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16. ABSTRACT

The selection of ground motions for time series analysis of structures remains a topic of considerable debate. While both time domain method and spectral matching are permitted by the Caltrans Seismic Design Criteria (SDC), the implications of the choice are not fully understood. To explore and compare how these different modification methodologies affect the estimation of means and distributions of bridge response parameters, two highway bridges in California were analyzed using suites of scaled and spectrally matched motions developed in accordance with Caltrans SDC. Hazard curves for engineering demand parameters (EDPs) are also developed using conditional scenario spectra (CSS) framework for each bridge to be used as a metric to evaluate the results. The results demonstrate that the spectral matching methodology consistently yields lower bias and variability in EDP predictions compared to amplitude scaling for both bridge models and at both sites. Specifically, spectral matching produced means closer to the CSS benchmark and more consistent predictions of peak drift ratios across suites.

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Scaling, matching, and variability: effects of ground motion selection in performance uncertainty

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Executive Summary

This research addresses a significant consideration in seismic design: evaluating the uncertainty in predicted structural response due to the selection and modification of earthquake time series. The primary objective was to evaluate how various ground motion preparation procedures—specifically scaling and spectral matching—impact the predicted seismic performance and the corresponding variance for two representative Caltrans bridges. The findings aim to provide recommendations to improve the consistency for nonlinear response history analysis.

The study focused on two prototype structures modeled using the nonlinear finite element analysis framework OpenSees: a 2-span reinforced concrete bridge in San Jose (SJ), California; and a 4-span reinforced concrete bridge in Orange County (OC), California. Engineering demand parameter (EDP) hazard curves based on column drift were generated using the Conditional Scenario Spectrum (CSS) method. The drift predictions from the drift hazard curves were used as the benchmark to compare the scaling results against.

Seven suites each of amplitude-scaled time series and spectrally-matched time series were generated for each location (SJ and OC). Both bridges were analyzed for the ground motions at each site and the peak drift values were recorded to compare with the CSS response. The analysis demonstrated that the method used to modify the time series has a discernible effect on the predicted median demand and the variability of the results. The spectral matching methodology consistently yielded lower bias and variability in EDP predictions compared to amplitude scaling for both bridge models and at both sites. Specifically, spectral matching produced suite means closer to the CSS benchmark and more consistent predictions of peak drift ratios across suites. This reduced variability across suites is especially important for practical applications, where engineers typically rely on a single suite of motions. The analysis shows that amplitude-scaled suites led to more variable results, making final predictions more sensitive to the selection of time series which is a subjective process.

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1 Introduction

The selection of ground motions for time series analysis of structures remains a topic of considerable debate. While both time domain method and spectral matching are permitted by the Caltrans Seismic Design Criteria (SDC), the implications of the choice are not fully understood. To explore and compare how these different modification methodologies affect the estimation of means and distributions of bridge response parameters, two highway bridges in California were analyzed using suites of scaled and spectrally matched motions developed in accordance with Caltrans SDC. Hazard curves for engineering demand parameters (EDPs) are also developed using conditional scenario spectra (CSS) framework for each bridge to be used as a metric to evaluate the results. The first bridge, the Oka Road Undercrossing (Bridge No. 37-0536F), is located in San Jose. This structure includes two abutment backwalls and a single reinforced concrete bent. According to the USGS Earthquake Hazard Map (Unified Hazard Tool), the site has a peak ground acceleration (PGA) of 0.9g at a 975-year return period for Site Class D conditions. The second bridge, the E22-N55 Connector Overcrossing (Bridge No. 55-0909G), is located in Orange County. This structure consists of two abutment backwalls and three reinforced concrete bents, with a site PGA of 0.55g at a 975-year return period for Site Class D conditions.

2 Development of Bridge Models

2.1 Overview

This chapter presents the numerical models for two bridges analyzed in this project. The first is the 2-span bridge located in San Jose (SJ), California (Bridge No. 37-0536F), while the second is the 4-span bridge located in Orange County (OC), California (Bridge No. 55-0909G). The development of these models was mainly guided by the Caltrans Seismic Design Criteria (SDC) Version 2.0 (Caltrans, 2019), along with findings from prior research by Aviram et al. (2008) and Kaviani et al. (2014). Additionally, the models incorporate insights gained from discussions between Caltrans engineers, Slate Geotechnical Consultants and the research team at UC Berkeley.

The bridge models were developed using the nonlinear finite element analysis framework OpenSees (version 3.0.3; McKenna et al., 2000). The dynamic characteristics of the models were verified by finite element software SAP2000 (Computers & Structures Inc. [CSI], 2019). OpenSees offers an extensive library of elements and materials tailored for earthquake engineering applications and enables scripted execution of repetitive nonlinear response history analyses. The OpenSees scripts for the bridge models and Python scripts developed to automate these analyses are provided in the Electronic Supplement of this report.

2.2 Bridge Geometry and Discretization

The discretization as well as the coordinate system used for the modeling and analysis of the two bridges are shown in Figures 1 and 2. The global X-axis is in the direction of the chord connecting the abutments, denoted as the longitudinal direction; the global Y-axis defines the vertical direction of the bridge; while the global Z-axis is orthogonal to the chord in the horizontal plane, representing the transverse direction. The geometry, nodes, and connectivity of the elements in the model were determined according to plans.

The discretization employs a three-dimensional spine model of the bridge structure, where line elements are located at the centroid of the cross section and follow the alignment of the bridge as viewed from the side, with curved alignments approximated as straight. According to the Caltrans Seismic Design Criteria (SDC, 2019), an analytic model should use at least three elements per column and four elements per span. Following this guideline, as illustrated in Figures 1 and 2, three additional nodes were added to the deck elements, and the columns were modeled using distributed plasticity elements in OpenSees. Further details on the component models are provided in subsequent sections.

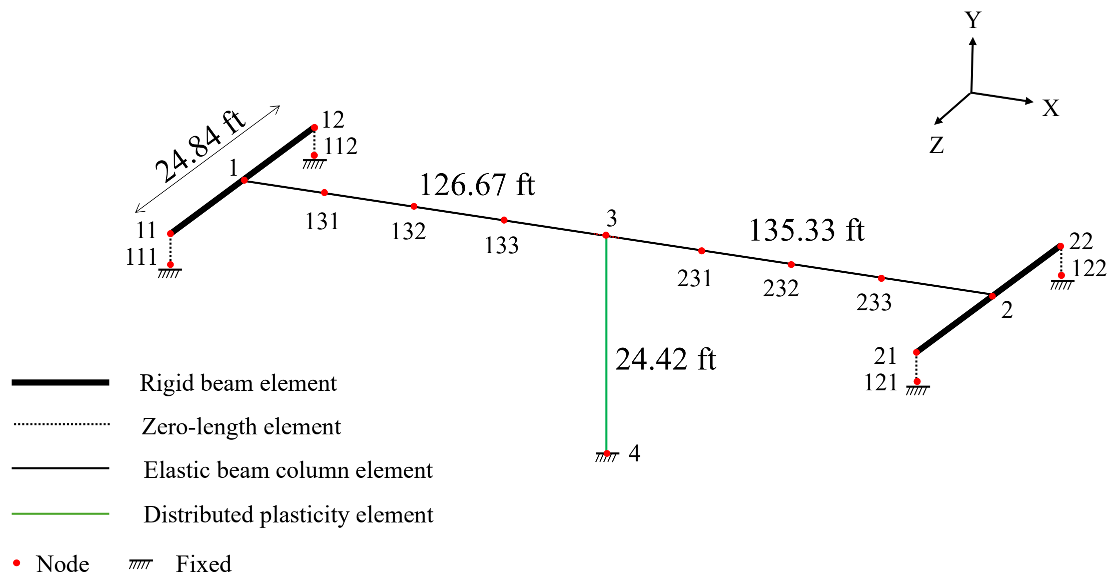


Figure 1. The discretization of the 2-span bridge.

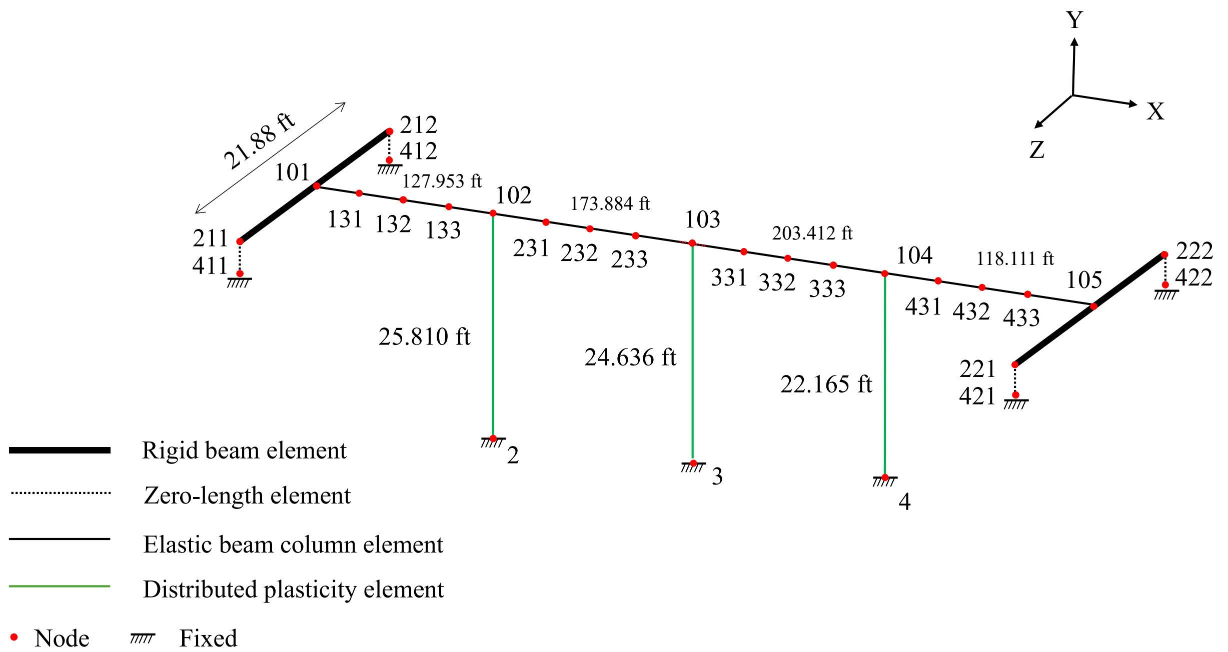


Figure 2. The discretization of the 4-span bridge.

2.3 Model Attributes

2.3.1 Material Properties

Material properties are assigned in accordance with Caltrans SDC (2019). For the reinforced concrete column, the model by Mander et al. (1988) is used. Figure 3 illustrates the stress-strain curves for both confined and unconfined concrete used in this study. Table 1 summarizes the key parameters for reinforcing steel and concrete. The confined compressive strain ϵ_{cc} that is determined using Equation 1-1

$$\epsilon_{cc} = \epsilon_{c0}\left[1 + 5\left(\frac{f'_{cc}}{f'_c} - 1\right)\right] \tag{1-1}$$

The value for the ultimate compression strain is $\epsilon_{cu} = 0.035$ and $\epsilon_{cu} = 0.033$ for the 2-span and the 4-span bridge, respectively, which are in the range from 0.012 to 0.05 suggested by Caltrans SDC (2019). They are determined using Equation 1-2 (Moehle, 2014):

$$\epsilon_{cu} = 0.004 + \frac{f_{emin}}{4f'_c} \tag{1-2}$$

where f_{emin} can be determined based on Equation 1-3 in (Moehle, 2014):

$$f_{emin} = \left(1 - \frac{s}{D}\right)\left(\frac{\rho_s f_s}{2}\right) = \left(1 - \frac{s}{D}\right)\left(\frac{4A_{sp}}{Ds}\right)\frac{f_s}{2} \quad (1\text{-}3)$$

where s is spacing, D is the concrete core dimension measured to the outside of the spiral reinforcement, ρ_s is the ratio of the volume of spiral reinforcement to the total volume of core confined by the spiral, A_{sp} is the cross-sectional area of spiral reinforcement, and $f_s = f_{ye} =$ 68 ksi. The concrete modulus of elasticity, as given by Caltrans SDC (2019), is shown in Equation 1-4:

$$E_c = 33w^{1.5}\sqrt{f_c'} \approx 57{,}000\sqrt{f_c'} \quad (1\text{-}4)$$

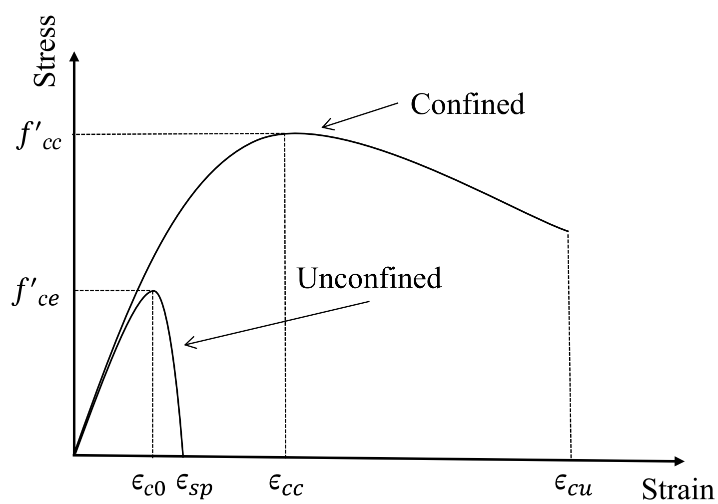


Figure 3. Generic stress-strain curve for confined and unconfined concrete.

Table 1 Material Properties Used in Numerical Models

Material Parameter	Symbol	Value
Reinforcing Steel		
Modulus of Elasticity	E	29,000 ksi
Expected Yield Strength	f_{ye}	68 ksi
Confined Concrete		
Peak Compressive Stress	f_{cc}'	6.5 ksi (= 1.3 f_c')
Compressive Strain at Peak	ϵ_{cc}	0.005
Ultimate Compression Strain (2-Span)	ϵ_{cu}	0.035
Ultimate Compression Strain (4-Span)	ϵ_{cu}	0.033
Unconfined Concrete		
Peak Compressive Strain	ϵ_{c0}	0.002
Peak Compressive Stress	f_{ce}'	5 ksi (= f_c')
Spalling Strain	ϵ_{sp}	0.005
Concrete Modulus of Elasticity	E_c	$\approx 57{,}000\sqrt{f_c'}$

2.3.2 Mass and Weight Assignments

In an OpenSees model, mass and weight must be assigned separately. Figures 4 and 5 illustrate the mass and weight assignments for the two bridge models. A uniformly distributed mass and weight are applied to the deck, while the nodal mass and concentrated load corresponding to the upper half of the pier are applied at the pier top. The mass is assigned to the three translational directions and is neglected in the torsional direction. All assigned values are detailed in Figures 4 and 5.

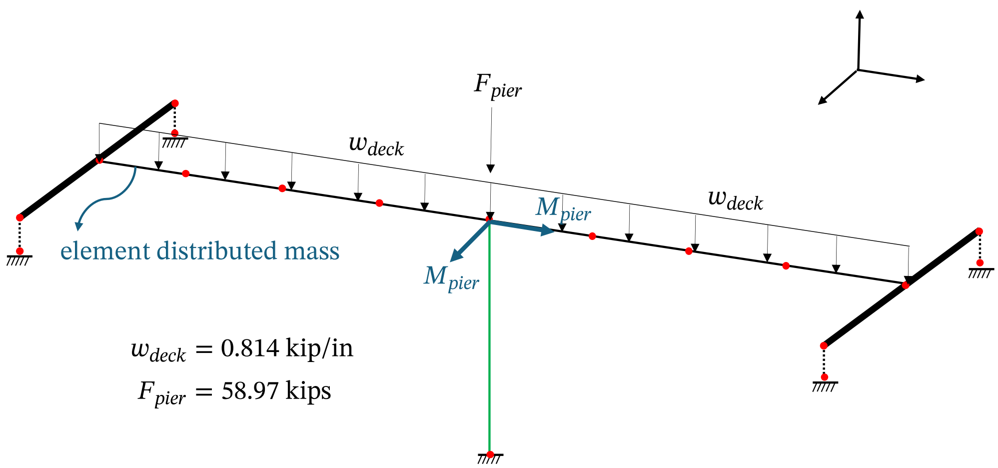


Figure 4. The mass and weight assignments for the 2-span bridge.

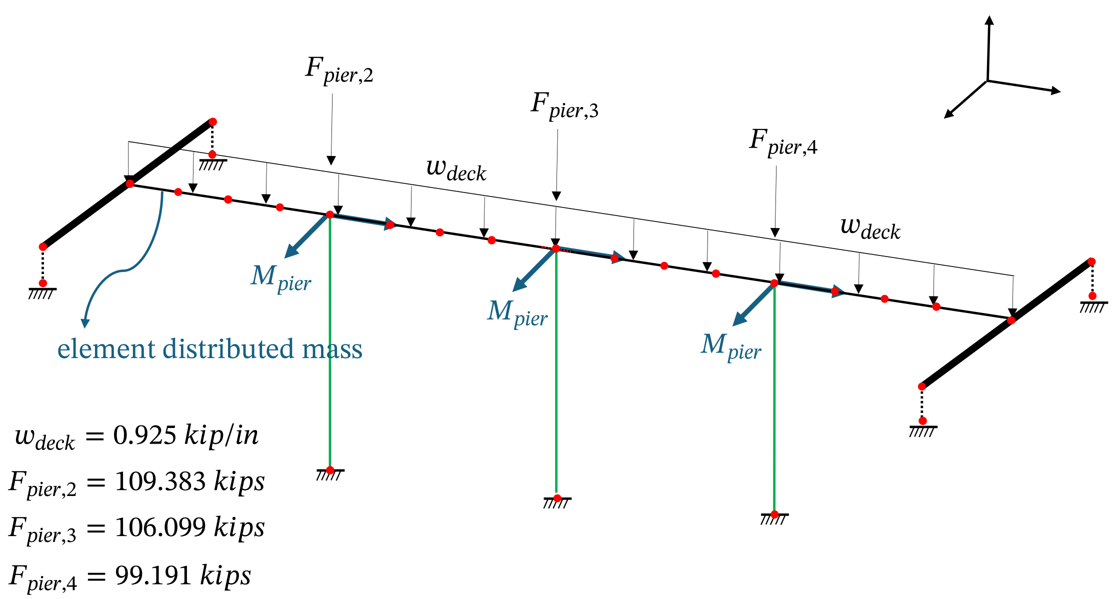


Figure 5. The mass and weight assignments for the 4-span bridge.

2.3.3 Effective Section Properties

According to Caltrans SDC (2019), section properties, including moment of inertia and gross torsional moment of inertia, should account for cracking that occurs prior to yielding. The effective moment of inertia (I_{eff}) for the piers was determined using the secant slope of the moment-curvature ($M - \phi$) curve between the origin and the point corresponding to the first yield of reinforcing bars. Figure 6 illustrates this method for the 2-span bridge pier as an example. For the 2-span bridge pier, $I_{eff} = 0.56I_g$, while for the 4-span bridge piers, an average value of $I_{eff} = 0.55I_g$ is used. The effective moment of inertia for the deck is $I_{eff} = 0.7I_g$, which falls within the range suggested by Caltrans SDC (2019) Section 3.4.3 ($0.5I_g$ to $0.75I_g$). The effective torsional moment of inertia (J_{eff}) is calculated as $J_{eff} = 0.2J_g$, based on the guidance in Caltrans SCE (2019) Section 3.4.4.

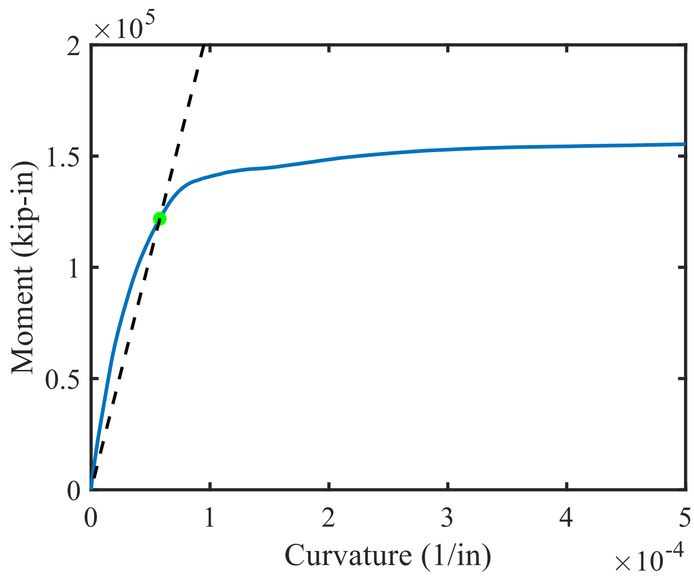


Figure 6. Moment-curvature ($M - \phi$) curve and the secant slope for the 2-span bridge pier.

2.3.4 Modal Analysis and Damping

Figures 7 and 8 and Table 2 present the first four modal periods and mode shapes of the two bridges. The dynamic characteristics, both modes and their respective shapes, obtained from OpenSees were verified against results from SAP2000 (Computers & Structures Inc. [CSI], 2019). It is important to note that the elastic beam-column elements used for the deck in the OpenSees model do not account for shear deformations. To ensure comparability with the SAP2000 models, the shear area modifier was set to zero when defining the section properties in SAP2000. For the 2-span bridge, the first and second modal periods, corresponding to the first two transverse translational modes, are used to define the modal (Rayleigh) damping with 5% of critical damping for each mode. For the 4-span bridge, the third and fourth modal periods, corresponding to the first longitudinal and transverse translational modes, are used for the same damping definition.

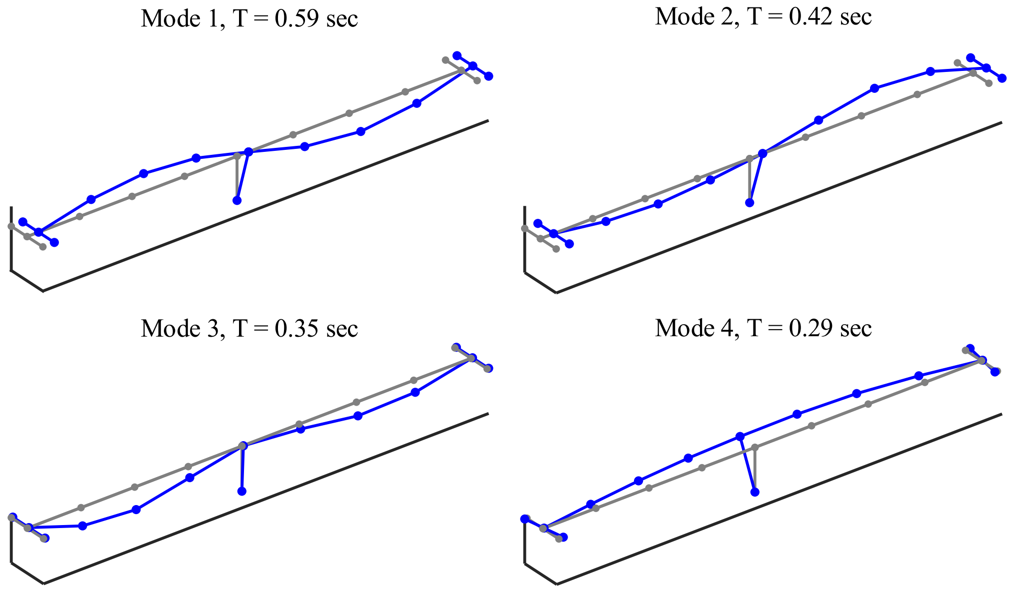


Figure 7. Modal periods and mode shapes of the 2-span bridge.

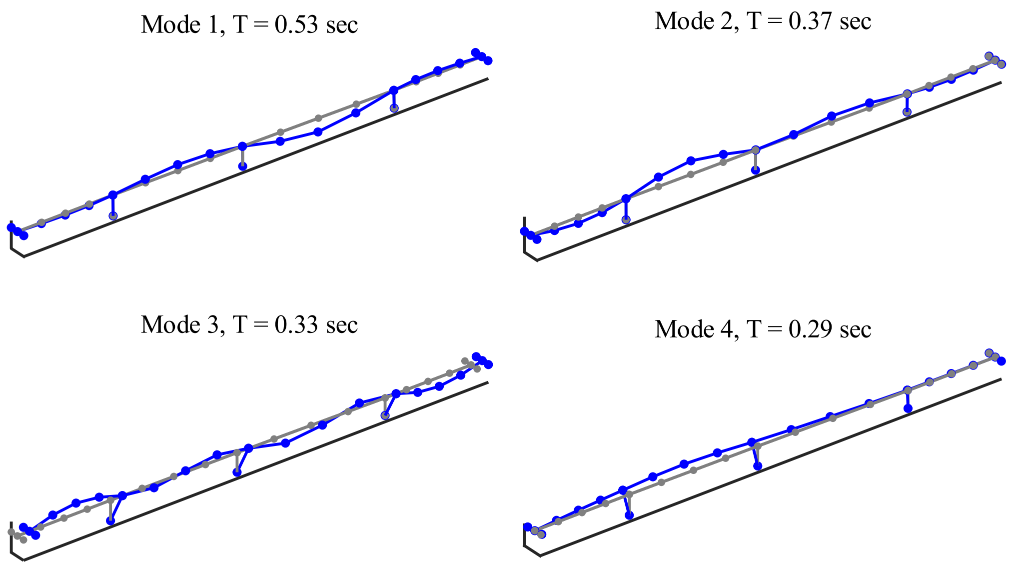


Figure 8. Modal periods and mode shapes of the 4-span bridge.

Table 2 Comparison of modal periods between models in OpenSees and SAP2000

	2-span bridge			
	Mode 1	Mode 2	Mode 3	Mode 4
OpenSees	0.59 s	0.42 s	0.35 s	0.29 s
SAP2000	0.61 s	0.44 s	0.35 s	0.31 s
	4-span bridge			
	Mode 1	Mode 2	Mode 3	Mode 4
OpenSees	0.52 s	0.37 s	0.32 s	0.28 s
SAP2000	0.53 s	0.37 s	0.36 s	0.33 s

2.4 Component Models

2.4.1 Deck Modeling

The concrete box-girder decks are models as "spline-lines", using elastic beam-column elements *elasticBeamColumn*. The elastic beam is used because flexural yielding of the deck during seismic response is not expected. Cracked section properties are used in the model to obtain realistic values for the structures period and the seismic demands generated from the analyses. The effective moment of inertia of the deck (I_{eff}) is determined following Section 2.3.3.

2.4.2 Bridge Pier Modeling

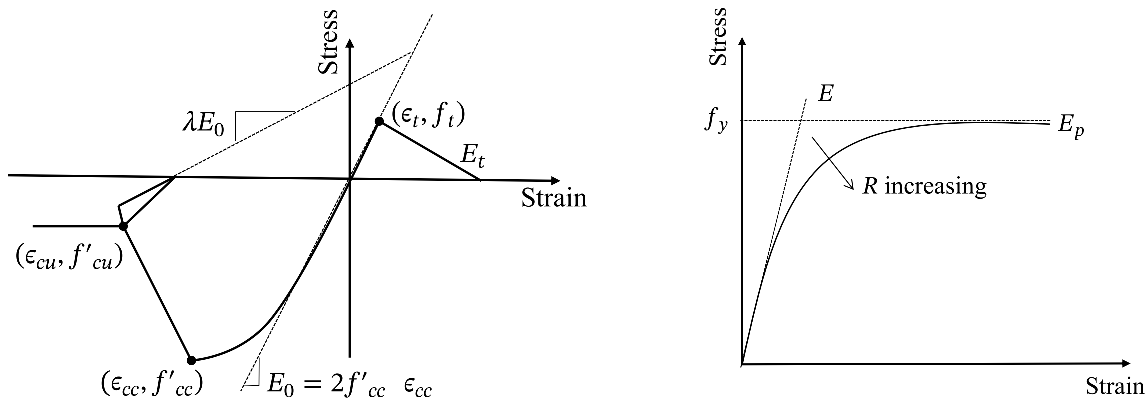
The bridge piers are modeled using distributed plasticity elements in OpenSees. The *forceBeamColumn* element is employed, and all fiber sections are assigned a *UniaxialMaterial* model tag. For confined and unconfined concrete, the *Concrete02* material is used. The constitutive law is illustrated in Figure 9(a), with parameters assigned based on the Mander's model (1988) as described in Section 2.3.1. To fit the Mander's model, f'_{cu} is set to $0.6f'_{cc}$ and f_t is set to $0.14f'_{cc}$. The parameter λ, representing the ratio between unloading slope at ϵ_{cu} and initial slope, is assigned the default value of 0.1.

For the reinforcing bars, the *Steel02* material is employed, as shown in Figure 9(b). The hardening ratio is assumed to be 0.01, and the parameters controlling the transition from the elastic to plastic branches are set to their default values: $R_0 = 10$, $cR_1 = 0.95$ and $cR_2 = 0.15$.

As distributed plasticity is considered, the analytical length of the plastic hinge in the column is determined according to Caltrans SDC (2019) Section 5.3.4, using the following equation:

$$L_b = 0.08L + 0.15f_{ye}d_{bl} \geq 0.3f_{ye}d_{bl} \tag{1-5}$$

where L is the length of the bridge pier from the point of maximum moment at the point of contraflexure, $f_{ye} = 68$ ksi, and d_{bl} is the nominal bar diameter of longitudinal column reinforcement. For the 2-span bridge, the calculated plastic hinge length is $L_p = 37.9$ in., and for the 4-span bridge, $L_p = 41.2$ in. is applied.



(a) Concrete02 (b) Steel02

Figure 9 Constitutive models used for bridge pier models.

2.4.3 Abutment Modeling

The abutment of the bridge is modeled using the simplified abutment model proposed by Kaviani et al. (2014). In this approach, the abutment is represented as a rigid element with a length equal to the deck width, connected to the deck's centerline through a rigid joint (Figures 1 and 2). At each end of the rigid link, a *zeroLength* element is employed, which is defined by two nodes at the same location. These nodes are connected by multiple *UniaxialMaterial* objects, which capture the force-deformation behavior in six directions. In the longitudinal direction, as shown in Figure 10(a), the model assigns a linear elastic material to represent the shear stiffness of the bearing pads, acting in parallel with an elastic-perfectly-plastic backbone curve with a gap (*ElasticPPGap*) to represent the abutment backwall. The stiffness of the bearing pad (K_{pad}) is calculated as:

$$K_{pad} = \frac{GA}{L} \tag{1-6}$$

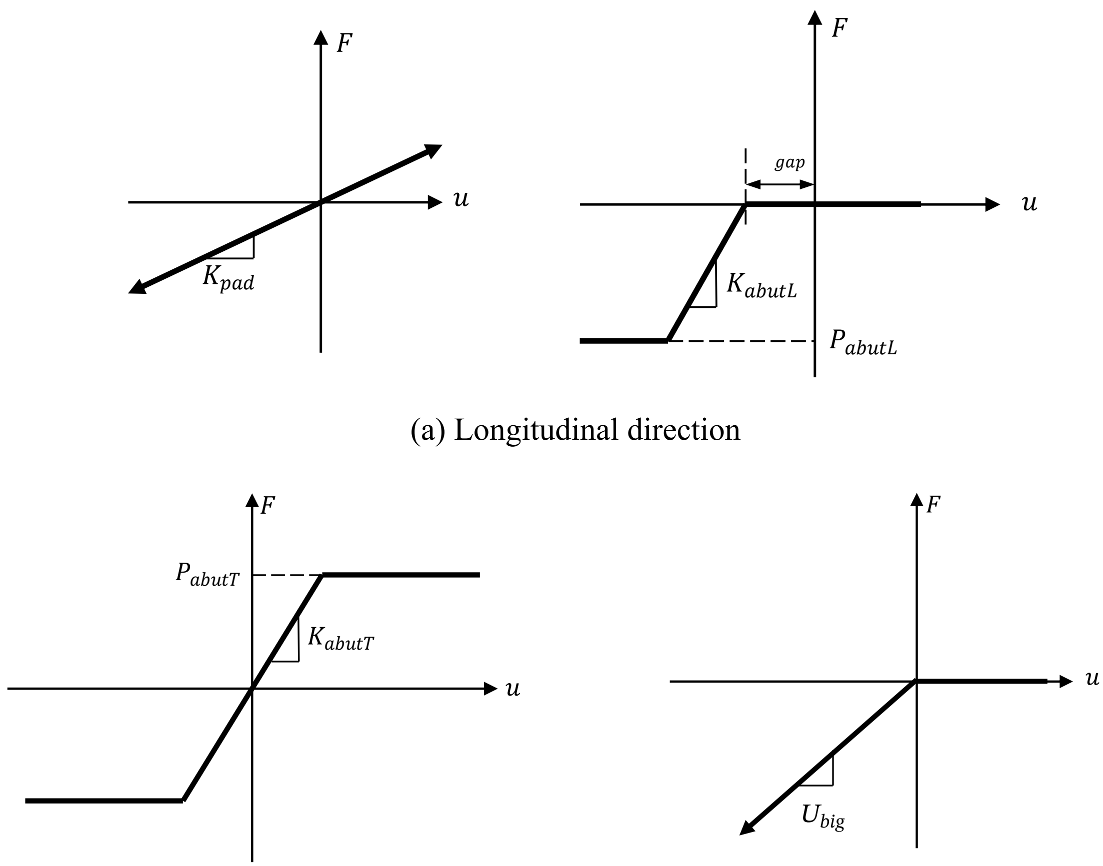
where A and L are dimensions of the bearing bads, and $G \approx 0.1$ ksi. The stiffness of the (K_{abutL}) and ultimate strength (P_{abutL}) of the abutment backwall are determined based on Caltrans SDC (2019):

$$K_{abutL} = w_{abutL}(5.5h_{abutL} + 20)R_{sk} \tag{1-7}$$

$$P_{abutL} = w_{abutL}\left(\frac{5.5h_{abutL}^{2.5}}{1 + 2.37h_{abutL}}\right)R_{sk} \tag{1-8}$$

Here, w_{abutL} and h_{abutL} are the backwall width and height, respectively, and R_{sk} is the skew reduction factor which, assumed to be one (for zero skew angle).

In the transverse direction, an elastic-perfectly-plastic backbone curve (*ElasticPP*) is employed, as shown in Figure 10(b). The abutment stiffness and strength for the longitudinal direction are modified using factors corresponding to wall effectiveness ($C_L = \frac{2}{3}$) and participation coefficients ($C_W = \frac{4}{3}$) according to Maroney and Chai (1994). The resistance of the (brittle) shear keys and distributed bearing pads are ignored in this model for simplicity. In the vertical direction, an elastic material only in compression (*ENT*), as shown in Figure 10(c), is defined with a stiffness representing the vertical stiffness of bearing pads K_{abv}, which is assumed to be a large value.



(a) Longitudinal direction

(b) Transverse direction

(c) Vertical direction

Figure 10. The force-displacement relationship for the abutment model.

3 Design Ground Motion Development

3.1 Overview

This chapter presents the suites of horizontal time series developed for each site. This includes development of a site-specific design response spectrum in accordance with Caltrans SDC Version 2.0 (Caltrans, 2019) for each of the two sites. The site-specific spectra development was followed by selecting seven suites of horizontal acceleration time series for each site, each of which was then scaled and spectrally matched to the corresponding site-specific design response spectrum. Details of the site-specific spectra and time series development are presented in the sections below.

3.1.1 Design Response Spectra Development

Per the Caltrans SDC guidelines (Caltrans, 2019) to develop the design spectra, a site-specific probabilistic seismic hazard analysis (PSHA) was performed for the approximate site locations:

- OC site coordinates: 33.7765, -117.8316
- SJ site coordinates: 37.2573, -121.9568

The PSHA calculations were performed using the computer program Haz45.2 developed by Norm Abrahamson (Abrahamson, 2017) and modified by Slate to include the Third Uniform California Earthquake Rupture Forecast (UCERF3, Field et al., 2013). This program was validated as part of the Pacific Earthquake Engineering Research (PEER) center Probabilistic Seismic Hazard Analysis Code Verification Project (Hale et al., 2018). The seismic source characterization is based on UCERF3 (Field et al., 2013).

The ground motion is characterized by using a suite of four ground motion models (GMMs) from the Next Generation Attenuation Relationships for Western US (NGA-West2) Project. The GMMs selected for this analysis were Abrahamson et al. (2014), Boore et al. (2014), Campbell and Bozorgnia (2014) and Chiou and Youngs (2014). The ground motion was characterized with a V_{S30} of 350 m/s for the OC Site and 300 m/s for the SJ site (consistent with Site Class D). Uniform hazard spectra (UHS) for the 2,475- and 975-year return periods (RP) (corresponding to a 2% and 5% probability of exceedance in 50 years, respectively) were developed, as shown on Figure 11. Additional return periods were also calculated for use in the development of the CSS and are noted in Section 4. Following the Caltrans SDC guidelines, the design response spectrum for each site was taken as the 975-year UHS.

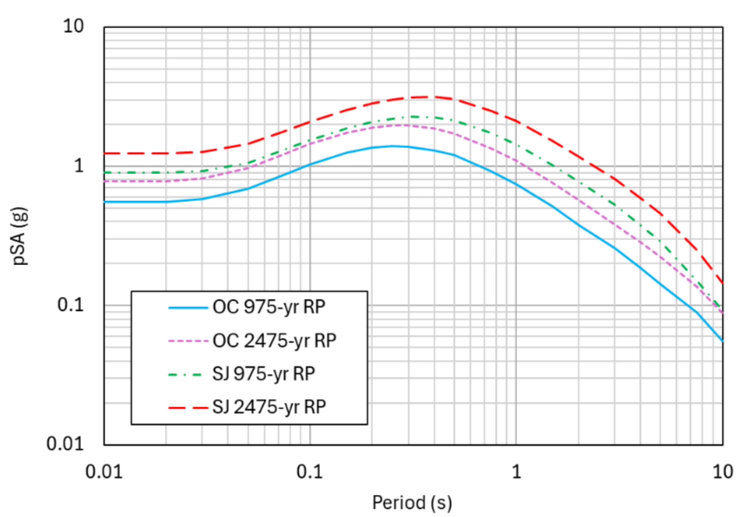


Figure 11. Site-specific UHS developed from mean hazard for each site (OC site and SJ site).

The PSHA results were deaggregated to show the contribution of sources with different magnitudes and distances to the total mean hazard. The deaggregations at periods of 0.5, 0.75, 1.0, and 2.0 s for the 975-year RP are shown in Figures 12 and 13 for the OC and SJ sites, respectively. The primary contributors to the hazard at the OC site have high magnitudes and short to moderate distances, with modal magnitudes and distances of M7.8 and 10 km, respectively, for all four periods, and mean magnitude and distance ranges of M7.22-M7.43 and 22.75-27.09 km, respectively. The primary contribution to the hazard at the SJ is also high magnitude sources, but with much shorter distances than those for the OC site, consistent with the significantly higher mean hazard observed for the SJ site. For the SJ site, the modal magnitude ranges from M7.2 to M8.0, with a modal distance of 5 km for all four periods, and the mean magnitude and distance have ranges of M7.46-M7.64 and 7.9-8.71 km, respectively.

3.1.2 Time Series Selection and Modification

Seven suites of ground motion records were selected for scaling and spectral matching to the 975-Year RP final target spectrum developed for each site in the previous section. The specific earthquake source parameters that represent the dominant earthquake scenarios in the seismic hazard were used in the selection of seed time histories. Criteria used to sort, prioritize, and select seed time histories from the PEER Center NGA-West2 Ground Motion Database included magnitude, distance, average duration (D_{5-95}), Arias Intensity, and proportion of pulse motions. The overall spectral shape and scale factor were also considered in the selection. The suites of time histories selected for amplitude scaling and spectral matching to the target spectra and properties associated with the seed time histories are plotted and listed in Appendix A.

Spectral modification was performed by amplitude scaling and spectral matching. Seven pairs of two-component horizontal recorded time histories (as-recorded) for each set at each site were scaled such that the geomean of the horizontal components matched the target. The suites of time series were subsequently spectrally matched to the target horizontal 975-year RP UHS using RSPMatch (2018 release, executable received from N. Abrahamson via email November 12, 2018), resulting in a total of 14 suites per site – seven suites of scaled motions and seven suites of the same motions spectrally matched.

RSPMatch was originally developed by Abrahamson (1992) as a modification to the method by Lilhanand and Tseng (1988). The approach developed by Lilhanand and Tseng (1988) makes small wavelet adjustments to the time history, which are used to make non-stationary modifications to the seed time history. The introduction of non-stationary modifications allows for modification of the time history while maintaining non-stationary properties. The 2018 release of RSPMatch allows for the component-to-component variability of the two horizontal components to be maintained, which also preserves velocity pulses in the time histories. The velocity pulses from the scaled and matched time history components are demonstrated on the figures in Appendix B Maintaining the component-to-component variability and the velocity pulses is accomplished within the program by calculating the ratio of each component to the geomean of the two components and multiplying this ratio by the target to achieve a component-specific target. The geomean of the matched components then matches the target. The geomean for each pair of time history components after scaling are plotted with the target response spectra in Appendix A. For all selected ground motions, the two components were rotated to align with the bridge orientation based on the angle specified in their file names. For the 2-span bridge, the longitudinal direction aligns with the east-west axis, while for the 4-span bridge, the longitudinal direction is rotated 30 degrees clockwise from north.

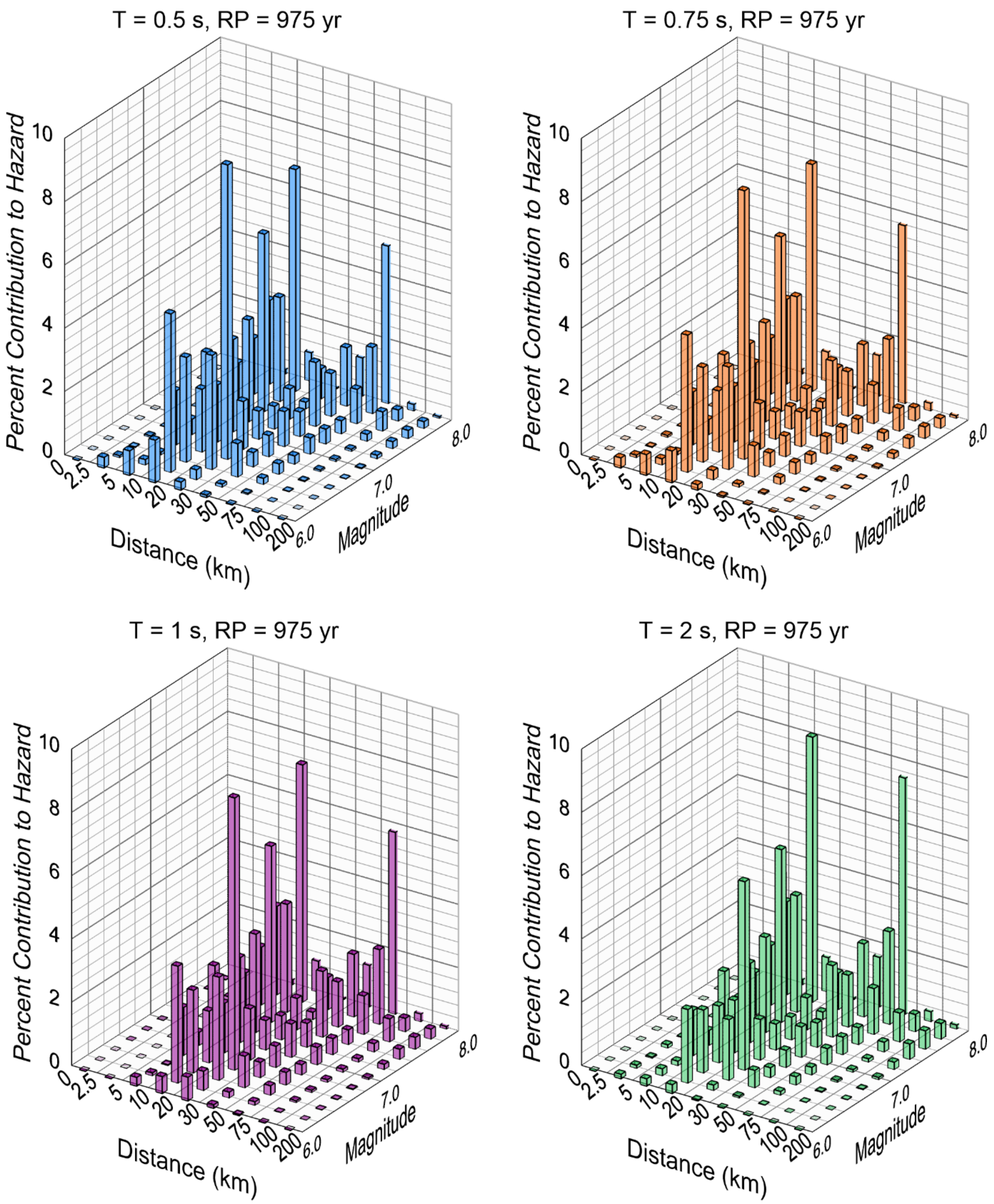


Figure 12. Deaggregation results for the Orange County (OC) site.

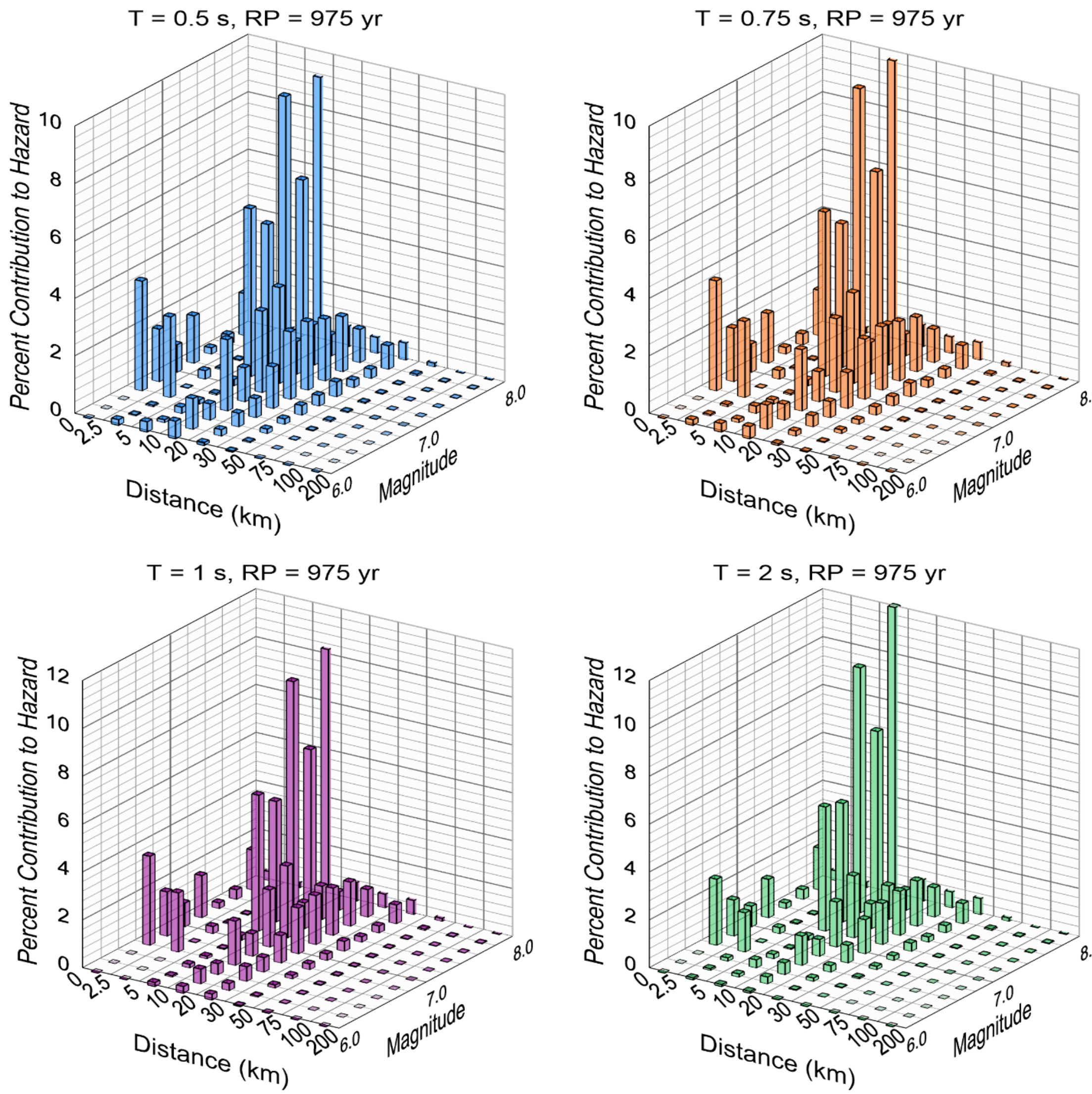


Figure 13. Deaggregation results for the San Jose (SJ) site.

4 Engineering Demand Parameter Hazard Curve Development

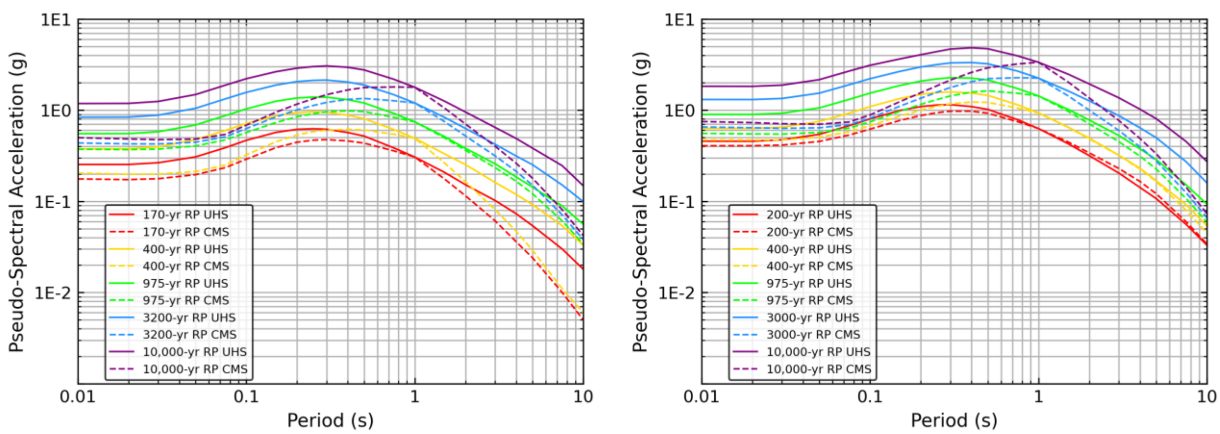
4.1 Overview

This chapter presents the development of the EDP hazard curve using the CSS framework. Specifically, hazard curves for peak drift ratio for the top of columns were developed for each bridge. The CSS were developed following the methodology presented by Arteta and Abrahamson (2019). This framework leads to a large number of time histories each with a scale factor and rate of occurrence such that the hazard is reproduced over the period range of interest. The time histories and associated rates of occurrence can then be used as inputs to structural models to compute the engineering demand parameter resulting from each time history and, subsequently, develop hazard curves of the engineering demand parameter of interest (i.e. drift ratio). These hazard curves allow the determination of EDPs at specific return periods (e.g., 975-year RP), which serve as ground truth for evaluating the effectiveness of matching and scaling methods.

A brief summary of the CSS development is presented in Section 4.2 followed by the development of the hazard curves developed for the peak drift ratio of the top of columns for each bridge in Section 4.3.

4.2 CSS Development

CSS were developed for each site using the results of the PSHA (Section 3.1.1) over a range of return periods. Conditional mean spectra (CMS) were developed for each hazard level using the controlling scenarios from the deaggregation results. The conditioning period for each CMS was selected as 1.0 sec. While the conditioning period should be within the period range of interest, the specific value has minimal impact on the hazard curve results (Williams et. al., 2021). The conditioning period of 1.0 second was selected as a middle value to best capture both short period and long period motions rather than skewing selected motions towards short periods or long periods. The UHS and CMS for each hazard level are presented in Figure 14.



(a) OC Site (b) SJ Site

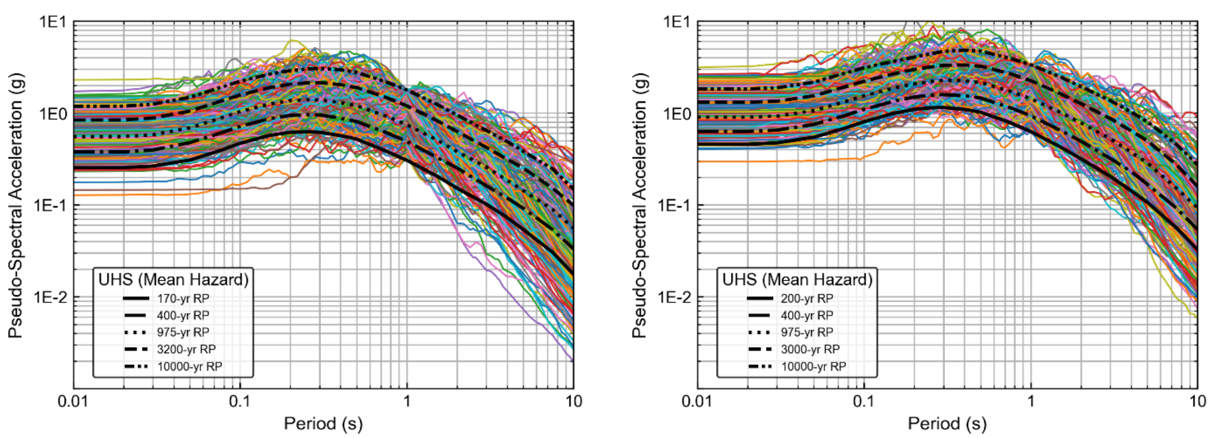
Figure 14. Site-specific UHS and CMS for each site.

Time histories were then selected and scaled to fall between each UHS. The time history selection was based on how well the CMS and variability about the CMS was reproduced by the time histories. We also considered deaggregation results and overall spectral shape. Each time history was then assigned an initial rate of occurrence by subtracting neighboring hazard values and dividing by the number of time histories that fall between the two hazard levels using Equation 4-1.

$$Rate_{CSS_i} = \frac{HazLevel_i - HazLevel_{i+1}}{N_{TH}} \tag{4-1}$$

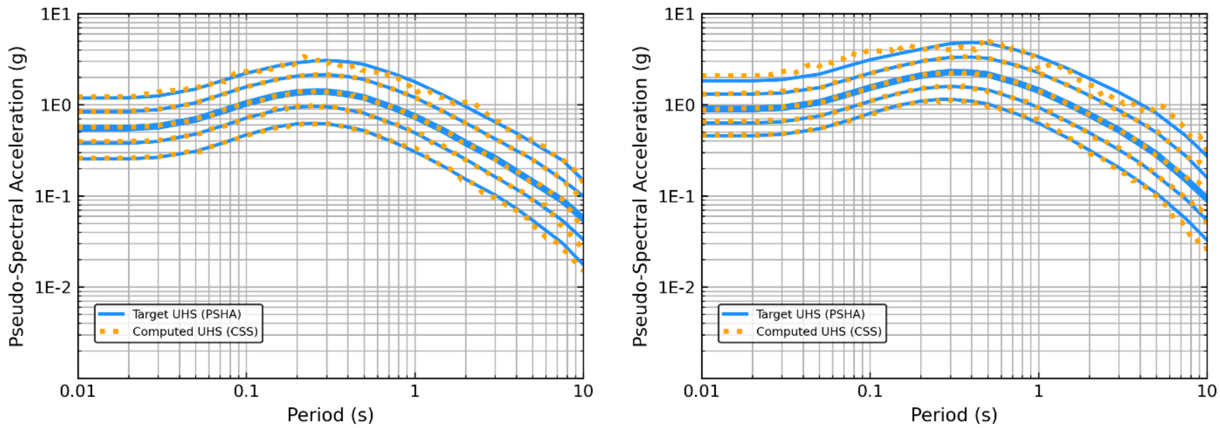
In this equation, N_{TH} is the number of time histories scaled to fall between the two UHS, one at hazard level i and the other at $i + 1$. The rate of each time history was then iteratively adjusted so that the UHS computed in Section 3.1.1 are recaptured by the CSS. This process is discussed in further detail in the paper by Arteta and Abrahamson (2019). The final CSS for the OC site consists of 201 time history pairs (2 horizontal components) and the final CSS for the SJ site consists of 194 time history pairs, which are presented in Figure 15.

The final step in CSS development is to confirm the UHS developed in Section 3.1.1 is recovered by the CSS within the period range and hazard levels of interest. It should be noted that the highest and lowest hazard levels are generally not recovered well and are used as upper and lower bounds in the CSS development. As demonstrated in Figure 16, the CSS reproduce the UHS well for both sites near the hazard level or return period of interest (975-year RP, bold blue line). A detailed listing of the two suites of motions is provided in Appendix C.



(a) 201 scaled time history pairs for OC Site (b) 194 scaled time history pairs for SJ Site

Figure 15. CSS developed for each site.



(a) OC Site (b) SJ Site

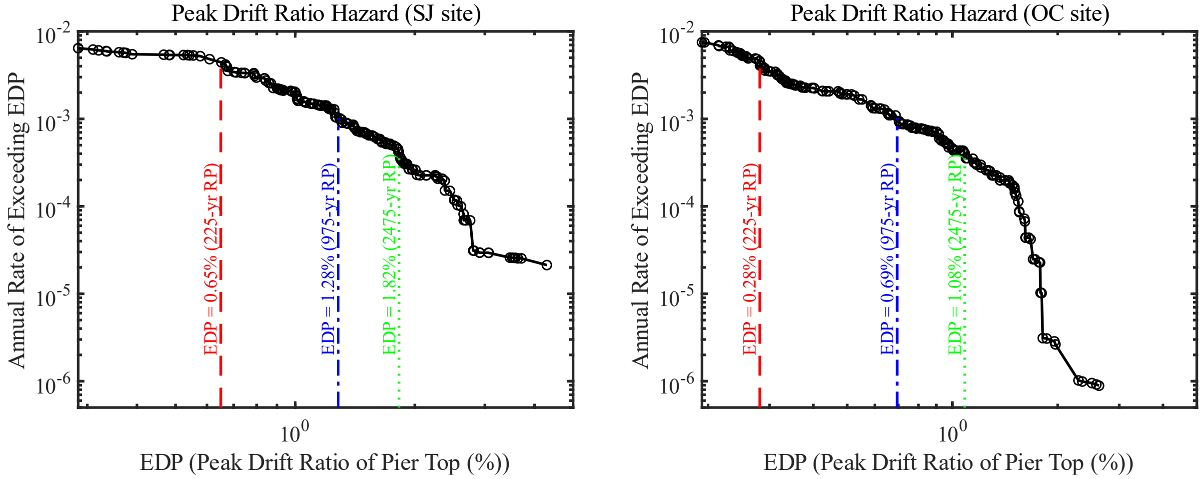
Figure 16. CSS compared with PSHA results for each site. Solid, bold line shows the 975-year UHS.

4.3 EDP Hazard Curve Development

Using the scaled time histories from CSS as inputs to the dynamic analysis of the two bridges, pier drift ratios were obtained, and their values are listed in Tables C1 to C4. Each scaled motion has an associated rate of occurrence and EDP (pier drift ratio). EDP hazard curves were constructed for the two bridges based on the following equation (Arteta and Abrahamson, 2019):

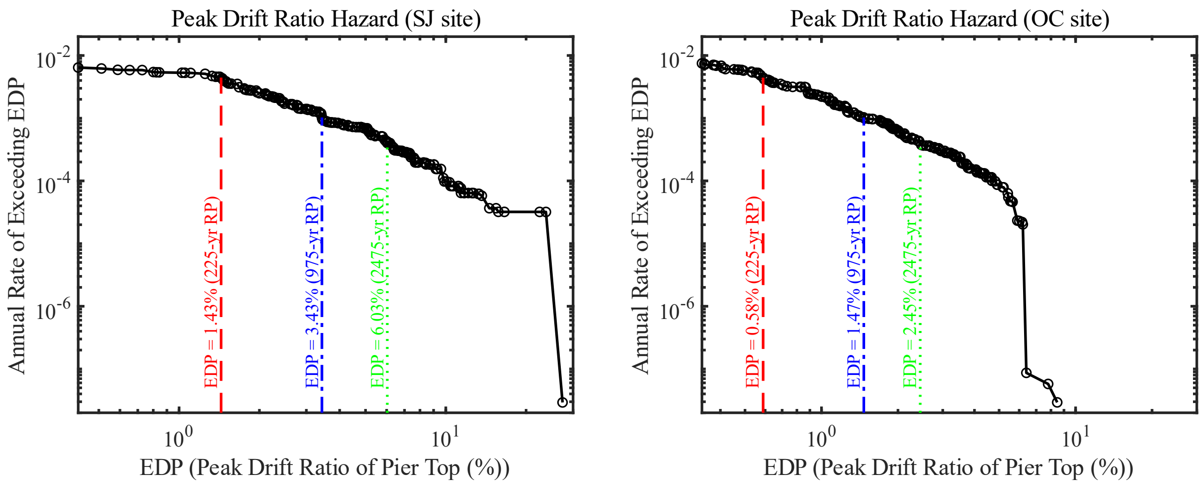
$$Haz(EDP > z) = \sum_{i=1}^{\#\, time\ histories} Rate_{CSS,i} H(EDP_i - z) \quad (3\text{-}1)$$

where $EDP_{\ i}$ is the structural response for EDP of interest from the i^{th} time history, $Rate_{CSS,i}$ is the rate of occurrence to each time history, $H(EDP_i - z)$ is the Heaviside function, which takes a value of 1 if the EDP from the i^{th} time series exceeds level z, and 0 otherwise. Figures 17 and 18 show estimated hazard curves for the peak pier drift ratio. Three EDP levels at return periods of 225-year, 975-year, and 2475-year are available from these curves. These EDP levels, derived from the EDP hazard curves, will be used to evaluate the effectiveness of the matching and scaling methods.



(a) (b)

Figure 17. Peak drift ratio hazard curve for the 2-span bridge.



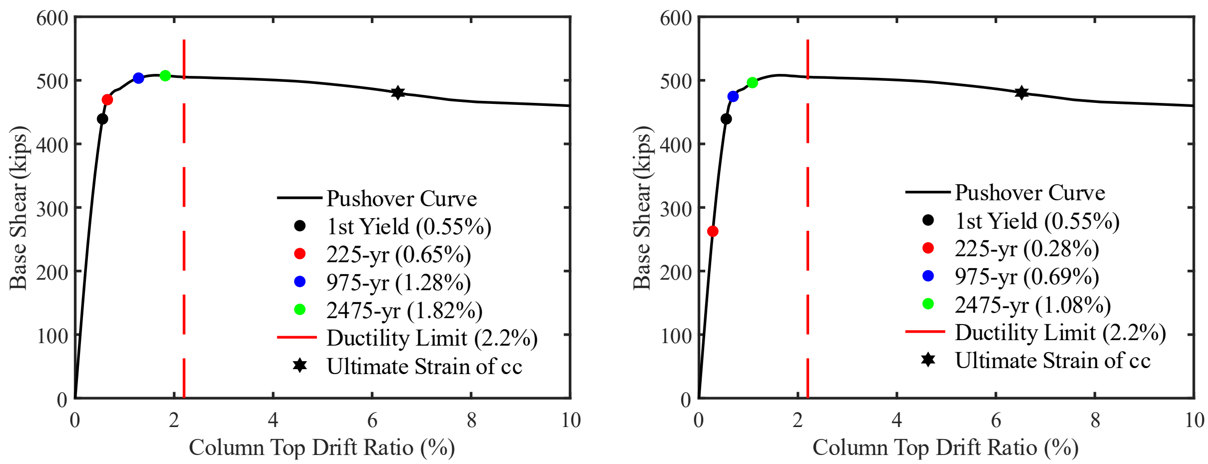
(a) (b)

Figure 18. Peak drift ratio hazard curve for the 4-span bridge.

5 Bridge Performance Comparison

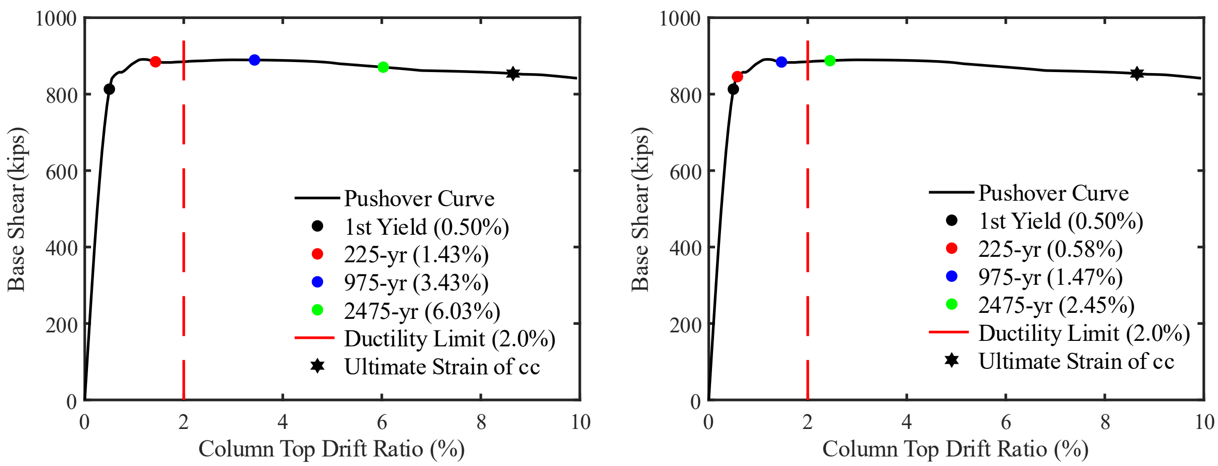
Figures 19 and 20 shows the pushover curves of the two bridges, highlighting peak drift ratios associated with these return periods. The figures also show the peak drift ratio corresponding to the first yield and to the ductility limit, which is assumed to be 4 at 975-year return period. For the 2-span bridge, the yield drift is 0.55%, and for the 4-span bridge, the yield drift is 0.50%.

Although the 2-span bridge is in San Jose (and is assumed to be designed for the SJ site) and the 4-span bridge is located in Orange County, both bridges are analyzed under the suites of motions from both sites for research purposes. For the 2-span bridge under SJ motions, the ductility demand at the 975-year return period is less than 4, with a peak vale of 1.28%. For the 4-span bridge subjected to OC ground motions, the ductility demand at the 975-year return period is less than 4, with a peak value of 1.47%.



(a) San Jose site (b) Orange County site

Figure 19. Pushover curves of the 2-span bridge with peak drift ratios corresponding to multiple return periods.



(a) San Jose site (b) Orange County site

Figure 20. Pushover curves of the 4-span bridge with peak drift ratios corresponding to multiple return periods.

Figures 21 and 22 show the drift ratios of the two bridges under the amplitude scaled and the spectrally matched time series suites at the two sites (eight cases in total). Appendix D lists all resulting EDPs. These EDPs are compared to predictions from the drift ratio hazard curves. For each case, three metrics are used to evaluate the two time series modification methods. The first metric is the Mean Absolute Percentage Error (MAPE), which quantifies the average magnitude of the absolute bias between the suite mean drift ratios and the CSS prediction. The absolute value is taken to avoid cancellation of positive and negative errors. The MAPE of the EDP predictions for each bridge, based on the different time series modification methods, is computed using the following equation:

$$MAPE = \frac{1}{\#\, suites} \sum_{i=1}^{\#\, suites} \frac{|\overline{EDP_i} - CSS|}{CSS} \tag{4-1}$$

where $\overline{EDP_i}$ is the mean drift ratio of suite i, and CSS is the benchmark drift ratio obtained from the drift ratio hazard curve.

The second metric is the variability in the suite means, which quantifies how much the means of each suite varies from one another, reflecting whether the method for each case produces consistent estimates of central tendency. It is calculated as

$$Variance(\overline{EDP_i}) = \frac{1}{\#\, suites} \sum_{i=1}^{\#\, suites} (\overline{EDP_i} - \overline{EDP})^2 \tag{4-2}$$

where $\overline{EDP}$ is the mean of suite means $\overline{EDP_i}$. If this variance is small, the suite means are consistent, showing little variation across the seven suites for each case. Conversely, a large variance indicates that the suite means fluctuate considerably, meaning that the method produces less reliable estimates of central tendency.

The third is the variability in the suite variances, which captures how much the spread of drift ratio differs across suites and whether certain suites yield much broader or narrower distributions, even when their means are similar. It is calculated as

$$Variance(Var_i) = \frac{1}{\#\, suites} \sum_{i=1}^{\#\, suites} (Var_i - \overline{Var})^2 \tag{4-3}$$

where Var_i is the variance of suite i and $\overline{Var}$ is the mean of the suite variance. Even when suite means are similar, large variability in the suite variances indicates that some suites produce much more dispersed responses than others. The time series modification method may yield inconsistent estimates of response variability. Tables 3 and 4 list the three metrics for the eight cases.

Matched motions consistently achieve lower bias and variability compared to scaled motions for both bridges. This trend is evident across both the SJ and OC sites. For the 2-span bridge, matched motions exhibit smaller absolute bias (0.0539 for SJ and 0.1037 for OC) compared to scaled motions (0.0876 for SJ and 0.1098 for OC). Additionally, the variability in suite means and variances are all lower for matched motions.

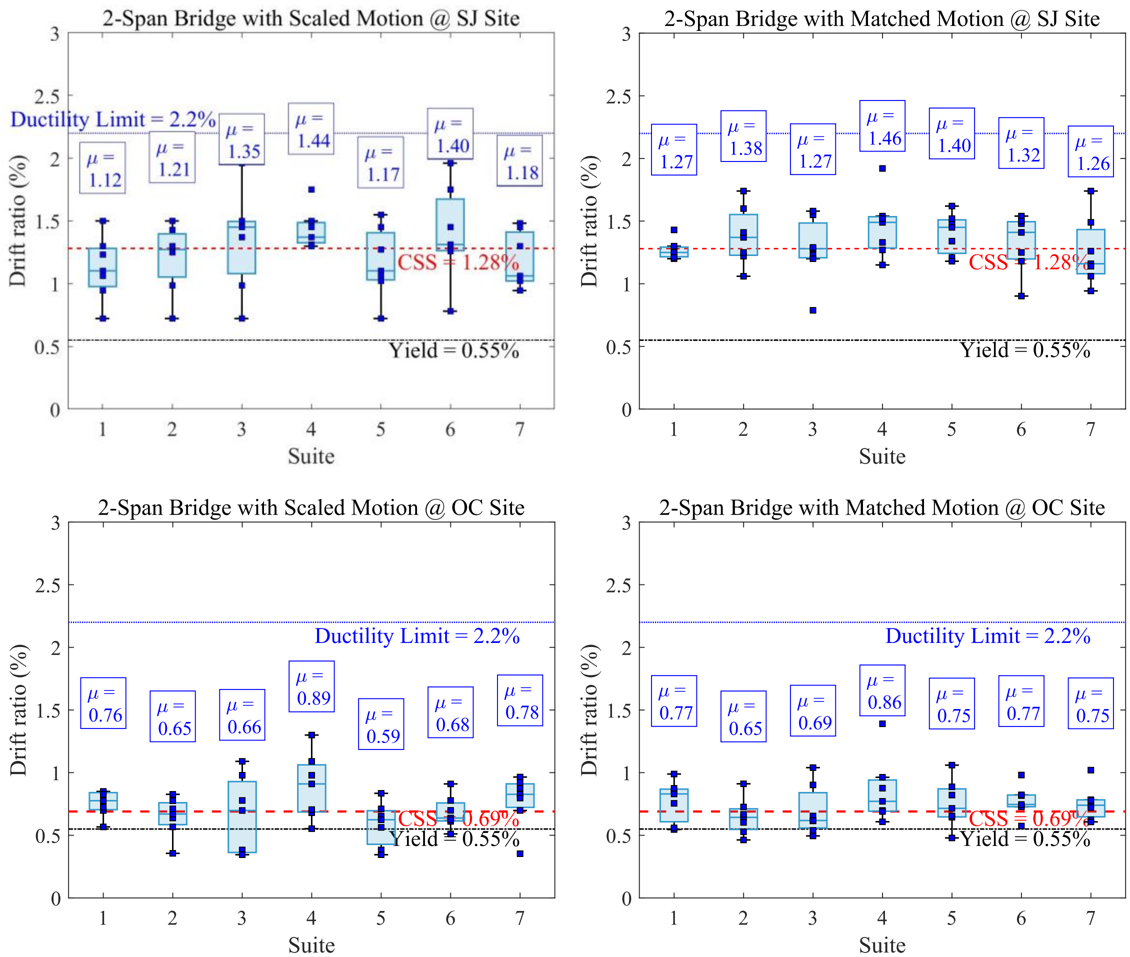


Figure 21. EDPs (drift ratio) of the 2-span bridge under scaled and spectral matched motions. The value displayed in the box above each suite represents the average predicted EDP, μ, for that suite.

This reduced variability is particularly important in practical applications because engineers typically work with only a single suite. All of the suites selected were plausible for use in design. As such, the resulting EDP predictions vary significantly based on the selected suite when using scaled motions. Matched motions demonstrate less dependence on the specific selection of time series, which is often subjective and varies between practitioners. Therefore, matched motions not only produce more accurate estimates on average but also yield predictions that are more stable and reproducible, regardless of who performs the suite selection.

The SJ site presents an additional challenge for the 4-span bridge due to its significantly larger seismic hazard, with peak ground acceleration (PGA) approximately 1.6 times that of the OC site. As shown in Figure 17, the drift demand at the SJ site exceeds the ductility design limit of the 4-span bridge, which was not designed for such high seismic intensity. Consequently, scaled motions at the SJ site result in substantially higher bias and variability. The bias for scaled motions at the SJ site is 0.4067, considerably higher than the 0.2795 at the OC site. Matched motions, while also affected by the increased seismic demand, exhibit lower bias (0.3027 for SJ) and reduced variability.

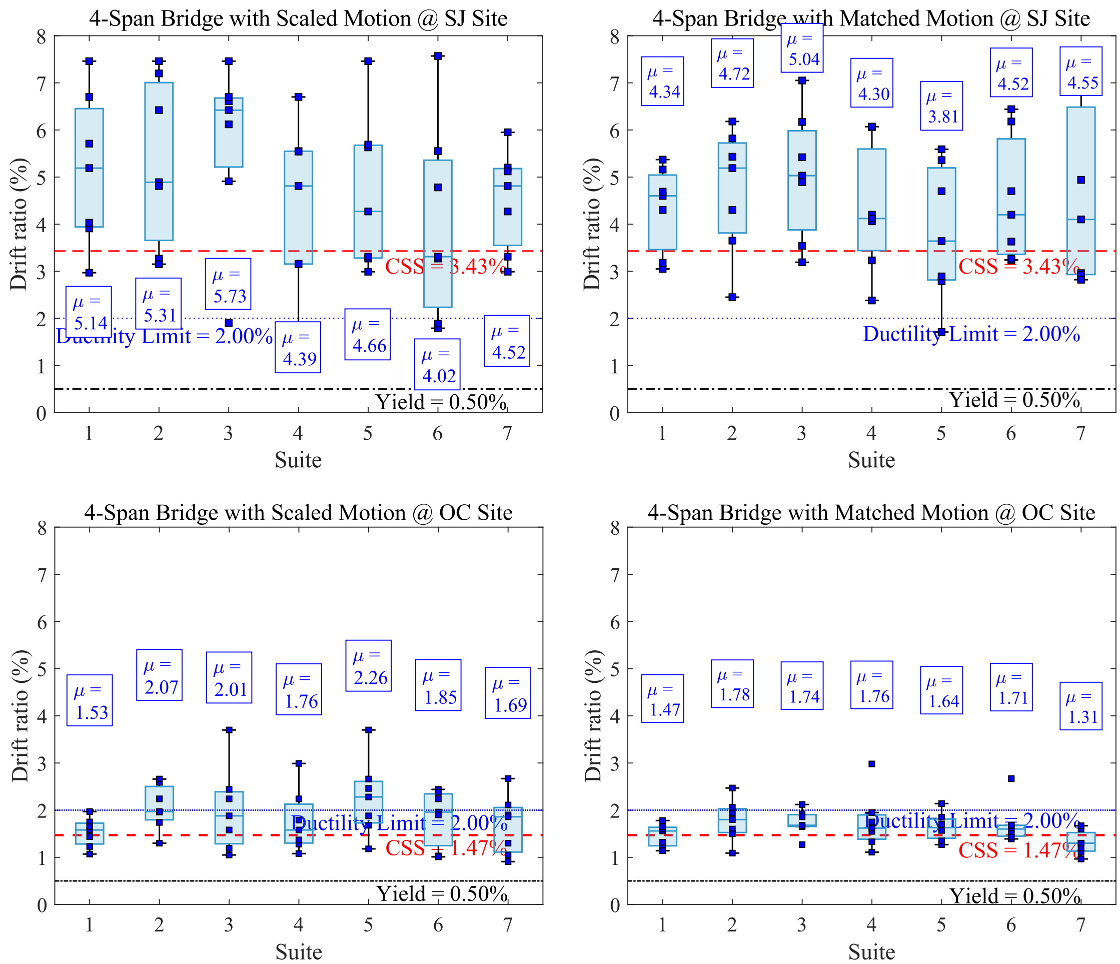


Figure 22. EDPs (drift ratio) of the 4-span bridge under scaled and spectral matched motions.

Table 3. Error and variability of EDPs of the 2-span bridge from scaled and matched motions

		MAPE	$Variance(\overline{EDP_i})$	$Variance(Var_i)$
SJ	Scaled	0.0876	0.0157	0.0024
	Matched	0.0537	0.0060	0.0006
OC	Scaled	0.1098	0.0100	0.0009
	Matched	0.1037	0.0043	0.0003

Table 4. Error and variability of EDPs of the 4-span bridge from scaled and matched motions

		MAPE	$Variance(\overline{EDP_i})$	$Variance(Var_i)$
SJ	Scaled	0.4067	0.3525	0.9457
	Matched	0.3027	0.1460	0.6305
OC	Scaled	0.2795	0.0626	0.0595
	Matched	0.1403	0.0313	0.0127

6 Conclusions

This study compared two time series modification methodologies, amplitude scaling and spectral matching, on the estimation of means repeatability between suites using two bridge and two locations. Nonlinear models of a 2-span bridge in San Jose and a 4-span bridge in Orange County were developed in OpenSees and subjected to time series suites prepared via both methodologies. The site-specific seismic hazard was characterized using PSHA, and benchmark EDP hazard curves were established using the CSS approach to provide an objective basis for comparison.

The results demonstrate that the spectral matching methodology consistently yields lower bias and variability in EDP predictions compared to amplitude scaling for both bridge models and at both sites. Specifically, spectral matching produced means closer to the CSS benchmark and more consistent predictions of peak drift ratios across suites. This reduced variability across suites is especially important for practical applications, where engineers typically rely on a single suite of motions. The analysis shows that amplitude-scaled suites lead to more variable results, making final predictions more sensitive to the subjective selection of time series. In contrast, spectral matching shows much less dependence on the individual motions selected, offering more reproducible and reliable EDP estimates across users. These findings suggest that modern spectral matching techniques may offer an effective alternative in bridge design without the limitations traditionally associated with spectral matching.

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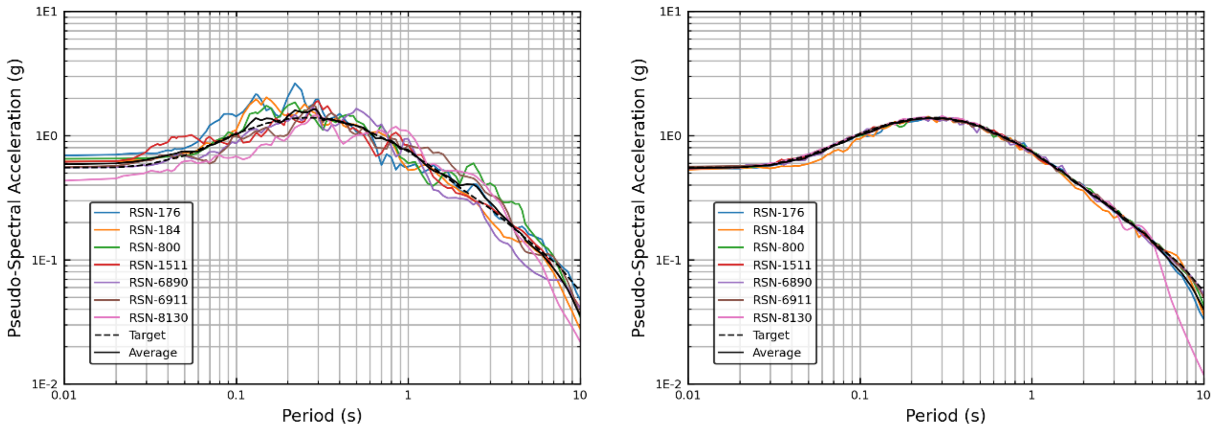
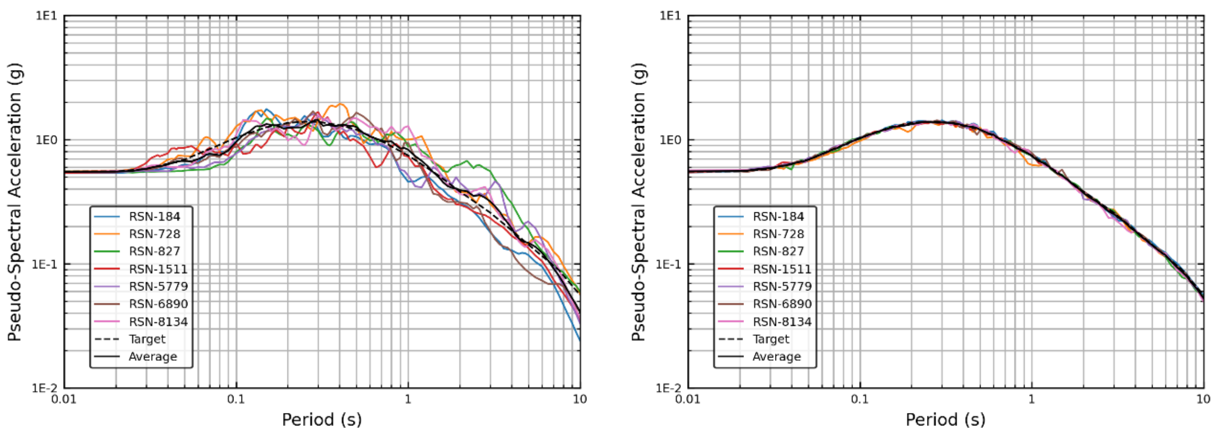
Appendix A: Plots and list of Time Series Selected for Modification (Amplitude Scaling and Spectral Matching to Design Response Spectrum)



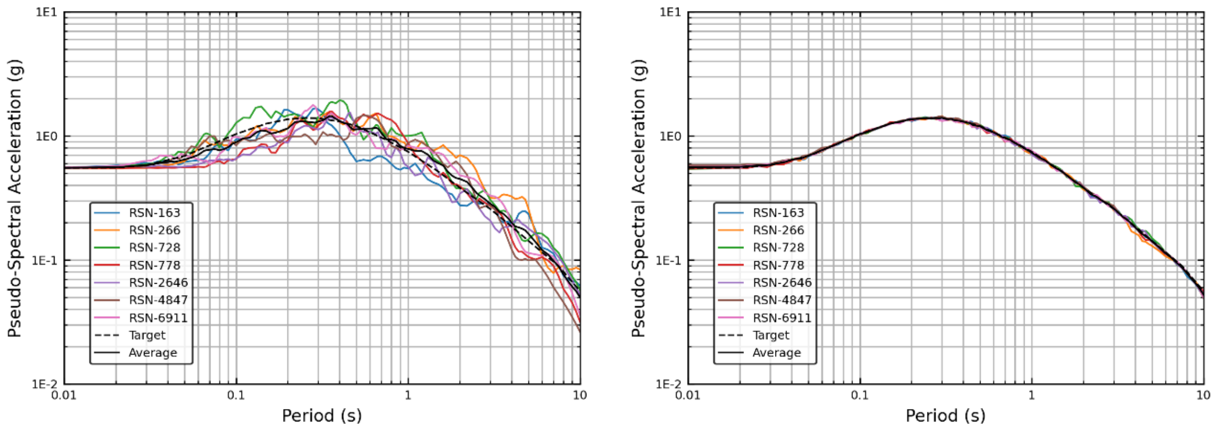
(a) scaled (b) matched

Figure A1. Suite 1 time history response spectra (geomean) for OC Site.



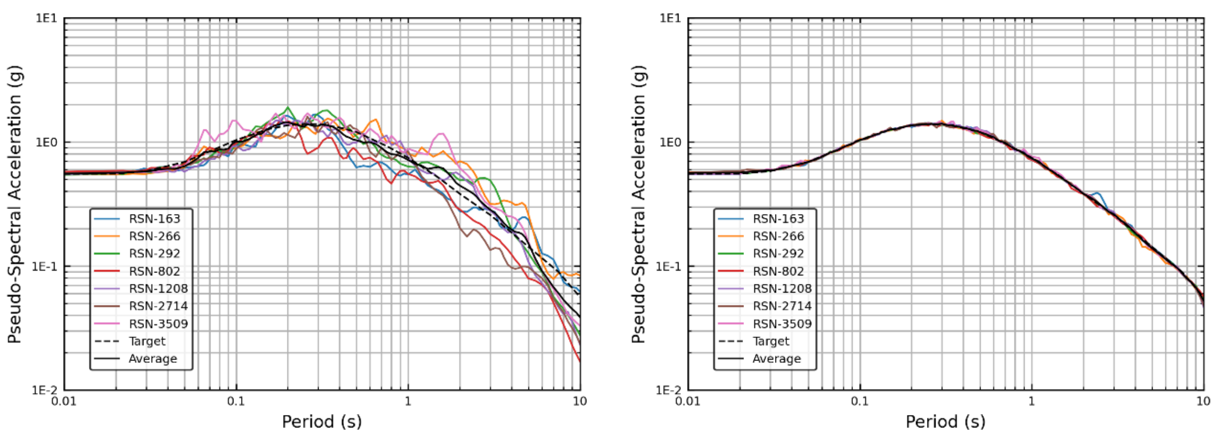
(a) scaled (b) matched

Figure A2. Suite 2 time history response spectra (geomean) for OC Site.



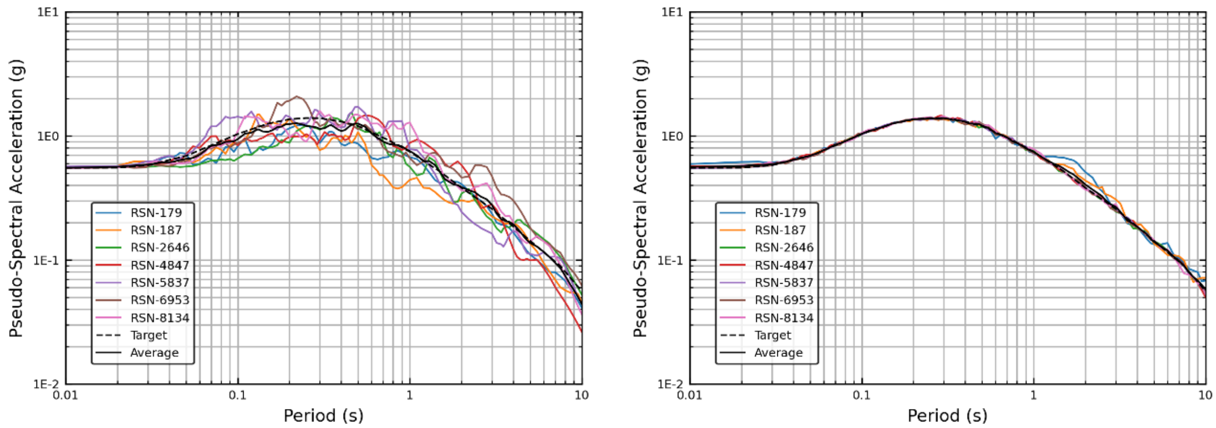
(a) scaled (b) matched

Figure A3. Suite 3 time history response spectra (geomean) for OC Site.



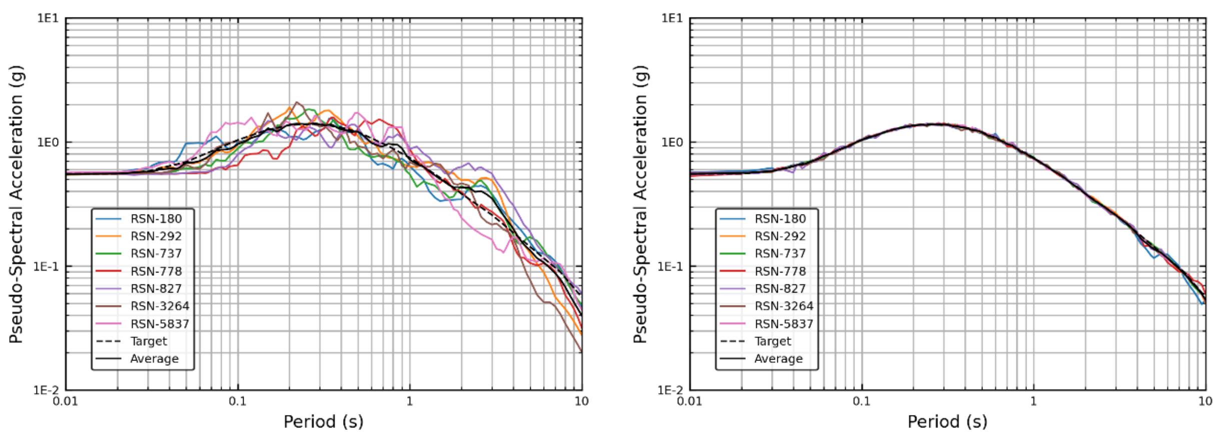
(a) scaled (b) matched

Figure A4. Suite 4 time history response spectra (geomean) for OC Site.



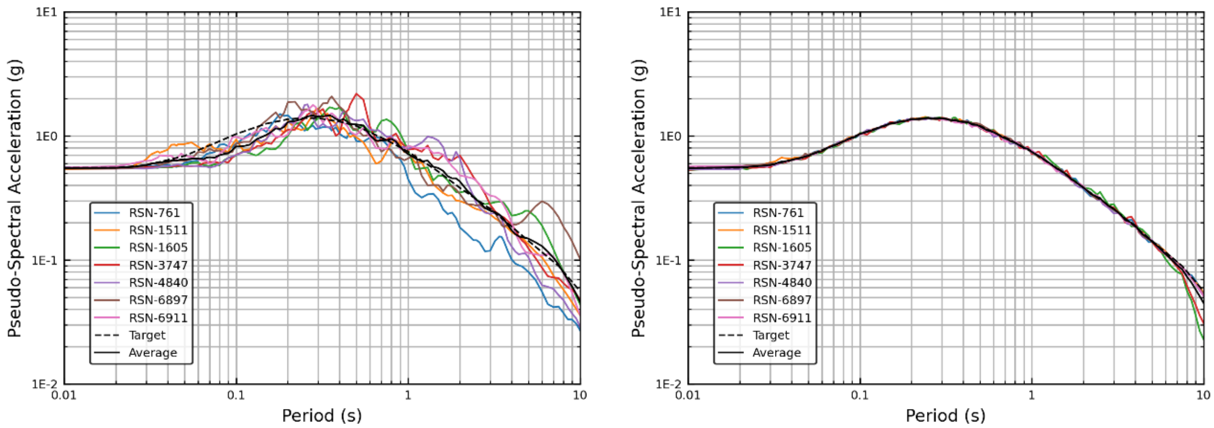
(a) scaled (b) matched

Figure A5. Suite 5 time history response spectra (geomean) for OC Site.



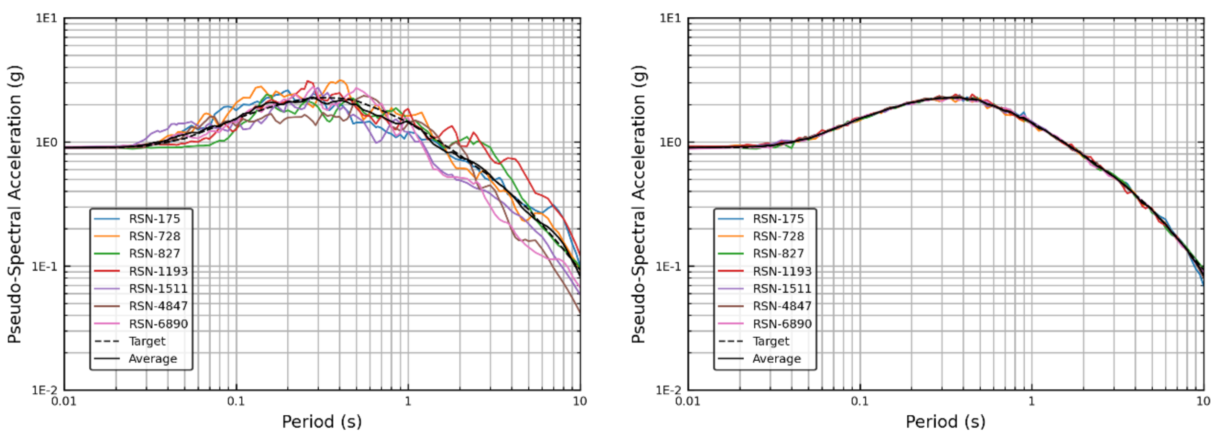
(a) scaled (b) matched

Figure A6. Suite 6 time history response spectra (geomean) for OC Site.



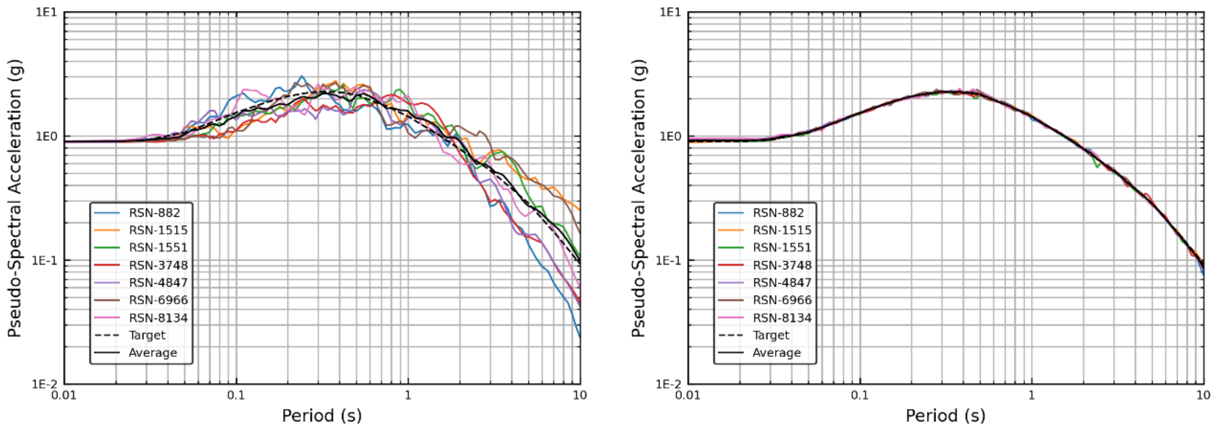
(a) scaled (b) matched

Figure A7. Suite 7 time history response spectra (geomean) for OC Site.



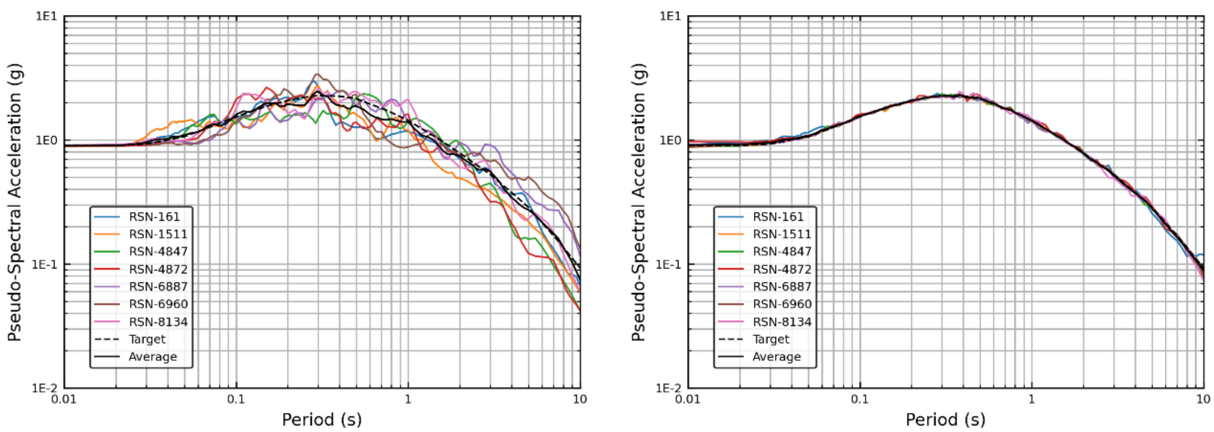
(a) scaled (b) matched

Figure A8. Suite 1 time history response spectra (geomean) for SJ Site.



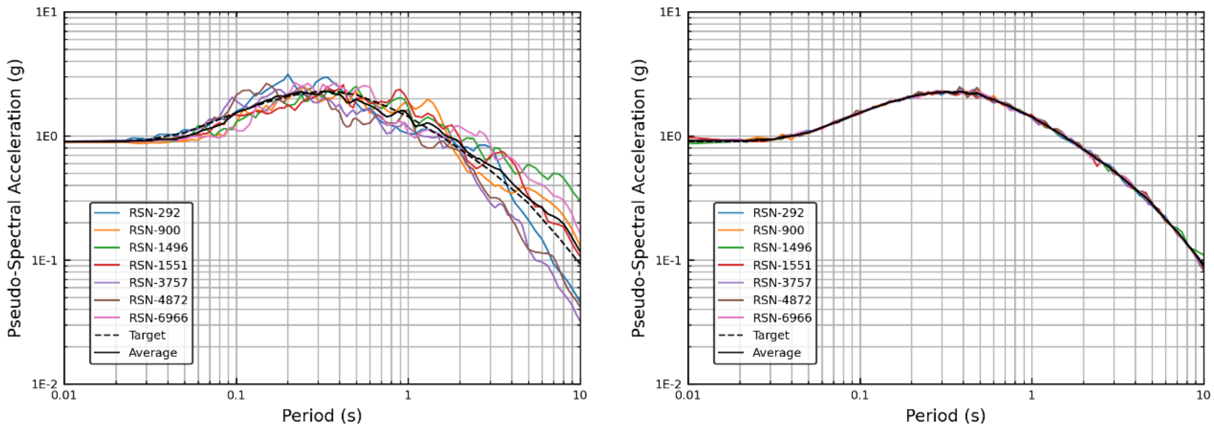
(a) scaled (b) matched

Figure A9. Suite 2 time history response spectra (geomean) for SJ Site.



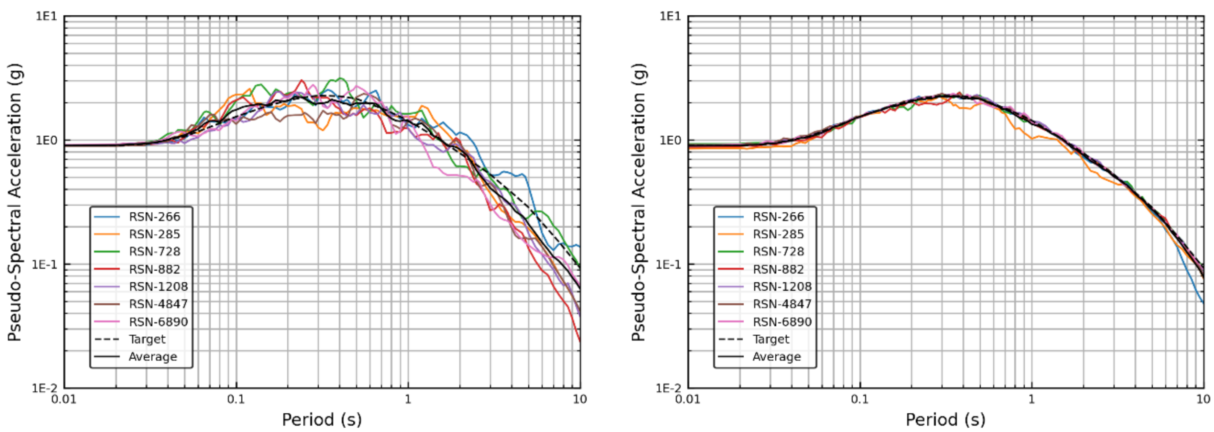
(a) scaled (b) matched

Figure A10. Suite 3 time history response spectra (geomean) for SJ Site.



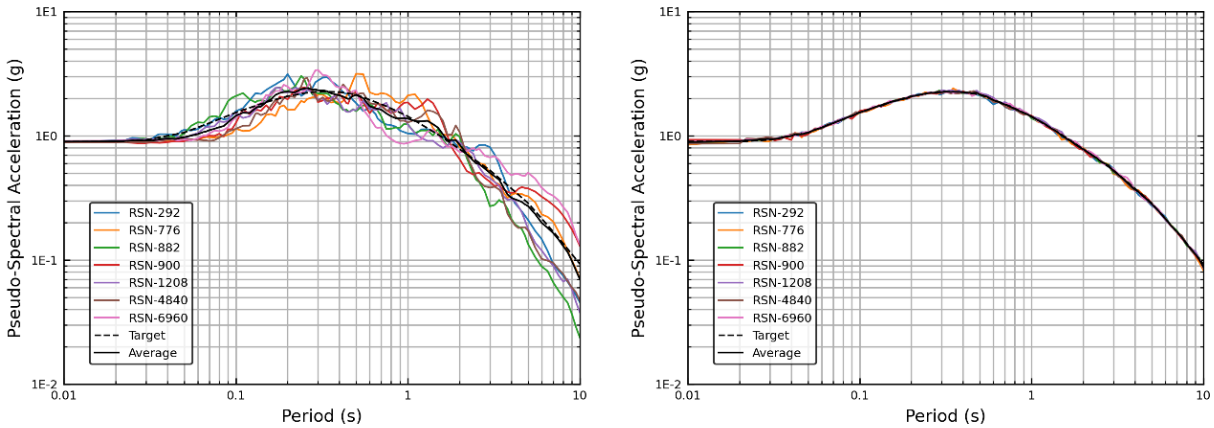
(a) scaled (b) matched

Figure A11. Suite 4 time history response spectra (geomean) for SJ Site.



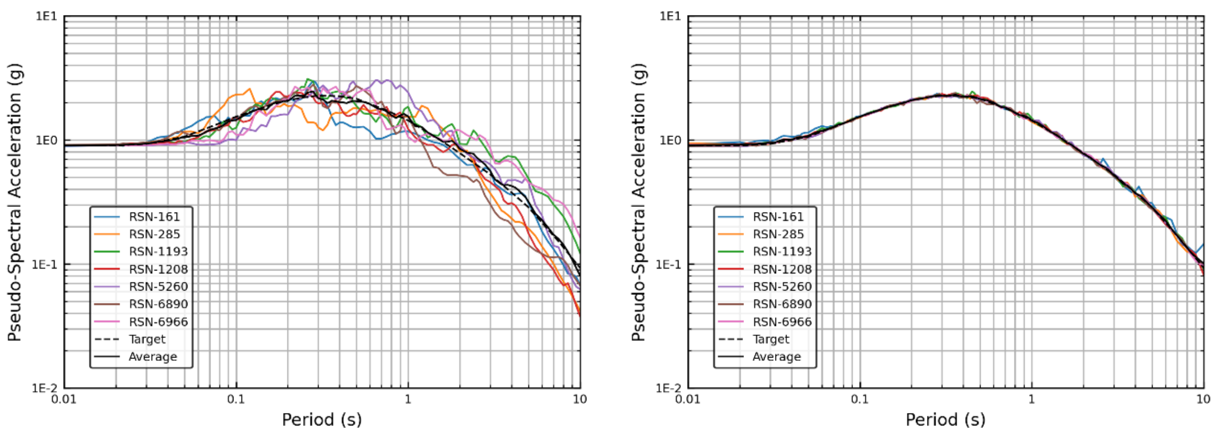
(a) scaled (b) matched

Figure A12. Suite 5 time history response spectra (geomean) for SJ Site.



(a) scaled (b) matched

Figure A13. Suite 6 time history response spectra (geomean) for SJ Site.



(a) scaled (b) matched

Figure A14. Suite 7 time history response spectra (geomean) for SJ Site.

Table A1. Seed time histories selected for scaling and spectral matching at OC Site – Suite 1

Record Number	Earthquake Name	Pulse Period	Scale Factor
176	“Imperial Valley-06”	--	5.4
184	“Imperial Valley-06”	6.265	1.5
800	“Loma Prieta”	--	6.4
1511	“Chi-Chi_Taiwan”	4.732	1.6
6890	“Darfield_ New Zealand”	--	2.3
6911	“Darfield_ New Zealand”	9.919	1.2
8130	“Christchurch_ New Zealand”	--	1.3

Table A2. Seed Time Histories Selected for Scaling and Spectral Matching at OC Site – Suite 2

Record Number	Earthquake Name	Pulse Period	Scale Factor
184	"Imperial Valley-06"	6.265	1.5
728	"Superstition Hills-02"	--	2.5
827	"Cape Mendocino"	--	4.8
1511	"Chi-Chi_Taiwan"	4.732	1.6
5779	"Iwate_ Japan"	--	5.5
6890	"Darfield_ New Zealand"	--	2.3
8134	"Christchurch_ New Zealand"	--	3.1

Table A3. Seed Time Histories Selected for Scaling and Spectral Matching at OC Site – Suite 3

Record Number	Earthquake Name	Pulse Period	Scale Factor
163	"Imperial Valley-06"	--	6.9
266	"Victoria_Mexico"	--	4.1
728	"Superstition Hills-02"	--	2.5
778	"Loma Prieta"	--	1.9
2646	"Chi-Chi_Taiwan-03"	--	6.9
4847	"Chuetsu-oki_ Japan"	1.400	1.6
6911	"Darfield_ New Zealand"	9.919	1.2

Table A4. Seed Time Histories Selected for Scaling and Spectral Matching at OC Site – Suite 4

Record Number	Earthquake Name	Pulse Period	Scale Factor
163	"Imperial Valley-06"	--	6.9
266	"Victoria_Mexico"	--	4.1
292	"Irpinia_ Italy-01"	3.272	2.0
802	"Loma Prieta"	4.571	2.0
1208	"Chi-Chi_Taiwan"	--	3.5
2714	"Chi-Chi_Taiwan-04"	--	5.2
3509	"Chi-Chi_Taiwan-06"	--	8.1

Table A5. Seed Time Histories Selected for Scaling and Spectral Matching at OC Site – Suite 5

Record Number	Earthquake Name	Pulse Period	Scale Factor
179	“Imperial Valley-06”	4.788	1.7
187	“Imperial Valley-06”	--	5.6
2646	“Chi-Chi_Taiwan-03”	--	6.9
4847	“Chuetsu-oki- Japan”	1.400	1.6
5837	“El Mayor-Cucapah_ Mexico”	--	1.4
6953	“Darfield_ New Zealand”	--	2.6
8134	“Christchurch_ New Zealand”	--	3.1

Table A6. Seed Time Histories Selected for Scaling and Spectral Matching at OC Site – Suite 6

Record Number	Earthquake Name	Pulse Period	Scale Factor
180	“Imperial Valley-06”	4.130	1.4
292	“Irpinia_ Italy-01”	3.272	2.0
737	“Loma Prieta”	--	3.8
778	“Loma Prieta”	--	1.9
827	“Cape Mendocino”	--	4.8
3264	“Chi-Chi_Taiwan-06”	--	4.4
5837	“El Mayor-Cucapah_ Mexico”	--	1.4

Table A7. Seed Time Histories Selected for Scaling and Spectral Matching at OC Site – Suite 7

Record Number	Earthquake Name	Pulse Period	Scale Factor
761	“Loma Prieta”	--	4.3
1511	“Chi-Chi_Taiwan”	4.732	1.6
1605	“Duzce_ Turkey”	--	1.2
3747	“Cape Mendocino”	--	3.2
4840	“Chuetsu-oki- Japan”	--	3.9
6897	“Darfield_ New Zealand”	7.826	2.2
6911	“Darfield_ New Zealand”	9.919	1.2

Table A8. Seed time histories selected for scaling and spectral matching at SJ Site – Suite 1

Record Number	Earthquake Name	Pulse Period	Scale Factor
175	"Imperial Valley-06"	-	8.2
728	"Superstition Hills-02"	-	4.3
827	"Cape Mendocino"	-	8.5
1193	"Chi-Chi_ Taiwan"	6.650	4.2
1511	"Chi-Chi_ Taiwan"	4.732	2.8
4847	"Chuetsu-oki_ Japan"	1.400	2.8
6890	"Darfield_ New Zealand"	-	4.0

Table A9. Seed Time Histories Selected for Scaling and Spectral Matching at SJ Site – Suite 2

Record Number	Earthquake Name	Pulse Period	Scale Factor
882	"Landers"	-	7.6
1515	"Chi-Chi_ Taiwan"	8.099	4.2
1551	"Chi-Chi_ Taiwan"	-	4.2
3748	"Cape Mendocino"	-	3
4847	"Chuetsu-oki_ Japan"	1.400	2.8
6966	"Darfield_ New Zealand"	8.757	5
8134	"Christchurch_ New Zealand"	-	5.5

Table A10. Seed Time Histories Selected for Scaling and Spectral Matching at SJ Site – Suite 3

Record Number	Earthquake Name	Pulse Period	Scale Factor
161	"Imperial Valley-06"	1.713	6.0
1511	"Chi-Chi_ Taiwan"	8.099	2.9
4847	"Chuetsu-oki_ Japan"	-	2.7
4872	"Chuetsu-oki_ Japan"	1.400	8.2
6887	"Darfield_ New Zealand"	9.394	5.4
6960	"Darfield_ New Zealand"	8.757	4.7
8134	"Christchurch_ New Zealand"	-	5.7

Table A11. Seed Time Histories Selected for Scaling and Spectral Matching at SJ Site – Suite 4

Record Number	Earthquake Name	Pulse Period	Scale Factor
292	"Irpinia_ Italy-01"	3.273	3.5
900	"Landers"	7.504	4.5
1496	"Chi-Chi_ Taiwan"	8.939	5.9
1551	"Chi-Chi_ Taiwan"	-	4.2
3757	"Landers"	-	8
4872	"Chuetsu-oki_ Japan"	-	8.4
6966	"Darfield_ New Zealand"	8.757	5.0

Table A12. Seed Time Histories Selected for Scaling and Spectral Matching at SJ Site – Suite 5

Record Number	Earthquake Name	Pulse Period	Scale Factor
266	"Victoria_ Mexico"	-	7.3
285	"Irpinia_ Italy-01"	1.713	6.7
728	"Superstition Hills-02"	-	4.3
882	"Landers"	-	7.6
1208	"Chi-Chi_ Taiwan"	-	6.1
4847	"Chuetsu-oki_ Japan"	1.400	2.8
6890	"Darfield_ New Zealand"	-	4.0

Table A13. Seed Time Histories Selected for Scaling and Spectral Matching at SJ Site – Suite 6

Record Number	Earthquake Name	Pulse Period	Scale Factor
292	"Irpinia_ Italy-01"	3.273	3.5
776	"Loma Prieta"	-	3.5
882	"Landers"	-	7.6
900	"Landers"	7.504	4.5
1208	"Chi-Chi_ Taiwan"	-	6.1
4840	"Chuetsu-oki_ Japan"	-	6.9
6960	"Darfield_ New Zealand"	9.394	4.7

Table A14. Seed Time Histories Selected for Scaling and Spectral Matching at SJ Site – Suite 7

Record Number	Earthquake Name	Pulse Period	Scale Factor
161	"Imperial Valley-06"	4.396	6.1
285	"Irpinia_ Italy-01"	1.713	6.7
1193	"Chi-Chi_ Taiwan"	6.650	4.2
1208	"Chi-Chi_ Taiwan"	-	6.1
5260	"Chuetsu-oki_ Japan"	-	7.0
6890	"Darfield_ New Zealand"	-	4.0
6966	"Darfield_ New Zealand"	8.757	5.0

Appendix B: Scaled and Matched Time Series

All figures showing the scaled and matched time series, including acceleration, velocity, and displacement, are available at the following link: Electronic_Supplement_OneDrive.

As an example, the time series for RSN1511 (Chi-Chi, Taiwan, TCU056; see Table A1) are presented to demonstrate that the presence of a velocity pulse was explicitly considered during the selection and modification of the ground motion records.

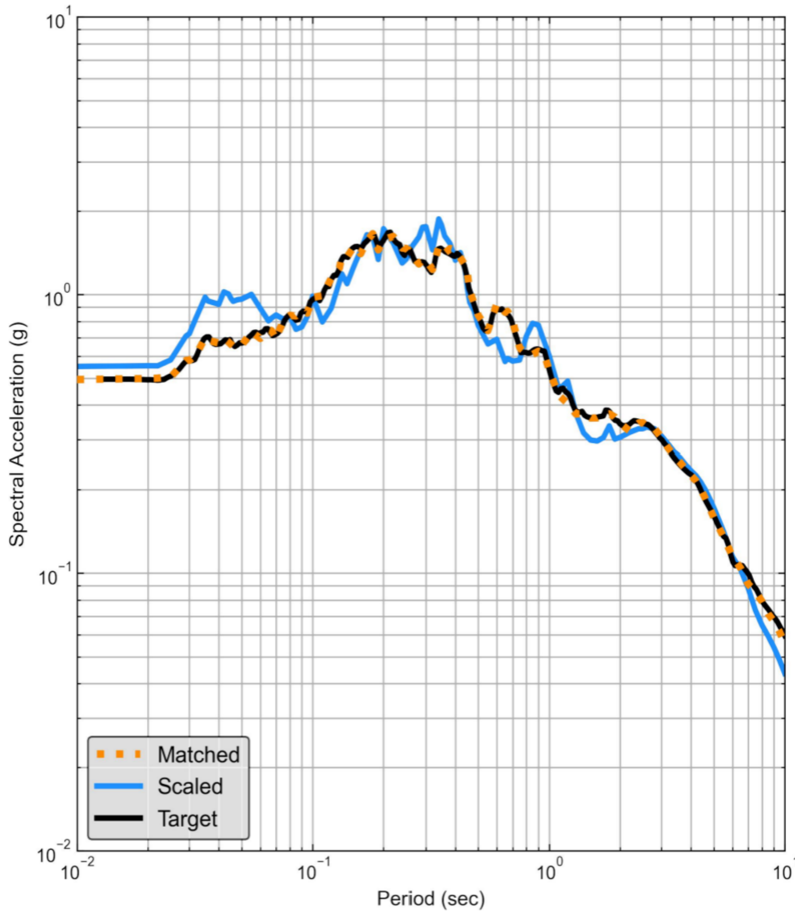


Figure B1. Comparison of the matched, scaled, and target response spectra of RSN1511 H1, Chi-Chi, Taiwan, TCU076.

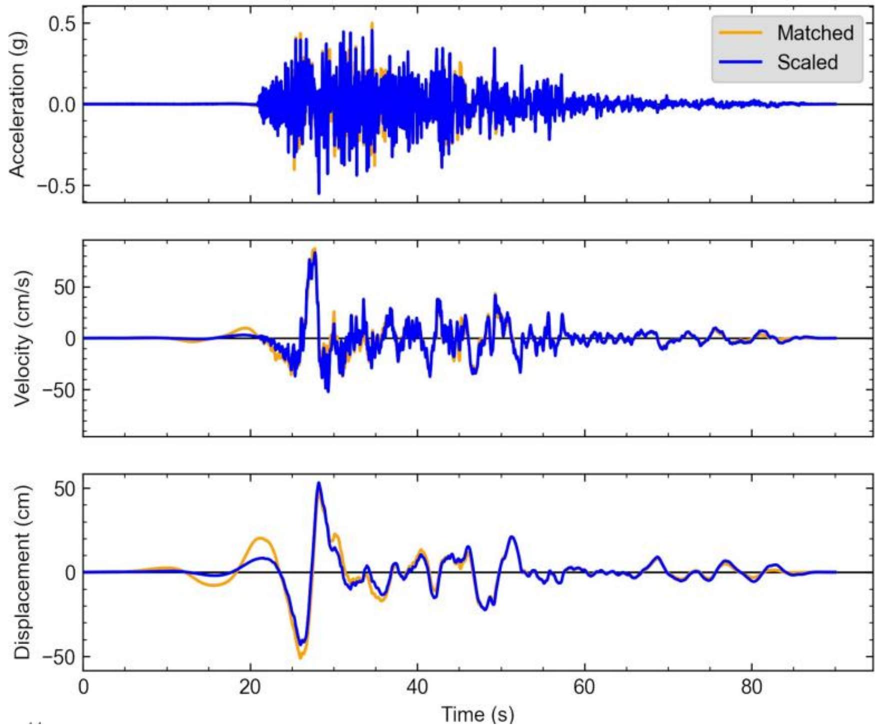


Figure B2. Comparison of the matched and scaled time histories of RSN1511 H1, Chi-Chi, Taiwan, TCU076.

Appendix C: List of CSS Motions and Resulting EDPs

Table C1. CSS at San Jose and resulting EDPs (pier drift ratio) of the 2-span bridge

Index	RSN	S.F.	Rate	H1	H2	EDP (in.)	EDP (%)	Cum. Rate
138	754	14.99	2.13E-05	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	12.59	4.30	2.13E-05
192	269	55.97	4.10E-06	VICT\HPB000.AT2	VICT\HPB270.AT2	10.86	3.71	2.54E-05
177	1500	13.57	2.93E-08	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	10.64	3.63	2.54E-05
144	1039	10.93	3.11E-07	NORTHR\MRP090.AT2	NORTHR\MRP180.AT2	10.49	3.58	2.57E-05
174	1532	14.66	2.80E-08	CHICHI\TCU105-E.AT2	CHICHI\TCU105-N.AT2	10.40	3.55	2.58E-05
141	755	7.38	7.51E-08	LOMAP\CYC195.AT2	LOMAP\CYC285.AT2	10.30	3.51	2.58E-05
169	1227	11.96	7.50E-08	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	10.16	3.47	2.59E-05
137	1158	4.93	3.45E-06	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	8.99	3.07	2.94E-05
142	165	6.51	1.22E-07	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	8.98	3.06	2.95E-05
162	1546	9.77	2.93E-08	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	8.53	2.91	2.95E-05
149	238	39.46	7.60E-08	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	8.53	2.91	2.96E-05
160	1208	11.53	1.54E-06	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	8.25	2.82	3.11E-05
181	2650	16.72	2.92E-08	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	8.21	2.80	3.11E-05
154	159	9.75	3.79E-05	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	8.07	2.76	6.90E-05
139	3473	6.80	1.31E-07	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	7.86	2.68	6.91E-05
159	1512	5.75	2.93E-08	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	7.85	2.68	6.92E-05
172	730	10.05	7.52E-08	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	7.85	2.68	6.93E-05
178	728	8.54	2.90E-08	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	7.78	2.66	6.93E-05
189	1106	2.36	1.22E-05	KOBE\KJM000.AT2	KOBE\KJM090.AT2	7.77	2.65	8.15E-05
116	1500	8.98	1.83E-05	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	7.65	2.61	9.99E-05
175	988	8.58	3.14E-06	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	7.51	2.56	1.03E-04
151	1497	11.57	1.32E-05	CHICHI\TCU057-E.AT2	CHICHI\TCU057-N.AT2	7.48	2.55	1.16E-04
112	1227	7.88	1.92E-06	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	7.38	2.52	1.18E-04
193	322	9.12	3.94E-08	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	7.36	2.51	1.18E-04
180	1108	6.32	3.19E-05	KOBE\KBU000.AT2	KOBE\KBU090.AT2	7.18	2.45	1.50E-04
84	754	9.64	1.49E-06	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	6.98	2.38	1.52E-04
150	779	3.42	4.38E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	6.97	2.38	1.95E-04
115	1532	9.68	1.10E-05	CHICHI\TCU105-E.AT2	CHICHI\TCU105-N.AT2	6.87	2.34	2.06E-04
147	1490	11.01	2.88E-08	CHICHI\TCU050-E.AT2	CHICHI\TCU050-N.AT2	6.86	2.34	2.06E-04
185	215	38.07	3.32E-08	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	6.70	2.29	2.06E-04
106	1546	6.40	1.03E-05	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	6.68	2.28	2.17E-04
165	864	6.91	5.19E-07	LANDERS\JOS000.AT2	LANDERS\JOS090.AT2	6.64	2.27	2.17E-04
170	1533	9.17	2.76E-06	CHICHI\TCU106-E.AT2	CHICHI\TCU106-N.AT2	6.63	2.26	2.20E-04
146	316	8.33	5.82E-06	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	6.59	2.25	2.26E-04
183	1244	4.29	2.93E-08	CHICHI\CHY101-E.AT2	CHICHI\CHY101-N.AT2	6.59	2.25	2.26E-04
153	1515	7.50	2.90E-08	CHICHI\TCU082-E.AT2	CHICHI\TCU082-N.AT2	6.26	2.14	2.26E-04

135	192	25.82	2.93E-08	IMPVALL.H\H-WSM090.AT2	IMPVALL.H\H-WSM180.AT2	6.26	2.14	2.26E-04
182	289	9.48	2.14E-07	ITALY\A-CTR000.AT2	ITALY\A-CTR270.AT2	6.04	2.06	2.26E-04
132	3468	28.43	2.64E-06	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	5.93	2.02	2.29E-04
103	1512	3.76	3.24E-05	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	5.88	2.01	2.61E-04
155	1082	5.24	2.90E-08	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	5.79	1.98	2.61E-04
134	2893	16.06	2.90E-08	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	5.78	1.97	2.61E-04
128	322	6.11	5.35E-06	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	5.77	1.97	2.67E-04
114	730	6.63	1.70E-07	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	5.67	1.93	2.67E-04
130	1495	7.45	2.89E-08	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	5.66	1.93	2.67E-04
67	1500	5.75	3.77E-05	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	5.60	1.91	3.05E-04
145	1100	9.07	7.50E-08	KOBE\ABN000.AT2	KOBE\ABN090.AT2	5.56	1.90	3.05E-04
186	2461	10.20	3.30E-06	CHICHI.03\CHY028N.AT2	CHICHI.03\CHY028E.AT2	5.51	1.88	3.08E-04
120	2650	11.10	4.53E-06	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	5.50	1.88	3.12E-04
194	1063	2.29	7.60E-08	NORTHR\RRS228.AT2	NORTHR\RRS318.AT2	5.48	1.87	3.13E-04
119	1108	4.19	1.24E-05	KOBE\KBU000.AT2	KOBE\KBU090.AT2	5.45	1.86	3.25E-04
91	238	25.55	1.01E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	5.44	1.86	3.35E-04
158	544	18.91	8.56E-06	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	5.40	1.84	3.44E-04
85	3473	4.38	1.67E-05	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	5.39	1.84	3.60E-04
148	1519	12.13	7.53E-08	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	5.38	1.84	3.60E-04
86	165	4.20	5.66E-05	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	5.34	1.82	4.17E-04
173	1203	6.00	2.24E-07	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	5.33	1.82	4.17E-04
73	269	23.87	3.12E-05	VICT\HPB000.AT2	VICT\HPB270.AT2	5.32	1.82	4.48E-04
136	1493	9.17	1.23E-07	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	5.31	1.81	4.48E-04
98	159	6.35	2.64E-07	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	5.31	1.81	4.49E-04
63	1227	5.06	2.58E-05	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	5.27	1.80	4.75E-04
166	1101	3.40	1.80E-05	KOBE\AMA000.AT2	KOBE\AMA090.AT2	5.20	1.77	4.93E-04
39	754	6.25	1.04E-05	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	5.11	1.74	5.03E-04
143	1530	8.33	1.38E-05	CHICHI\TCU103-E.AT2	CHICHI\TCU103-N.AT2	5.08	1.73	5.17E-04
188	1202	5.57	2.90E-08	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	5.07	1.73	5.17E-04
97	1515	4.88	4.00E-07	CHICHI\TCU082-E.AT2	CHICHI\TCU082-N.AT2	5.02	1.71	5.17E-04
167	2654	19.75	7.52E-08	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	4.96	1.69	5.17E-04
44	1039	4.57	2.12E-05	NORTHR\MRP090.AT2	NORTHR\MRP180.AT2	4.94	1.69	5.38E-04
163	729	8.83	2.90E-08	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	4.84	1.65	5.38E-04
117	728	5.65	1.85E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	4.81	1.64	5.57E-04
104	1527	7.83	3.01E-05	CHICHI\TCU100-E.AT2	CHICHI\TCU100-N.AT2	4.79	1.63	5.87E-04
124	215	25.37	4.41E-06	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	4.72	1.61	5.92E-04
187	1509	2.85	2.91E-08	CHICHI\TCU074-E.AT2	CHICHI\TCU074-N.AT2	4.72	1.61	5.92E-04
122	289	6.30	2.70E-05	ITALY\A-CTR000.AT2	ITALY\A-CTR270.AT2	4.65	1.59	6.19E-04
23	1227	3.33	1.66E-05	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	4.60	1.57	6.35E-04
95	1521	4.83	1.10E-05	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	4.57	1.56	6.46E-04
66	1532	6.21	1.67E-06	CHICHI\TCU105-E.AT2	CHICHI\TCU105-N.AT2	4.49	1.53	6.48E-04

113	1533	6.04	2.79E-05	CHICHI\TCU106-E.AT2	CHICHI\TCU106-N.AT2	4.43	1.51	6.76E-04
179	447	31.98	2.91E-08	MORGAN\AGW240.AT2	MORGAN\AGW330.AT2	4.43	1.51	6.76E-04
176	1541	6.38	5.39E-08	CHICHI\TCU116-E.AT2	CHICHI\TCU116-N.AT2	4.42	1.51	6.76E-04
164	297	15.05	7.60E-08	ITALY\B-BIS000.AT2	ITALY\B-BIS270.AT2	4.41	1.51	6.76E-04
96	723	2.38	9.65E-06	SUPER.B\B-PTS225.AT2	SUPER.B\B-PTS315.AT2	4.40	1.50	6.85E-04
131	1551	5.30	1.38E-05	CHICHI\TCU138-N.AT2	CHICHI\TCU138-W.AT2	4.38	1.50	6.99E-04
121	1508	2.44	2.12E-06	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	4.36	1.49	7.01E-04
79	3468	18.19	4.17E-06	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	4.32	1.48	7.06E-04
152	1194	8.08	3.69E-07	CHICHI\CHY025-E.AT2	CHICHI\CHY025-N.AT2	4.27	1.46	7.06E-04
93	779	2.22	2.18E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	4.20	1.43	7.28E-04
83	1489	4.25	7.50E-08	CHICHI\TCU049-E.AT2	CHICHI\TCU049-N.AT2	4.19	1.43	7.28E-04
48	779	1.43	4.90E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	4.14	1.41	7.77E-04
99	1499	8.32	2.15E-05	CHICHI\TCU060-E.AT2	CHICHI\TCU060-N.AT2	4.13	1.41	7.98E-04
123	97	13.15	7.49E-08	PTMUGU\PHN180.AT2	PTMUGU\PHN270.AT2	4.12	1.41	7.98E-04
68	728	3.62	1.84E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	4.11	1.40	8.17E-04
109	864	4.54	1.23E-07	LANDERS\JOS000.AT2	LANDERS\JOS090.AT2	4.11	1.40	8.17E-04
58	1546	4.12	3.71E-05	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	4.11	1.40	8.54E-04
90	1519	7.85	1.76E-06	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	4.09	1.40	8.56E-04
53	159	4.10	2.78E-05	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	3.98	1.36	8.83E-04
191	1547	8.31	2.94E-08	CHICHI\TCU123-E.AT2	CHICHI\TCU123-N.AT2	3.97	1.36	8.84E-04
75	1495	4.75	1.68E-07	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	3.96	1.35	8.84E-04
56	1512	2.42	1.09E-05	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	3.95	1.35	8.95E-04
76	266	8.02	1.21E-07	VICT\CHI102.AT2	VICT\CHI192.AT2	3.93	1.34	8.95E-04
133	286	12.76	9.25E-06	ITALY\A-BIS000.AT2	ITALY\A-BIS270.AT2	3.85	1.31	9.04E-04
161	1182	3.78	1.63E-06	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	3.85	1.31	9.06E-04
156	1531	11.47	2.80E-08	CHICHI\TCU104-E.AT2	CHICHI\TCU104-N.AT2	3.84	1.31	9.06E-04
72	215	16.20	7.47E-05	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	3.83	1.31	9.80E-04
102	544	12.34	1.24E-05	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	3.81	1.30	9.93E-04
87	1530	5.38	5.22E-06	CHICHI\TCU103-E.AT2	CHICHI\TCU103-N.AT2	3.80	1.30	9.98E-04
37	1158	2.05	1.53E-05	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	3.79	1.29	1.01E-03
40	3473	2.84	2.54E-05	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	3.72	1.27	1.04E-03
51	723	1.54	5.43E-07	SUPER.B\B-PTS225.AT2	SUPER.B\B-PTS315.AT2	3.72	1.27	1.04E-03
100	1082	3.41	1.15E-05	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	3.70	1.26	1.05E-03
50	1521	3.12	1.29E-04	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	3.68	1.25	1.18E-03
18	1512	1.60	1.04E-04	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	3.67	1.25	1.28E-03
82	1493	5.89	1.43E-05	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	3.61	1.23	1.30E-03
26	1500	3.78	4.32E-06	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	3.57	1.22	1.30E-03
168	821	3.75	2.90E-08	ERZINCAN\ERZ-NS.AT2	ERZINCAN\ERZ-EW.AT2	3.57	1.22	1.30E-03
57	1208	4.86	1.44E-05	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	3.55	1.21	1.32E-03
89	316	5.38	5.52E-05	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	3.53	1.21	1.37E-03
129	1063	1.54	4.28E-05	NORTHR\RRS228.AT2	NORTHR\RRS318.AT2	3.51	1.20	1.41E-03

92	1545	4.55	4.03E-06	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	3.51	1.20	1.42E-03
107	1193	4.24	3.30E-07	CHICHI\CHY024-E.AT2	CHICHI\CHY024-N.AT2	3.48	1.19	1.42E-03
125	2461	6.80	1.21E-07	CHICHI.03\CHY028N.AT2	CHICHI.03\CHY028E.AT2	3.47	1.18	1.42E-03
32	1176	2.55	1.74E-07	KOCAELI\YPT060.AT2	KOCAELI\YPT150.AT2	3.42	1.17	1.42E-03
190	1045	4.32	2.93E-08	NORTHR\WPI046.AT2	NORTHR\WPI316.AT2	3.39	1.16	1.42E-03
157	1529	4.54	2.88E-08	CHICHI\TCU102-E.AT2	CHICHI\TCU102-N.AT2	3.39	1.16	1.42E-03
108	729	5.79	1.24E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	3.39	1.16	1.43E-03
88	1100	5.86	9.08E-06	KOBE\ABN000.AT2	KOBE\ABN090.AT2	3.36	1.15	1.44E-03
118	447	21.19	1.68E-07	MORGAN\AGW240.AT2	MORGAN\AGW330.AT2	3.36	1.15	1.44E-03
80	286	8.17	1.01E-05	ITALY\A-BIS000.AT2	ITALY\A-BIS270.AT2	3.33	1.14	1.45E-03
43	165	2.72	3.71E-05	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	3.26	1.11	1.49E-03
42	755	3.08	3.12E-07	LOMAP\CYC195.AT2	LOMAP\CYC285.AT2	3.23	1.10	1.49E-03
140	803	4.07	3.07E-07	LOMAP\WVC000.AT2	LOMAP\WVC270.AT2	3.22	1.10	1.49E-03
69	2650	7.10	1.71E-05	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	3.20	1.09	1.51E-03
70	289	4.03	2.80E-05	ITALY\A-CTR000.AT2	ITALY\A-CTR270.AT2	3.12	1.07	1.53E-03
126	1202	3.72	1.54E-06	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	3.12	1.06	1.54E-03
64	1533	3.88	3.03E-05	CHICHI\TCU106-E.AT2	CHICHI\TCU106-N.AT2	3.09	1.06	1.57E-03
65	730	4.25	2.17E-05	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	3.08	1.05	1.59E-03
101	1531	7.48	2.28E-05	CHICHI\TCU104-E.AT2	CHICHI\TCU104-N.AT2	3.00	1.02	1.61E-03
31	3468	11.83	1.74E-07	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	2.97	1.01	1.61E-03
28	2650	4.65	6.92E-05	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	2.96	1.01	1.68E-03
77	1551	3.39	2.50E-05	CHICHI\TCU138-N.AT2	CHICHI\TCU138-W.AT2	2.96	1.01	1.70E-03
52	1515	3.15	1.31E-04	CHICHI\TCU082-E.AT2	CHICHI\TCU082-N.AT2	2.96	1.01	1.84E-03
20	1546	2.72	1.69E-04	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	2.93	1.00	2.00E-03
13	238	11.01	4.01E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	2.92	1.00	2.04E-03
94	827	9.21	6.95E-06	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	2.89	0.98	2.05E-03
81	2893	10.30	6.90E-07	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	2.88	0.98	2.05E-03
46	316	3.48	3.87E-05	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	2.85	0.97	2.09E-03
9	3473	1.90	1.03E-05	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	2.73	0.93	2.10E-03
110	1101	2.23	3.14E-05	KOBE\AMA000.AT2	KOBE\AMA090.AT2	2.73	0.93	2.13E-03
127	1045	2.88	8.11E-08	NORTHR\WPI046.AT2	NORTHR\WPI316.AT2	2.71	0.92	2.13E-03
38	1489	2.76	3.12E-07	CHICHI\TCU049-E.AT2	CHICHI\TCU049-N.AT2	2.69	0.92	2.13E-03
35	192	10.76	4.15E-05	IMPVALL.H\H-WSM090.AT2	IMPVALL.H\H-WSM180.AT2	2.69	0.92	2.17E-03
47	1545	2.94	7.14E-06	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	2.68	0.91	2.18E-03
111	2654	12.98	1.22E-07	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	2.67	0.91	2.18E-03
60	729	3.73	2.63E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	2.66	0.91	2.21E-03
78	1198	3.83	1.42E-05	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	2.64	0.90	2.22E-03
34	2893	6.69	3.30E-05	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	2.58	0.88	2.26E-03
6	1158	1.38	2.94E-04	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	2.54	0.87	2.55E-03
105	1182	2.47	2.78E-05	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	2.51	0.86	2.58E-03
25	988	2.39	1.66E-04	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	2.47	0.84	2.74E-03

29	215	10.59	1.51E-04	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	2.46	0.84	2.89E-03
33	179	1.83	1.24E-05	IMPVALL.H\H-E04140.AT2	IMPVALL.H\H-E04230.AT2	2.45	0.84	2.91E-03
36	1493	3.82	5.88E-05	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	2.34	0.80	2.97E-03
54	1082	2.20	1.34E-04	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	2.32	0.79	3.10E-03
10	755	2.06	1.48E-04	LOMAP\CYC195.AT2	LOMAP\CYC285.AT2	2.31	0.79	3.25E-03
171	1517	1.57	2.70E-05	CHICHI\TCU084-E.AT2	CHICHI\TCU084-N.AT2	2.31	0.79	3.27E-03
74	1063	0.98	5.63E-05	NORTHR\RRS228.AT2	NORTHR\RRS318.AT2	2.31	0.79	3.33E-03
184	1104	4.49	2.88E-08	KOBE\FKS000.AT2	KOBE\FKS090.AT2	2.19	0.75	3.33E-03
30	322	2.54	2.03E-05	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	2.19	0.75	3.35E-03
71	97	8.40	2.03E-06	PTMUGU\PHN180.AT2	PTMUGU\PHN270.AT2	2.15	0.73	3.35E-03
59	1193	2.73	3.98E-05	CHICHI\CHY024-E.AT2	CHICHI\CHY024-N.AT2	2.08	0.71	3.39E-03
55	544	7.95	3.18E-05	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	2.06	0.70	3.43E-03
49	827	5.95	1.09E-04	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	1.98	0.68	3.53E-03
12	316	2.32	4.10E-04	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	1.97	0.67	3.94E-03
45	1100	3.79	7.54E-05	KOBE\ABN000.AT2	KOBE\ABN090.AT2	1.96	0.67	4.02E-03
19	1208	3.21	1.70E-04	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	1.96	0.67	4.19E-03
15	1521	2.08	2.36E-04	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	1.91	0.65	4.43E-03
24	730	2.80	3.90E-04	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	1.78	0.61	4.82E-03
7	1489	1.85	4.02E-04	CHICHI\TCU049-E.AT2	CHICHI\TCU049-N.AT2	1.69	0.58	5.22E-03
16	159	2.72	9.08E-05	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	1.62	0.55	5.31E-03
61	2654	8.34	8.90E-06	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	1.59	0.54	5.32E-03
4	192	7.21	4.71E-05	IMPVALL.H\H-WSM090.AT2	IMPVALL.H\H-WSM180.AT2	1.57	0.54	5.36E-03
3	179	1.23	8.26E-07	IMPVALL.H\H-E04140.AT2	IMPVALL.H\H-E04230.AT2	1.53	0.52	5.37E-03
41	803	1.70	1.00E-05	LOMAP\WVC000.AT2	LOMAP\WVC270.AT2	1.42	0.48	5.38E-03
62	821	1.58	1.74E-07	ERZINCAN\ERZ-NS.AT2	ERZINCAN\ERZ-EW.AT2	1.41	0.48	5.38E-03
17	1082	1.46	3.99E-05	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	1.37	0.47	5.42E-03
8	754	4.18	6.70E-05	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	1.14	0.39	5.48E-03
21	1193	1.80	1.93E-04	CHICHI\CHY024-E.AT2	CHICHI\CHY024-N.AT2	1.10	0.37	5.68E-03
11	1100	2.53	5.03E-05	KOBE\ABN000.AT2	KOBE\ABN090.AT2	1.08	0.37	5.73E-03
1	1491	2.08	5.13E-05	CHICHI\TCU051-E.AT2	CHICHI\TCU051-N.AT2	1.06	0.36	5.78E-03
27	728	2.38	1.32E-04	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	0.98	0.34	5.91E-03
22	2654	5.50	4.75E-05	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	0.98	0.33	5.96E-03
14	779	0.95	1.17E-04	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	0.94	0.32	6.07E-03
5	1493	2.56	1.32E-04	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	0.91	0.31	6.21E-03
2	286	3.56	2.24E-04	ITALY\A-BIS000.AT2	ITALY\A-BIS270.AT2	0.83	0.28	6.43E-03

Table C2. CSS at Orange County site and resulting EDPs (pier drift ratio) of the 2-span bridge

Index	RSN	S.F.	Rate	H1	H2	EDP (in.)	EDP (%)	Cum. Rate
131	1184	6.92	8.88E-07	CHICHI\CHY010-N.AT2	CHICHI\CHY010-W.AT2	7.69	2.63	8.88E-07
185	1158	3.40	2.88E-08	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	7.56	2.58	9.17E-07
179	212	12.19	3.48E-08	LIVERMOR\A-DVD156.AT2	LIVERMOR\A-DVD246.AT2	7.34	2.51	9.52E-07
159	549	5.81	3.97E-08	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	6.89	2.35	9.92E-07
161	150	3.48	2.91E-08	COYOTELK\G06230.AT2	COYOTELK\G06320.AT2	6.72	2.29	1.02E-06
154	165	3.82	1.61E-06	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	5.77	1.97	2.63E-06
180	728	4.52	2.20E-07	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	5.74	1.96	2.85E-06
128	1039	5.41	2.24E-07	NORTHR\MRP090.AT2	NORTHR\MRP180.AT2	5.45	1.86	3.08E-06
181	1500	7.24	2.87E-08	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	5.31	1.81	3.11E-06
152	558	2.73	7.05E-06	CHALFANT.A\A-ZAK270.AT2	CHALFANT.A\A-ZAK360.AT2	5.27	1.80	1.02E-05
139	154	14.83	7.51E-08	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	5.27	1.80	1.02E-05
156	568	2.54	3.34E-08	SANSALV\GIC090.AT2	SANSALV\GIC180.AT2	5.23	1.79	1.03E-05
157	2625	27.66	1.25E-05	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	5.22	1.78	2.27E-05
183	768	4.94	2.01E-07	LOMAP\G04000.AT2	LOMAP\G04090.AT2	5.18	1.77	2.29E-05
182	1490	7.12	2.88E-08	CHICHI\TCU050-E.AT2	CHICHI\TCU050-N.AT2	5.18	1.77	2.30E-05
153	960	2.96	3.49E-08	NORTHR\LOS000.AT2	NORTHR\LOS270.AT2	5.18	1.77	2.30E-05
188	316	5.58	1.77E-06	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	5.05	1.72	2.48E-05
201	322	4.87	3.49E-08	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	4.98	1.70	2.48E-05
133	238	19.80	1.72E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	4.90	1.67	4.20E-05
163	159	5.54	1.77E-06	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	4.84	1.65	4.38E-05
172	1494	4.88	7.54E-08	CHICHI\TCU054-E.AT2	CHICHI\TCU054-N.AT2	4.75	1.62	4.39E-05
155	802	3.66	2.93E-08	LOMAP\STG000.AT2	LOMAP\STG090.AT2	4.74	1.62	4.39E-05
162	721	5.15	2.33E-05	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	4.72	1.61	6.72E-05
114	1500	4.78	4.93E-06	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	4.71	1.61	7.21E-05
95	960	1.91	1.37E-05	NORTHR\LOS000.AT2	NORTHR\LOS270.AT2	4.55	1.55	8.58E-05
166	1521	4.33	1.75E-06	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	4.55	1.55	8.75E-05
112	212	8.03	2.62E-05	LIVERMOR\A-DVD156.AT2	LIVERMOR\A-DVD246.AT2	4.52	1.54	1.14E-04
80	1184	4.34	1.86E-05	CHICHI\CHY010-N.AT2	CHICHI\CHY010-W.AT2	4.46	1.52	1.32E-04
169	1510	4.43	1.15E-05	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	4.43	1.51	1.44E-04
194	1493	6.60	2.86E-08	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	4.42	1.51	1.44E-04
158	1208	6.10	1.45E-05	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	4.41	1.51	1.58E-04
178	1165	5.58	7.85E-06	KOCAELI\IZT180.AT2	KOCAELI\IZT090.AT2	4.40	1.50	1.66E-04
167	169	4.30	1.33E-07	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	4.40	1.50	1.66E-04
164	1545	4.15	7.86E-06	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	4.35	1.49	1.74E-04
115	768	3.27	8.63E-06	LOMAP\G04000.AT2	LOMAP\G04090.AT2	4.28	1.46	1.83E-04
175	1534	4.39	6.22E-06	CHICHI\TCU107-E.AT2	CHICHI\TCU107-N.AT2	4.26	1.45	1.89E-04
173	1495	5.16	8.88E-06	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	4.25	1.45	1.98E-04
141	723	1.88	2.88E-08	SUPER.B\B-PTS225.AT2	SUPER.B\B-PTS315.AT2	4.14	1.41	1.98E-04

149	988	4.05	3.31E-08	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	4.14	1.41	1.98E-04
143	983	1.36	3.49E-08	NORTHR\JGB022.AT2	NORTHR\JGB292.AT2	4.01	1.37	1.98E-04
176	2661	8.33	2.93E-08	CHICHI.03\TCU138N.AT2	CHICHI.03\TCU138W.AT2	4.01	1.37	1.98E-04
86	154	9.40	1.53E-05	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	4.01	1.37	2.13E-04
98	2625	17.88	1.23E-05	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	3.91	1.33	2.26E-04
184	1496	5.88	7.58E-08	CHICHI\TCU056-E.AT2	CHICHI\TCU056-N.AT2	3.85	1.31	2.26E-04
138	158	3.81	3.48E-08	IMPVALL.H\H-AEP045.AT2	IMPVALL.H\H-AEP315.AT2	3.82	1.30	2.26E-04
100	549	3.76	7.38E-08	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	3.81	1.30	2.26E-04
187	161	6.46	8.91E-07	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	3.80	1.30	2.27E-04
105	1521	2.82	2.61E-05	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	3.75	1.28	2.53E-04
106	169	2.80	5.40E-06	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	3.71	1.27	2.58E-04
192	544	11.89	2.86E-08	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	3.66	1.25	2.58E-04
177	1498	3.35	1.96E-05	CHICHI\TCU059-E.AT2	CHICHI\TCU059-N.AT2	3.53	1.21	2.78E-04
197	729	5.47	2.02E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	3.53	1.21	2.98E-04
190	1141	2.99	3.19E-08	DINAR\DIN090.AT2	DINAR\DIN180.AT2	3.45	1.18	2.98E-04
117	161	4.29	2.77E-06	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	3.43	1.17	3.01E-04
126	779	1.62	1.20E-06	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	3.43	1.17	3.02E-04
191	827	9.38	1.32E-05	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	3.41	1.17	3.15E-04
142	458	4.89	2.91E-08	MORGAN\G04270.AT2	MORGAN\G04360.AT2	3.38	1.15	3.15E-04
99	1208	3.94	3.50E-05	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	3.35	1.14	3.50E-04
165	1519	7.26	4.35E-06	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	3.23	1.10	3.55E-04
168	1052	2.98	2.88E-08	NORTHR\PKC090.AT2	NORTHR\PKC360.AT2	3.20	1.09	3.55E-04
55	549	2.40	4.80E-05	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	3.18	1.08	4.03E-04
135	1549	2.28	1.56E-05	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	3.16	1.08	4.18E-04
189	1202	2.90	5.13E-06	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	3.15	1.08	4.23E-04
96	165	2.46	7.31E-06	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	3.15	1.07	4.31E-04
199	1198	4.60	2.84E-06	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	3.13	1.07	4.34E-04
200	1547	4.48	7.57E-08	CHICHI\TCU123-E.AT2	CHICHI\TCU123-N.AT2	3.08	1.05	4.34E-04
195	1203	3.50	2.91E-08	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	3.02	1.03	4.34E-04
150	1013	2.28	5.65E-07	NORTHR\LDM064.AT2	NORTHR\LDM334.AT2	2.98	1.02	4.34E-04
130	953	1.27	2.87E-08	NORTHR\MUL009.AT2	NORTHR\MUL279.AT2	2.95	1.01	4.34E-04
109	1495	3.38	1.40E-05	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	2.95	1.01	4.48E-04
111	1165	3.67	1.51E-05	KOCAELI\IZT180.AT2	KOCAELI\IZT090.AT2	2.92	1.00	4.63E-04
122	1493	4.41	8.45E-06	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	2.86	0.98	4.72E-04
137	1508	1.54	4.14E-05	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	2.85	0.97	5.13E-04
94	558	1.75	3.52E-06	CHALFANT.A\A-ZAK270.AT2	CHALFANT.A\A-ZAK360.AT2	2.85	0.97	5.17E-04
129	1086	1.90	5.19E-07	NORTHR\SYL090.AT2	NORTHR\SYL360.AT2	2.84	0.97	5.17E-04
132	722	5.71	3.39E-08	SUPER.B\B-KRN270.AT2	SUPER.B\B-KRN360.AT2	2.83	0.96	5.17E-04
145	719	7.52	2.14E-05	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	2.80	0.96	5.39E-04
136	1082	2.54	2.69E-08	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	2.79	0.95	5.39E-04
47	154	6.11	2.76E-05	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	2.77	0.94	5.66E-04

118	316	3.71	7.50E-08	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	2.76	0.94	5.66E-04
147	828	1.70	2.90E-07	CAPEMEND\PET000.AT2	CAPEMEND\PET090.AT2	2.73	0.93	5.67E-04
144	296	21.90	9.73E-08	ITALY\B-BAG000.AT2	ITALY\B-BAG270.AT2	2.72	0.93	5.67E-04
60	169	1.78	2.94E-05	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	2.69	0.92	5.96E-04
54	2625	11.44	6.32E-05	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	2.68	0.91	6.59E-04
42	238	8.14	1.05E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	2.68	0.91	6.70E-04
66	1500	3.01	4.21E-05	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	2.64	0.90	7.12E-04
104	1519	4.72	7.89E-08	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	2.59	0.89	7.12E-04
174	1503	1.34	1.28E-07	CHICHI\TCU065-E.AT2	CHICHI\TCU065-N.AT2	2.58	0.88	7.12E-04
140	1004	1.56	7.46E-08	NORTHR\SPV270.AT2	NORTHR\SPV360.AT2	2.57	0.88	7.12E-04
103	1545	2.70	1.34E-05	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	2.55	0.87	7.26E-04
134	642	5.97	2.91E-08	WHITTIER.A\A-W70000.AT2	WHITTIER.A\A-W70270.AT2	2.55	0.87	7.26E-04
198	2114	2.36	7.54E-08	DENALI\PS10-047.AT2	DENALI\PS10-317.AT2	2.50	0.85	7.26E-04
124	729	3.66	1.58E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	2.49	0.85	7.41E-04
69	1158	1.41	1.31E-05	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	2.44	0.83	7.55E-04
101	3468	11.86	4.95E-06	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	2.43	0.83	7.59E-04
71	1141	1.25	7.30E-07	DINAR\DIN090.AT2	DINAR\DIN180.AT2	2.42	0.83	7.60E-04
68	1496	2.45	9.12E-06	CHICHI\TCU056-E.AT2	CHICHI\TCU056-N.AT2	2.40	0.82	7.69E-04
146	285	5.04	4.78E-06	ITALY\A-BAG000.AT2	ITALY\A-BAG270.AT2	2.39	0.81	7.74E-04
170	668	7.92	2.90E-08	WHITTIER.A\A-NOR090.AT2	WHITTIER.A\A-NOR360.AT2	2.38	0.81	7.74E-04
116	1496	3.89	7.44E-07	CHICHI\TCU056-E.AT2	CHICHI\TCU056-N.AT2	2.31	0.79	7.75E-04
83	1511	1.45	2.41E-06	CHICHI\TCU076-E.AT2	CHICHI\TCU076-N.AT2	2.30	0.79	7.77E-04
113	728	2.98	1.41E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	2.30	0.78	7.91E-04
160	1083	4.47	3.44E-08	NORTHR\GLE170.AT2	NORTHR\GLE260.AT2	2.29	0.78	7.91E-04
148	527	3.41	1.22E-07	PALMSPR\MVH045.AT2	PALMSPR\MVH135.AT2	2.27	0.77	7.92E-04
92	988	2.60	7.14E-08	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	2.24	0.77	7.92E-04
90	502	4.50	4.41E-05	MTLEWIS\HVR000.AT2	MTLEWIS\HVR090.AT2	2.22	0.76	8.36E-04
110	2661	5.47	8.24E-06	CHICHI.03\TCU138N.AT2	CHICHI.03\TCU138W.AT2	2.20	0.75	8.44E-04
107	1510	2.89	7.51E-08	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	2.19	0.75	8.44E-04
120	827	6.25	1.69E-05	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	2.18	0.74	8.61E-04
97	802	2.36	1.05E-05	LOMAP\STG000.AT2	LOMAP\STG090.AT2	2.12	0.72	8.71E-04
102	721	3.35	5.36E-06	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	2.09	0.71	8.77E-04
171	2654	10.64	1.04E-06	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	2.08	0.71	8.78E-04
151	1182	1.93	6.63E-06	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	2.08	0.71	8.84E-04
64	1495	2.14	3.69E-05	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	2.06	0.70	9.21E-04
85	158	2.41	2.06E-05	IMPVALL.H\H-AEP045.AT2	IMPVALL.H\H-AEP315.AT2	2.06	0.70	9.42E-04
44	1511	0.95	1.52E-04	CHICHI\TCU076-E.AT2	CHICHI\TCU076-N.AT2	2.02	0.69	1.09E-03
119	1202	1.93	8.82E-06	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	1.95	0.67	1.10E-03
193	182	2.55	2.92E-08	IMPVALL.H\H-E07140.AT2	IMPVALL.H\H-E07230.AT2	1.93	0.66	1.10E-03
91	828	1.09	1.03E-06	CAPEMEND\PET000.AT2	CAPEMEND\PET090.AT2	1.93	0.66	1.10E-03
78	1086	1.19	3.30E-05	NORTHR\SYL090.AT2	NORTHR\SYL360.AT2	1.93	0.66	1.14E-03

121	544	7.93	3.06E-06	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	1.92	0.65	1.14E-03
82	1549	1.44	2.71E-05	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	1.92	0.65	1.17E-03
9	154	3.86	1.07E-04	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	1.87	0.64	1.27E-03
76	322	2.03	3.66E-05	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	1.83	0.62	1.31E-03
125	1198	3.08	7.72E-08	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	1.81	0.62	1.31E-03
61	1510	1.84	9.35E-06	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	1.76	0.60	1.32E-03
123	1203	2.34	6.75E-06	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	1.74	0.59	1.33E-03
27	1165	1.51	6.19E-05	KOCAELI\IZT180.AT2	KOCAELI\IZT090.AT2	1.72	0.59	1.39E-03
88	719	4.80	4.03E-05	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	1.71	0.58	1.43E-03
16	2625	7.34	2.39E-04	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	1.62	0.55	1.67E-03
108	2654	6.96	7.50E-08	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	1.59	0.54	1.67E-03
43	1549	0.94	1.73E-04	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	1.54	0.52	1.84E-03
11	458	1.28	6.25E-05	MORGAN\G04270.AT2	MORGAN\G04360.AT2	1.51	0.51	1.90E-03
81	642	3.76	2.73E-07	WHITTIER.A\A-W70000.AT2	WHITTIER.A\A-W70270.AT2	1.47	0.50	1.90E-03
70	161	2.69	2.72E-06	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	1.46	0.50	1.91E-03
79	302	5.62	4.32E-06	ITALY\B-VLT000.AT2	ITALY\B-VLT270.AT2	1.42	0.48	1.91E-03
53	802	1.51	3.85E-05	LOMAP\STG000.AT2	LOMAP\STG090.AT2	1.40	0.48	1.95E-03
7	368	0.45	5.61E-05	COALINGA.H\H-PVY045.AT2	COALINGA.H\H-PVY135.AT2	1.40	0.48	2.01E-03
52	2893	3.98	5.94E-05	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	1.38	0.47	2.06E-03
196	1492	1.70	2.83E-08	CHICHI\TCU052-E.AT2	CHICHI\TCU052-N.AT2	1.30	0.44	2.06E-03
73	544	4.95	1.70E-07	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	1.28	0.44	2.06E-03
58	1519	3.01	9.23E-06	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	1.25	0.43	2.07E-03
49	983	0.56	1.15E-05	NORTHR\JGB022.AT2	NORTHR\JGB292.AT2	1.24	0.42	2.09E-03
4	1184	1.78	1.46E-04	CHICHI\CHY010-N.AT2	CHICHI\CHY010-W.AT2	1.18	0.40	2.23E-03
127	97	7.58	2.47E-05	PTMUGU\PHN180.AT2	PTMUGU\PHN270.AT2	1.18	0.40	2.26E-03
186	1509	1.47	1.74E-07	CHICHI\TCU074-E.AT2	CHICHI\TCU074-N.AT2	1.16	0.40	2.26E-03
87	296	13.96	1.27E-05	ITALY\B-BAG000.AT2	ITALY\B-BAG270.AT2	1.11	0.38	2.27E-03
67	1490	2.96	1.80E-05	CHICHI\TCU050-E.AT2	CHICHI\TCU050-N.AT2	1.10	0.38	2.29E-03
45	1082	1.05	1.18E-06	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	1.09	0.37	2.29E-03
75	729	2.28	2.48E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	1.09	0.37	2.31E-03
51	719	3.10	7.75E-05	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	1.08	0.37	2.39E-03
32	544	3.25	1.66E-05	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	1.04	0.36	2.41E-03
59	1521	1.80	6.27E-05	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	1.03	0.35	2.47E-03
72	827	3.90	5.62E-06	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	1.02	0.35	2.48E-03
84	1508	0.97	3.66E-05	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	1.02	0.35	2.51E-03
57	721	2.13	6.96E-06	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	1.00	0.34	2.52E-03
40	1086	0.78	3.44E-05	NORTHR\SYL090.AT2	NORTHR\SYL360.AT2	0.99	0.34	2.55E-03
77	779	1.01	2.49E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	0.98	0.34	2.58E-03
89	285	3.22	3.14E-05	ITALY\A-BAG000.AT2	ITALY\A-BAG270.AT2	0.98	0.33	2.61E-03
65	728	1.88	4.96E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	0.98	0.33	2.66E-03
93	1182	1.24	5.36E-05	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	0.98	0.33	2.71E-03

8	158	0.99	2.88E-05	IMPVALL.H\H-AEP045.AT2	IMPVALL.H\H-AEP315.AT2	0.98	0.33	2.74E-03
37	322	1.34	8.94E-05	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	0.96	0.33	2.83E-03
74	1493	2.75	2.46E-05	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	0.96	0.33	2.86E-03
56	3468	7.57	2.54E-05	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	0.95	0.32	2.88E-03
21	1521	1.16	1.94E-04	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	0.94	0.32	3.08E-03
18	549	1.54	2.24E-05	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	0.93	0.32	3.10E-03
30	316	1.52	6.79E-05	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	0.93	0.32	3.17E-03
25	1495	1.39	1.00E-04	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	0.93	0.32	3.27E-03
63	1494	2.02	8.35E-06	CHICHI\TCU054-E.AT2	CHICHI\TCU054-N.AT2	0.92	0.31	3.27E-03
22	169	1.15	1.75E-04	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	0.91	0.31	3.45E-03
41	302	3.69	4.10E-05	ITALY\B-VLT000.AT2	ITALY\B-VLT270.AT2	0.88	0.30	3.49E-03
14	960	0.78	3.47E-05	NORTHR\LOS000.AT2	NORTHR\LOS270.AT2	0.87	0.30	3.52E-03
48	1004	0.64	4.24E-05	NORTHR\SPV270.AT2	NORTHR\SPV360.AT2	0.85	0.29	3.57E-03
13	2893	2.54	2.14E-04	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	0.85	0.29	3.78E-03
20	1545	1.11	7.98E-05	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	0.84	0.29	3.86E-03
29	161	1.76	2.07E-04	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	0.83	0.28	4.07E-03
50	296	9.03	7.11E-06	ITALY\B-BAG000.AT2	ITALY\B-BAG270.AT2	0.82	0.28	4.07E-03
6	1549	0.59	4.78E-04	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	0.82	0.28	4.55E-03
62	2654	4.41	2.28E-05	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	0.82	0.28	4.58E-03
17	1208	1.62	2.41E-04	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	0.81	0.28	4.82E-03
46	1508	0.63	8.43E-05	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	0.80	0.27	4.90E-03
31	827	2.56	9.88E-06	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	0.76	0.26	4.91E-03
23	1510	1.19	1.60E-04	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	0.76	0.26	5.07E-03
35	729	1.50	1.39E-04	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	0.75	0.26	5.21E-03
36	1198	1.26	3.91E-05	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	0.74	0.25	5.25E-03
19	721	1.37	3.30E-05	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	0.73	0.25	5.28E-03
12	719	1.97	1.53E-04	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	0.73	0.25	5.43E-03
5	642	1.54	5.03E-07	WHITTIER.A\A-W70000.AT2	WHITTIER.A\A-W70270.AT2	0.73	0.25	5.43E-03
33	1493	1.81	1.99E-04	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	0.72	0.25	5.63E-03
39	779	0.67	6.54E-06	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	0.72	0.24	5.64E-03
10	1004	0.41	1.19E-04	NORTHR\SPV270.AT2	NORTHR\SPV360.AT2	0.71	0.24	5.76E-03
15	802	0.97	2.29E-04	LOMAP\STG000.AT2	LOMAP\STG090.AT2	0.69	0.24	5.99E-03
34	1203	0.96	8.11E-05	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	0.68	0.23	6.07E-03
28	728	1.22	3.98E-04	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	0.68	0.23	6.47E-03
3	3470	2.82	2.01E-04	CHICHI.06\TCU072N.AT2	CHICHI.06\TCU072E.AT2	0.67	0.23	6.67E-03
38	170	1.26	6.21E-06	IMPVALL.H\H-ECC002.AT2	IMPVALL.H\H-ECC092.AT2	0.66	0.23	6.67E-03
24	2654	2.86	1.27E-04	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	0.63	0.22	6.80E-03
26	1498	0.90	1.24E-04	CHICHI\TCU059-E.AT2	CHICHI\TCU059-N.AT2	0.63	0.21	6.93E-03
2	1113	1.62	5.52E-04	KOBE\OSA000.AT2	KOBE\OSA090.AT2	0.57	0.20	7.48E-03
1	170	0.78	1.38E-05	IMPVALL.H\H-ECC002.AT2	IMPVALL.H\H-ECC092.AT2	0.56	0.19	7.49E-03

Table C3. CSS at Orange County site and resulting EDPs (maximum pier drift ratio among three piers) of the 4-span bridge

Index	RSN	S.F.	Rate	H1	H2	EDP (%)	Cum. Rate
176	2661	8.33	2.93E-08	CHICHI.03\TCU138N.AT2	CHICHI.03\TCU138W.AT2	8.47	2.93E-08
196	1492	1.70	2.83E-08	CHICHI\TCU052-E.AT2	CHICHI\TCU052-N.AT2	7.80	5.76E-08
170	668	7.92	2.90E-08	WHITTIER.A\A-NOR090.AT2	WHITTIER.A\A-NOR360.AT2	6.40	8.67E-08
197	729	5.47	2.02E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	6.20	2.03E-05
188	316	5.58	1.77E-06	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	6.16	2.20E-05
187	161	6.46	8.91E-07	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	6.01	2.29E-05
162	721	5.15	2.33E-05	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	5.90	2.33E-05
156	568	2.54	3.34E-08	SANSALV\GIC090.AT2	SANSALV\GIC180.AT2	5.65	4.62E-05
171	2654	10.64	1.04E-06	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	5.61	4.73E-05
180	728	4.52	2.20E-07	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	5.54	4.75E-05
152	558	2.73	7.05E-06	CHALFANT.A\A-ZAK270.AT2	CHALFANT.A\A-ZAK360.AT2	5.44	5.45E-05
173	1495	5.16	8.88E-06	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	5.41	6.34E-05
135	1549	2.28	1.56E-05	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	5.21	7.90E-05
184	1496	5.88	7.58E-08	CHICHI\TCU056-E.AT2	CHICHI\TCU056-N.AT2	5.16	7.91E-05
164	1545	4.15	7.86E-06	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	4.92	8.69E-05
186	1509	1.47	1.74E-07	CHICHI\TCU074-E.AT2	CHICHI\TCU074-N.AT2	4.91	8.71E-05
169	1510	4.43	1.15E-05	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	4.83	9.86E-05
195	1203	3.50	2.91E-08	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	4.82	9.86E-05
166	1521	4.33	1.75E-06	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	4.69	1.00E-04
147	828	1.70	2.90E-07	CAPEMEND\PET000.AT2	CAPEMEND\PET090.AT2	4.68	1.01E-04
191	827	9.38	1.32E-05	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	4.67	1.14E-04
132	722	5.71	3.39E-08	SUPER.B\B-KRN270.AT2	SUPER.B\B-KRN360.AT2	4.66	1.14E-04
167	169	4.30	1.33E-07	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	4.65	1.14E-04
193	182	2.55	2.92E-08	IMPVALL.H\H-E07140.AT2	IMPVALL.H\H-E07230.AT2	4.63	1.14E-04
130	953	1.27	2.87E-08	NORTHR\MUL009.AT2	NORTHR\MUL279.AT2	4.61	1.14E-04
200	1547	4.48	7.57E-08	CHICHI\TCU123-E.AT2	CHICHI\TCU123-N.AT2	4.60	1.14E-04
172	1494	4.88	7.54E-08	CHICHI\TCU054-E.AT2	CHICHI\TCU054-N.AT2	4.58	1.14E-04
192	544	11.89	2.86E-08	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	4.54	1.14E-04
182	1490	7.12	2.88E-08	CHICHI\TCU050-E.AT2	CHICHI\TCU050-N.AT2	4.45	1.14E-04
133	238	19.80	1.72E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	4.38	1.32E-04
181	1500	7.24	2.87E-08	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	4.33	1.32E-04
144	296	21.90	9.73E-08	ITALY\B-BAG000.AT2	ITALY\B-BAG270.AT2	4.30	1.32E-04
194	1493	6.60	2.86E-08	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	4.27	1.32E-04
155	802	3.66	2.93E-08	LOMAP\STG000.AT2	LOMAP\STG090.AT2	4.24	1.32E-04
189	1202	2.90	5.13E-06	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	4.19	1.37E-04
183	768	4.94	2.01E-07	LOMAP\G04000.AT2	LOMAP\G04090.AT2	4.09	1.37E-04
110	2661	5.47	8.24E-06	CHICHI.03\TCU138N.AT2	CHICHI.03\TCU138W.AT2	4.08	1.45E-04
175	1534	4.39	6.22E-06	CHICHI\TCU107-E.AT2	CHICHI\TCU107-N.AT2	4.05	1.52E-04

123	1203	2.34	6.75E-06	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	3.86	1.58E-04
179	212	12.19	3.48E-08	LIVERMOR\A-DVD156.AT2	LIVERMOR\A-DVD246.AT2	3.84	1.58E-04
117	161	4.29	2.77E-06	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	3.77	1.61E-04
124	729	3.66	1.58E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	3.75	1.77E-04
102	721	3.35	5.36E-06	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	3.72	1.82E-04
101	3468	11.86	4.95E-06	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	3.71	1.87E-04
131	1184	6.92	8.88E-07	CHICHI\CHY010-N.AT2	CHICHI\CHY010-W.AT2	3.64	1.88E-04
201	322	4.87	3.49E-08	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	3.62	1.88E-04
129	1086	1.90	5.19E-07	NORTHR\SYL090.AT2	NORTHR\SYL360.AT2	3.62	1.89E-04
94	558	1.75	3.52E-06	CHALFANT.A\A-ZAK270.AT2	CHALFANT.A\A-ZAK360.AT2	3.56	1.92E-04
151	1182	1.93	6.63E-06	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	3.55	1.99E-04
137	1508	1.54	4.14E-05	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	3.52	2.40E-04
174	1503	1.34	1.28E-07	CHICHI\TCU065-E.AT2	CHICHI\TCU065-N.AT2	3.51	2.40E-04
163	159	5.54	1.77E-06	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	3.48	2.42E-04
153	960	2.96	3.49E-08	NORTHR\LOS000.AT2	NORTHR\LOS270.AT2	3.40	2.42E-04
143	983	1.36	3.49E-08	NORTHR\JGB022.AT2	NORTHR\JGB292.AT2	3.35	2.42E-04
158	1208	6.10	1.45E-05	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	3.35	2.57E-04
178	1165	5.58	7.85E-06	KOCAELI\IZT180.AT2	KOCAELI\IZT090.AT2	3.33	2.65E-04
142	458	4.89	2.91E-08	MORGAN\G04270.AT2	MORGAN\G04360.AT2	3.27	2.65E-04
109	1495	3.38	1.40E-05	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	3.23	2.79E-04
149	988	4.05	3.31E-08	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	3.22	2.79E-04
190	1141	2.99	3.19E-08	DINAR\DIN090.AT2	DINAR\DIN180.AT2	3.16	2.79E-04
108	2654	6.96	7.50E-08	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	3.14	2.79E-04
199	1198	4.60	2.84E-06	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	3.10	2.81E-04
140	1004	1.56	7.46E-08	NORTHR\SPV270.AT2	NORTHR\SPV360.AT2	3.07	2.82E-04
177	1498	3.35	1.96E-05	CHICHI\TCU059-E.AT2	CHICHI\TCU059-N.AT2	3.05	3.01E-04
134	642	5.97	2.91E-08	WHITTIER.A\A-W70000.AT2	WHITTIER.A\A-W70270.AT2	2.95	3.01E-04
168	1052	2.98	2.88E-08	NORTHR\PKC090.AT2	NORTHR\PKC360.AT2	2.95	3.01E-04
120	827	6.25	1.69E-05	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	2.90	3.18E-04
157	2625	27.66	1.25E-05	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	2.89	3.31E-04
139	154	14.83	7.51E-08	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	2.89	3.31E-04
159	549	5.81	3.97E-08	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	2.80	3.31E-04
115	768	3.27	8.63E-06	LOMAP\G04000.AT2	LOMAP\G04090.AT2	2.79	3.39E-04
114	1500	4.78	4.93E-06	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	2.78	3.44E-04
165	1519	7.26	4.35E-06	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	2.70	3.49E-04
154	165	3.82	1.61E-06	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	2.69	3.50E-04
113	728	2.98	1.41E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	2.66	3.64E-04
126	779	1.62	1.20E-06	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	2.65	3.65E-04
125	1198	3.08	7.72E-08	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	2.59	3.66E-04
91	828	1.09	1.03E-06	CAPEMEND\PET000.AT2	CAPEMEND\PET090.AT2	2.52	3.67E-04
122	1493	4.41	8.45E-06	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	2.47	3.75E-04

93	1182	1.24	5.36E-05	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	2.43	4.29E-04
118	316	3.71	7.50E-08	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	2.42	4.29E-04
106	169	2.80	5.40E-06	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	2.42	4.34E-04
128	1039	5.41	2.24E-07	NORTHR\MRP090.AT2	NORTHR\MRP180.AT2	2.40	4.34E-04
105	1521	2.82	2.61E-05	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	2.33	4.60E-04
185	1158	3.40	2.88E-08	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	2.31	4.60E-04
148	527	3.41	1.22E-07	PALMSPR\MVH045.AT2	PALMSPR\MVH135.AT2	2.27	4.61E-04
127	97	7.58	2.47E-05	PTMUGU\PHN180.AT2	PTMUGU\PHN270.AT2	2.26	4.85E-04
150	1013	2.28	5.65E-07	NORTHR\LDM064.AT2	NORTHR\LDM334.AT2	2.17	4.86E-04
146	285	5.04	4.78E-06	ITALY\A-BAG000.AT2	ITALY\A-BAG270.AT2	2.17	4.91E-04
141	723	1.88	2.88E-08	SUPER.B\B-PTS225.AT2	SUPER.B\B-PTS315.AT2	2.16	4.91E-04
75	729	2.28	2.48E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	2.13	5.15E-04
96	165	2.46	7.31E-06	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	2.12	5.23E-04
78	1086	1.19	3.30E-05	NORTHR\SYL090.AT2	NORTHR\SYL360.AT2	2.12	5.56E-04
95	960	1.91	1.37E-05	NORTHR\LOS000.AT2	NORTHR\LOS270.AT2	2.12	5.69E-04
138	158	3.81	3.48E-08	IMPVALL.H\H-AEP045.AT2	IMPVALL.H\H-AEP315.AT2	2.05	5.69E-04
145	719	7.52	2.14E-05	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	2.02	5.91E-04
111	1165	3.67	1.51E-05	KOCAELI\IZT180.AT2	KOCAELI\IZT090.AT2	2.02	6.06E-04
80	1184	4.34	1.86E-05	CHICHI\CHY010-N.AT2	CHICHI\CHY010-W.AT2	2.01	6.25E-04
87	296	13.96	1.27E-05	ITALY\B-BAG000.AT2	ITALY\B-BAG270.AT2	2.00	6.37E-04
99	1208	3.94	3.50E-05	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	1.96	6.72E-04
116	1496	3.89	7.44E-07	CHICHI\TCU056-E.AT2	CHICHI\TCU056-N.AT2	1.93	6.73E-04
98	2625	17.88	1.23E-05	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	1.90	6.85E-04
64	1495	2.14	3.69E-05	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	1.87	7.22E-04
82	1549	1.44	2.71E-05	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	1.86	7.49E-04
77	779	1.01	2.49E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	1.86	7.74E-04
57	721	2.13	6.96E-06	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	1.86	7.81E-04
107	1510	2.89	7.51E-08	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	1.84	7.81E-04
121	544	7.93	3.06E-06	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	1.84	7.84E-04
76	322	2.03	3.66E-05	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	1.83	8.21E-04
81	642	3.76	2.73E-07	WHITTIER.A\A-W70000.AT2	WHITTIER.A\A-W70270.AT2	1.81	8.21E-04
100	549	3.76	7.38E-08	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	1.80	8.21E-04
67	1490	2.96	1.80E-05	CHICHI\TCU050-E.AT2	CHICHI\TCU050-N.AT2	1.77	8.39E-04
136	1082	2.54	2.69E-08	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	1.75	8.39E-04
70	161	2.69	2.72E-06	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	1.75	8.42E-04
74	1493	2.75	2.46E-05	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	1.73	8.66E-04
112	212	8.03	2.62E-05	LIVERMOR\A-DVD156.AT2	LIVERMOR\A-DVD246.AT2	1.72	8.93E-04
72	827	3.90	5.62E-06	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	1.71	8.98E-04
161	150	3.48	2.91E-08	COYOTELK\G06230.AT2	COYOTELK\G06320.AT2	1.71	8.98E-04
60	169	1.78	2.94E-05	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	1.70	9.28E-04
66	1500	3.01	4.21E-05	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	1.60	9.70E-04

104	1519	4.72	7.89E-08	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	1.58	9.70E-04
61	1510	1.84	9.35E-06	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	1.54	9.79E-04
119	1202	1.93	8.82E-06	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	1.48	9.88E-04
103	1545	2.70	1.34E-05	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	1.48	1.00E-03
89	285	3.22	3.14E-05	ITALY\A-BAG000.AT2	ITALY\A-BAG270.AT2	1.46	1.03E-03
86	154	9.40	1.53E-05	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	1.43	1.05E-03
42	238	8.14	1.05E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	1.41	1.06E-03
36	1198	1.26	3.91E-05	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	1.40	1.10E-03
84	1508	0.97	3.66E-05	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	1.37	1.13E-03
37	322	1.34	8.94E-05	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	1.34	1.22E-03
92	988	2.60	7.14E-08	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	1.34	1.22E-03
97	802	2.36	1.05E-05	LOMAP\STG000.AT2	LOMAP\STG090.AT2	1.28	1.23E-03
40	1086	0.78	3.44E-05	NORTHR\SYL090.AT2	NORTHR\SYL360.AT2	1.27	1.27E-03
47	154	6.11	2.76E-05	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	1.26	1.30E-03
43	1549	0.94	1.73E-04	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	1.26	1.47E-03
14	960	0.78	3.47E-05	NORTHR\LOS000.AT2	NORTHR\LOS270.AT2	1.24	1.50E-03
54	2625	11.44	6.32E-05	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	1.24	1.57E-03
160	1083	4.47	3.44E-08	NORTHR\GLE170.AT2	NORTHR\GLE260.AT2	1.18	1.57E-03
62	2654	4.41	2.28E-05	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	1.17	1.59E-03
85	158	2.41	2.06E-05	IMPVALL.H\H-AEP045.AT2	IMPVALL.H\H-AEP315.AT2	1.16	1.61E-03
56	3468	7.57	2.54E-05	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	1.14	1.64E-03
39	779	0.67	6.54E-06	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	1.13	1.64E-03
29	161	1.76	2.07E-04	IMPVALL.H\H-BRA225.AT2	IMPVALL.H\H-BRA315.AT2	1.11	1.85E-03
83	1511	1.45	2.41E-06	CHICHI\TCU076-E.AT2	CHICHI\TCU076-N.AT2	1.10	1.85E-03
63	1494	2.02	8.35E-06	CHICHI\TCU054-E.AT2	CHICHI\TCU054-N.AT2	1.08	1.86E-03
59	1521	1.80	6.27E-05	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	1.08	1.92E-03
33	1493	1.81	1.99E-04	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	1.07	2.12E-03
198	2114	2.36	7.54E-08	DENALI\PS10-047.AT2	DENALI\PS10-317.AT2	1.05	2.12E-03
90	502	4.50	4.41E-05	MTLEWIS\HVR000.AT2	MTLEWIS\HVR090.AT2	1.03	2.17E-03
48	1004	0.64	4.24E-05	NORTHR\SPV270.AT2	NORTHR\SPV360.AT2	1.00	2.21E-03
65	728	1.88	4.96E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	0.99	2.26E-03
25	1495	1.39	1.00E-04	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	0.96	2.36E-03
58	1519	3.01	9.23E-06	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	0.96	2.37E-03
55	549	2.40	4.80E-05	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	0.93	2.42E-03
50	296	9.03	7.11E-06	ITALY\B-BAG000.AT2	ITALY\B-BAG270.AT2	0.91	2.42E-03
79	302	5.62	4.32E-06	ITALY\B-VLT000.AT2	ITALY\B-VLT270.AT2	0.91	2.43E-03
53	802	1.51	3.85E-05	LOMAP\STG000.AT2	LOMAP\STG090.AT2	0.90	2.47E-03
68	1496	2.45	9.12E-06	CHICHI\TCU056-E.AT2	CHICHI\TCU056-N.AT2	0.89	2.47E-03
23	1510	1.19	1.60E-04	CHICHI\TCU075-E.AT2	CHICHI\TCU075-N.AT2	0.88	2.63E-03
6	1549	0.59	4.78E-04	CHICHI\TCU129-E.AT2	CHICHI\TCU129-N.AT2	0.87	3.11E-03
88	719	4.80	4.03E-05	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	0.86	3.15E-03

5	642	1.54	5.03E-07	WHITTIER.A\A-W70000.AT2	WHITTIER.A\A-W70270.AT2	0.83	3.15E-03
45	1082	1.05	1.18E-06	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	0.83	3.15E-03
38	170	1.26	6.21E-06	IMPVALL.H\H-ECC002.AT2	IMPVALL.H\H-ECC092.AT2	0.82	3.16E-03
73	544	4.95	1.70E-07	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	0.77	3.16E-03
30	316	1.52	6.79E-05	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	0.73	3.23E-03
49	983	0.56	1.15E-05	NORTHR\JGB022.AT2	NORTHR\JGB292.AT2	0.73	3.24E-03
9	154	3.86	1.07E-04	COYOTELK\SJB213.AT2	COYOTELK\SJB303.AT2	0.71	3.35E-03
22	169	1.15	1.75E-04	IMPVALL.H\H-DLT262.AT2	IMPVALL.H\H-DLT352.AT2	0.69	3.52E-03
44	1511	0.95	1.52E-04	CHICHI\TCU076-E.AT2	CHICHI\TCU076-N.AT2	0.65	3.67E-03
69	1158	1.41	1.31E-05	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	0.64	3.69E-03
27	1165	1.51	6.19E-05	KOCAELI\IZT180.AT2	KOCAELI\IZT090.AT2	0.64	3.75E-03
19	721	1.37	3.30E-05	SUPER.B\B-ICC000.AT2	SUPER.B\B-ICC090.AT2	0.63	3.78E-03
10	1004	0.41	1.19E-04	NORTHR\SPV270.AT2	NORTHR\SPV360.AT2	0.63	3.90E-03
4	1184	1.78	1.46E-04	CHICHI\CHY010-N.AT2	CHICHI\CHY010-W.AT2	0.62	4.05E-03
71	1141	1.25	7.30E-07	DINAR\DIN090.AT2	DINAR\DIN180.AT2	0.62	4.05E-03
41	302	3.69	4.10E-05	ITALY\B-VLT000.AT2	ITALY\B-VLT270.AT2	0.62	4.09E-03
46	1508	0.63	8.43E-05	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	0.60	4.17E-03
16	2625	7.34	2.39E-04	CHICHI.03\TCU074N.AT2	CHICHI.03\TCU074E.AT2	0.59	4.41E-03
28	728	1.22	3.98E-04	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	0.58	4.81E-03
51	719	3.10	7.75E-05	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	0.57	4.89E-03
3	3470	2.82	2.01E-04	CHICHI.06\TCU072N.AT2	CHICHI.06\TCU072E.AT2	0.57	5.09E-03
21	1521	1.16	1.94E-04	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	0.56	5.28E-03
18	549	1.54	2.24E-05	CHALFANT.A\A-LAD180.AT2	CHALFANT.A\A-LAD270.AT2	0.55	5.30E-03
34	1203	0.96	8.11E-05	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	0.53	5.39E-03
35	729	1.50	1.39E-04	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	0.53	5.52E-03
15	802	0.97	2.29E-04	LOMAP\STG000.AT2	LOMAP\STG090.AT2	0.49	5.75E-03
24	2654	2.86	1.27E-04	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	0.49	5.88E-03
52	2893	3.98	5.94E-05	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	0.47	5.94E-03
32	544	3.25	1.66E-05	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	0.47	5.96E-03
11	458	1.28	6.25E-05	MORGAN\G04270.AT2	MORGAN\G04360.AT2	0.45	6.02E-03
7	368	0.45	5.61E-05	COALINGA.H\H-PVY045.AT2	COALINGA.H\H-PVY135.AT2	0.42	6.08E-03
17	1208	1.62	2.41E-04	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	0.41	6.32E-03
2	1113	1.62	5.52E-04	KOBE\OSA000.AT2	KOBE\OSA090.AT2	0.40	6.87E-03
31	827	2.56	9.88E-06	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	0.38	6.88E-03
12	719	1.97	1.53E-04	SUPER.B\B-BRA225.AT2	SUPER.B\B-BRA315.AT2	0.38	7.03E-03
1	170	0.78	1.38E-05	IMPVALL.H\H-ECC002.AT2	IMPVALL.H\H-ECC092.AT2	0.38	7.04E-03
8	158	0.99	2.88E-05	IMPVALL.H\H-AEP045.AT2	IMPVALL.H\H-AEP315.AT2	0.37	7.07E-03
20	1545	1.11	7.98E-05	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	0.35	7.15E-03
13	2893	2.54	2.14E-04	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	0.35	7.37E-03
26	1498	0.90	1.24E-04	CHICHI\TCU059-E.AT2	CHICHI\TCU059-N.AT2	0.34	7.49E-03

Table C4. CSS at San Jose site and resulting EDPs (maximum pier drift ratio among three piers) of the 4-span bridge

Index	RSN	S.F.	Rate	H1	H2	EDP (%)	Cum. Rate
181	2650	16.72	2.92E-08	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	27.39	2.92E-08
180	1108	6.32	3.19E-05	KOBE\KBU000.AT2	KOBE\KBU090.AT2	23.74	3.19E-05
169	1227	11.96	7.50E-08	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	22.48	3.20E-05
162	1546	9.77	2.93E-08	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	16.58	3.20E-05
191	1547	8.31	2.94E-08	CHICHI\TCU123-E.AT2	CHICHI\TCU123-N.AT2	15.74	3.21E-05
120	2650	11.10	4.53E-06	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	15.43	3.66E-05
177	1500	13.57	2.93E-08	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	14.56	3.66E-05
138	754	14.99	2.13E-05	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	13.65	5.79E-05
192	269	55.97	4.10E-06	VICT\HPB000.AT2	VICT\HPB270.AT2	13.31	6.20E-05
178	728	8.54	2.90E-08	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	13.23	6.20E-05
112	1227	7.88	1.92E-06	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	12.69	6.40E-05
157	1529	4.54	2.88E-08	CHICHI\TCU102-E.AT2	CHICHI\TCU102-N.AT2	12.52	6.40E-05
167	2654	19.75	7.52E-08	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	12.14	6.41E-05
193	322	9.12	3.94E-08	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	11.76	6.41E-05
153	1515	7.50	2.90E-08	CHICHI\TCU082-E.AT2	CHICHI\TCU082-N.AT2	11.68	6.41E-05
149	238	39.46	7.60E-08	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	11.40	6.42E-05
119	1108	4.19	1.24E-05	KOBE\KBU000.AT2	KOBE\KBU090.AT2	11.39	7.66E-05
188	1202	5.57	2.90E-08	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	11.23	7.67E-05
146	316	8.33	5.82E-06	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	11.18	8.25E-05
163	729	8.83	2.90E-08	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	11.11	8.25E-05
156	1531	11.47	2.80E-08	CHICHI\TCU104-E.AT2	CHICHI\TCU104-N.AT2	10.65	8.25E-05
152	1194	8.08	3.69E-07	CHICHI\CHY025-E.AT2	CHICHI\CHY025-N.AT2	10.52	8.29E-05
187	1509	2.85	2.91E-08	CHICHI\TCU074-E.AT2	CHICHI\TCU074-N.AT2	10.41	8.29E-05
189	1106	2.36	1.22E-05	KOBE\KJM000.AT2	KOBE\KJM090.AT2	10.31	9.52E-05
132	3468	28.43	2.64E-06	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	10.07	9.78E-05
190	1045	4.32	2.93E-08	NORTHR\WPI046.AT2	NORTHR\WPI316.AT2	9.88	9.78E-05
151	1497	11.57	1.32E-05	CHICHI\TCU057-E.AT2	CHICHI\TCU057-N.AT2	9.79	1.11E-04
150	779	3.42	4.38E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	9.59	1.55E-04
139	3473	6.80	1.31E-07	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	9.29	1.55E-04
179	447	31.98	2.91E-08	MORGAN\AGW240.AT2	MORGAN\AGW330.AT2	9.17	1.55E-04
171	1517	1.57	2.70E-05	CHICHI\TCU084-E.AT2	CHICHI\TCU084-N.AT2	9.03	1.82E-04
173	1203	6.00	2.24E-07	CHICHI\CHY036-E.AT2	CHICHI\CHY036-N.AT2	9.02	1.82E-04
165	864	6.91	5.19E-07	LANDERS\JOS000.AT2	LANDERS\JOS090.AT2	8.74	1.83E-04
194	1063	2.29	7.60E-08	NORTHR\RRS228.AT2	NORTHR\RRS318.AT2	8.68	1.83E-04
182	289	9.48	2.14E-07	ITALY\A-CTR000.AT2	ITALY\A-CTR270.AT2	8.43	1.83E-04
106	1546	6.40	1.03E-05	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	8.41	1.93E-04
130	1495	7.45	2.89E-08	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	8.34	1.93E-04
186	2461	10.20	3.30E-06	CHICHI.03\CHY028N.AT2	CHICHI.03\CHY028E.AT2	8.25	1.97E-04

176	1541	6.38	5.39E-08	CHICHI\TCU116-E.AT2	CHICHI\TCU116-N.AT2	7.87	1.97E-04
174	1532	14.66	2.80E-08	CHICHI\TCU105-E.AT2	CHICHI\TCU105-N.AT2	7.87	1.97E-04
136	1493	9.17	1.23E-07	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	7.74	1.97E-04
142	165	6.51	1.22E-07	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	7.68	1.97E-04
117	728	5.65	1.85E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	7.67	2.16E-04
144	1039	10.93	3.11E-07	NORTHR\MRP090.AT2	NORTHR\MRP180.AT2	7.67	2.16E-04
135	192	25.82	2.93E-08	IMPVALL.H\H-WSM090.AT2	IMPVALL.H\H-WSM180.AT2	7.66	2.16E-04
185	215	38.07	3.32E-08	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	7.65	2.16E-04
69	2650	7.10	1.71E-05	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	7.60	2.33E-04
128	322	6.11	5.35E-06	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	7.39	2.38E-04
116	1500	8.98	1.83E-05	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	7.38	2.57E-04
166	1101	3.40	1.80E-05	KOBE\AMA000.AT2	KOBE\AMA090.AT2	7.33	2.75E-04
175	988	8.58	3.14E-06	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	7.30	2.78E-04
111	2654	12.98	1.22E-07	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	7.21	2.78E-04
183	1244	4.29	2.93E-08	CHICHI\CHY101-E.AT2	CHICHI\CHY101-N.AT2	7.12	2.78E-04
158	544	18.91	8.56E-06	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	7.12	2.87E-04
147	1490	11.01	2.88E-08	CHICHI\TCU050-E.AT2	CHICHI\TCU050-N.AT2	7.10	2.87E-04
172	730	10.05	7.52E-08	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	6.99	2.87E-04
159	1512	5.75	2.93E-08	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	6.92	2.87E-04
160	1208	11.53	1.54E-06	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	6.89	2.88E-04
108	729	5.79	1.24E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	6.85	3.01E-04
84	754	9.64	1.49E-06	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	6.77	3.02E-04
184	1104	4.49	2.88E-08	KOBE\FKS000.AT2	KOBE\FKS090.AT2	6.68	3.02E-04
126	1202	3.72	1.54E-06	CHICHI\CHY035-E.AT2	CHICHI\CHY035-N.AT2	6.68	3.04E-04
141	755	7.38	7.51E-08	LOMAP\CYC195.AT2	LOMAP\CYC285.AT2	6.60	3.04E-04
170	1533	9.17	2.76E-06	CHICHI\TCU106-E.AT2	CHICHI\TCU106-N.AT2	6.46	3.07E-04
92	1545	4.55	4.03E-06	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	6.46	3.11E-04
161	1182	3.78	1.63E-06	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	6.39	3.12E-04
122	289	6.30	2.70E-05	ITALY\A-CTR000.AT2	ITALY\A-CTR270.AT2	6.37	3.39E-04
143	1530	8.33	1.38E-05	CHICHI\TCU103-E.AT2	CHICHI\TCU103-N.AT2	6.30	3.53E-04
91	238	25.55	1.01E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	6.27	3.63E-04
154	159	9.75	3.79E-05	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	6.18	4.01E-04
134	2893	16.06	2.90E-08	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	6.10	4.01E-04
155	1082	5.24	2.90E-08	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	6.08	4.01E-04
148	1519	12.13	7.53E-08	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	6.04	4.01E-04
63	1227	5.06	2.58E-05	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	6.02	4.27E-04
79	3468	18.19	4.17E-06	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	5.95	4.31E-04
101	1531	7.48	2.28E-05	CHICHI\TCU104-E.AT2	CHICHI\TCU104-N.AT2	5.90	4.54E-04
123	97	13.15	7.49E-08	PTMUGU\PHN180.AT2	PTMUGU\PHN270.AT2	5.90	4.54E-04
89	316	5.38	5.52E-05	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	5.79	5.09E-04
137	1158	4.93	3.45E-06	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	5.75	5.13E-04

97	1515	4.88	4.00E-07	CHICHI\TCU082-E.AT2	CHICHI\TCU082-N.AT2	5.75	5.13E-04
76	266	8.02	1.21E-07	VICT\CHI102.AT2	VICT\CHI192.AT2	5.72	5.13E-04
124	215	25.37	4.41E-06	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	5.44	5.18E-04
93	779	2.22	2.18E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	5.42	5.39E-04
118	447	21.19	1.68E-07	MORGAN\AGW240.AT2	MORGAN\AGW330.AT2	5.25	5.40E-04
115	1532	9.68	1.10E-05	CHICHI\TCU105-E.AT2	CHICHI\TCU105-N.AT2	5.24	5.50E-04
129	1063	1.54	4.28E-05	NORTHR\RRS228.AT2	NORTHR\RRS318.AT2	5.22	5.93E-04
121	1508	2.44	2.12E-06	CHICHI\TCU072-E.AT2	CHICHI\TCU072-N.AT2	5.16	5.95E-04
104	1527	7.83	3.01E-05	CHICHI\TCU100-E.AT2	CHICHI\TCU100-N.AT2	5.14	6.25E-04
168	821	3.75	2.90E-08	ERZINCAN\ERZ-NS.AT2	ERZINCAN\ERZ-EW.AT2	5.14	6.26E-04
95	1521	4.83	1.10E-05	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	5.11	6.36E-04
75	1495	4.75	1.68E-07	CHICHI\TCU055-E.AT2	CHICHI\TCU055-N.AT2	5.10	6.37E-04
103	1512	3.76	3.24E-05	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	5.09	6.69E-04
99	1499	8.32	2.15E-05	CHICHI\TCU060-E.AT2	CHICHI\TCU060-N.AT2	5.07	6.91E-04
125	2461	6.80	1.21E-07	CHICHI.03\CHY028N.AT2	CHICHI.03\CHY028E.AT2	5.03	6.91E-04
107	1193	4.24	3.30E-07	CHICHI\CHY024-E.AT2	CHICHI\CHY024-N.AT2	4.95	6.91E-04
102	544	12.34	1.24E-05	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	4.90	7.03E-04
85	3473	4.38	1.67E-05	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	4.82	7.20E-04
127	1045	2.88	8.11E-08	NORTHR\WPI046.AT2	NORTHR\WPI316.AT2	4.81	7.20E-04
83	1489	4.25	7.50E-08	CHICHI\TCU049-E.AT2	CHICHI\TCU049-N.AT2	4.71	7.20E-04
109	864	4.54	1.23E-07	LANDERS\JOS000.AT2	LANDERS\JOS090.AT2	4.61	7.20E-04
94	827	9.21	6.95E-06	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	4.48	7.27E-04
68	728	3.62	1.84E-05	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	4.33	7.46E-04
105	1182	2.47	2.78E-05	CHICHI\CHY006-N.AT2	CHICHI\CHY006-W.AT2	4.29	7.74E-04
145	1100	9.07	7.50E-08	KOBE\ABN000.AT2	KOBE\ABN090.AT2	4.17	7.74E-04
61	2654	8.34	8.90E-06	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	4.12	7.83E-04
113	1533	6.04	2.79E-05	CHICHI\TCU106-E.AT2	CHICHI\TCU106-N.AT2	4.08	8.10E-04
60	729	3.73	2.63E-05	SUPER.B\B-IVW090.AT2	SUPER.B\B-IVW360.AT2	3.95	8.37E-04
114	730	6.63	1.70E-07	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	3.94	8.37E-04
131	1551	5.30	1.38E-05	CHICHI\TCU138-N.AT2	CHICHI\TCU138-W.AT2	3.83	8.51E-04
98	159	6.35	2.64E-07	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	3.76	8.51E-04
87	1530	5.38	5.22E-06	CHICHI\TCU103-E.AT2	CHICHI\TCU103-N.AT2	3.73	8.56E-04
31	3468	11.83	1.74E-07	CHICHI.06\TCU067N.AT2	CHICHI.06\TCU067E.AT2	3.70	8.56E-04
90	1519	7.85	1.76E-06	CHICHI\TCU087-E.AT2	CHICHI\TCU087-N.AT2	3.67	8.58E-04
23	1227	3.33	1.66E-05	CHICHI\CHY074-E.AT2	CHICHI\CHY074-N.AT2	3.59	8.75E-04
39	754	6.25	1.04E-05	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	3.59	8.85E-04
66	1532	6.21	1.67E-06	CHICHI\TCU105-E.AT2	CHICHI\TCU105-N.AT2	3.58	8.87E-04
70	289	4.03	2.80E-05	ITALY\A-CTR000.AT2	ITALY\A-CTR270.AT2	3.50	9.15E-04
58	1546	4.12	3.71E-05	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	3.45	9.52E-04
35	192	10.76	4.15E-05	IMPVALL.H\H-WSM090.AT2	IMPVALL.H\H-WSM180.AT2	3.45	9.93E-04
82	1493	5.89	1.43E-05	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	3.43	1.01E-03

52	1515	3.15	1.31E-04	CHICHI\TCU082-E.AT2	CHICHI\TCU082-N.AT2	3.42	1.14E-03
86	165	4.20	5.66E-05	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	3.41	1.20E-03
42	755	3.08	3.12E-07	LOMAP\CYC195.AT2	LOMAP\CYC285.AT2	3.37	1.20E-03
67	1500	5.75	3.77E-05	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	3.36	1.23E-03
110	1101	2.23	3.14E-05	KOBE\AMA000.AT2	KOBE\AMA090.AT2	3.34	1.26E-03
100	1082	3.41	1.15E-05	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	3.26	1.28E-03
96	723	2.38	9.65E-06	SUPER.B\B-PTS225.AT2	SUPER.B\B-PTS315.AT2	3.19	1.29E-03
72	215	16.20	7.47E-05	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	3.12	1.36E-03
81	2893	10.30	6.90E-07	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	3.09	1.36E-03
164	297	15.05	7.60E-08	ITALY\B-BIS000.AT2	ITALY\B-BIS270.AT2	3.04	1.36E-03
59	1193	2.73	3.98E-05	CHICHI\CHY024-E.AT2	CHICHI\CHY024-N.AT2	3.02	1.40E-03
32	1176	2.55	1.74E-07	KOCAELI\YPT060.AT2	KOCAELI\YPT150.AT2	2.98	1.40E-03
78	1198	3.83	1.42E-05	CHICHI\CHY029-E.AT2	CHICHI\CHY029-N.AT2	2.87	1.42E-03
57	1208	4.86	1.44E-05	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	2.81	1.43E-03
40	3473	2.84	2.54E-05	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	2.79	1.46E-03
50	1521	3.12	1.29E-04	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	2.79	1.58E-03
53	159	4.10	2.78E-05	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	2.76	1.61E-03
71	97	8.40	2.03E-06	PTMUGU\PHN180.AT2	PTMUGU\PHN270.AT2	2.76	1.61E-03
140	803	4.07	3.07E-07	LOMAP\WVC000.AT2	LOMAP\WVC270.AT2	2.69	1.61E-03
56	1512	2.42	1.09E-05	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	2.67	1.62E-03
48	779	1.43	4.90E-05	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	2.65	1.67E-03
38	1489	2.76	3.12E-07	CHICHI\TCU049-E.AT2	CHICHI\TCU049-N.AT2	2.62	1.67E-03
73	269	23.87	3.12E-05	VICT\HPB000.AT2	VICT\HPB270.AT2	2.49	1.71E-03
49	827	5.95	1.09E-04	CAPEMEND\FOR000.AT2	CAPEMEND\FOR090.AT2	2.47	1.81E-03
22	2654	5.50	4.75E-05	CHICHI.03\TCU120N.AT2	CHICHI.03\TCU120E.AT2	2.42	1.86E-03
8	754	4.18	6.70E-05	LOMAP\CLD195.AT2	LOMAP\CLD285.AT2	2.41	1.93E-03
10	755	2.06	1.48E-04	LOMAP\CYC195.AT2	LOMAP\CYC285.AT2	2.38	2.08E-03
133	286	12.76	9.25E-06	ITALY\A-BIS000.AT2	ITALY\A-BIS270.AT2	2.35	2.09E-03
43	165	2.72	3.71E-05	IMPVALL.H\H-CHI012.AT2	IMPVALL.H\H-CHI282.AT2	2.29	2.12E-03
77	1551	3.39	2.50E-05	CHICHI\TCU138-N.AT2	CHICHI\TCU138-W.AT2	2.27	2.15E-03
64	1533	3.88	3.03E-05	CHICHI\TCU106-E.AT2	CHICHI\TCU106-N.AT2	2.27	2.18E-03
26	1500	3.78	4.32E-06	CHICHI\TCU061-E.AT2	CHICHI\TCU061-N.AT2	2.26	2.18E-03
13	238	11.01	4.01E-05	MAMMOTH.AH\A-LVL000.AT2	MAMMOTH.AH\A-LVL090.AT2	2.23	2.22E-03
44	1039	4.57	2.12E-05	NORTHR\MRP090.AT2	NORTHR\MRP180.AT2	2.18	2.24E-03
65	730	4.25	2.17E-05	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	2.16	2.27E-03
4	192	7.21	4.71E-05	IMPVALL.H\H-WSM090.AT2	IMPVALL.H\H-WSM180.AT2	2.14	2.31E-03
36	1493	3.82	5.88E-05	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	2.11	2.37E-03
46	316	3.48	3.87E-05	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	2.11	2.41E-03
28	2650	4.65	6.92E-05	CHICHI.03\TCU116N.AT2	CHICHI.03\TCU116E.AT2	2.11	2.48E-03
30	322	2.54	2.03E-05	COALINGA.H\H-CAK270.AT2	COALINGA.H\H-CAK360.AT2	2.00	2.50E-03
16	159	2.72	9.08E-05	IMPVALL.H\H-AGR003.AT2	IMPVALL.H\H-AGR273.AT2	1.96	2.59E-03

20	1546	2.72	1.69E-04	CHICHI\TCU122-E.AT2	CHICHI\TCU122-N.AT2	1.95	2.76E-03
47	1545	2.94	7.14E-06	CHICHI\TCU120-E.AT2	CHICHI\TCU120-N.AT2	1.87	2.77E-03
33	179	1.83	1.24E-05	IMPVALL.H\H-E04140.AT2	IMPVALL.H\H-E04230.AT2	1.84	2.78E-03
55	544	7.95	3.18E-05	CHALFANT.B\B-LAD180.AT2	CHALFANT.B\B-LAD270.AT2	1.84	2.81E-03
62	821	1.58	1.74E-07	ERZINCAN\ERZ-NS.AT2	ERZINCAN\ERZ-EW.AT2	1.80	2.81E-03
74	1063	0.98	5.63E-05	NORTHR\RRS228.AT2	NORTHR\RRS318.AT2	1.76	2.87E-03
14	779	0.95	1.17E-04	LOMAP\LGP000.AT2	LOMAP\LGP090.AT2	1.75	2.99E-03
5	1493	2.56	1.32E-04	CHICHI\TCU053-E.AT2	CHICHI\TCU053-N.AT2	1.68	3.12E-03
7	1489	1.85	4.02E-04	CHICHI\TCU049-E.AT2	CHICHI\TCU049-N.AT2	1.65	3.52E-03
17	1082	1.46	3.99E-05	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	1.57	3.56E-03
37	1158	2.05	1.53E-05	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	1.53	3.57E-03
54	1082	2.20	1.34E-04	NORTHR\RO3000.AT2	NORTHR\RO3090.AT2	1.51	3.71E-03
29	215	10.59	1.51E-04	LIVERMOR\A-SRM070.AT2	LIVERMOR\A-SRM340.AT2	1.50	3.86E-03
18	1512	1.60	1.04E-04	CHICHI\TCU078-E.AT2	CHICHI\TCU078-N.AT2	1.47	3.96E-03
19	1208	3.21	1.70E-04	CHICHI\CHY046-E.AT2	CHICHI\CHY046-N.AT2	1.46	4.13E-03
88	1100	5.86	9.08E-06	KOBE\ABN000.AT2	KOBE\ABN090.AT2	1.46	4.14E-03
21	1193	1.80	1.93E-04	CHICHI\CHY024-E.AT2	CHICHI\CHY024-N.AT2	1.45	4.34E-03
15	1521	2.08	2.36E-04	CHICHI\TCU089-E.AT2	CHICHI\TCU089-N.AT2	1.42	4.57E-03
80	286	8.17	1.01E-05	ITALY\A-BIS000.AT2	ITALY\A-BIS270.AT2	1.41	4.58E-03
51	723	1.54	5.43E-07	SUPER.B\B-PTS225.AT2	SUPER.B\B-PTS315.AT2	1.37	4.58E-03
27	728	2.38	1.32E-04	SUPER.B\B-WSM090.AT2	SUPER.B\B-WSM180.AT2	1.33	4.71E-03
24	730	2.80	3.90E-04	SPITAK\GUK000.AT2	SPITAK\GUK090.AT2	1.25	5.10E-03
25	988	2.39	1.66E-04	NORTHR\CCN090.AT2	NORTHR\CCN360.AT2	1.10	5.27E-03
34	2893	6.69	3.30E-05	CHICHI.04\TCU122N.AT2	CHICHI.04\TCU122E.AT2	1.05	5.30E-03
9	3473	1.90	1.03E-05	CHICHI.06\TCU078N.AT2	CHICHI.06\TCU078E.AT2	1.02	5.31E-03
45	1100	3.79	7.54E-05	KOBE\ABN000.AT2	KOBE\ABN090.AT2	0.84	5.39E-03
41	803	1.70	1.00E-05	LOMAP\WVC000.AT2	LOMAP\WVC270.AT2	0.82	5.40E-03
1	1491	2.08	5.13E-05	CHICHI\TCU051-E.AT2	CHICHI\TCU051-N.AT2	0.80	5.45E-03
12	316	2.32	4.10E-04	WESMORL\PTS225.AT2	WESMORL\PTS315.AT2	0.73	5.86E-03
3	179	1.23	8.26E-07	IMPVALL.H\H-E04140.AT2	IMPVALL.H\H-E04230.AT2	0.65	5.86E-03
11	1100	2.53	5.03E-05	KOBE\ABN000.AT2	KOBE\ABN090.AT2	0.59	5.91E-03
6	1158	1.38	2.94E-04	KOCAELI\DZC180.AT2	KOCAELI\DZC270.AT2	0.51	6.21E-03
2	286	3.56	2.24E-04	ITALY\A-BIS000.AT2	ITALY\A-BIS270.AT2	0.42	6.43E-03

Appendix D: List of Motions from Amplitude Scaling and Spectral Matching, and Resulting EDPs

Table D1. EDPs of the 2-span bridge from the amplitude scaled method (SJ site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
175	1.30	882	1.27	161	1.48	292	1.75	266	1.55	292	1.75	161	1.48
728	1.10	1515	1.43	1511	1.50	900	1.31	285	1.02	776	0.78	285	1.02
827	1.23	1551	1.50	4847	0.72	1496	1.37	728	1.10	882	1.27	1193	0.95
1193	0.95	3748	1.25	4872	1.37	1551	1.50	882	1.27	900	1.31	1208	1.45
1511	1.50	4847	0.72	6887	1.45	3757	1.45	1208	1.45	1208	1.45	5260	1.02
4847	0.72	6966	1.30	6960	1.96	4872	1.37	4847	0.72	4840	1.26	6890	1.06
6890	1.06	8134	0.98	8134	0.98	6966	1.30	6890	1.06	6960	1.96	6966	1.30

Table D2. EDPs of the 2-span bridge from the spectral matched method (SJ site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
175	1.23	882	1.74	161	0.79	292	1.49	266	1.48	292	1.41	161	0.94
728	1.43	1515	1.37	1511	1.28	900	1.54	285	1.34	776	0.90	285	1.26
827	1.27	1551	1.22	4847	1.23	1496	1.52	728	1.62	882	1.48	1193	1.16
1193	1.30	3748	1.60	4872	1.55	1551	1.15	882	1.52	900	1.54	1208	1.74
1511	1.25	4847	1.25	6887	1.29	3757	1.27	1208	1.45	1208	1.50	5260	1.14
4847	1.20	6966	1.41	6960	1.58	4872	1.92	4847	1.21	4840	1.18	6890	1.06
6890	1.21	8134	1.06	8134	1.20	6966	1.33	6890	1.18	6960	1.25	6966	1.49

Table D3. EDPs of the 2-span bridge from the amplitude scaled method (OC site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
176	0.84	184	0.57	163	0.98	163	0.98	179	0.65	180	0.51	761	0.88
184	0.57	728	0.36	266	1.09	266	1.09	187	0.83	292	0.91	1511	0.83
800	0.85	827	0.64	728	0.36	292	0.91	2646	0.38	737	0.61	1605	0.80
1511	0.83	1511	0.83	778	0.78	802	0.55	4847	0.35	778	0.78	3747	0.96
6890	0.78	5779	0.67	2646	0.38	1208	0.68	5837	0.62	827	0.64	4840	0.35
6911	0.70	6890	0.78	4847	0.35	2714	1.30	6953	0.56	3264	0.70	6897	0.92
8130	0.72	8134	0.71	6911	0.70	3509	0.70	8134	0.71	5837	0.62	6911	0.70

Table D4. EDPs of the 2-span bridge from the spectral matched method (OC site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
176	0.85	184	0.64	163	0.65	163	0.70	179	0.82	180	0.73	761	0.78
184	0.55	728	0.53	266	0.62	266	0.61	187	1.06	292	0.73	1511	0.74
800	0.87	827	0.60	728	1.04	292	0.88	2646	0.48	737	0.57	1605	0.62
1511	0.83	1511	0.91	778	0.90	802	0.69	4847	0.64	778	0.98	3747	0.78
6890	0.56	5779	0.46	2646	0.54	1208	0.96	5837	0.89	827	0.82	4840	0.61
6911	0.76	6890	0.67	4847	0.49	2714	1.39	6953	0.72	3264	0.82	6897	1.02
8130	0.99	8134	0.73	6911	0.62	3509	0.77	8134	0.65	5837	0.75	6911	0.72

Table D5. EDPs of the 4-span bridge from the amplitude scaled method (SJ site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
175	3.91	882	3.27	161	6.12	292	5.55	266	5.63	292	5.55	161	5.95
728	5.71	1515	4.89	1511	6.61	900	1.79	285	4.27	776	7.57	285	4.27
827	4.03	1551	3.15	4847	7.46	1496	5.54	728	5.69	882	3.27	1193	5.20
1193	5.19	3748	7.20	4872	6.70	1551	3.15	882	3.27	900	1.79	1208	3.31
1511	6.70	4847	7.46	6887	4.91	3757	3.16	1208	3.31	1208	3.31	5260	5.12
4847	7.46	6966	4.81	6960	1.90	4872	6.70	4847	7.46	4840	4.78	6890	2.99
6890	2.97	8134	6.42	8134	6.42	6966	4.81	6890	2.99	6960	1.89	6966	4.81

Table D6. EDPs of the 4-span bridge from the spectral matched method (SJ site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
175	4.30	882	3.65	161	7.05	292	6.06	266	4.70	292	6.18	161	7.00
728	4.60	1515	4.30	1511	5.42	900	4.20	285	1.71	776	6.44	285	4.10
827	3.05	1551	2.45	4847	5.03	1496	4.06	728	5.59	882	3.63	1193	4.94
1193	4.69	3748	5.82	4872	4.89	1551	2.38	882	3.64	900	4.20	1208	2.96
1511	5.37	4847	5.19	6887	3.54	3757	3.23	1208	2.79	1208	3.24	5260	2.92
4847	5.16	6966	6.18	6960	3.19	4872	4.12	4847	5.36	4840	4.70	6890	2.82
6890	3.18	8134	5.43	8134	6.17	6966	6.07	6890	2.89	6960	3.27	6966	7.09

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Table D7. EDPs of the 4-span bridge from the amplitude scaled method (OC site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
176	1.58	184	1.74	163	1.19	163	1.28	179	2.28	180	1.03	761	2.67
184	1.75	728	2.24	266	1.58	266	1.58	187	1.18	292	2.24	1511	1.30
800	1.65	827	1.96	728	2.24	292	2.24	2646	1.88	737	1.01	1605	2.11
1511	1.44	1511	1.30	778	2.44	802	1.08	4847	3.70	778	2.44	3747	1.90
6890	1.97	5779	2.59	2646	1.88	1208	1.79	5837	2.46	827	1.96	4840	1.86
6911	1.07	6890	1.97	4847	3.70	2714	1.37	6953	1.68	3264	1.90	6897	0.91
8130	1.23	8134	2.66	6911	1.05	3509	2.99	8134	2.66	5837	2.38	6911	1.05

Table D8. EDPs of the 4-span bridge from the spectral matched method (OC site)

Suite 1		Suite 2		Suite 3		Suite 4		Suite 5		Suite 6		Suite 7	
RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)	RSN	EDP (%)
176	1.78	184	2.47	163	1.68	163	1.55	179	1.85	180	1.60	761	0.97
184	1.22	728	1.94	266	1.92	266	1.62	187	1.27	292	2.67	1511	1.11
800	1.56	827	1.80	728	1.65	292	2.98	2646	2.14	737	1.51	1605	1.20
1511	1.14	1511	1.09	778	1.27	802	1.95	4847	1.63	778	1.39	3747	1.30
6890	1.60	5779	2.06	2646	1.86	1208	1.11	5837	1.70	827	1.43	4840	1.60
6911	1.65	6890	1.60	4847	2.12	2714	1.33	6953	1.35	3264	1.68	6897	1.30
8130	1.32	8134	1.50	6911	1.67	3509	1.75	8134	1.57	5837	1.68	6911	1.67