APPENDIX A - NOTATIONS & ACRONYMS

A_b	=	Area of individual reinforcing steel bar (in^2, mm^2) (Section 3.8.1)
A_e	=	Effective shear area (Section 3.6.2)
A_g	=	Gross cross section area (in^2, mm^2) (Section 3.6.2)
A_{jh}	=	The effective horizontal area of a moment resisting joint (Section 7.4.4.1)
A_{jh}^{ftg}	=	The effective horizontal area for a moment resisting footing joint (Section 7.7.1.4)
A_{jv}	=	The effective vertical area for a moment resisting joint (Section 7.4.4.1)
A_{jv}^{ftg}	=	The effective vertical area for a moment resisting footing joint (Section 7.7.1.4)
A_s	=	Area of supplemental non-prestressed tension reinforcement (Section 4.3.2.2)
A_s'	=	Area of supplemental compression reinforcement (Section 4.3.2.2)
A_s^{jh}	=	Area of horizontal joint shear reinforcement required at moment resisting joints (Section 7.4.4.3)
A_s^{jv}	=	Area of vertical joint shear reinforcement required at moment resisting joints (Section 7.4.4.3)
$A_s^{j\text{-}bar}$	=	Area of vertical j-bar reinforcement required at moment resisting joints with a skew angle >20° (Section 7.4.4.3)
ARS	=	5% damped elastic Acceleration Response Spectrum, expressed in terms of g (Section 2.1)
A_s^{sf}	=	Area of bent cap side face steel required at moment resisting joints (Section 7.4.4.3)
A_{st}	=	Area of longitudinal column steel anchored in the joint (Section 7.4.4.3)
ASTM	=	American Society for Testing Materials
A_v	=	Area of shear reinforcement perpendicular to flexural tension reinforcement (Section 3.6.3)
B_c	=	The other cross-sectional dimension of a rectangular column (Section 7.7.1.4)
B_{cap}	=	Bent cap width (Section 7.3.1.1)
B_{eff}	=	Effective width of the superstructure for resisting longitudinal seismic moments (Section 7.2.1.1)
B_{eff}^{ftg}	=	Effective width of the footing for calculating average normal stress in the horizontal direction within a footing moment resisting joint (Section 7.7.1.4)
BDD	=	Caltrans Bridge Design Details (Section 7.7.1.7)
BDS	=	Caltrans Bridge Design Specification (Section 3.2.1)
$C_{(i)}^{pile}$	=	Axial compression demand on a pile (Section 7.7.1.1)
CIDH	=	Cast-in-drilled-hole pile (Section 1.2)
CISS	=	Cast-in-steel-shell pile (Section 1.2)
D_c	=	Column cross sectional dimension in the direction of interest (Section 3.1.4.1)

$D_{c.g.}$	=	Distance from the top of column the center of gravity of the superstructure (Section 4.3.2.1)
$D_{c,max}$	=	Largest cross sectional dimension of the column (Section 8.2.4)
D_{ftg}	=	Depth of footing (Section 7.7.1.1)
D_{Rs}	=	Depth of resultant soil resistance measured from top of footing (Section 7.7.1.1)
D_s	=	Depth of superstructure at the bent cap (Section 7.2.1.1)
D'	=	Cross-sectional dimension of confined concrete core measured between the centerline of the peripheral hoop or spiral. (Section 3.6.3)
D^*	=	Cross-sectional dimension of pile shaft in the direction of interest (Section 7.6.2)
E_c	=	Modulus of elasticity of concrete (psi, MPa) (Section 3.2.6)
EDA	=	Elastic Dynamic Analysis (Section 2.2.1)
E_s	=	Modulus of elasticity of steel (psi, MPa) (Section 3.2.3)
ESA	=	Equivalent Static Analysis (Section 2.2.1)
F_{sk}	=	Abutment shear key force capacity (Section 7.8.4)
G	=	The gap between an isolated flare and the soffit of the bent cap (Section 7.6.2)
G_c	=	Shear modulus (modulus of rigidity) for concrete (ksi, MPa) (Section 5.6.1)
GS	=	Geotechnical Services
H	=	Average height of column supporting bridge deck between expansion joints (Section 7.8.3)
H'	=	Length of pile shaft/column from ground surface to the point of zero moment above ground (Section 7.6.2)
$H_{o\text{-}max}$	=	Length of pile shaft/colum from point of maximum moment to point of contraflexure above ground considering the base of plastic hinge at the point of maximum moment (Section 7.6.2 (c))
H_s	=	Length of column/shaft considered for sesmic shear demand on Type I pile shafts. (Section 7.7.3.1)
$I_{c.g.}$	=	Moment of inertia of the pile group (Section 7.7.1.1)
I_{eff}	=	Effective moment of inertia for computing member stiffness (Section 5.6.1)
I_g	=	Moment of inertia about centroidal axis of the gross section of the member (Section 5.6.1)
ISA	=	Inelastic Static Analysis (Section 5.2.3)
J_{eff}	=	Effective polar moment of inertia for computing member stiffness (Section 5.6.1)
J_g	=	Gross polar moment of inertia about centroidal axis of the gross section of the member (Section 5.6.1)
K_{eff}	=	Effective abutment backwall stiffness $\frac{\text{kip/in}}{\text{ft}}$ ($\frac{\text{kN/mm}}{\text{m}}$) (Section 7.8.1)
K_i	=	Initial abutment backwall stiffness (Section 7.8.1)
L	=	Member length from the point of maximum moment to the point of contra-flexure (ft, m) (Section 3.1.3)
L	=	Length of bridge deck between adjacent expansion joints (Section 7.8.3)
L_b	=	Length used for flexural bond requirements (Section 8.2.3.1)

L_p	=	Equivalent analytical plastic hinge length (ft, m) (Section 3.1.3)
L_{pr}	=	Plastic hinge region which defines the region of a column or pier that requires enhanced lateral confinement (Section 7.6.2)
L_{ftg}	=	Cantilever length of the footing or pile cap measured from face of column to edge of footing along the principal axis of the footing (Section 7.7.1.3)
MCE	=	Maximum Credible Earthquake (Section 2.1)
M_{dl}	=	Moment attributed to dead load (Section 4.3.2.1)
M_{eq}^{col}	=	The column moment when coupled with any existing M_{dl} & $M_{p/s}$ will equal the column's overstrength moment capacity, M_o^{col} (Section 4.3.2)
$M_{eq}^{R,L.}$	=	Portion of M_{eq}^{col} distributed to the left or right adjacent superstructure spans (Section 4.3.2.1)
$M_{(i)}^{pile}$	=	The moment demand generated in pile (i) (Section 7.7.1.1)
M_m	=	Earthquake moment magnitude (Section 6.1.2.2)
$M_{p/s}$	=	Moment attributed to secondary prestress effects (Section 4.3.2)
M_n	=	Nominal moment capacity based on the nominal concrete and steel strengths when the concrete strain reaches 0.003.
M_{ne}	=	Nominal moment capacity based on the expected material properties and a concrete strain, $\varepsilon_c = 0.003$ (Section 3.4)
$M_{ne}^{\sup R,L}$	=	Expected nominal moment capacity of the right and left superstructure spans utilizing expected material properties (Section 4.3.2.1)
M_{ne}^{typeII}	=	Expected nominal moment capacity of a type II pile shaft (Section 7.7.3.2)
M_o^{col}	=	Column overstrength moment (Section 2.3.1)
M_p^{col}	=	Idealized plastic moment capacity of a column calculated by M-φ analysis (kip-ft, N-m) (Section 2.3.1)
M_y	=	Moment capacity of a ductile component corresponding to the first reinforcing bar yielding (Section 5.6.1.1)
M-φ	=	Moment curvature analysis (Section 3.1.3)
MTD	=	Memo to Designers (Section 1.1)
N	=	Blow count per foot (0.3m) for the California Standard Penetration Test (Section 6.1.3)
N_A	=	Abutment support width normal to centerline of bearing (Section 7.8.3)
N_p	=	Total number of piles in a footing (Section 7.7.1.1)
OSD	=	Offices Of Structure Design (Section 1.1)
P_b	=	The effective axial force at the center of the joint including prestress (Section 7.4.4.1)

P_c	=	The column axial force including the effects of overturning (Section 3.6.2)
P_{dl}	=	Axial load attributed to dead load (Section 3.5)
P_{dl}^{sup}	=	Superstructure axial load resultant at the abutment (Section 7.8.4)
PGR	=	Preliminary Geology Report (Section 2.1)
P_p	=	Total axial load on the pile group including column axial load (dead load + EQ load due to any overturning effects), footing weight, and overburden soil weight (Section 7.7.1.1)
P/S	=	Prestressed Concrete (i.e. P/S concrete, P/S strand) (Section 2.1.4)
R_D	=	Displacement reduction factor for damping ratios exceeding 5% (Section 2.1.5)
R_s	=	Total resultant expected soil resistance along the end and sides of a footing (Section 7.7.1.1)
S	=	Skew angle of abutment (Section 7.8.2)
SDC	=	Seismic Design Criteria (Section 1.1)
SDSEE	=	Structure Design Services and Earthquake Engineering
T	=	Natural period of vibration, in seconds $T = 2\pi\sqrt{m/k}$ (Section 6.1.2.1)
T_c	=	Total tensile force in column longitudinal reinforcement associated with M_o^{col} (Section 7.4.4.1)
$T_{(i)}^{pile}$	=	Axial tension demand on a pile (Section 7.7.1.1)
T_{jv}	=	Net tension force in moment resisting footing joints (Section 7.7.2.2)
V_c	=	Nominal shear strength provided by concrete (Section 3.6.1)
$V_{(i)}^{pile}$	=	Shear demand on a pile (Section 7.7.1.1)
V_n	=	Nominal shear strength (Section 3.6.1)
V_{pile}	=	Abutment pile shear capacity (Section 7.8.4)
V_s	=	Nominal shear strength provided by shear reinforcement (Section 3.6.1)
V_o	=	Overstrength shear associated with the overstrength moment M_o (Section 3.6.1)
V_o^{col}	=	Column overstrength shear, typically defined as M_o^{col}/L (kips, N) (Section 2.3.1)
V_p^{col}	=	Column plastic shear, typically defined as M_p^{col}/L (kips, N) (Section 2.3.2.1)
V_n^{pw}	=	Nominal shear strength of pier wall in the strong direction (Section 3.6.6.2)
V_u^{pw}	=	Shear demand on a pier wall in the strong direction (Section 3.6.6.2)
$c_{(i)}$	=	Distance from pile (i) to the center of gravity of the pile group in the X or Y direction (Section 7.7.1.1)
c	=	Damping ratio (Section 2.1.5)
d_{bl}	=	Nominal bar diameter of longitudinal column reinforcement (Section 7.6.2)

d_{bb}	=	Effective diameter of bundled reinforcement (Section 8.2.3.1)
f_h	=	Average normal stress in the horizontal direction within a moment resisting joint (Section 7.4.4.1)
f_{ps}	=	Tensile stress for 270 ksi (1900 MPa) 7 wire low relaxation prestress strand (ksi, MPa) (Section 3.2.4)
f_u	=	Specified minimum tensile strength for A706 reinforcement (ksi, MPa) (Section 3.2.3)
f_{ue}	=	Expected minimum tensile strength for A706 reinforcement (ksi, MPa) (Section 3.2.3)
f_{yh}	=	Nominal yield stress of transverse column reinforcement (hoops/spirals) (ksi, Mpa) (Section 3.6.2)
f_v	=	Average normal stress in the vertical direction within a moment resisting joint (Section 7.4.4.1)
f_y	=	Nominal yield stress for A706 reinforcement (ksi, MPa) (section 3.2.1)
f_{ye}	=	Expected yield stress for A706 reinforcement (ksi, MPa) (Section 3.2.1)
f'_c	=	Compressive strength of unconfined concrete, (Section 3.2.6)
f'_{cc}	=	Confined compression strength of concrete (Section 3.2.5)
f'_{ce}	=	Expected compressive strength of unconfined concrete, (psi, MPa) (Section 3.2.1)
$\sqrt{f'_c}$	=	Square root of the specified compressive strength of concrete, (psi, MPa) (section 3.2.6)
g	=	Acceleration due to gravity, 32.2 ft/sec^2 (9.81 m/sec^2) (Section 1.1)
h_{bw}	=	Abutment backwall height (Section 7.8.1)
$k_{(i)}^e$	=	Effective stiffness of bent or column (i) (Section 7.1.1)
l_{ac}	=	Length of column reinforcement embedded into bent cap (Section 7.4.4.1)
l_b	=	Length used for flexural bond requirements (Section 8.2.2.1)
$m_{(i)}$	=	Tributary mass associated with column or bent (i), m = W/g (kip-sec^2/ft, kg) (Section 7.1.1)
n	=	The total number of piles at distance $c_{(i)}$ from the center of gravity of the pile group (Section 7.7.1.1)
p_{bw}	=	Maximum abutment backwall soil pressure (Section 7.8.1)
p_c	=	Nominal principal compression stress in a joint (psi, MPa) (Section 7.4.2)
p_t	=	Nominal principal tension stress in a joint (psi, MPa) (Section 7.4.2)
s	=	Spacing of shear/transverse reinforcement measured along the longitudinal axis of the structural member (in, mm) (Section 3.6.3)
s_u	=	Undrained shear strength (psf, KPa) (Section 6.1.3)
t	=	Top or bottom slab thickness (Section 7.3.1.1)
v_{jv}	=	Nominal vertical shear stress in a moment resisting joint (psi, MPa) (Section 7.4.4.1)
v_c	=	Permissible shear stress carried by concrete (psi, MPa) (Section 3.6.2)
v_s	=	Shear wave velocity (ft/sec, m/sec) (Section 6.1.3)
ε_c	=	Specified concrete compressive strain for essentially elastic members (Section 3.4.1)
ε_{cc}	=	Concrete compressive strain at maximum compressive stress of confined concrete (Section 3.2.6)
ε_{co}	=	Concrete compressive strain at maximum compressive stress of unconfined concrete (Section 3.2.6)

ε_{sp} = Ultimate compressive strain (spalling strain) of unconfined concrete (Section 3.2.5)

ε_{cu} = Ultimate compression strain for confined concrete (Section 3.2.6)

ε_{ps} = Tensile strain for 7-wire low relaxation prestress strand (Section 3.2.4)

$\varepsilon_{ps,EE}$ = Tensile strain in prestress steel at the essentially elastic limit state (Section 3.2.4)

$\varepsilon_{ps,u}^{R}$ = Reduced ultimate tensile strain in prestress steel (Section 3.2.4)

ε_{sh} = Tensile strain at the onset of strain hardening for A706 reinforcement (Section 3.2.3)

ε_{su} = Ultimate tensile strain for A706 reinforcement (Section 3.2.3)

ε_{su}^{R} = Reduced ultimate tensile strain for A706 reinforcement (Section 3.2.3)

ε_{y} = Nominal yield tensile strain for A706 reinforcement (Section 3.2.3)

ε_{ye} = Expected yield tensile strain for A706 reinforcement (Section 3.2.3)

Δ_b = Displacement due to beam flexibility (Section 2.2.2)

Δ_c = Local member displacement capacity (Section 3.1.2)

Δ_{col} = Displacement attributed to the elastic and plastic deformation of the column (Section 2.2.4)

Δ_C = Global displacement capacity (Section 3.1.2)

Δ_{cr+sh} = Displacement due to creep and shrinkage (Section 7.2.5.5)

Δ_d = Local member displacement demand (Section 2.2.2)

Δ_D = Global system displacement (Section 2.2.1)

Δ_{eq} = The average displacement at an expansion joint due to earthquake (Section 7.2.5.5)

Δ_f = Displacement due to foundation flexibility (Section 2.2.2)

Δ_p = Local member plastic displacement capacity (in, mm) (Section 3.1.3)

$\Delta_{p/s}$ = Displacement due to prestress shortening (Section 7.2.5.5)

Δ_r = The relative lateral offset between the point of contra-flexure and the base of the plastic hinge (Section 4.2)

Δ_s = The displacement in Type I shafts at the point of maximum moment (Section 4.2)

Δ_{temp} = The displacement due to temperature variation (Section 7.2.5.5)

Δ_y^{col} = Idealized yield displacement of the column (Section 2.2.4)

Δ_Y = Idealized yield displacement of the subsystem at the formation of the plastic hinge (in, mm) (Section 2.2.3)

θ_p = Plastic rotation capacity (radians) (Section 3.1.3)

ρ = Ratio of non-prestressed tension reinforcement (Section 4.4)

ρ_l = Area ratio of longitudinal column reinforcement (Section 8.2.1)

ρ_s = Ratio of volume of spiral or hoop reinforcement to the core volume confined by the spiral or hoop reinforcement (measured out-to-out), $\rho_s = 4 \times A_b / (D' \times s)$ for circular cross sections (Section 3.6.2)

ρ_{fs} = Area ratio of transverse reinforcement in column flare (Section 7.6.5.3)

ϕ = Strength reduction factor (Section 3.6.1)

ϕ_p = Idealized plastic curvature $1/\text{in}$ ($1/\text{mm}$) (Section 3.1.3)

ϕ_u = Ultimate curvature capacity (Section 3.1.3)

ϕ_y = yield curvature corresponding to the yield of the fist tension reinforcement in a ductile component (Section 5.6.1.1)

ϕ_Y = Idealized yield curvature (Section 3.1.3)

μ_d = Local displacement ductility demand (Section 3.6.2)

μ_D = Global displacement ductility demand (Section 2.2.3)

μ_c = Local displacement ductility capacity (Section 3.1.4)