Appendix F
Notation

a Reciprocal of the initial shear stiffness of the interface K_{si} under initial loading; reciprocal of the initial tangent modulus E_i of the soil

b Reciprocal of the asymptotic shear stress τ_{ult} for initial loading of the interface; reciprocal of the asymptotic deviator stress $(\sigma_1 - \sigma_3)$ of the soil

B Bulk modulus of the soil

C_c Coefficient of curvature

C_k Interface stiffness ratio

C_N Correction factor for the number of steps in the backside of a rock-founded gravity wall

C_s Correction factor for a rock-founded gravity retaining wall with an inclined backfill surface

C_u Uniformity coefficient

C_{wt} Correction factor for determination of the vertical shear force coefficient during inundation of the backfill

C_θ Correction factor for inclination of the backside of a rock-founded gravity wall

D_r Relative density

D_1 Thickness of the backfill above the hydrostatic water table

D_2 Thickness of the submerged backfill above the heel of the wall

D_{10} Particle size diameter corresponding to 10 percent passing in the grain size distribution curve

D_{30} Particle size diameter corresponding to 30 percent passing in the grain size distribution curve

D_{60} Particle size diameter corresponding to 60 percent passing in the grain size distribution curve

$d\Delta_s$ Infinitesimal increment in interface displacement

$d\tau^i$ Infinitesimal shear stress increment along an inclined stress path

$d\tau^v$, $d\tau^o$ Infinitesimal shear stress increments in the orthogonal directions v' and o', respectively

E_i Initial tangent (Young's) modulus of the soil

E_t Tangent modulus of the soil

E_{ur} Young's modulus for unloading-reloading

F_v Vertical force or downdrag per unit length of wall

$F_{v,q}$ Vertical force increment due to surcharge application

$F_{v,soil}$ Vertical earth force due to the self weight of the backfill

F_w Hydrostatic force on the wall

F_x Total horizontal force per unit length of wall

F_x' Effective horizontal force per unit length of wall

G_s Specific gravity

h Height of the horizontal earth force above the base of the wall

H Height measured along a vertical plane passing through the heel of the wall and extending through the backfill

H_b Total backfill height as measured in Figure 2-5

i Generic name for inclined stress paths; as a superscript in Figures 4-40 through 4-44, it denotes the ith load step in a finite element analysis

i' Generic name for the σ_n-Δ_s-τ response of the interface to an inclined stress path

i'' Generic name for the Δ_s-τ response of the interface to an inclined stress path

I Correction factor for inclination of the stress path

$[K]$	Global stiffness matrix
K	Modulus number
K_b	Bulk modulus number
k_n	Normal interface stiffness
k_s	Interface shear stiffness
$K_f\text{-}line$	Line joining the points in the p'-q plane that correspond to failure
K_h	Earth pressure coefficient for effective horizontal forces
K_I	Dimensionless interface stiffness number for initial loading
K_n	Normal stiffness of an interface element
K_o	At-rest pressure coefficient
K_{si}	Initial shear stiffness of the interface
K_{sno}	Normalized interface shear stiffness at zero-stress level
K_{sn}	Normalized shear stiffness of the interface
K_{sn}^{ts}	Transition stiffness number
K_{sn}^{ys}	Yield stiffness number
K_{st}	Interface tangent stiffness for vertical stress paths (as defined in Clough and Duncan (1971) hyperbolic model for interfaces)
K'_{st}	Interface tangent stiffness for stress paths of any orientation
K'^{I}_{st}	Interface tangent stiffness at point I
$K'_{s\,sec}$	Secant interface shear stiffness
K_{ur}	Unload-reload modulus number for soils
K_{urj}	Unload-reload stiffness number for interfaces
K_v	Vertical shear force coefficient
$K_{v,q}$	Vertical shear force coefficient for sloping backfill and surcharge
$K_{v,q,ref}$	Reference value of $K_{v,q}$ obtained for a value of $S = 0$

$K_{v,soil}$	Vertical shear force coefficient for self-weight of the backfill
$K_{v,soil,ref}$	Reference value of $K_{v,soil}$ obtained for an inclination of the back of the wall θ of 90 degrees
m	Bulk modulus exponent
m_k	Stiffness degradation parameter
N	Number of steps in the back of a stepped wall
n	Modulus exponent
n_j	Interface stiffness exponent
o'	Generic name for the line of intersection between the initial loading surface and a plane parallel to the σ_n-τ plane
o''	Generic name for the projection of o' in the Δ_s-τ plane
p'	$(\sigma_1'+\sigma_3')/2$
p_a	Atmospheric pressure = 101.3 kPa
q	Shear direction parameter; $(\sigma_1-\sigma_3)/2$
q_s	Applied surcharge pressure
R_f	Failure ratio for soils
R_{fj}	Failure ratio for interfaces
S	Horizontal distance from the vertical plane through the wall heel to the top of the backfill slope
SL_O	Stress level at the origin of unloading-reloading
SL^{ts}	Transition stress level
SL^{ys}	Stress level for current position of yield surface
v	Generic name for vertical stress paths
v'	Generic name for the σ_n-Δ_s-τ response of the interface to a vertical stress path
v''	Generic name for the Δ_s-τ response of the interface to a vertical stress path

α	Scaling factor for unloading-reloading
γ	Unit weight of the soil
γ_b	Buoyant unit weight of submerged backfill
γ_{max} , γ_{min}	Maximum and minimum density, respectively
γ_{moist}	Moist unit weight of the backfill above the water table
γ_w	Unit weight of water (9.8 kN/m^3)
δ	Peak interface friction angle
δ_r	Residual interface friction angle
Δ_{actual}	Actual sliding displacement between soil particles and concrete
Δ_{dis}	Deformation of the sand mass due to distortion under the applied shear stresses
Δ_{meas}	Displacement measured between the soil box and concrete specimen
Δ_n	Displacement normal to the interface
Δ_s	Displacement along the interface
Δ_s^{i-1}, Δ_s^i	Consecutive interface displacement readings
Δ_{so}	Interface displacement at the origin of unloading-reloading
Δ_{sp}	Interface displacement to peak
Δ_{sr}	Interface displacement to residual
Δ_v	Displacement normal to the interface; vertical displacement during interface testing
ΔP	$H_b - H$
$\{\Delta P\}$	Vector of nodal forces
$\{\Delta u\}$	Vector of unknown incremental displacements
$\Delta\gamma_{xy}$	Shear strain increment
$\Delta\Delta_s$	Increment of interface displacement

$\Delta\varepsilon_x$, $\Delta\varepsilon_y$	Horizontal and vertical strain increments, respectively
$\Delta\sigma_x$, $\Delta\sigma_y$	Horizontal and vertical stress increments, respectively
$\Delta\sigma_n$	Normal stress increment
$\Delta\tau^i$	Shear stress increment between points P and Q
$\Delta\tau^v$, $\Delta\tau^o$	Components of the shear stress increment in the orthogonal directions v' and o', respectively
$\Delta\tau_{xy}$	Shear stress increment in soils and backfills
$\Delta\tau$	Shear stress increment in interfaces
$\Delta\phi$	Reduction in the peak secant friction angle value for a tenfold increase in σ'_3
ε	Axial strain
ε_v	Volumetric strain
θ	Angle between the stress path direction and the τ-axis
ν	Poisson's ratio
ν_{nom}	Nominal Poisson's ratio
σ_h	Horizontal pressure
σ_n	Normal stress acting on the interface
σ_n^{ts}	Normal stress corresponding to point TS where the stress path intersects a transition surface
σ_{no}	Normal stress at the origin
σ_v	Vertical stress
$\sigma_v{}'$	Effective vertical stress
σ_1	Major principal total stress
$\sigma_1{}'$	Major principal effective stress
σ_3	Minor principal total stress

$\sigma_3{}'$	Minor principal effective stress
$(\sigma_1 - \sigma_3)$	Deviator stress
$(\sigma_1 - \sigma_3)_f$	Deviator stress at failure
$(\sigma_1 - \sigma_3)_{ult}$	Asymptotic deviator stress
τ	Interface shear stress
τ^{i-1}, τ^i	Consecutive interface shear stress readings
τ^{ts}	Shear stress at point TS where the stress path intersects a transition surface
τ_f	Interface shear strength
τ_o	Interface shear stress at the origin of unloading-reloading
τ_{ult}	Asymptotic interface shear stress
ϕ	Peak secant internal friction angle of the soil
ϕ'	Effective peak secant friction angle of the soil
ϕ_{cv}	Friction angle at a strain of 15 percent
ϕ_o	Peak secant friction angle at a confining pressure of 101.3 kPa (1atm)