



4-1 BRIDGE FOUNDATION LOADS

Table 1. End Supports (Abutments) at Service Limit State

Service Limit State		M_X (kip-ft)		V_Y (kips)		P (kips) ¹ Net	
		M_{X_total}	M_{X_perm}	V_{Y_total}	V_{Y_perm}	P_{total}	P_{perm}
Eccentricity	M_{X_max}						
	M_{X_min}						
	P_{total_min}						
	Controlling load combination ²						
Settlement	M_{X_max}						
	M_{X_min}						
	P_{total_max}						
	Controlling load combination ³						

Table 2. End Supports (Abutments) at Strength/Construction Limit States

Strength/Construction Limit States		M_X (kip-ft)	V_Y (kips)	P_{total} (kips) ¹ Gross
Bearing	M_{X_max}			
	M_{X_min}			
	P_{total_max}			
	Controlling load combination ³			
Sliding	V_{Y_max}			
	V_{Y_min}			
	P_{total_min}			
	Controlling load combination ⁴			

Notes:

- 1) Axial force (P) is assumed positive if compressive.
- 2) Controlling load combination is the one resulting in the highest eccentricity.
- 3) Controlling load combination is the one resulting in the highest $q_{n,u}/q_{pn}$ or $q_{g,u}/q_R$ ratio for foundations on soil, or $q_{n,max}/q_{pn}$ or $q_{g,max}/q_R$ ratio for foundations on rock.
- 4) Controlling load combination is the one resulting in the highest “factored sliding force/factored sliding resistance” ratio.



Table 3. Intermediate Supports (Bents & Piers) at Service Limit State

Service Limit State		M_X (kip-ft)		M_Y (kips)		P (kips) ¹ Net	
		M_{X_total}	M_{X_perm}	M_{Y_total}	M_{Y_perm}	P_{total}	P_{perm}
Eccentricity	M_{X_max}						
	M_{X_min}						
	M_{Y_max}						
	M_{Y_min}						
	P_{total_min}						
	Controlling load combination ²						
Settlement	M_{X_max}						
	M_{X_min}						
	M_{Y_max}						
	M_{Y_min}						
	P_{total_max}						
	Controlling load combination ³						

Table 4. Intermediate Supports (Bents & Piers) at Strength Limit State

Strength Limit State		M_X (kip-ft)	M_Y (kip-ft)	V_X (kips)	V_Y (kips)	P_{total} (kips) ¹ Gross
Bearing	M_{X_max}					
	M_{X_min}					
	M_{Y_max}					
	M_{Y_min}					
	P_{total_max}					
	Controlling load combination ³					
Sliding	V_{X_max}					
	V_{X_min}					
	V_{Y_max}					
	V_{Y_min}					
	P_{total_min}					
	Controlling load combination ⁴					

Notes:

- 1) Axial force (P) is assumed positive if compressive.
- 2) Controlling load combination is the one resulting in the highest eccentricity.
- 3) Controlling load combination is the one resulting in the highest $q_{n,u}/q_{pn}$ or $q_{g,u}/q_R$ ratio for foundations on soil, or $q_{n,max}/q_{pn}$ or $q_{g,max}/q_R$ ratio for foundations on rock.
- 4) Controlling load combination is the one resulting in the highest “factored sliding force/ factored sliding resistance” ratio.



Table 5. Intermediate Supports (Bents & Piers) at Extreme Event-I Limit State (Seismic)

Extreme Event-I Limit State	<i>M</i> (kip-ft)		<i>V</i> (kips)		<i>P</i> (kips)
	<i>M_X</i>	<i>M_Y</i>	<i>V_X</i>	<i>V_Y</i>	<i>P_{Total}</i>
<i>M_{d1}</i> -I ^{1,2}					
<i>M_{d2}</i> -I					
<i>M_{d3}</i> -I					
<i>M_{d4}</i> -I					
<i>M_{d5}</i> -I					
<i>M_{d6}</i> -I					
<i>M_{d7}</i> -I					
<i>M_{d1}</i> -II					
<i>M_{d2}</i> -II					
<i>M_{d3}</i> -II					
<i>M_{d4}</i> -II					
<i>M_{d5}</i> -II					
<i>M_{d6}</i> -II					
<i>M_{d7}</i> -II					

Notes:

- 1) *M_{d1}*-*M_{d7}* stand for cases where seismic overstrength moment (*M_o*) and associated shear (*V_o*) are applied at 15 degree increments (0°- 90°) to a symmetrical spread footing.
- 2) Cases I and II correspond to highest and lowest column axial forces resulted from seismic overturning in multicolumn bents. For single-column bents the two cases (I and II) will be summarized into one case.