Proposed Revisions to Seismic Design Standards of 2016 MOTEMS

Prevention First 2014

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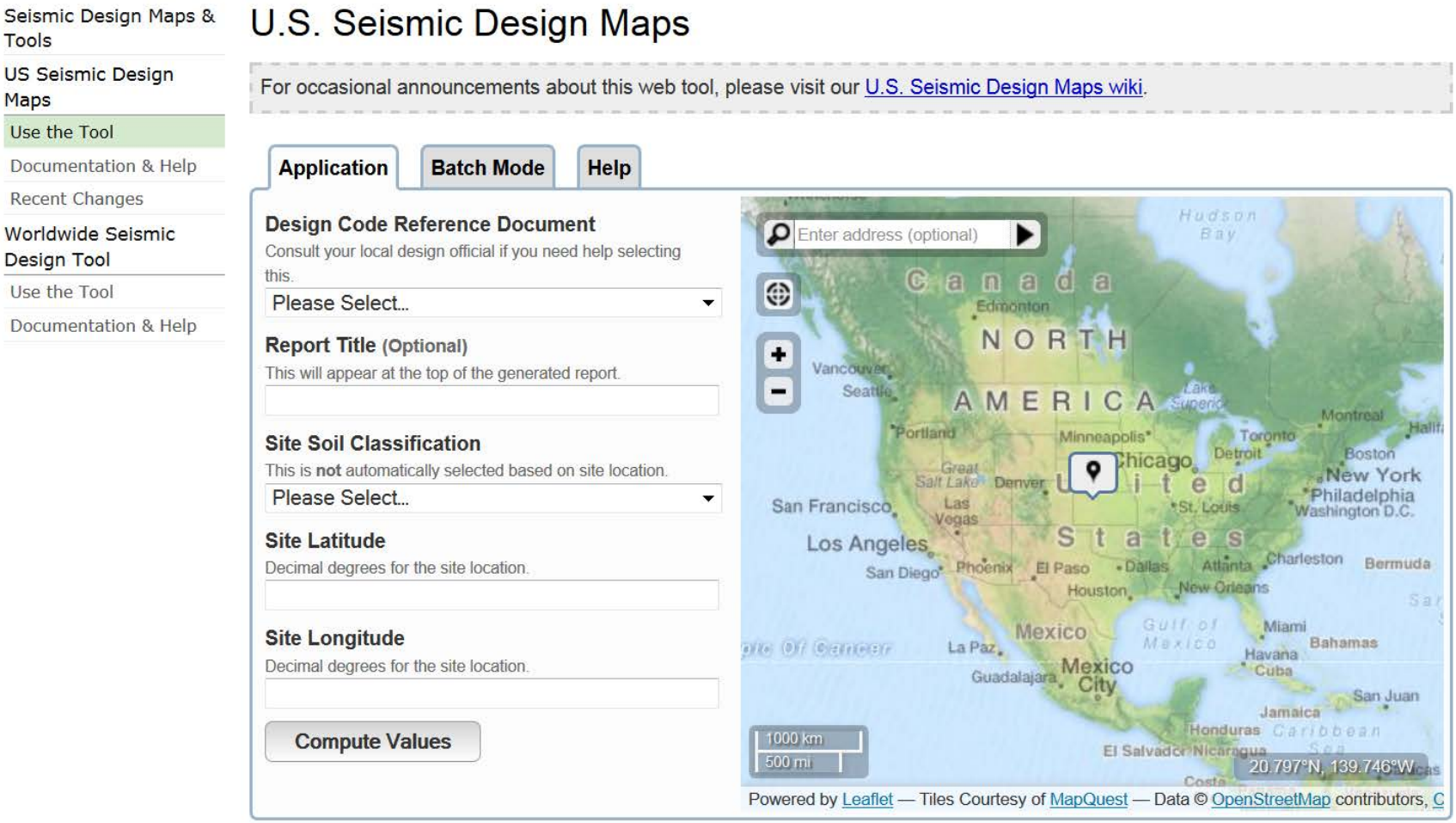
Division 3

- Section 3103F.4.2 – Design earthquake motion parameters
  - Replace second paragraph and three numbered sub-paragraphs with: “For site classes A to E, peak ground and design spectral accelerations may be evaluated using USGS Published Data (updated link and procedure) as discussed in Section 3103F4.2.2 or Site-Specific PSHA as discussed in Section 3103F4.2.2. However, site-specific PSHA is required for site class F.”
  - Delete PSHA results from POLA, POLB, and Port Hueneme

Division 3

- Section 3103F.4.2.2 – Earthquake motions from USGS maps
  - http://earthquake.usgs.gov/designmaps/us/application.php
  - Select 2013 ASCE 41, Custom Earthquake Hazard Option, Required Probability of Exceedance, and Site Soil condition
  - Provides site corrected design spectrum
    - No need for manual adjustment for probability of exceedance
    - No need to site class adjustment
    - Delete section 3103F.4.2.4 which provides details of site class adjustment and construction of spectra

USGS Data


Seismic Design Maps & Tools
US Seismic Design Maps
Use the Tool
Documentation & Help
Recent Changes
Worldwide Seismic Design Tool
Use the Tool
Documentation & Help
U.S. Seismic Design Maps
For occasional announcements about this web tool, please visit our U.S. Seismic Design Maps wiki.
Application
Batch Mode
Help
Design Code Reference Document
Consult your local design official if you need help selecting this.
Please Select...
Report Title (Optional)
This will appear at the top of the generated report.
Site Soil Classification
This is not automatically selected based on site location.
Please Select...
Site Latitude
Decimal degrees for the site location.
Site Longitude
Decimal degrees for the site location.
Compute Values
Enter address (optional)
Canada
NORTH AMERICA
United States
Mexico
Edmonton
Vancouver
Seattle
Portland
San Francisco
Los Angeles
San Diego
Las Vegas
Great Salt Lake
Denver
Phoenix
El Paso
Houston
Minneapolis
Chicago
Detroit
Toronto
Montreal
Boston
New York
Philadelphia
Washington D.C.
St. Louis
Dallas
Atlanta
Charleston
Bermuda
New Orleans
Miami
Bahamas
Havana
Cuba
Jamaica
San Juan
Honduras
Nicaragua
El Salvador
Caribbean Sea
Gulf of Mexico
La Paz
Guadalajara
Mexico City
1000 km
500 mi
20.797°N, 139.746°W
Powered by Leaflet — Tiles Courtesy of MapQuest — Data © OpenStreetMap contributors, C

Application | Batch Mode | Help

Design Code Reference Document

Consult your local design official if you need help selecting this.

2013 ASCE 41

Earthquake Hazard Level

The particular analysis procedure to use.

Custom

Probability of Exceedance (in 50 years)

The percent probability of ground motion exceedance in 50 years.

50

Report Title (Optional)

This will appear at the top of the generated report.

Demonstration

Site Soil Classification

This is **not** automatically selected based on site location.

Site Class E - "Soft Clay Soil"

Site Latitude

Decimal degrees for the site location.

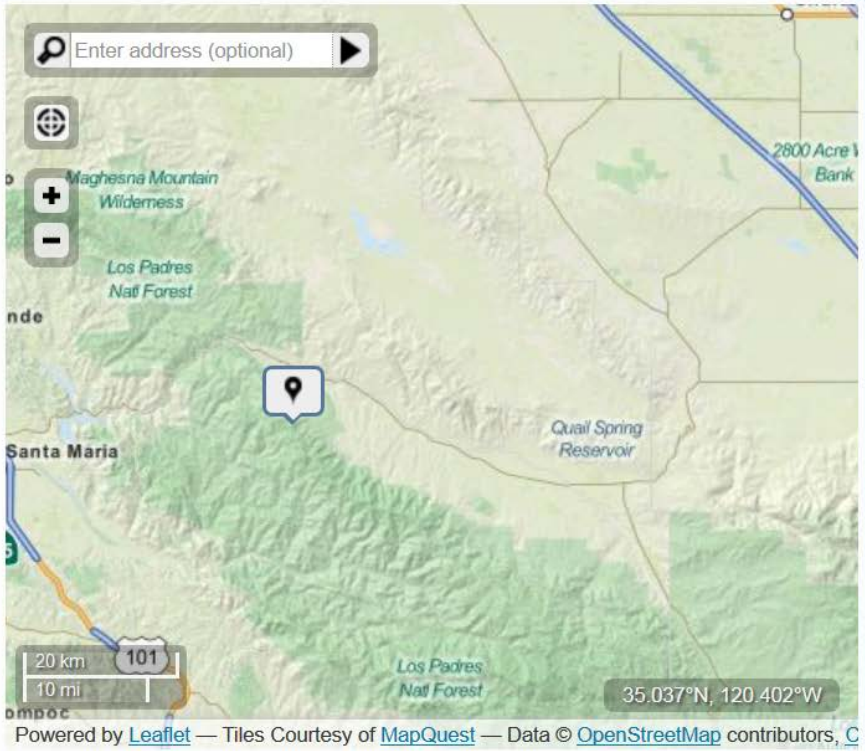
35

Site Longitude

Decimal degrees for the site location.

-120

Compute Values



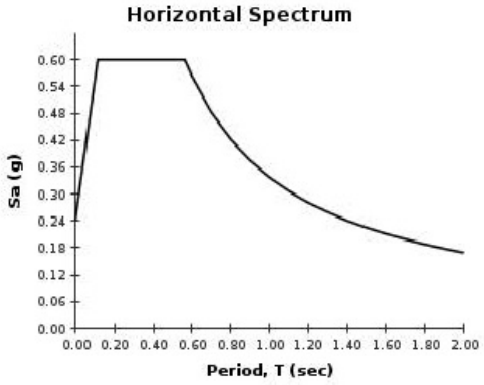
USGS Design Maps Summary Report

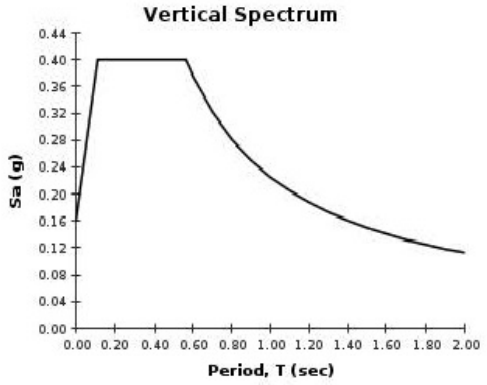
User-Specified Input

Report Title	Demonstration Mon September 22, 2014 19:03:25 UTC
Building Code Reference Document	ASCE 41-13 Retrofit Standard, Custom (50% in 50 year values) (which utilizes USGS hazard data available in 2008)
Site Coordinates	35°N, 120°W
Site Soil Classification	Site Class E – "Soft Clay Soil"

USGS-Provided Output

$S_{S,Custom}$	0.240 g	$S_{XS,Custom}$	0.600 g
$S_{1,Custom}$	0.096 g	$S_{X1,Custom}$	0.338 g





Division 3

- Section 3103F.4.2.3 – Earthquake motions from site specific PSHA
  - "For site-specific PSHA, DPGA and DSA shall use appropriate attenuation relationships, probability of exceedance, and site soil conditions. Site-specific PSHA shall be conducted by qualified California registered civil engineer with a California authorization as a geotechnical engineer per Section 3102F.3.4.8.

    If site-specific PSHA is used for site class other than site class F, results from site-specific PSHA shall be compared to those based on USGS published data in Section 3103F.4.2.2. If the two sets of values are significantly different, a justification for using the characterization chosen shall be provided. If DPGA or DSA from site-specific PSHA are less than 80% of the values from USGS data, a peer review may be required."
  - Delete all other details
  - No need for Sections 3103F.4.2.4 and 3103F.4.2.5
    - Site amplification effects should already be part of site-specific PSHA

Division 3

- Section 3103F.4.2.6 – Directivity effects
  - "1. Directivity effects may be reflected in the spectral acceleration values in deterministic manner by using [~~for example, the equation on page 213 (and Tables 6 and 7) of Somerville, et al. [3.9]~~] well established procedures with Division's approval."
  - Remove explicit reference to Somerville

Division 3

- Section 3103F.8.2 – Live load (L): Revise
  - "Appropriate value of live load on MOTs, depending on use, shall be considered."
- Modify Table 31F-3-12 to revise live load factor for earthquake combination
  - Use LRFD Load Factor of 0.1 (instead of 1) for live load combination with earthquake load
  - Add a footnote no. 5: "Higher value of live load factor for earthquake combination and its seismic effects may be considered for unusual cases."
- Modify Table 31F-2-13 for consistency
  - Use Service or ASD Load Factor of 0.07 for live load combination with earthquake load
  - Add a footnote no. 3: "Higher value of live load factor for earthquake combination and its seismic effects may be considered for unusual cases."

Division 4

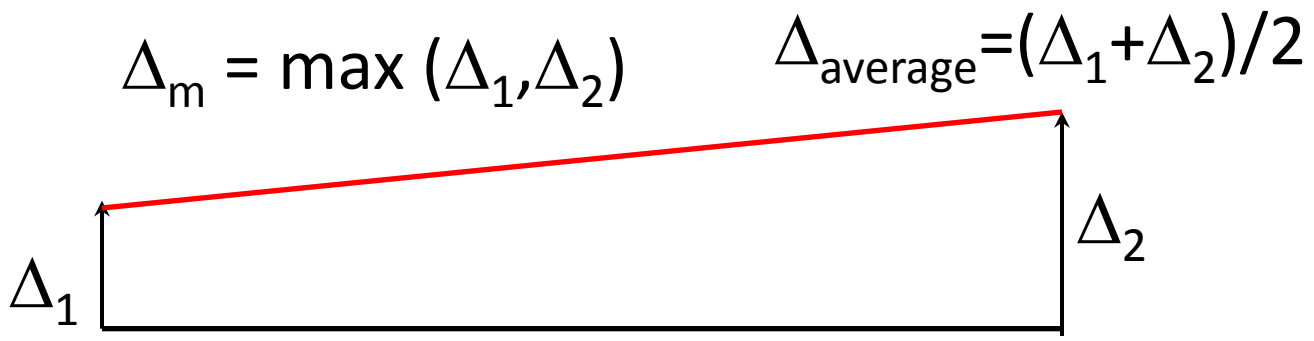
- Section 3104F.1.4 – Configuration classification
  - Current classification based only on plan
  - “Regular” plan-based configuration may exhibit torsional behavior depending on pile configuration/length
  - Configuration is needed to select displacement demand procedure in Table 31F-4-3

Division 4

- Section 3104F.1.4 – Configuration classification – revise as follows
  - Revise “Each MOT shall be designated as regular or irregular based upon criteria in this section.”
  - Add criteria based on ASCE 7-10 section 12.3.2.1 for horizontal irregularity classification
  - Delete Figure 31F-4-1, its reference, and second paragraph

Division 4

- ASCE 7-10 section 12.3.2.1 based irregularity classification
- Irregular if $\Delta_m > 1.2\ \Delta_{average}$



Division 4

- Table 31F-4-3: Add a footnote for displacement demand procedure for high/medium risk level, regular configuration, and concrete/steel materials
  - "Linear modal demand procedure may be required for unusual cases where more than one mode is expected to contribute to the displacement demand."

Division 4

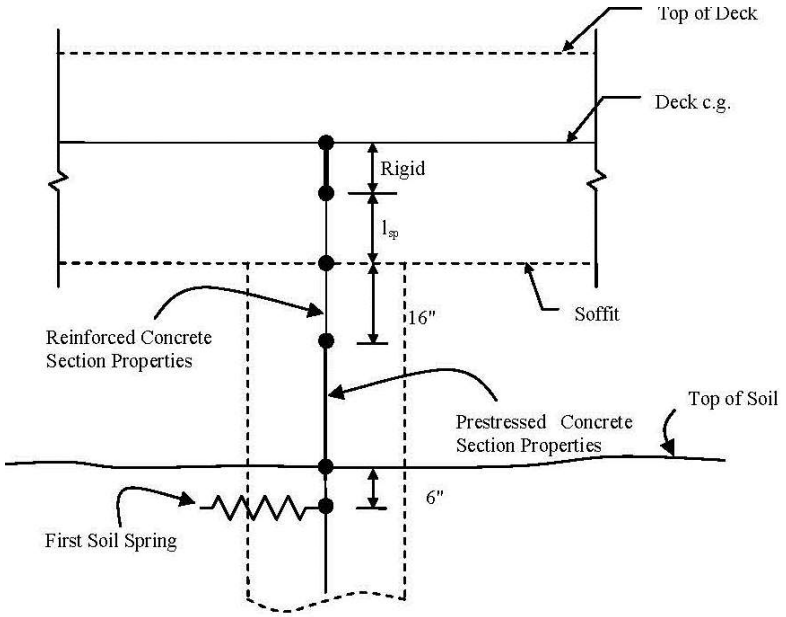
- Section 3104F.2.3 – Analytical procedure
  - Add after first sentence “For this purpose, displacement capacity for each element of the structure shall be checked against its displacement demand including orthogonal effects of section 3104F.4.2.”
  - Add “For nonlinear static (pushover) procedure, the pushover load shall be applied at center of mass of the MOT structure.”
  - Add after last sentence in second paragraph “Mass to be included in displacement demand calculation shall include mass from self weight of the structure, weight of permanent equipment, and portion of live load that may contribute to inertial mass during earthquake.”
  - Remove the word “target” from sections 3104F.2.3.1 and 3104F.2.3.2.3 to avoid confusion
    - Engineers may use this to check demand-capacity-ratio (DCR) instead of element DCR

Division 4

- Section 3104F.2.3.1 – Nonlinear static capacity procedure (add)
  - "Pile displacement capacity at a selected seismic level and for a load combination may be determined from one of the following procedure:
    - 3D nonlinear pushover analysis with 100% load in primary direction and 30% load in secondary direction and capacity estimated as square-root-of-square of the pile deflections in the two directions; or
    - Pushover analysis of an individual pile with appropriate axial load and pile-to-deck connection; or
    - Alternative procedure approved by the Division"

Division 4

- Section 3104F.2.3.1.1 Modeling (add)
  - "The effects of connection flexibility shall be considered in pile-to-deck connection modeling. A procedure described in ASCE/COPRI 61-14 section C6.6.5 may be used for this purpose."



Division 4

- Section 3104F.2.3.1.3 – Soil-structure interaction (SSI)
  - Delete section because SSI is described in Division 6

Division 4

- Section 3104F.2.3.2 – Nonlinear static demand procedures
  - Add “coefficient method” in ASCE 41-13 based on FEMA 440: ASCE/SEI 41-13 Section 7.4.3.3.1
  - Leave current “refined” MOTEMS procedure but rename it as “substitute structure method”
    - This method is referred to as “substitute structure method” in ASCE/COPRI 61-14 document
    - Remove restriction for substitute structure method to be used only when $T < T_o$
  - Add “Other methods approved by the Division may also be used.”

Division 4

- Section 3104F.2.3.2 – Nonlinear static demand procedures
  - "Coefficient method" in ASCE 41-13 based on FEMA 440
  - $\Delta_d = C_1 C_2 S_A (T^2/4\pi^2)$
  - Coefficients C_1 and C_2 are defined based on
    - Period
    - Soil type
    - Ratio of linear elastic demand and available strength

Division 4

- Section 3104F.2.3.3 – Linear modal demand procedures
  - Revise amplification of demand from linear modal demand procedure when $T < T_0$
    - "… the displacement demand shall be amplified by the ratio of S_d from Equation 4-4 and Δ_d of Equation 4-2 or by C_1C_2 ."
  - Current provision states
    - " … the displacement demand shall be amplified as specified in Section 3104F.2.3.2.5."
      - Section 3104F2.3.2.5 only describes the refined analysis procedure and does not discuss amplification of demand

Division 4

- Section 3104F.4.2 – Orthogonal effects
  - Revise symbols in Equations 4-7 to 4-11 to remove confusion

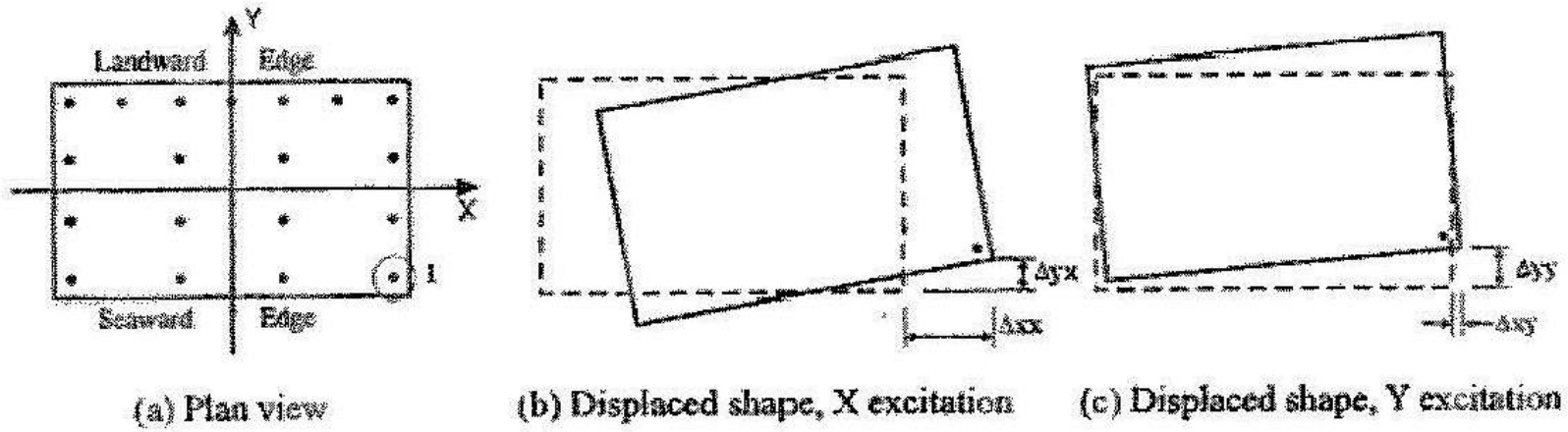


FIGURE 31F-4-7
PLAN VEW OF WHARF SEGMENT UNDER XAND V SEISMIC EXCITATIONS [4.3]

Division 4

- Section 3104F.4.2 – Orthogonal effects
  - Delete Equations 4-12 for marginal wharf type MOTs because it is subject to misuse

$$\Delta_d = \Delta_y \sqrt{1 + \left(0.3 \left(1 + 20 e / L_l \right) \right)^2}$$

Division 4

- Develop and add flowcharts for MOTEMS analysis procedures

Division 7

- Section 3107F.2.5.3 – Plastic hinge length
  - L_p = 2D for in-ground hinge formation
    - Consistent with ASCE/COPRI 61-14 recommendations
  - Delete Figure 31F-7-4 and Table 31F-7-4
    - These are no longer needed because in-ground plastic hinge length of ASCE/COPRI 61-14 does not depend on soil properties

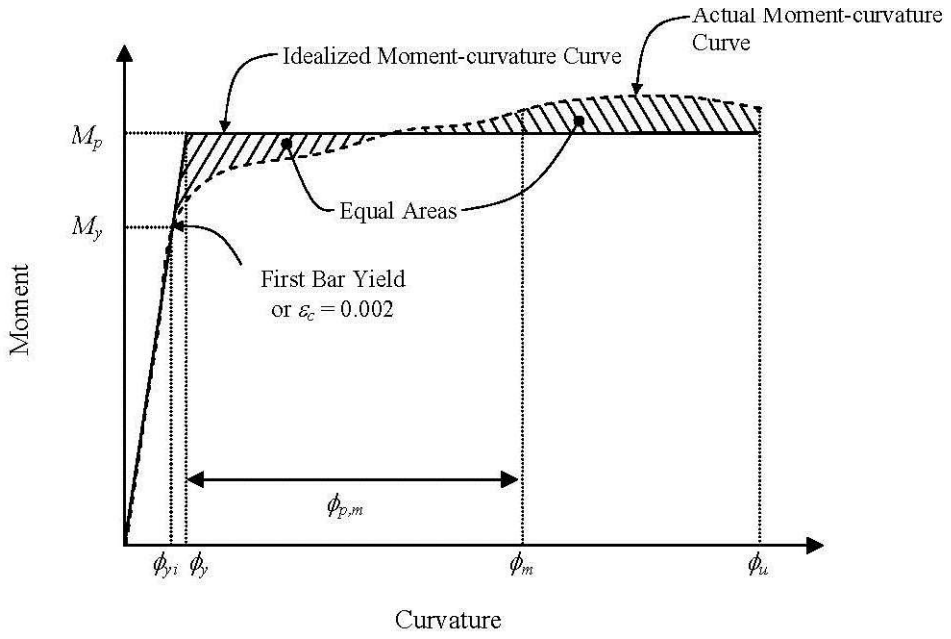
Division 7

- Section 3107F.2.5.3 – Plastic hinge length for pile-deck hinge
  - Keep current specification for concrete piles
  - Add Table 6-1 from ASCE/COPRI 61-14 for pile-deck connection in pre-stressed concrete piles

Connection Type	**L_p at deck (in.)**
Pile buildup	$0.15f_{ye}d_b \le L_p \le 0.30f_{ye}d_b$
Extended Strand	$0.20f_{pye}d_{st}$
Embeded pile	0.5D
Dowelled	$0.25f_{ye}d_b$
Hollow dowelled	$0.20f_{ye}d_b$
External confinement	$0.30f_{ye}d_b$
Isolated interface	$0.25f_{ye}d_b$

Division 7

- Section 3107F.2.5.4 – Plastic rotation
  - Add ASCE/COPRI 61-14 Figure 6.5 as additional way to idealize moment-curvature relationship



Division 7

- Section 3107F.2.6.3 – Plastic hinge length for steel piles
  - Adopt ASCE/COPRI 61-14 recommendations
  - L_p = 2D for in-ground hinge formation
  - ASCE/COPRI 61-14 Table 6-1 for pile-deck hinge

Connection Type	**L_p at deck (in.)**
Embeded pile	0.5D
Concrete plug	$0.30f_{ye}d_b$
Isolated shell	$0.30f_{ye}d_b + g$
Welded embed	0.5D