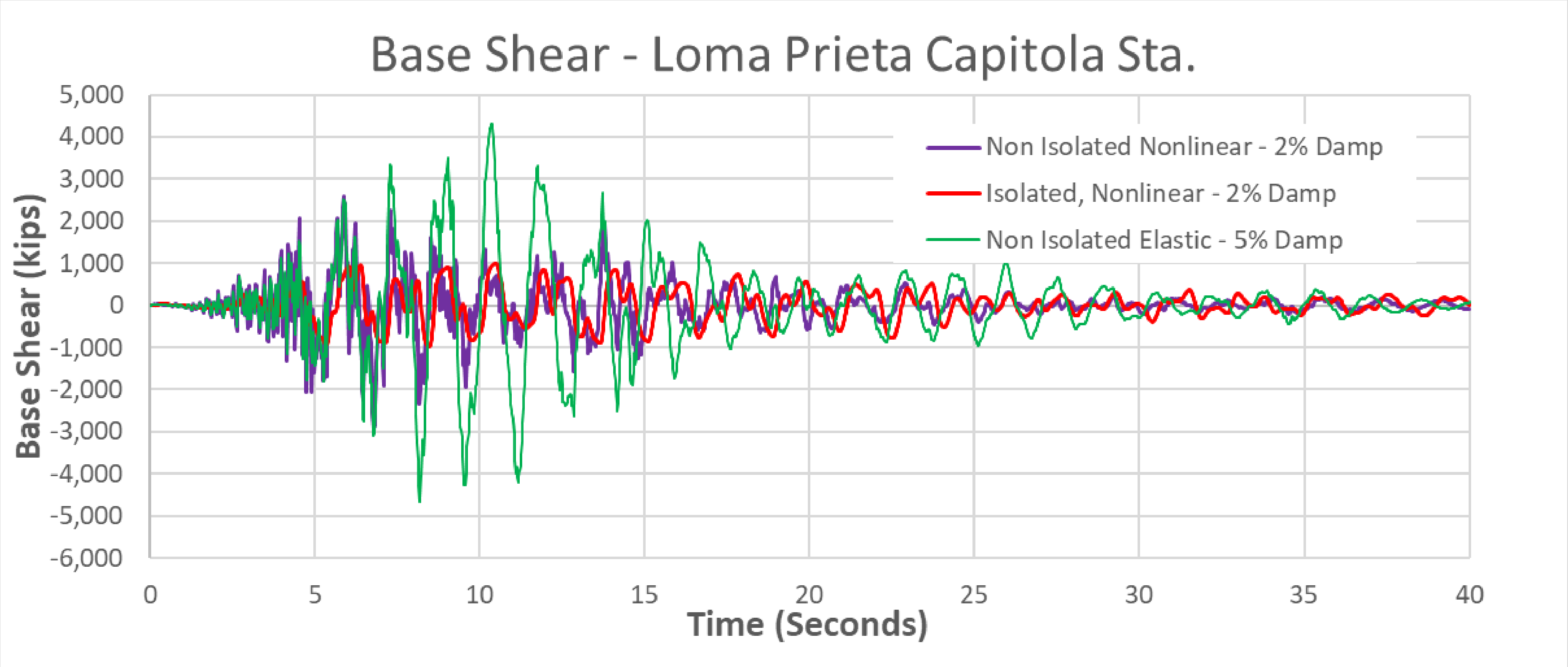
Base Shear Time History Comparisons – LP Capitola Sta.

- *PGA – 0.529g*

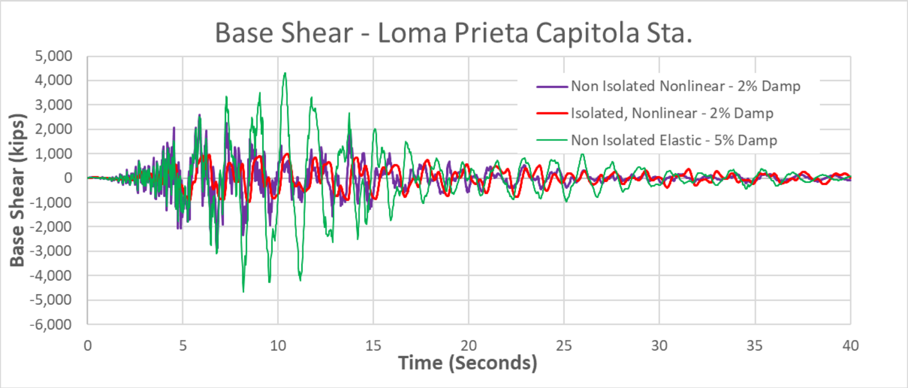


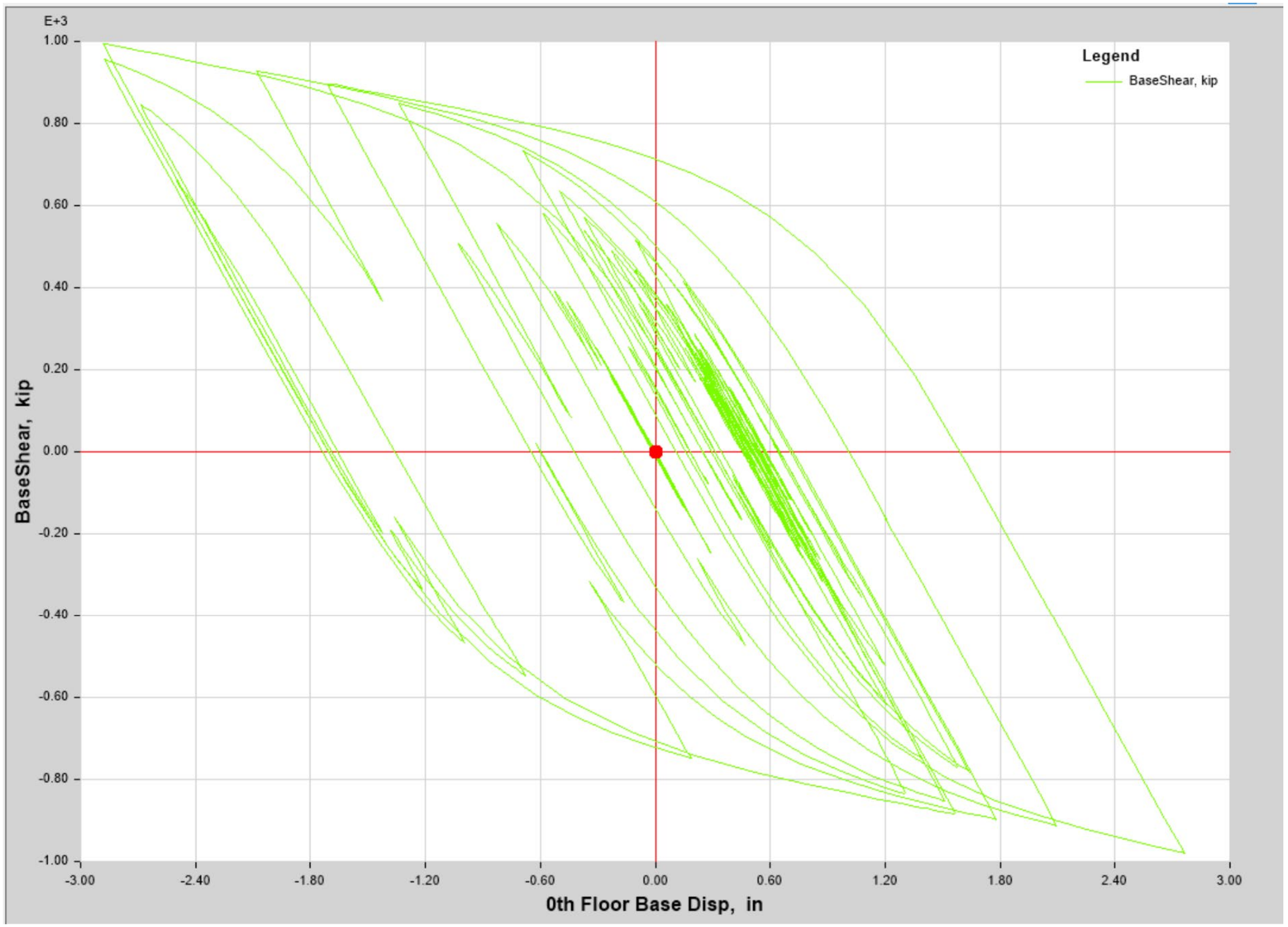
Example: 7-story Concrete MF + SW@1st floor

HCAi Department of Health Care Access and Information

Base Shear vs Isolator Displacement – LP Capitola Sta.

- *PGA – 0.529g*



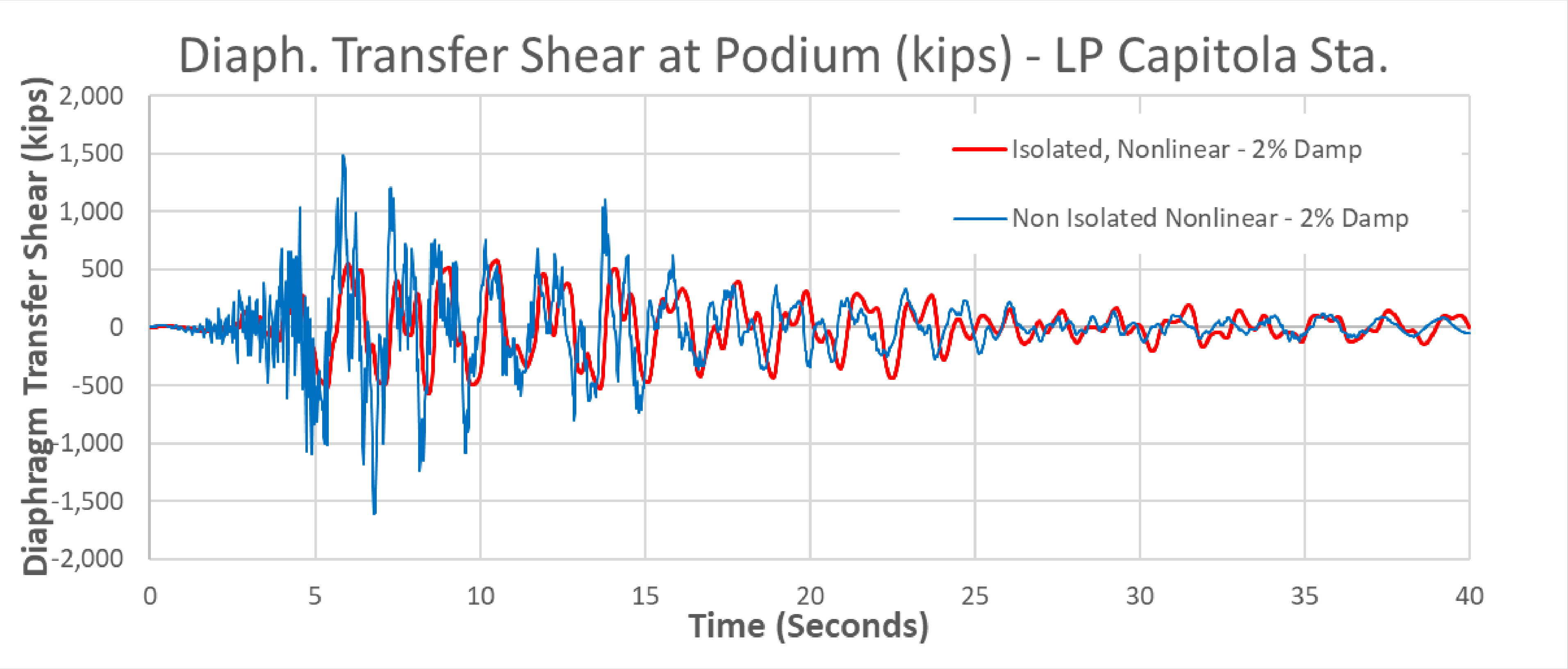


Example: 7-story Concrete MF + SW@1st floor

HCAi Department of Health Care Access and Information

Podium Shear Time History Comparisons – LP Capitola Sta.

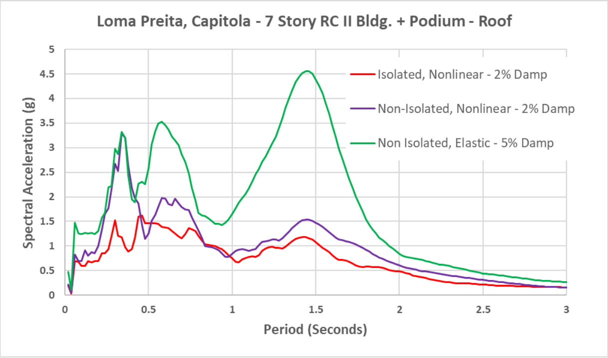
- *PGA – 0.529g*

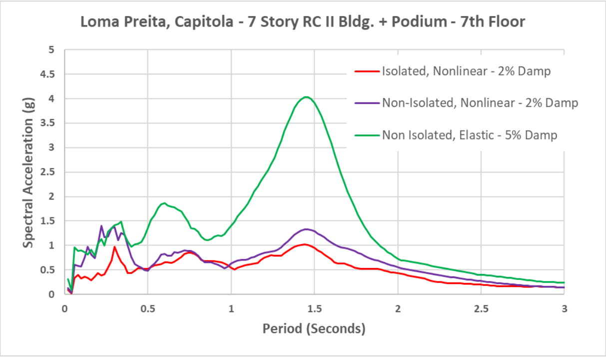


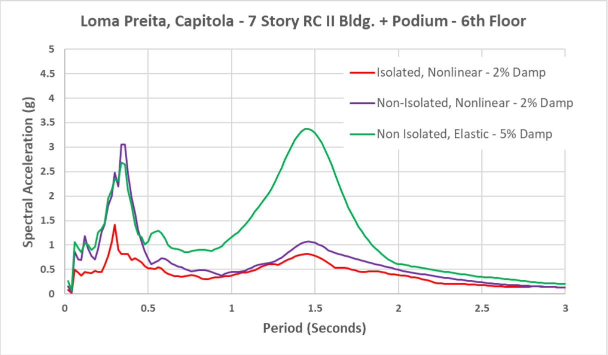
Example: 7-story Concrete MF + SW@1st floor

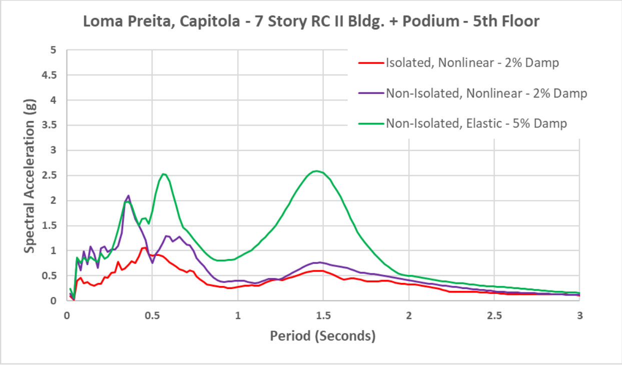
Spectral Response Comparisons for – Loma Prieta Capitola Sta.

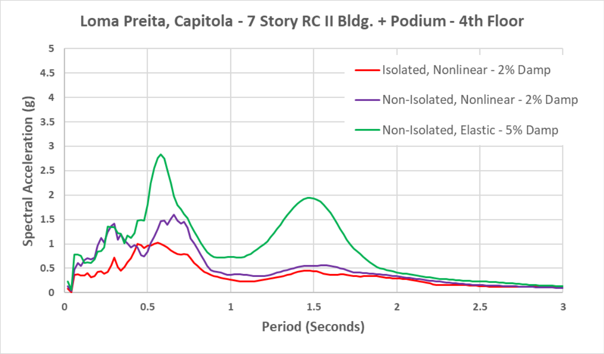
- ***PGA – 0.529g***

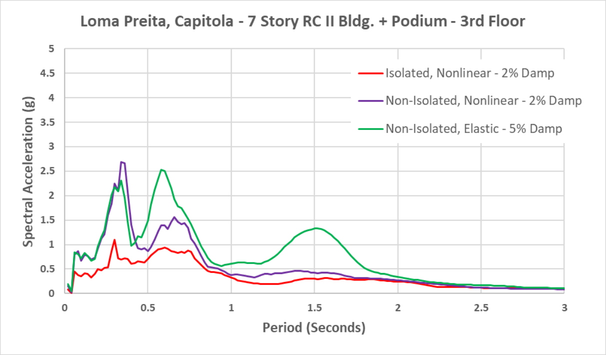


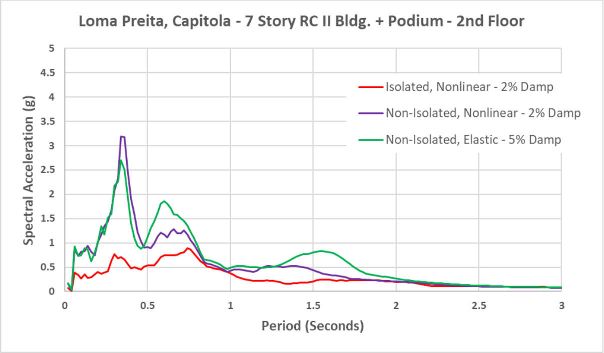


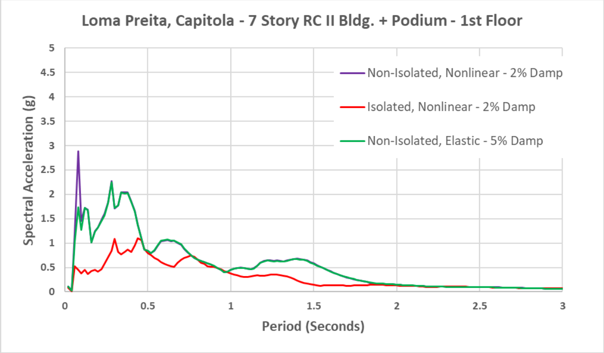






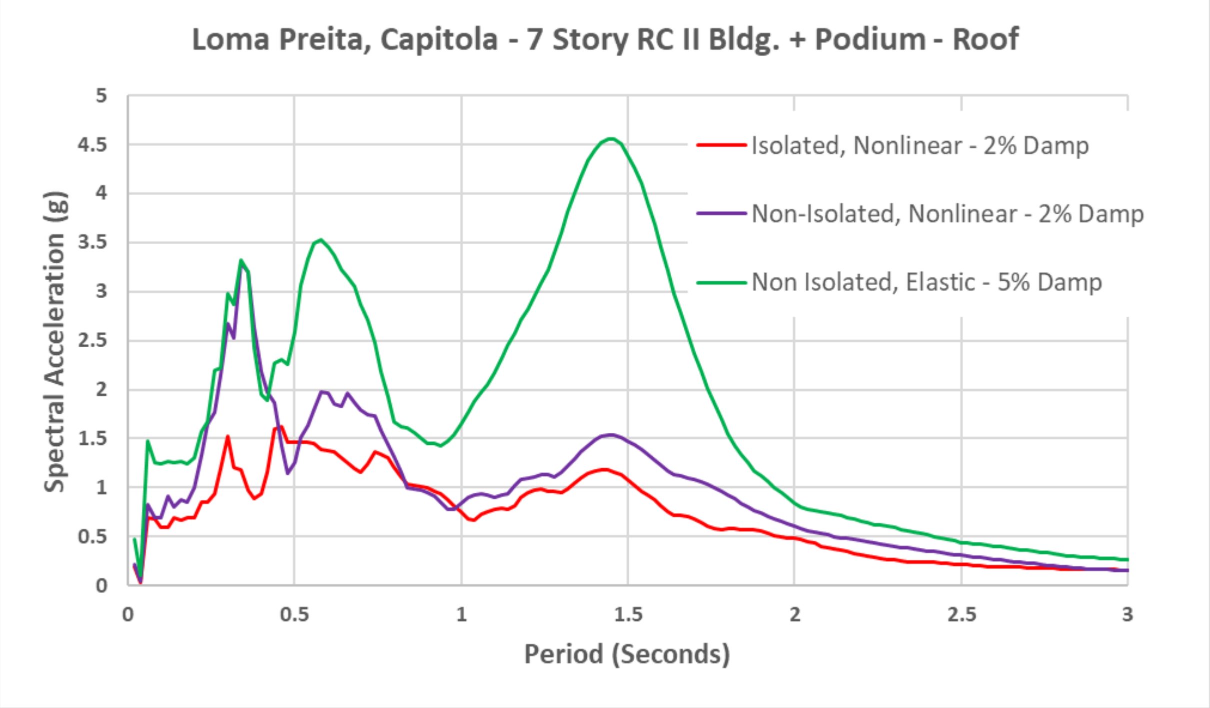


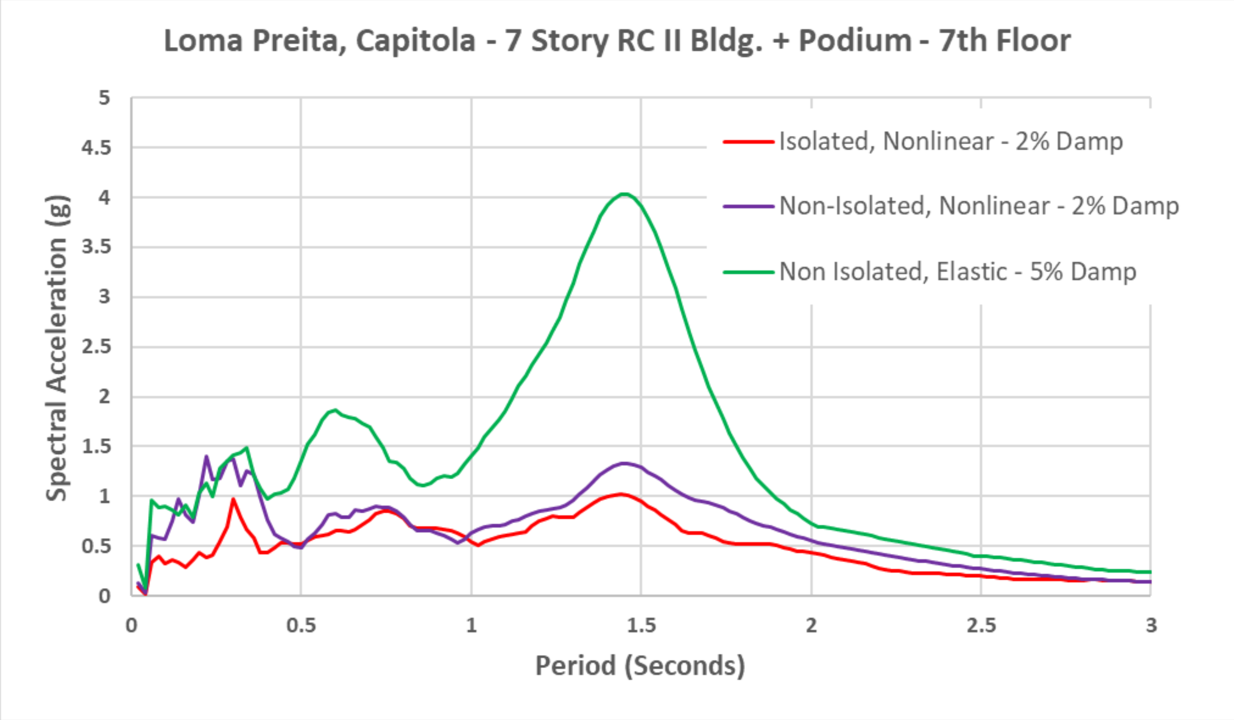




Spectral Response Comparisons for – Loma Prieta Capitola Sta.

- ***PGA – 0.529g***

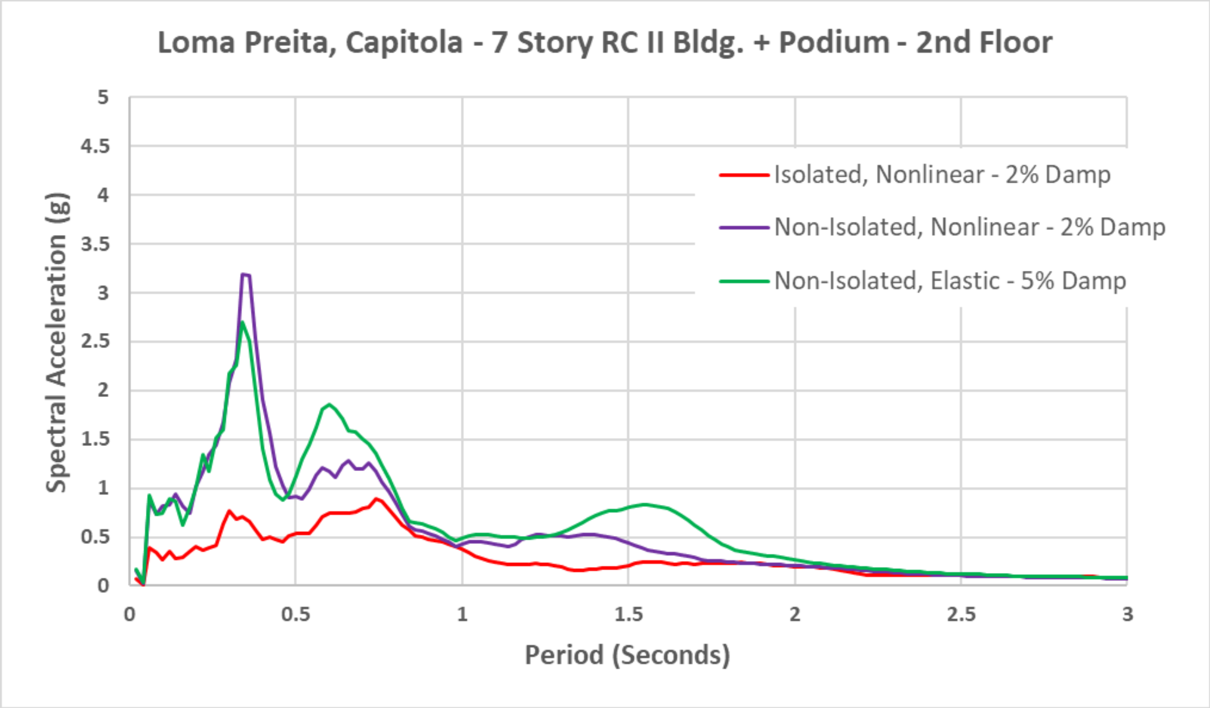


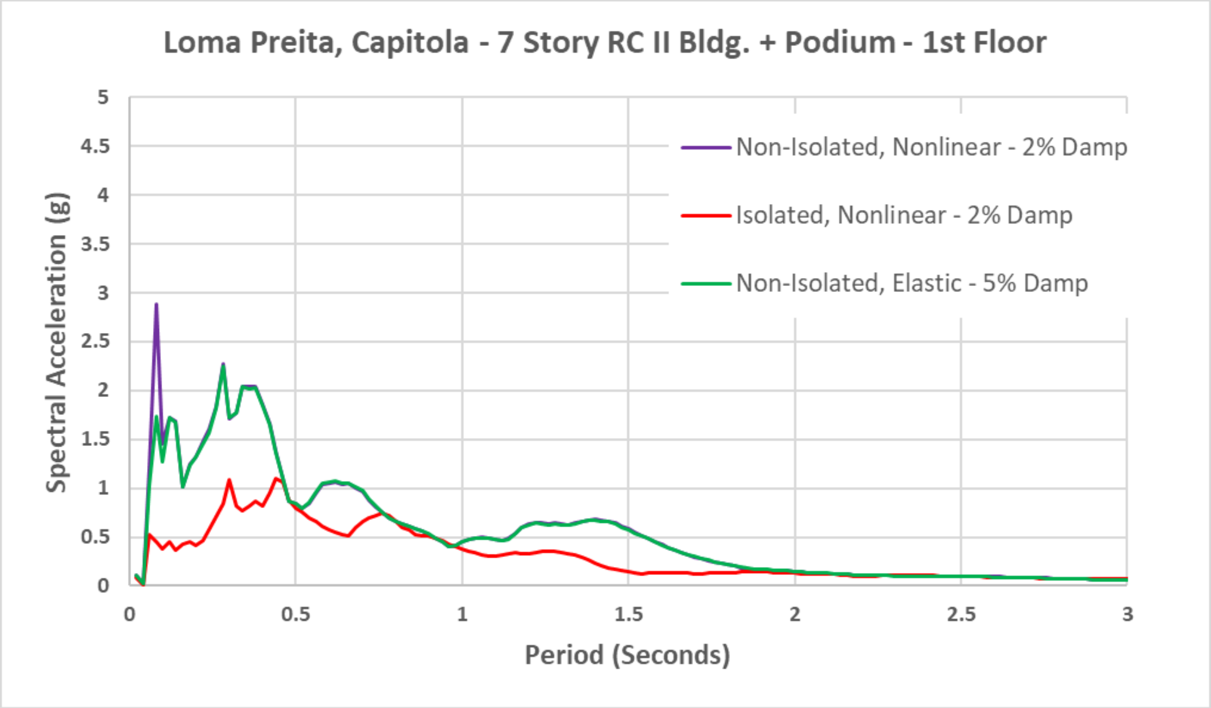


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – Loma Prieta Capitola Sta.

- *PGA – 0.529g*

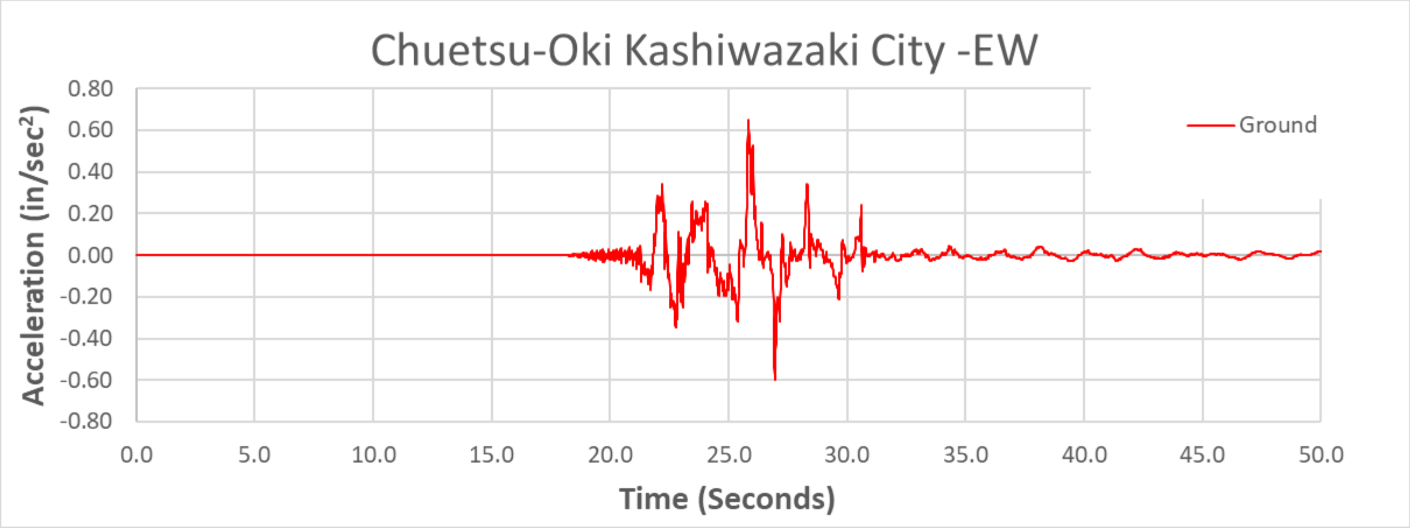


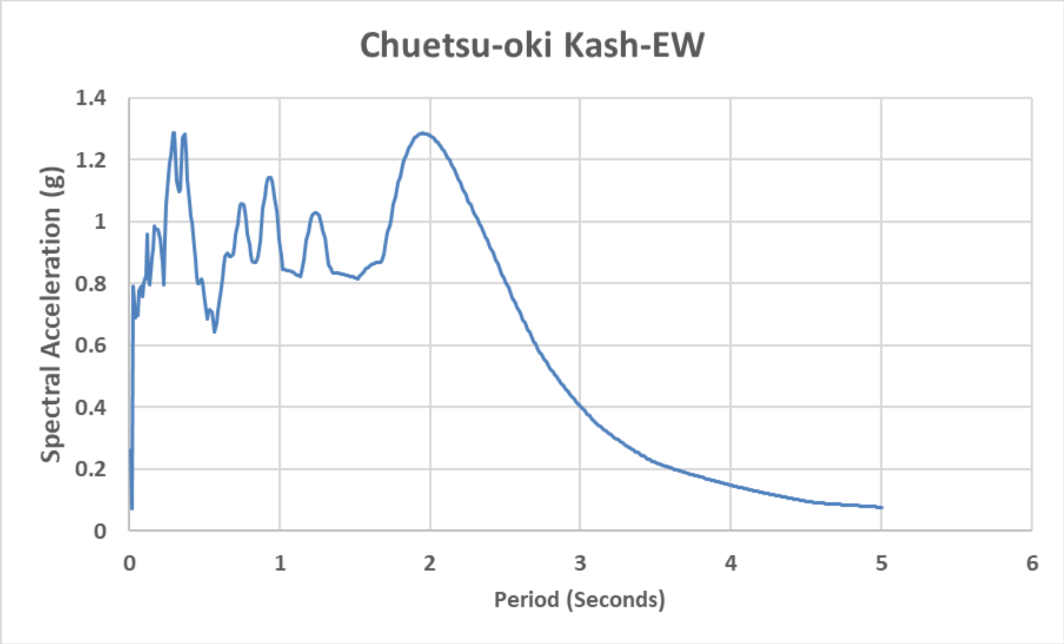


Example: 7-story Concrete MF + SW@1st floor

Response Comparisons for – Chuetsu-Kashiwazaki City - EW

- *PGA – 0.65g*

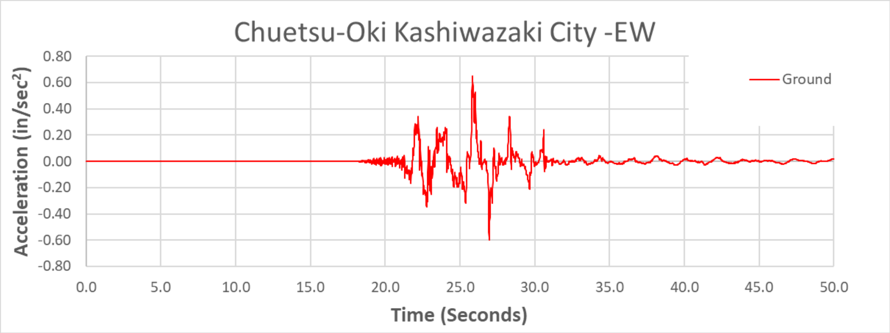


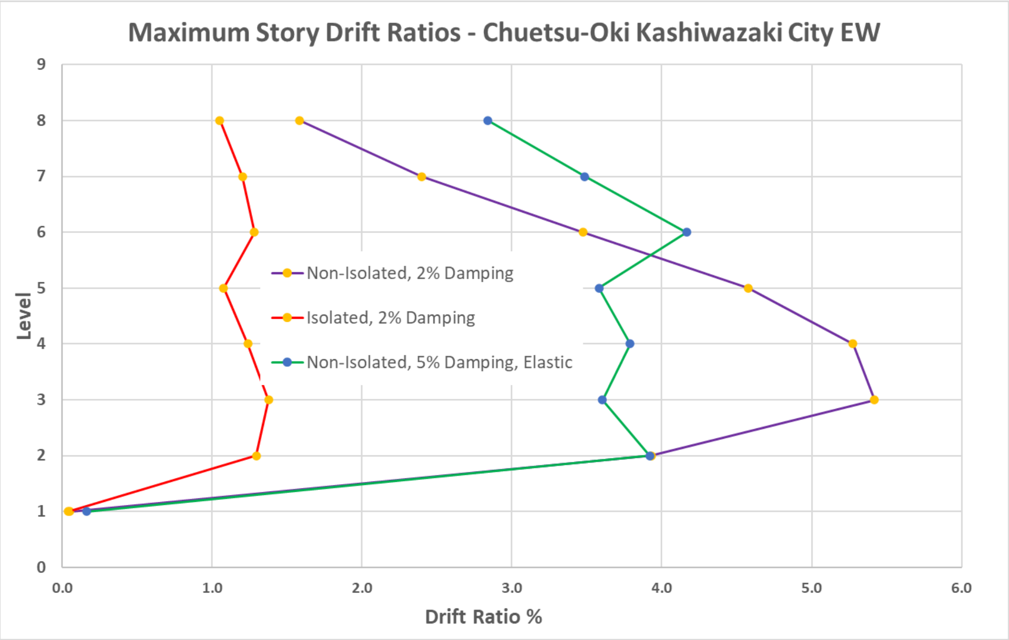


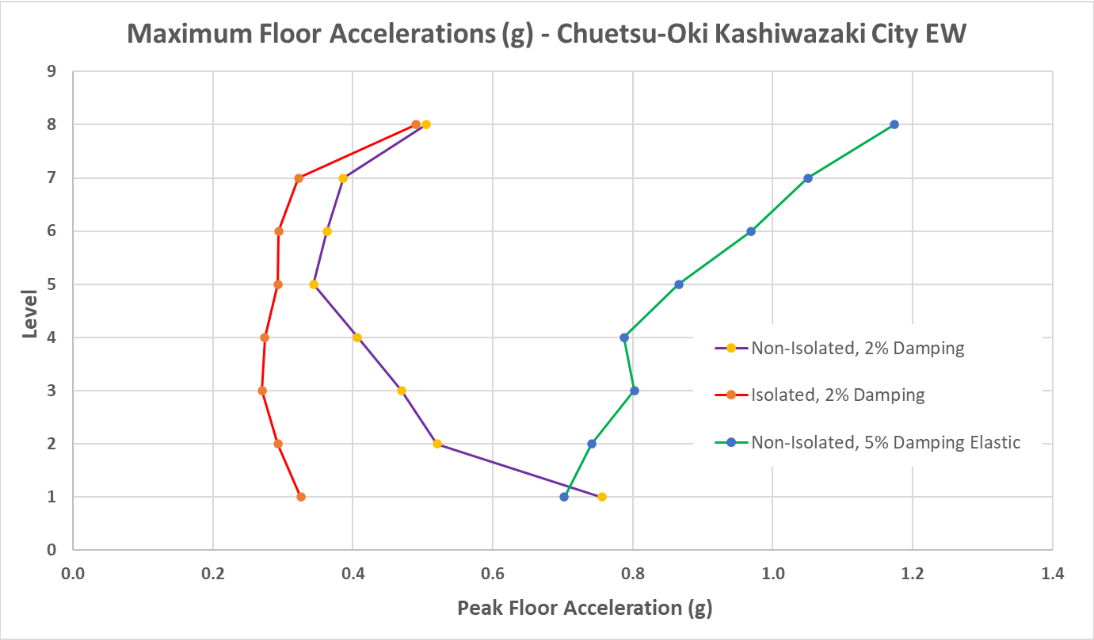
Example: 7-story Concrete MF + SW@1st floor

Comparison of Maximum Responses – Chuetsu-Kashiwazaki City - EW

- ***PGA – 0.65 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)





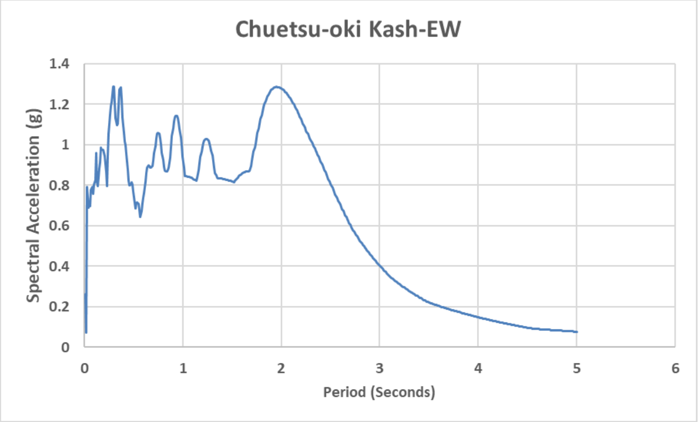


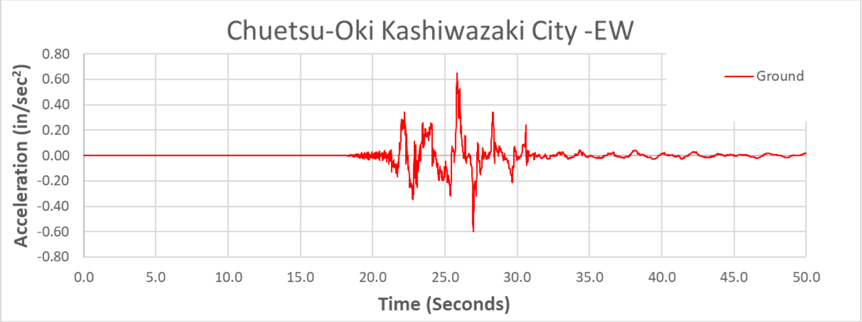
Example: 7-story Concrete MF + SW@1st floor

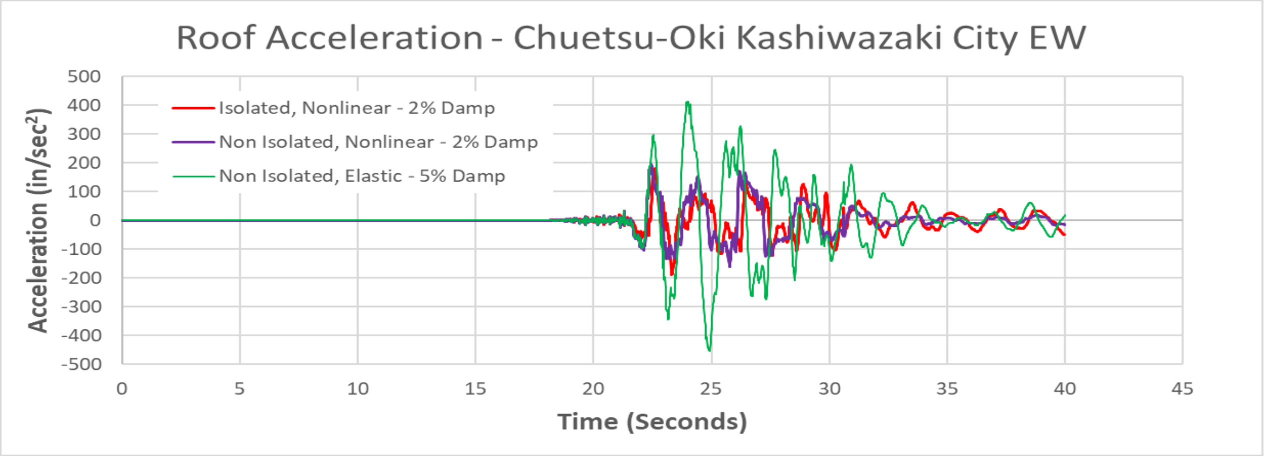
HCAi Department of Health Care Access and Information

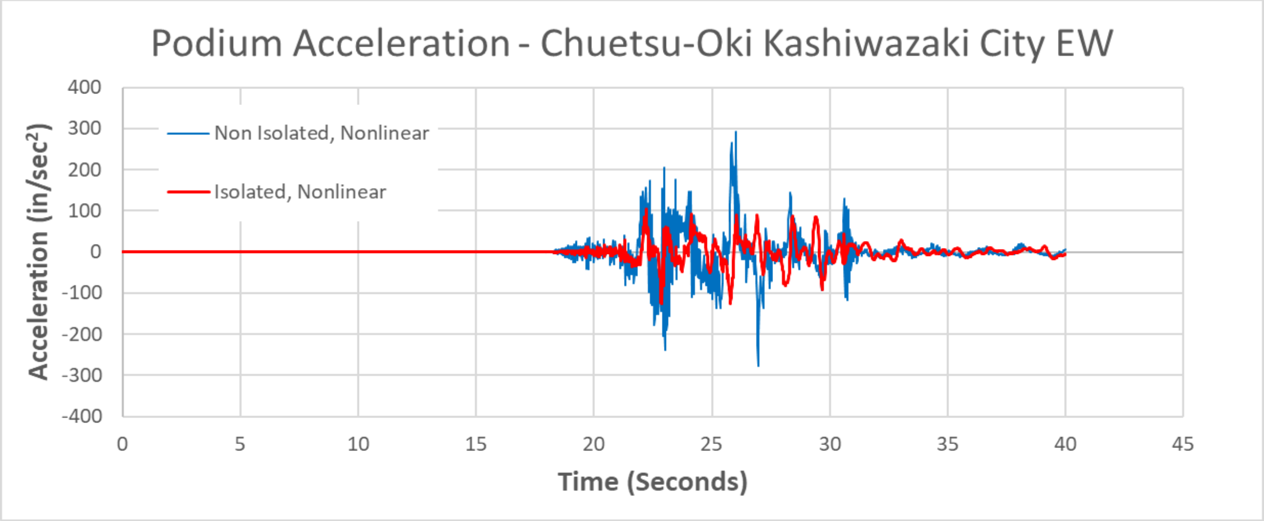
Time History Comparisons – Chuetsu-Kashiwazaki City - EW

- ***PGA – 0.65 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)





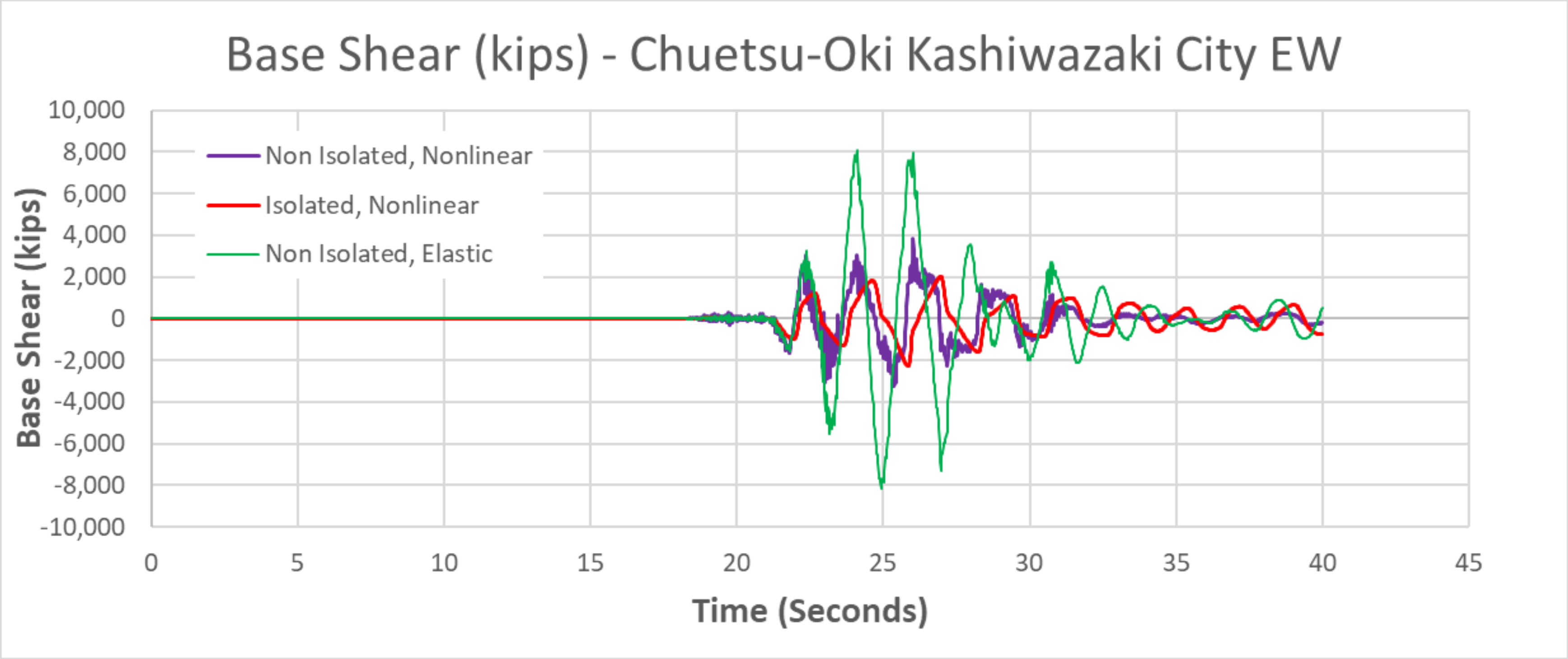




Example: 7-story Concrete MF + SW@1st floor

Base Shear Time History Comparisons – Chuetsu-Kashiwazaki City - EW

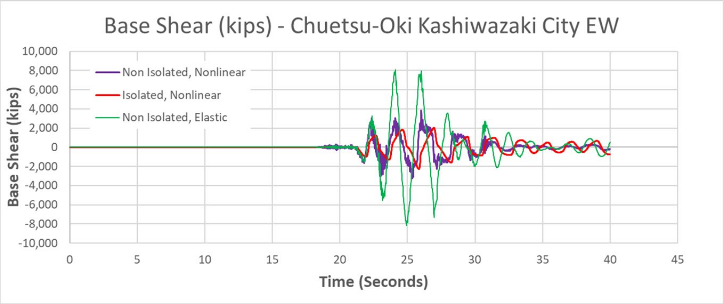
- ***PGA – 0.65g***

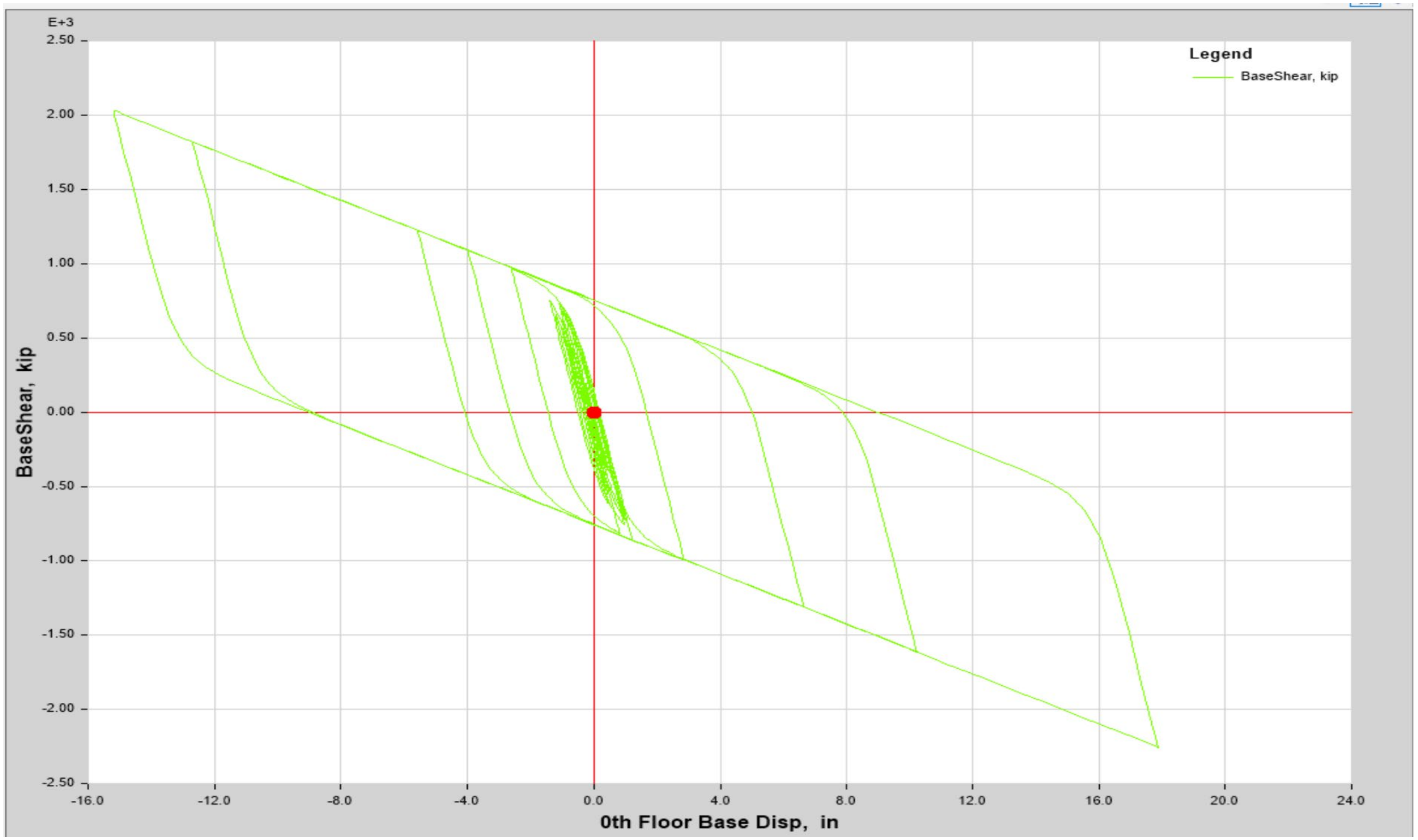


Example: 7-story Concrete MF + SW@1st floor

Base Shear Vs Isolator Displacement – Chuetsu-Kashiwazaki City - EW

- ***PGA – 0.65g***

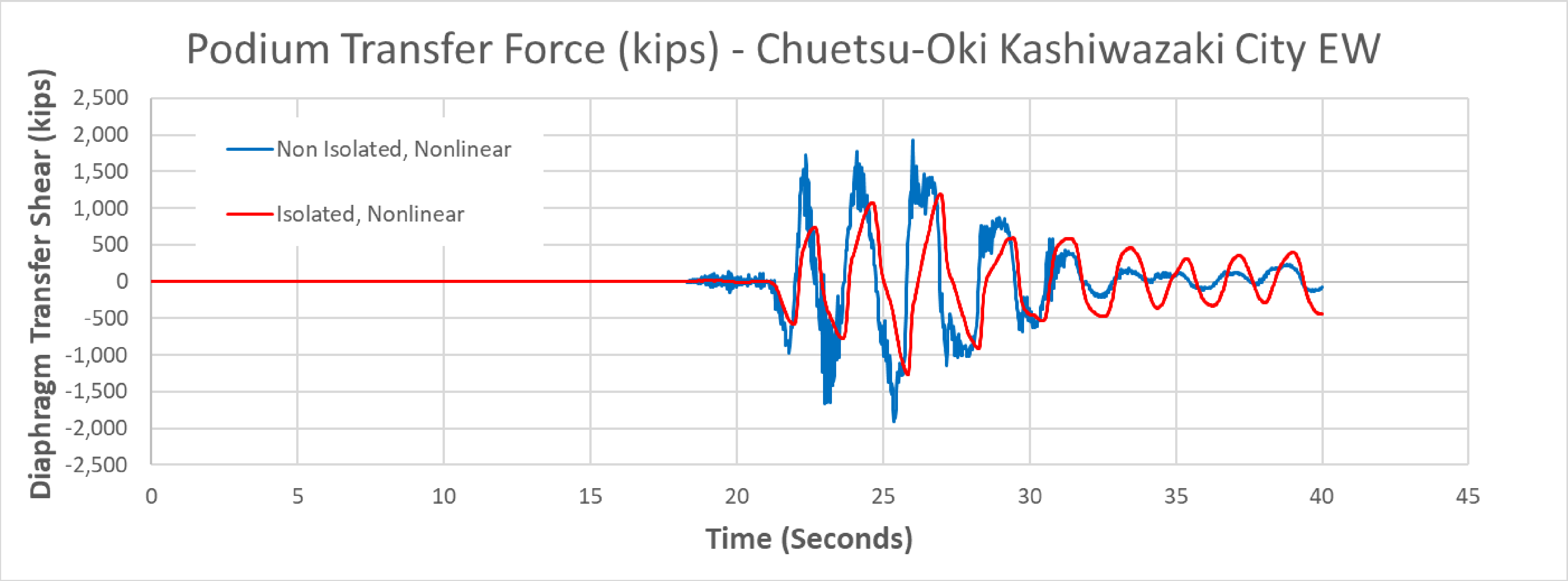




HCAi Department of Health Care Access and Information

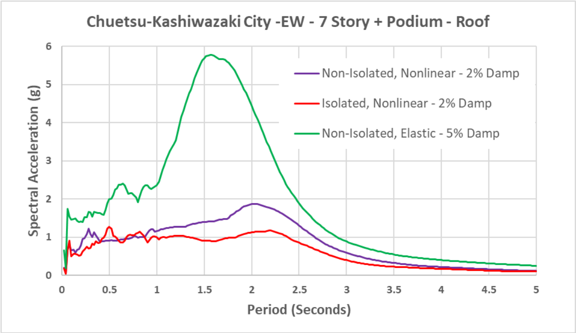
Podium Shear Time History Comp – Chuetsu-Kashiwazaki City - EW

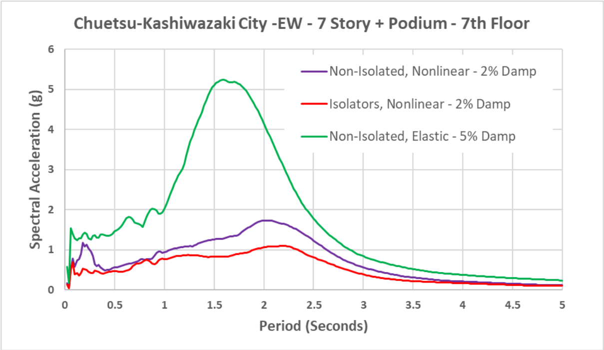
- *PGA – 0.65g*

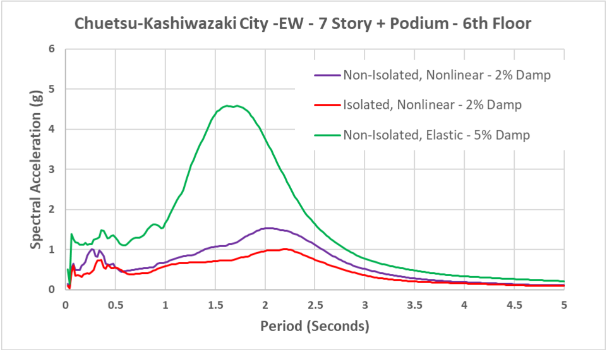


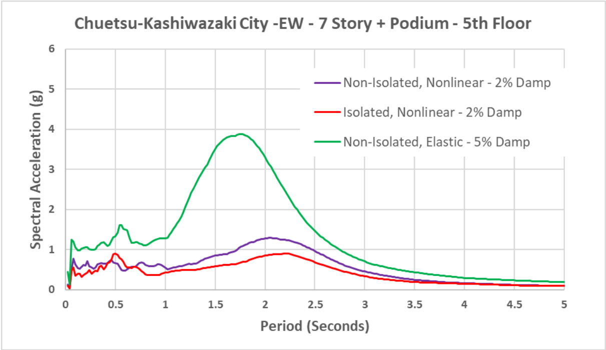
Spectral Response Comparisons for – Chuetsu-Kashiwazaki City - EW

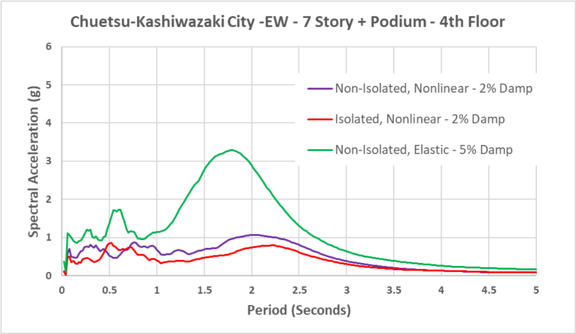
- ***PGA – 0.65g***

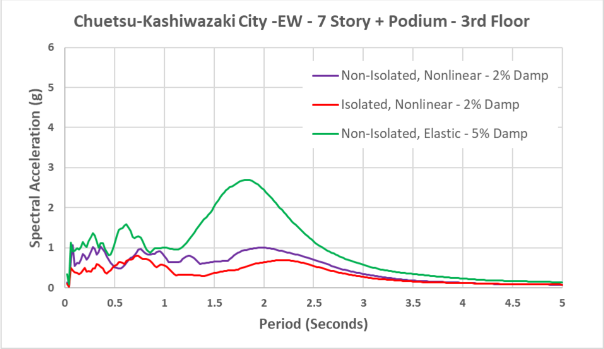


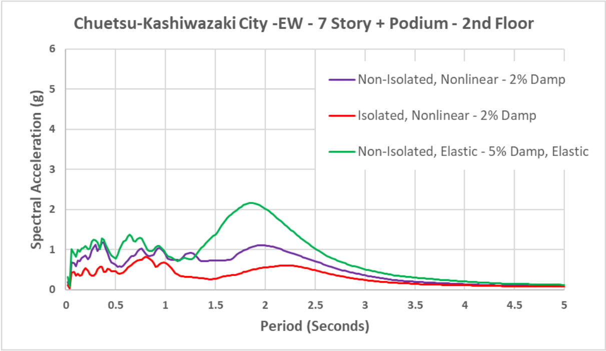


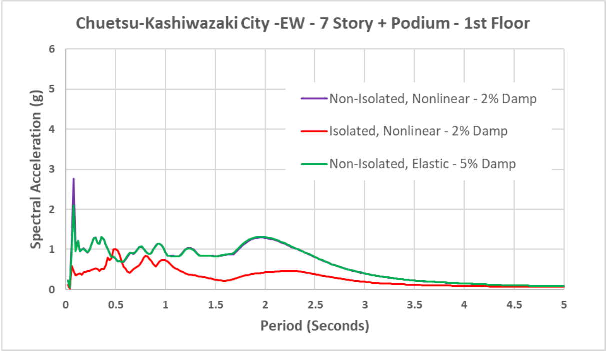








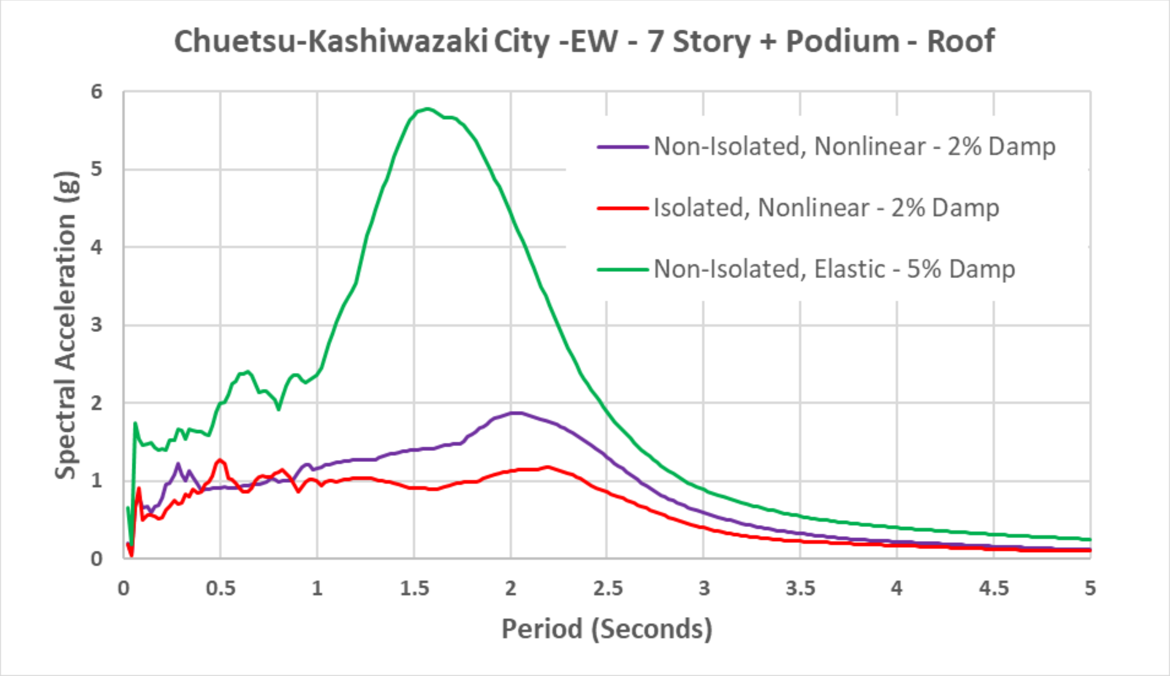


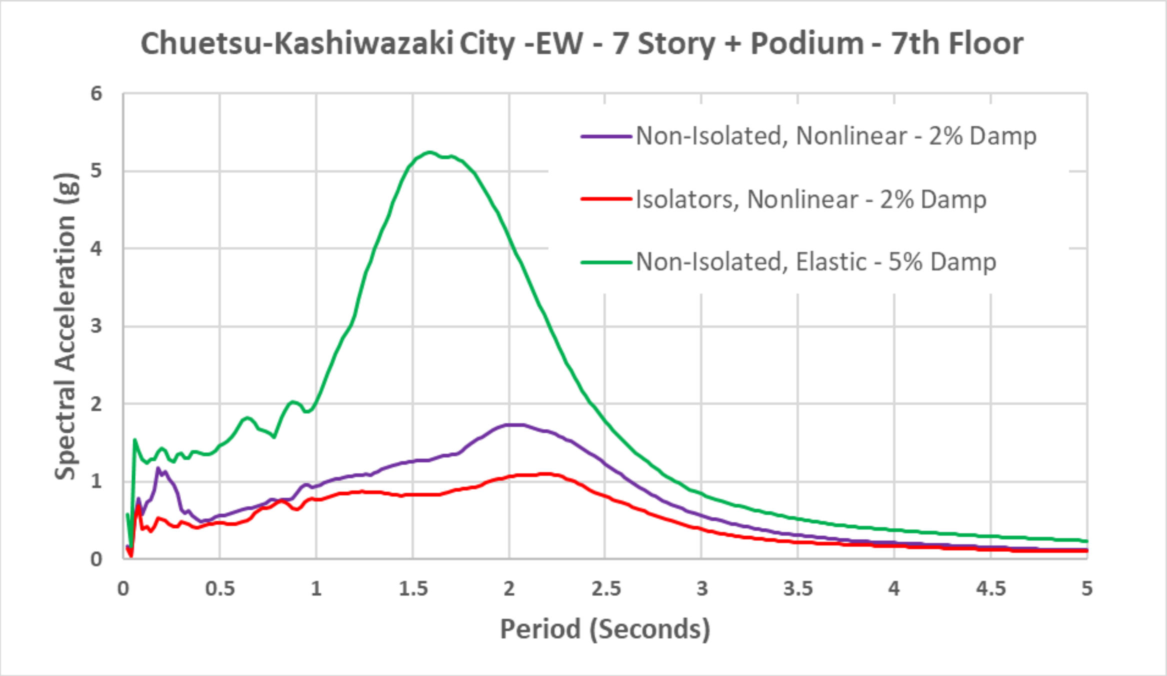


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – Chuetsu-Kashiwazaki City - EW

- *PGA – 0.65g*





Example: 7-story Concrete MF + SW@1st floor

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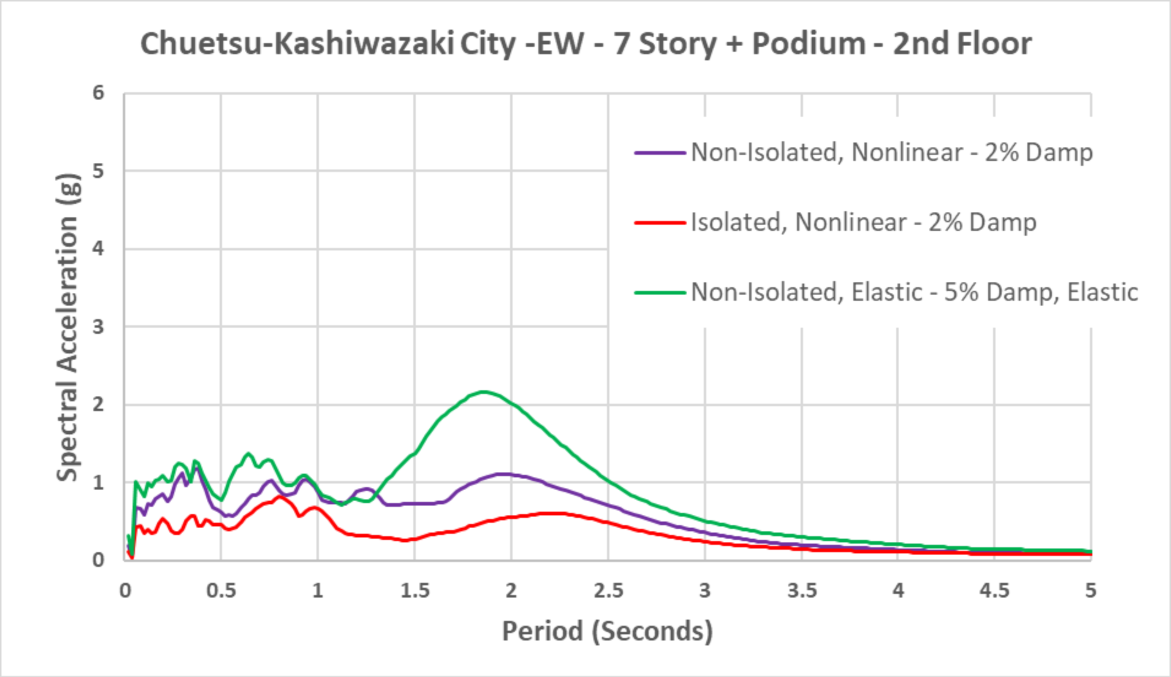
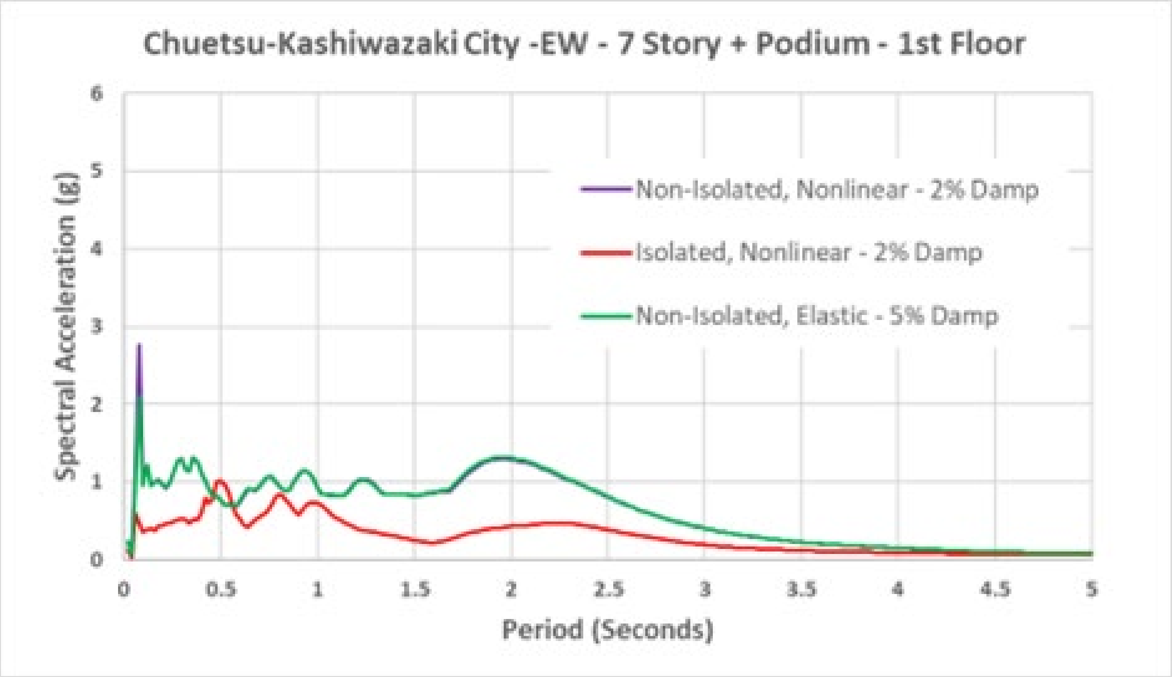
Spectral Response Comparisons for – Chuetsu-Kashiwazaki City - EW

- ***PGA – 0.65g***





Example: 7-story Concrete MF + SW@1st floor

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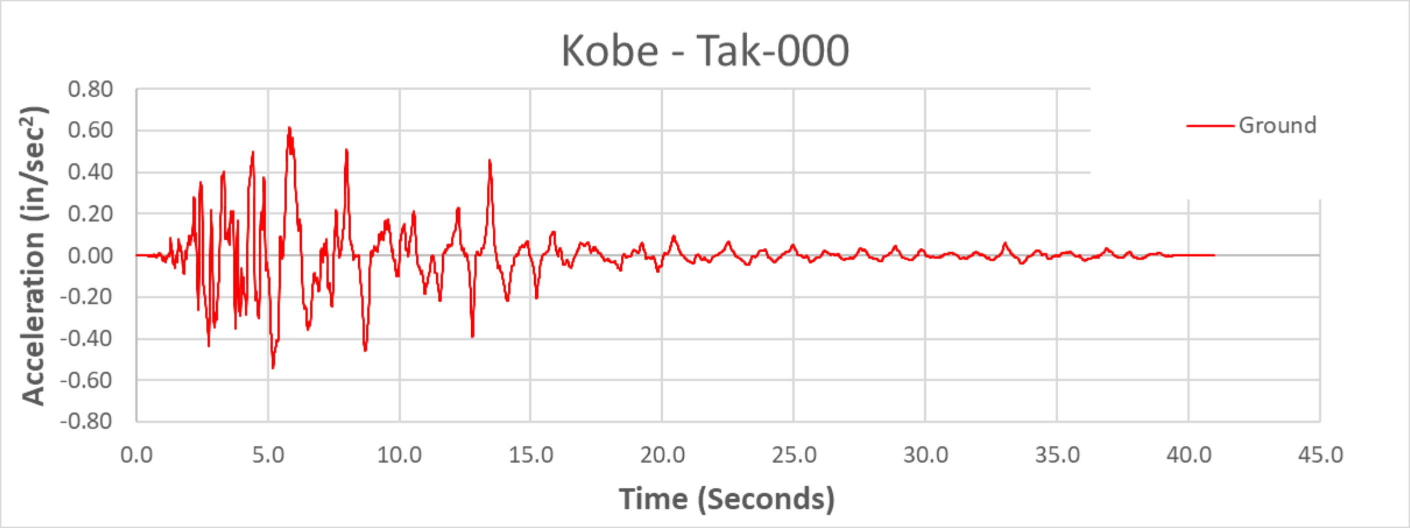
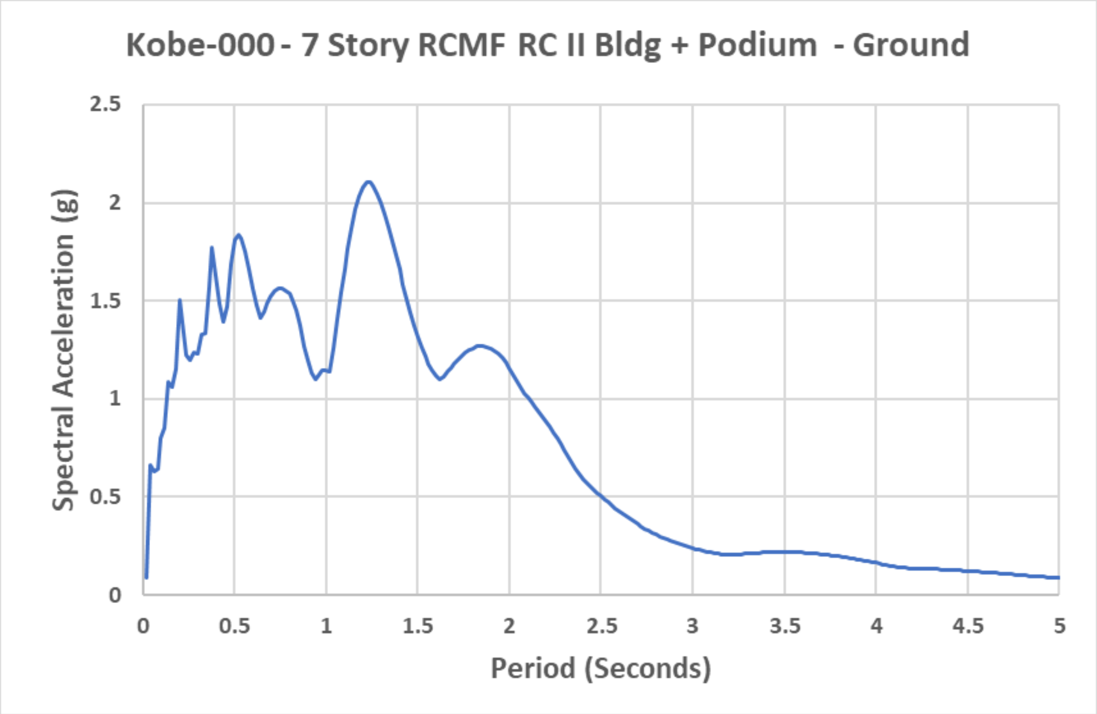
Response Comparisons for – Kobe Tak000

- *PGA – 0.618g*

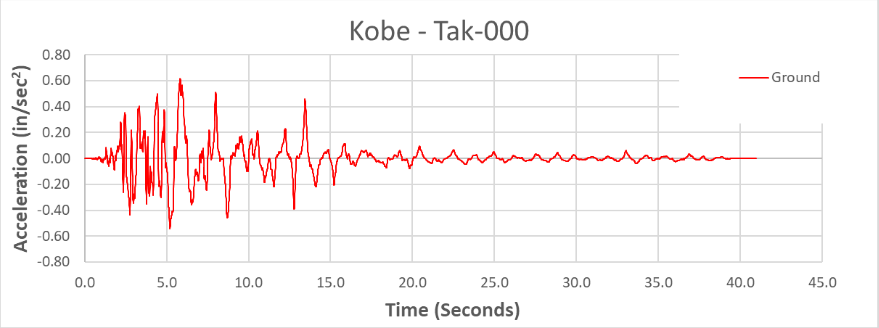


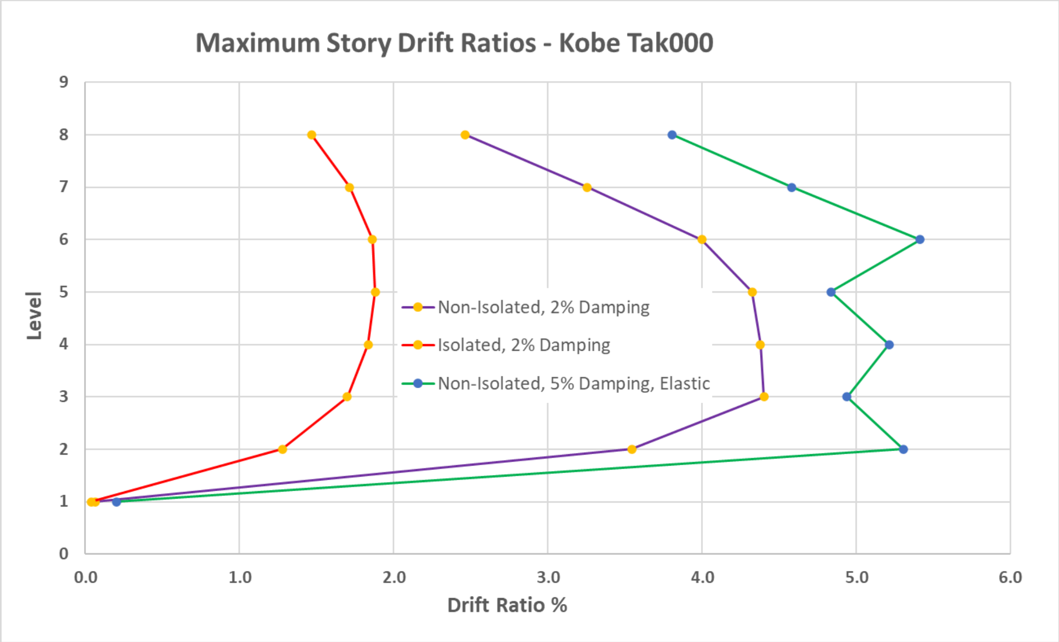


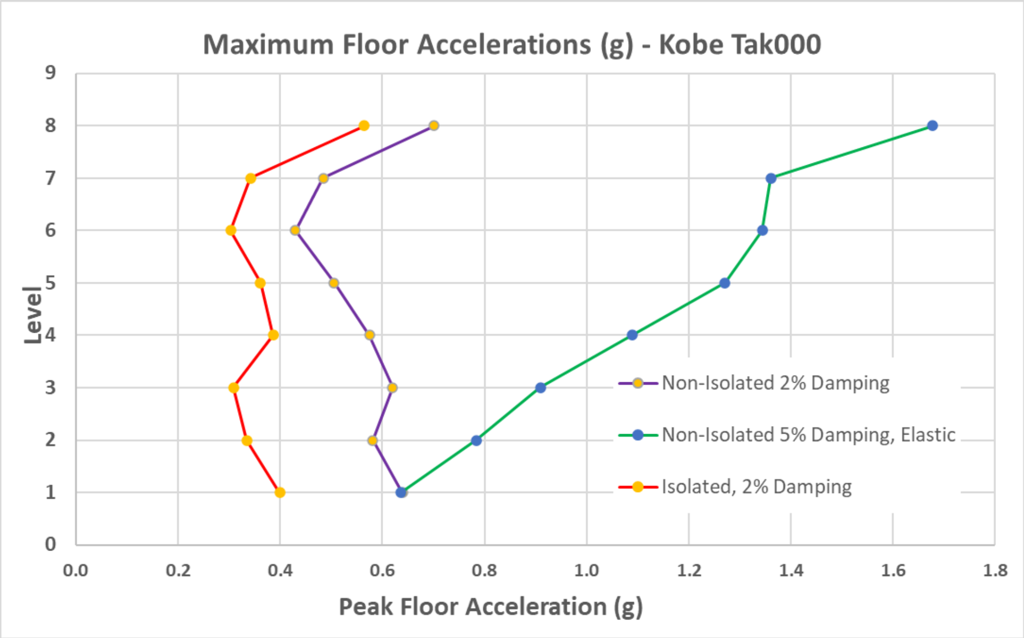
Example: 7-story Concrete MF + SW@1st floor

Comparison of Maximum Responses – Kobe Tak000

- ***PGA – 0.618 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)







Example: 7-story Concrete MF + SW@1st floor

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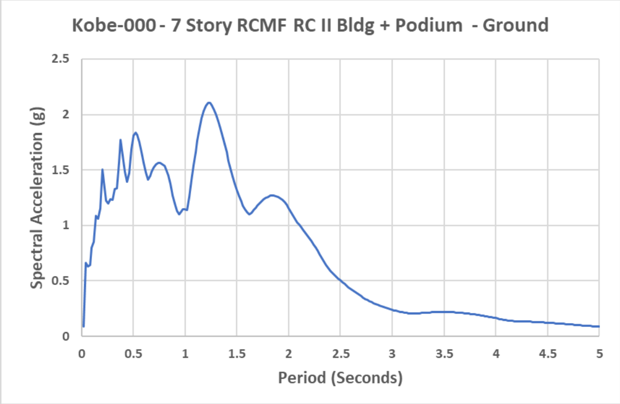
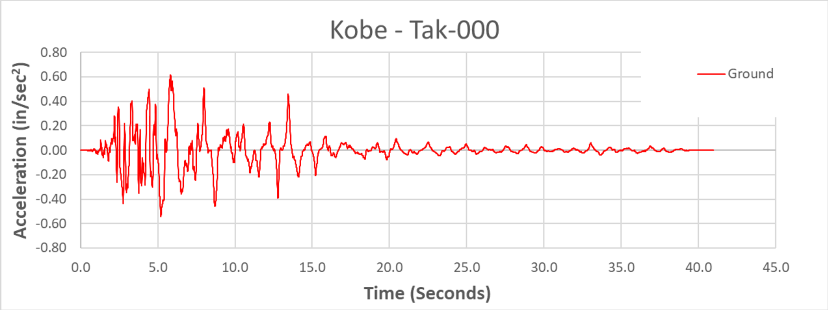
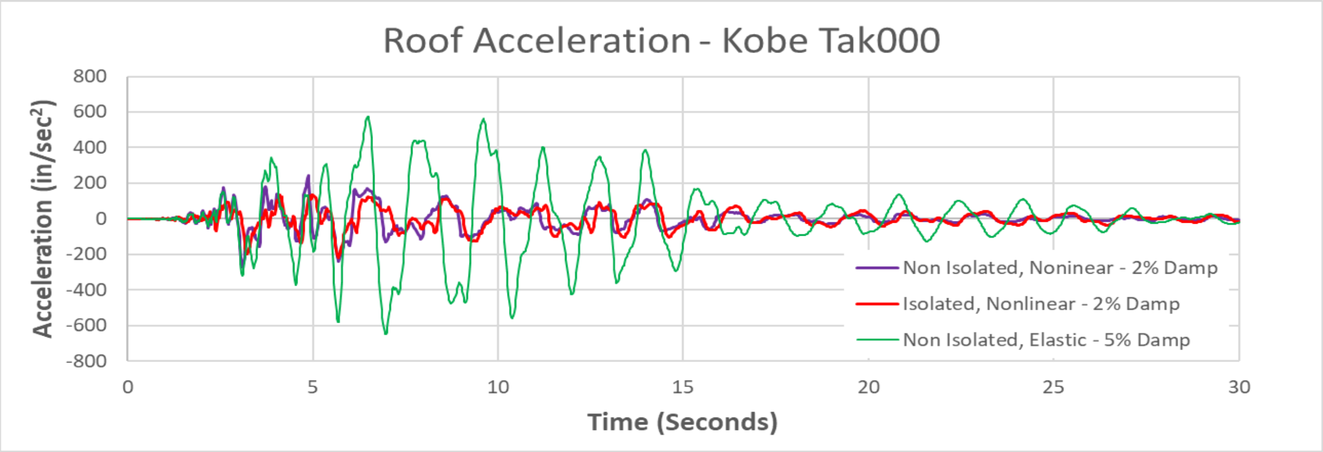
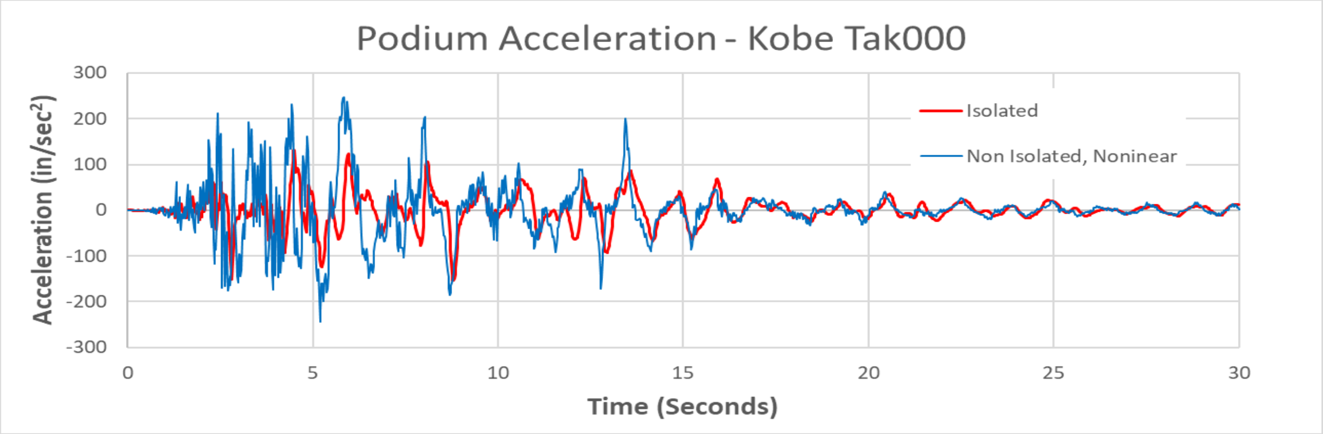
Time History Comparisons – Kobe Tak000

- ***PGA – 0.618 g***
- Model 1 (7 Story + Podium Non-Isolated)
- Model 2(7 Story + Podium Isolated)





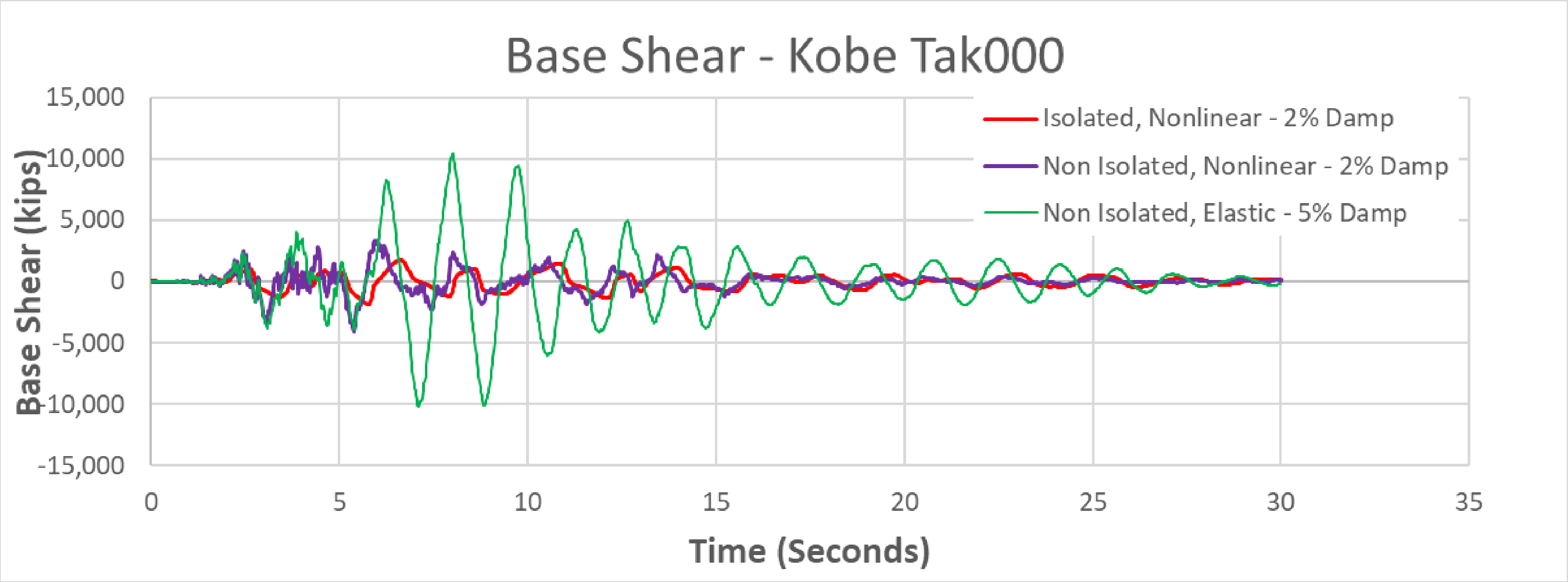




Example: 7-story Concrete MF + SW@1st floor

Base Shear Time History Comparisons – Kobe Tak000

- *PGA – 0.618g*



Example: 7-story Concrete MF + SW@1st floor

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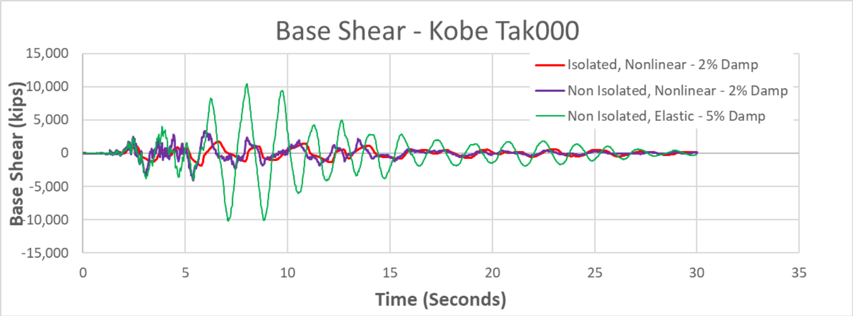
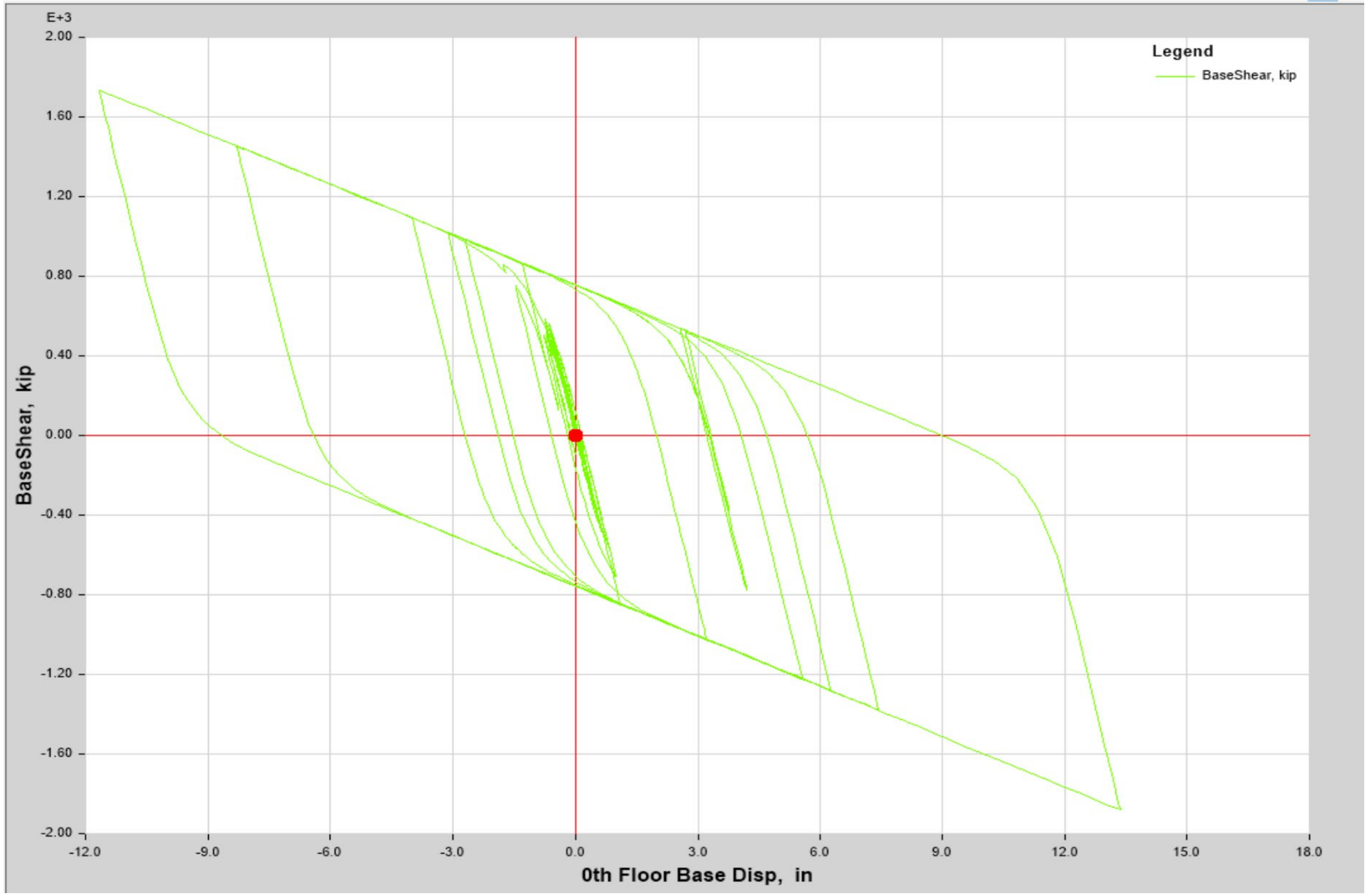
Base Shear Time History Comparisons – Kobe Tak000

- *PGA – 0.618g*

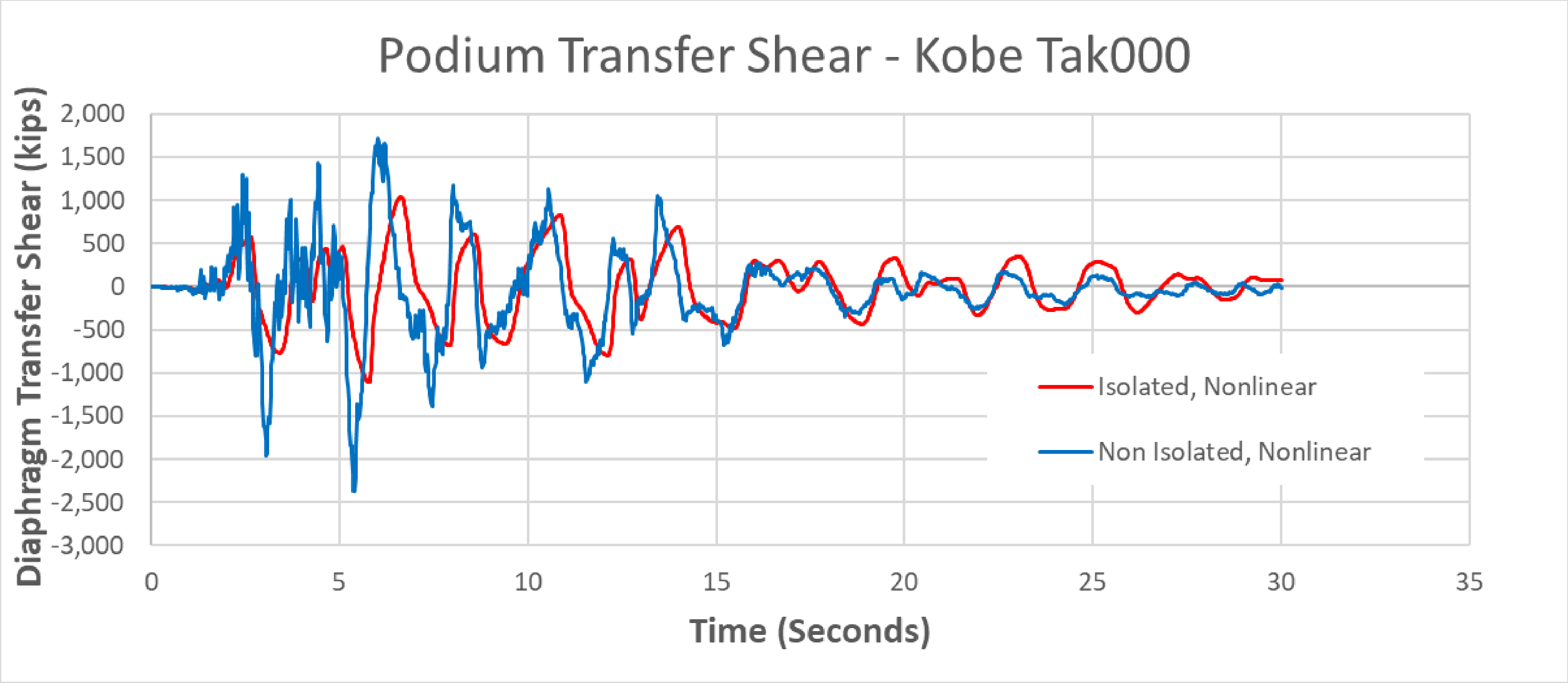




Example: 7-story Concrete MF + SW@1st floor

Podium Shear Time History Comp – Kobe Tak000

- *PGA – 0.618g*



Example: 7-story Concrete MF + SW@1st floor

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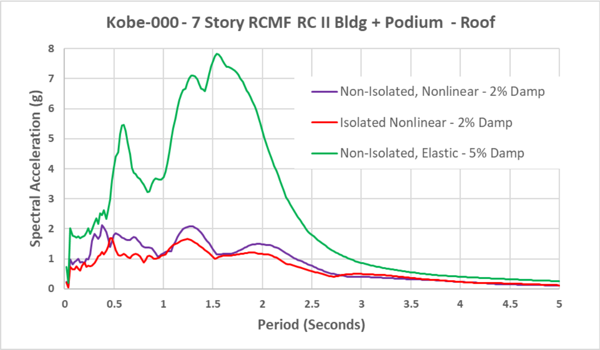
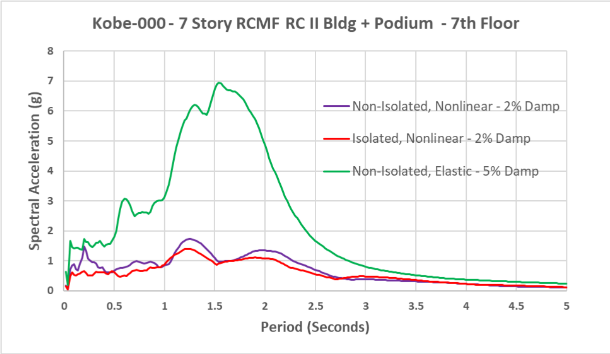
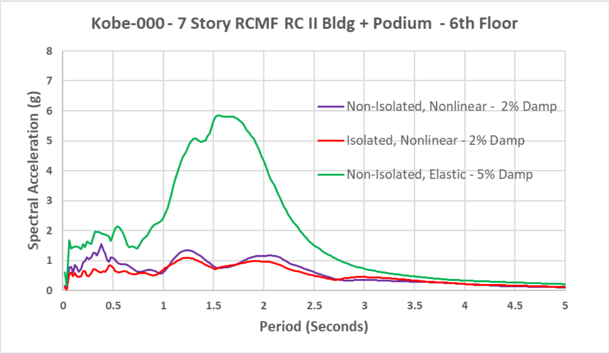
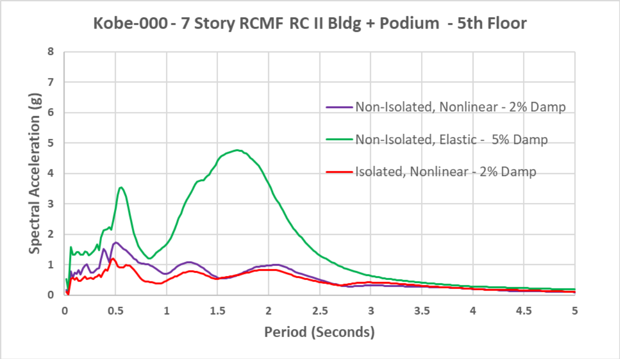
Spectral Response Comparisons for – Kobe Tak000

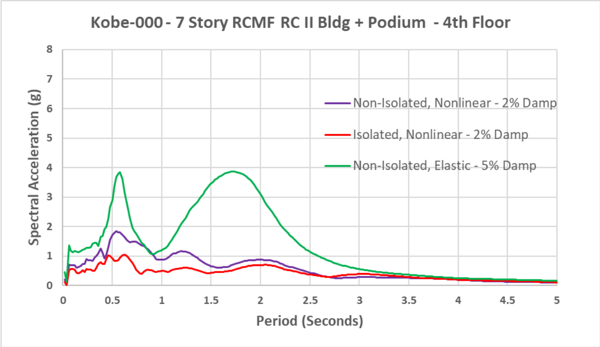
- ***PGA – 0.618g***

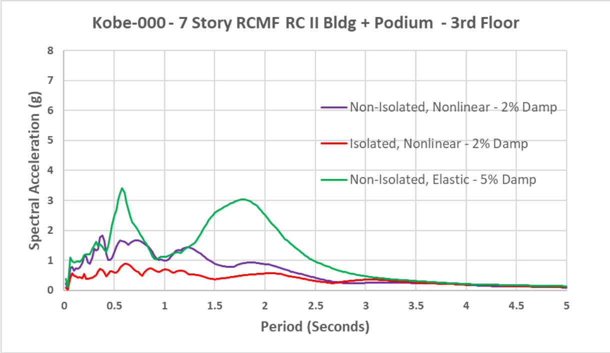


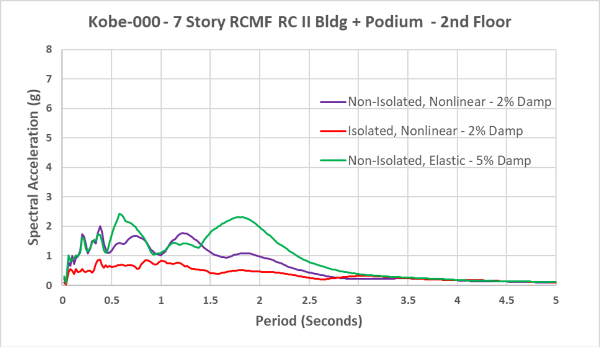


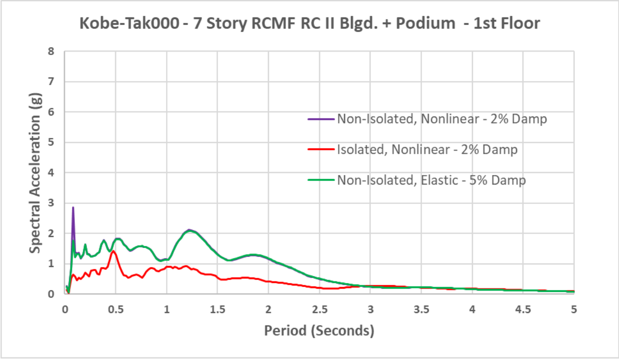








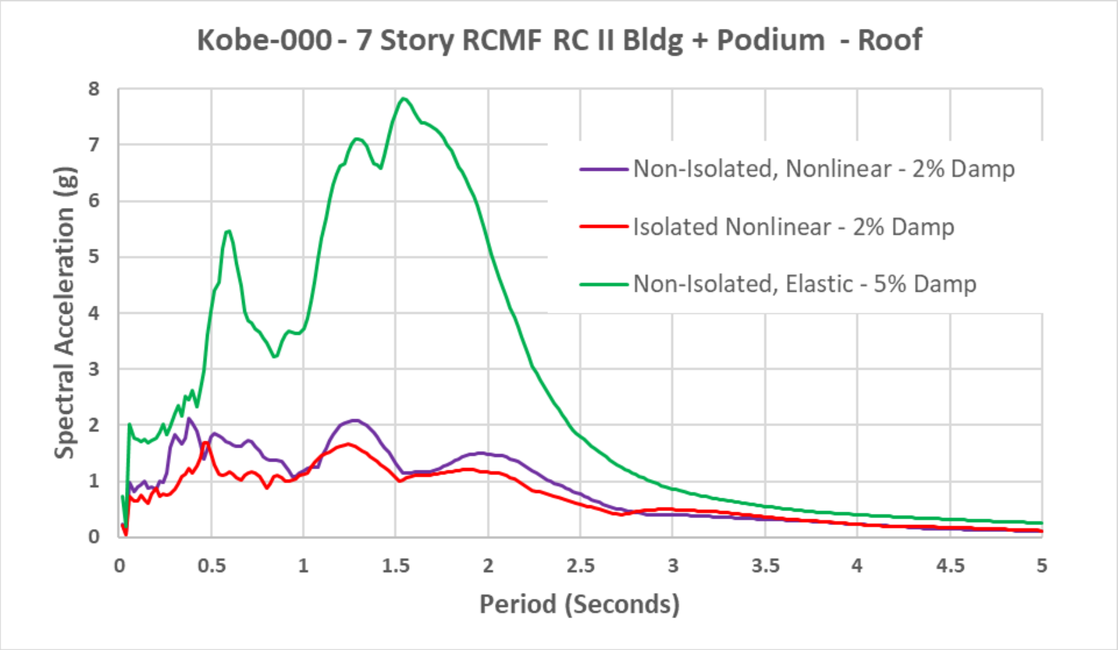


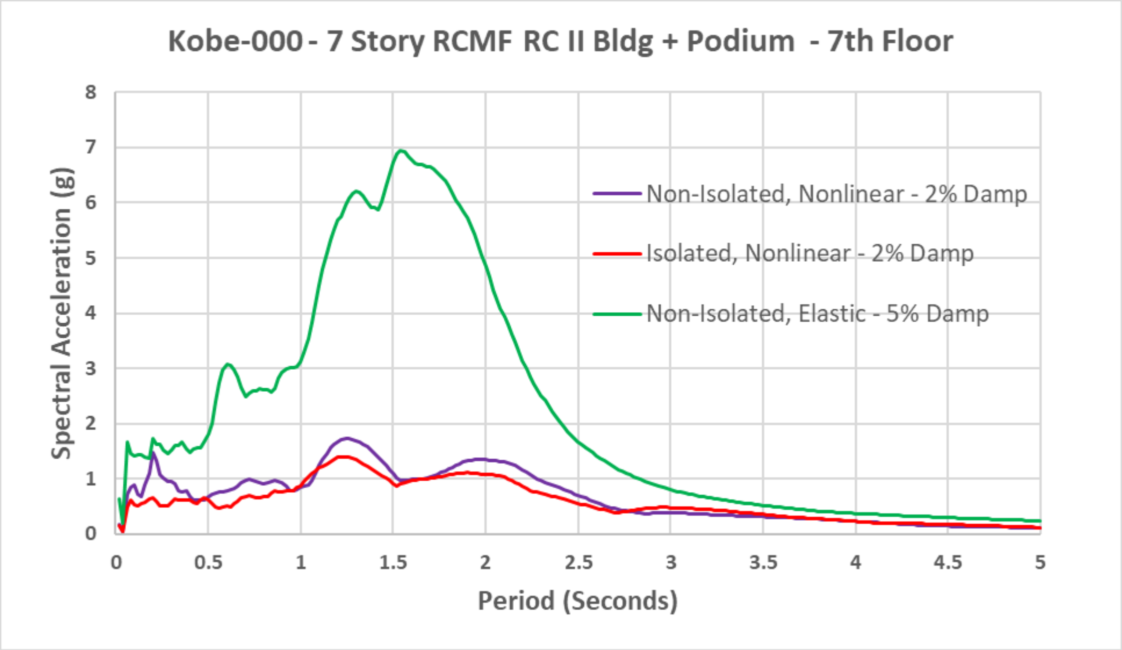


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – Kobe Tak000

- *PGA – 0.618g*

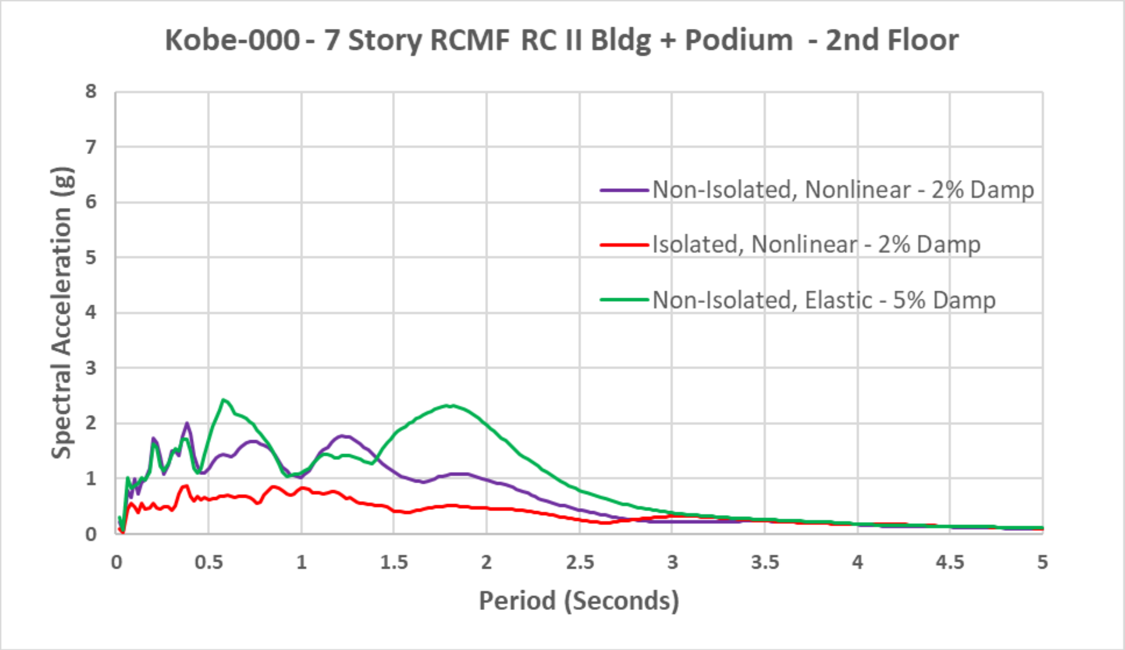


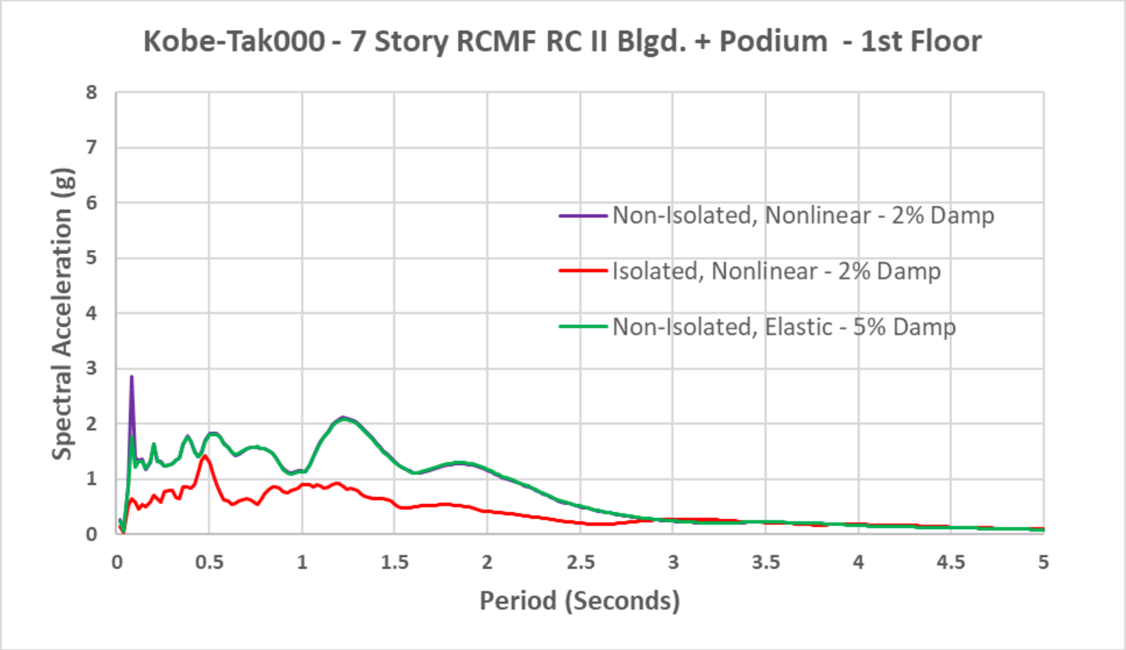


Example: 7-story Concrete MF + SW@1st floor

Spectral Response Comparisons for – Kobe Tak000

- *PGA – 0.618g*





Example: 7-story Concrete MF + SW@1st floor

Takeaways

- The Floor Spectral Acceleration for the isolated building model, is approximately half that of the non-isolated building model in the periods of interest, where nonlinearities are permitted in the non-isolated building model.

- Inelastic accelerations and inter-story drifts are significantly lower even in very damaging earthquakes

- Reduction in the minimum lower bound for design of nonstructural components in Chapter 13 of ASCE 7 is acceptable for well designed base isolated structures

- Diaphragm transfer forces are significantly reduced in the isolated case.

Proposed Lower Bound $F_{p,min}$ for Nonstructural Components in Base Isolated Buildings from ASCE 7, TC-7

- New proposed $F_{p,min}$ from seismic isolation committee of ASCE 7, TC-7
  - $F_{p,min} = 0.75 \times V_{st}/W \times I_p \times W_p$

Proposed Lower Bound $F_{p,min}$ for Nonstructural Components in Base Isolated Buildings

- $F_{p,min} = 0.75 \times V_{st}/W \times I_p \times W_p$

Where:

$$V_{st} = V_b \left(\frac{W_s}{W}\right)^{(1-2.5\beta m)}$$

$$V_b = k_M D_M$$

$$\beta_M = \frac{\sum E_M}{2\pi k_M D_M^2}$$

$$k_M = \frac{\sum |F_M^+| + \sum |F_M^-|}{2D_M}$$

$$T_M = 2\pi\sqrt{\frac{W}{k_M g}}$$

$$D_M = \frac{g S_{M1} T_M}{4\pi^2 B_M}$$

Table 17.5-1. Damping Factor, B_M.

Effective Damping, β_M (percentage of critical)[a,b]	B_M Factor
≤2	0.8
5	1.0
10	1.2
20	1.5
30	1.7
40	1.9
≥50	2.0

[a] The damping factor shall be based on the effective damping of the isolation system, determined in accordance with the requirements of Section 17.2.8.6.
[b] The damping factor shall be based on linear interpolation for effective damping values other than those given.

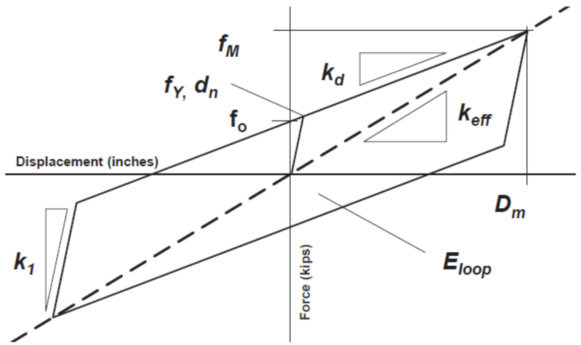


Figure 17.8-1. Nominal properties of the isolator bilinear force-deflection model.

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Comparison of Lower Bound $F_{p,min}$ for Nonstructural Components in Base Isolated Buildings with Current Lower Bound

- New proposed $F_{p,min}$ from seismic isolation committee of ASCE 7
  - $F_{p,min} = 0.75 \times V_{st}/W \times I_p \times W_p$

- Current $F_{p,min}$
  - $F_{p,min} = 0.3 \times S_{DS} \times I_p \times W_p$

- Substituting the base shear and maximum deformation from the analysis and approximating the $F_{p,min}$ from the new proposed equation shows a reduction in $F_{p,min}$ of approximately 2 – 5 times less than current minimum design requirements. (Committee substantiation pending).

- HCAI proposes a maximum of 2 times lower $F_{p,min}$ than current design provisions for non-isolated buildings to be used for hospital buildings designed with base isolation.
- Proposed $F_{p,min}$

$$\boxed{F_{p,min} = 0.15 \times S_{DS} \times I_p \times W_p}$$

Item #11 Proposed removal or revision of California Building Code exceptions to AISC (American Institute of Steel Construction) design specifications

- Discussion and public input

Facilitator: Jim Malley, SE, Senior Principal Degenkolb Engineers (or designee)

Proposed Removal or Revision of California Building Code Exceptions to AISC Design Specifications

Hospital Building Safety Board
Structural and Nonstructural Regulations Committee Meeting
March 12, 2025

OSHPD CBC Exceptions to National Standards

- OSHPD does regular in-depth review of changes to the national structural standards to assess their relevance in relation to California healthcare construction needs
- OSHPD has taken numerous exceptions to the national design structural standards for many years
  - ASCE/SEI 7
  - AISC 360/341/358
  - ACI 318
  - AISI
  - Etc.

OSHPD CBC Exceptions to National Standards

- Exceptions intended to reflect the special requirements of California healthcare construction projects
  - Sometimes more restrictive due to RC IV demands
  - At times reflected concerns about newly developed structural systems, design procedures, connection details, etc.
  - Also based on “lessons learned” on past projects
  - More recently also adopts new material that is in the process of being incorporated into national standards but will not be adopted by the IBC for a few years due to the typical six-year cycle (2020 NEHRP GM Spectra, e.g. prior to adoption of ASCE 7-22)
- At times OSHPD exceptions have been subsequently adopted by national standards
- And OSHPD has removed exceptions when the national standards have made changes to better align with OSHPD’s needs (QA/QC changes in 2024, e.g.)
- This is a healthy process!!!

OSHPD CBC Exceptions to AISC Standards

- The majority of OSHPD exceptions to AISC standards to AISC documents 341 and 358:
  - AISC 341- Seismic Provisions for Steel Buildings
  - AISC 358 – Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications
- The types of exceptions taken include the following:
  - Definition of terms
  - Restricting the use of steel and composite seismic systems allowed by ASCE 7 and AISC 341
  - Restrictions on member design
  - Design and detailing of seismic connections
  - QA/QC provisions (updated in 2024 with new PIN)

OSHPD CBC Exceptions to AISC Standards

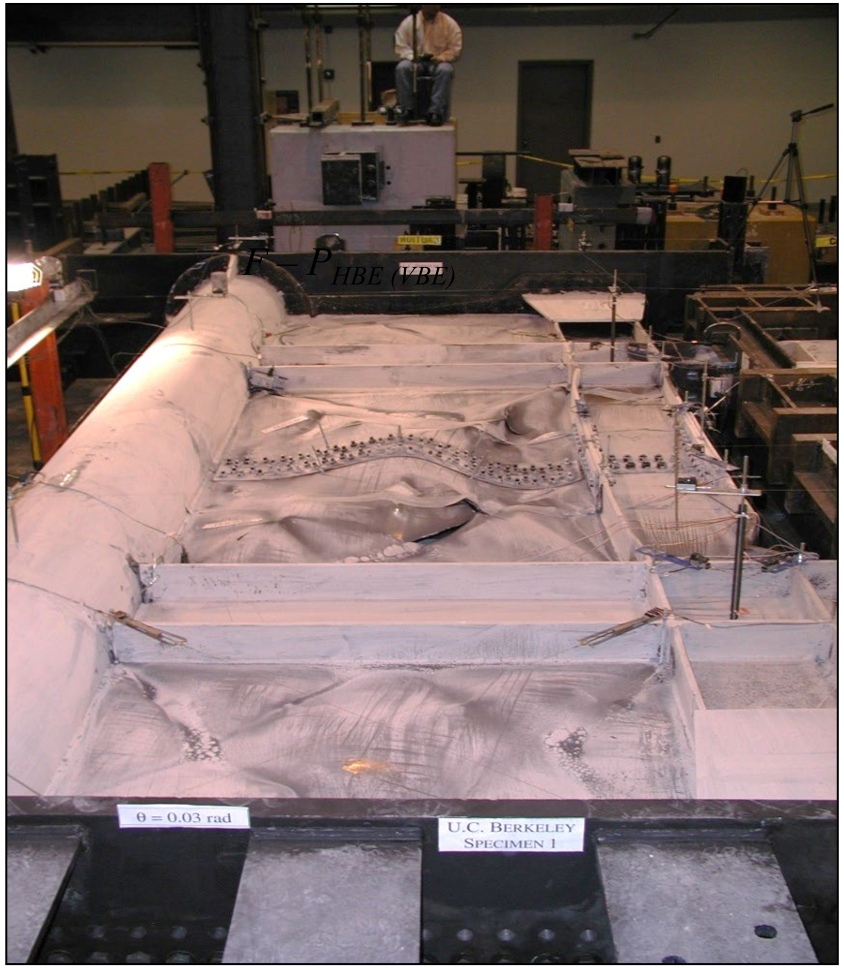
- A review of the exceptions taken to AISC Standards in the “45-Day Express Terms for Proposed Building Standards of the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development Regarding the 2025 California Building Code Title 24, Part 2, Volume 2 (5/24)”
- Based on this review, the exceptions were binned into the following categories:
  - Those requested for review by OSHPD to consider whether the exception could be modified or removed.
  - Those that would be recommended for review by AISC to consider whether they should adopt the exception in some form.
  - Those that need no further review at this time.
- The following slides will summarize the proposed exceptions in each of the categories.

OSHPD CBC Exceptions to AISC Standards

- Exceptions requested for review by OSHPD related to a few of the seismic systems allowed by ASCE 7 and AISC 341 that are not permitted by OSHPD. These systems can not be used following the standard design procedures, but only through the proposal and acceptance of an "Alternative Means of Compliance/Alternative System".
- The steel systems in this category include the following:
  - Special Plate Shear Walls
  - Special Truss Moment Frames
- In composite steel/concrete systems in this category include the following:
  - Composite Plate Shear Walls – Concrete Filled
  - Coupled Composite Plate Shear Walls – Concrete Filled

OSHPD CBC Exceptions to AISC Standards – Systems Suggested for OSHPD Consideration

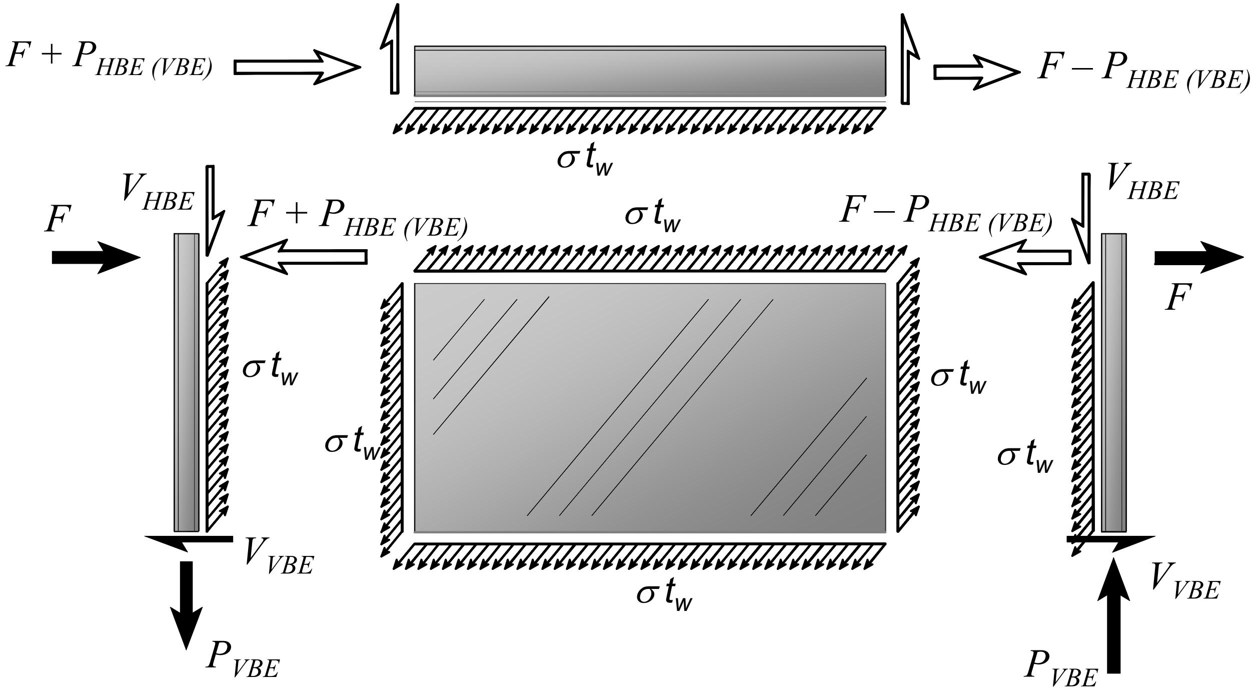
- Special Plate Shear Wall
  - First adopted in 2005 edition of AISC 341
  - Based on research in Canada and the U.S.
  - Design approach similar to plate girders – thin plate tension field theory
  - Previous concerns expressed by OSHPD related to post event buckling of panels requiring evacuation
    - No loss in lateral strength results from until significant tearing of the plate occurs due to ability of plate to readjust



Department of Health Care Access and Information

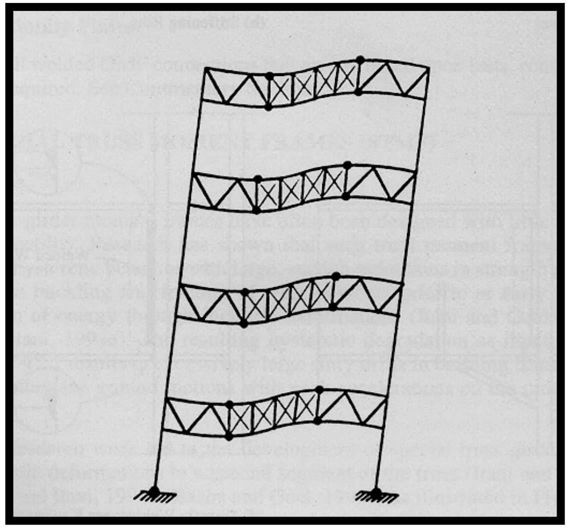
OSHPD CBC Exceptions to AISC Standards – Systems Suggested for OSHPD Consideration

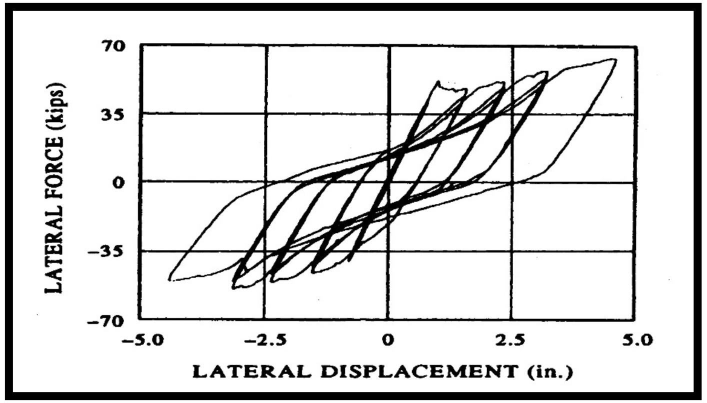
$$V_n = 0.42 F_y t_w L_{cf} \sin 2\alpha$$



OSHPD CBC Exceptions to AISC Standards – Systems Suggested for OSHP Consideration

- Special Truss Moment Frame
  - First adopted in 2002 edition of AISC 341
  - Based on research by Goel and recent work by Chao
  - Concept similar to EBF's
  - Ductile Special Segment acts like link beam
  - Remainder of truss remains elastic
  - Both cross-braced and Vierendeel configurations
  - Span Limited to 65 feet/Depth to 6 feet
  - Previous OSHPD concerns related to post event buckling of special segment diagonals requiring evacuation
    - Similar to SPSW no loss of strength due to buckling
  - Major update underway that will be balloted in March/April. Open for public comment.





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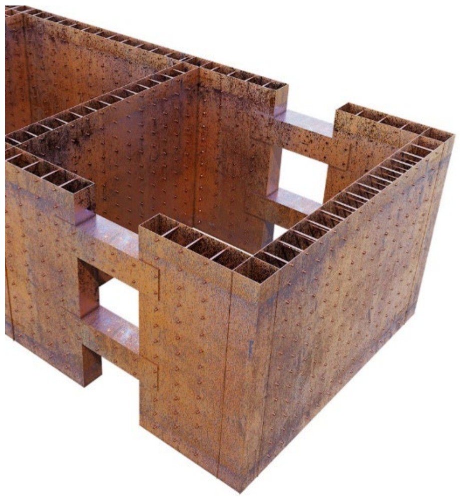
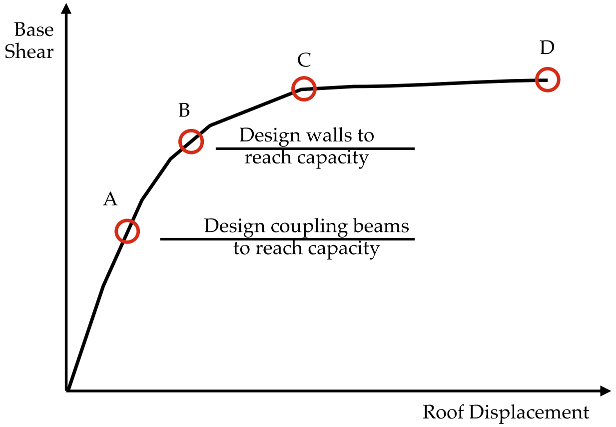
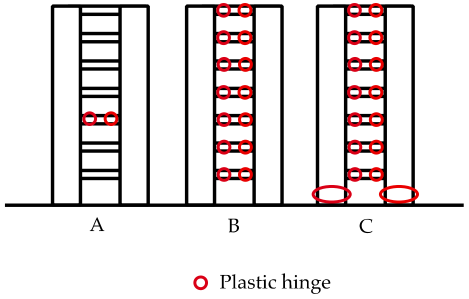
OSHPD CBC Exceptions to AISC Standards – Systems Suggested for OSHPD Consideration

- Special Composite Plate Shear Walls – Concrete Filled and Coupled Special Composite Plate Shear Walls – Composite filled (aka. “SpeedCore”)
  - Initial development for nuclear containment structures.
  - First adopted in 2016 edition of AISC 341. Coupled system adopted in 2022.
  - Coupled system fully vetted by P695 evaluation (R=8)
  - All composite systems presently must be done as alternate system.
  - Applications for core wall systems to replace R/C walls in steel framed buildings, resulting in significant time savings







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OSHPD CBC Exceptions to AISC Standards – Items Suggested for Consideration by AISC

- Exceptions recommended for review by AISC to consider for adoption in some form include:
  - Design of shear transfer at column bases
  - Depth of penetration of power actuated fasteners in protected zone regions
  - Additional requirements for the following pre-qualified Special Moment Frame connections:
    - ConXtech/ConXL
    - Welded Side Plate
    - Bolted Side Plate
    - Simpson Strong-Tie Strong
    - DuraFuse Frames

OSHPD CBC Exceptions to AISC Standards – Items Suggested to "Leave as is"

- Exceptions recommended for no further review at this time include:
  - Other steel systems not permitted by OSHPD (OCBF, OMF*, IMF* and Special Cantilever Columns*). "*" indicates systems that are allowed in limited applications.
  - Consideration of highly restrained connections.

Questions, Comments, Suggestions?

Item #12 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: Jim Malley (or designee)

Future Structural and Nonstructural Regulations Committee meeting:

- October 22, 2025

Item #13 Adjournment