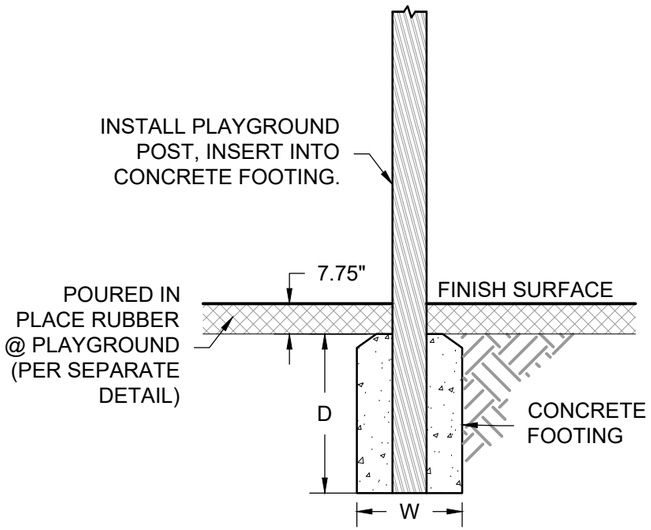


FOOTINGS TABLE		
TYPE	DIAMETER/SIDE, W	DEPTH, D
A	1'-6"	3'-6"
B	1'-2"	2'-6"
C	2'-0"	4'-6"
D	2'-0"	2'-6"



ORIGINS
ENGINEERING CO

BOB KILDEE PARK PLAYGROUND
FOOTING DETAIL

SHEET 1 OF 1

EH-1

PLAYGROUND POST FOOTING — NONCONSTRAINED EMBEDMENT CALCULATION

2025 CBC (2024 IBC) 1807.3.2.1, Eq. 18-1 (nonconstrained); 1806.2 / 1806.3.4. ASD loads.

Project	Bob Kildee Park Playground
Location / Jurisdiction	Camarillo, CA
Footing ID / Equipment	Footing A
Prepared by / Date	DG - 11/04/2026
Checked by / Date	TA - 11/05/2026
Building code	2025 California Building Code (Cal. Code of Regs. Title 24, Part 2), effective 1/1/2026 — based on the 2024 IBC
Referenced standards	ASCE 7-22 (incl. Supplement 1) for loads · ACI 318-19 for concrete · ASTM F1487 / manufacturer installation detail
Local amendments to CBC Ch. 18	None identified for City of Camarillo

1. LOADS AT FOOTING — Governing ASD combination

Item	Symbol	Value	Units	Reference / note
Applied lateral force (Eq. 18-1 P)	P	276	lb	*Governing: 7. D + 0.525Ev + 0.525Eh + 0.75L*
Moment at finish surface	M_s	851	lb-ft	*Same combination as P*
Maximum axial compression	C	615	lb	*Max vertical over all ASD combinations*
Structure dead load on footing	D	215	lb	*Uplift resistance, factored 0.6D*
Uplift demand (excl. dead load)	T	42	lb	*Max over all combinations (Footing Calc resists with 0.6D)*

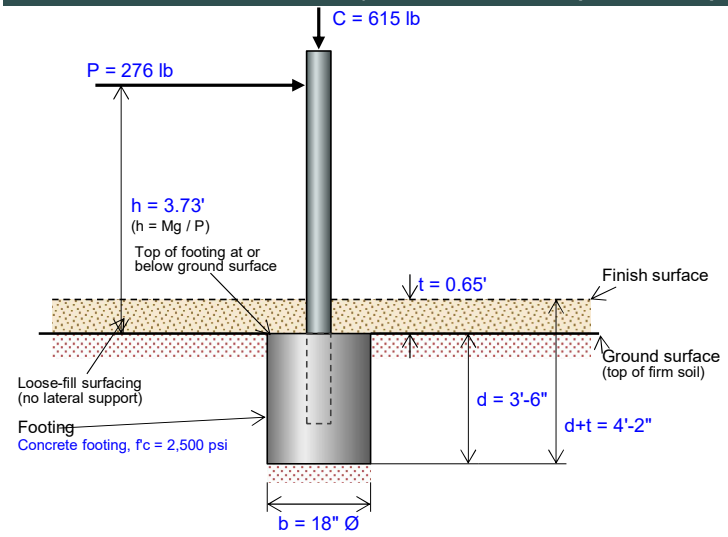
2. INPUTS — SOIL

Item	Symbol	Value	Units	Reference / note
Allowable lateral soil-bearing pressure, per ft of depth	s_0	150	psf/ft	*Table 1806.2 or geotech report*
Apply 1806.3.4 isolated-pole doubling?		Yes	Y/N	*Isolated poles tolerating ½" motion; presumptive values only unless geotech allows*
Allowable vertical bearing	q_a	2,000	psf	*Table 1806.2 or geotech report*
Allowable skin friction for uplift	f_s	0	psf	*Use 0 unless provided by geotech report*
Surfacing / disturbed soil above ground surface	t	0.65	ft	*Sheet variable; finish surface is always above top of footing*

3. INPUTS — FOOTING

Item	Symbol	Value	Units	Reference / note
Diameter of round footing (Eq. 18-1 b)	b	18	in	*Trial size; converted to ft below*
Top of footing below ground surface	c	0.00	ft	*≥ 0 (top of footing never above ground surface); keep ≤ 0.5 ft*
Concrete unit weight	γc	145	pcf	*Normal-weight concrete*
Concrete design strength	$f'c$	2,500	psi	*Verify exposure class (ACI 318 Table 19.3.2.1)*
Manufacturer minimum embedment		2.50	ft	*From manufacturer footing detail*
Manufacturer minimum diameter		18	in	*From manufacturer footing detail*
Round embedment up to nearest		6	in	*Specification increment*

4. SKETCH — NOMENCLATURE (not to scale; labels update with inputs and results)



Nomenclature

Not to scale. Values update with inputs.

KEY VALUES	
Lateral load, P	276 lb
Moment at grade, Mg	1,029 lb-ft
Height of P, h	3.73 ft
Surfacing depth, t	0.65 ft
Lat. bearing rate, s	300 psf/ft
Min. embedment, d_min	3.14 ft
Embedment, d_prov	**3'-6"**
Bottom below finish surf.	**4'-2"**
Footing diameter, b	18"
Governed by	Calculation
d_req / d_prov	0.84
Bearing ratio	0.43
Uplift ratio	0.06
Overall	**OK**

5. DERIVED VALUES

Item	Symbol	Value	Units	Reference / note
Lateral bearing factor		2		*1806.3.4*
Design lateral soil-bearing pressure, per ft of depth	*s*	300	psf/ft	*s_0 × factor*
Maximum lateral bearing, 15 × s		4,500	psf	*1806.3.3 (cannot govern with 12-ft limit on d)*
Diameter of round footing	*b*	1.500	ft	*Eq. 18-1 b, in feet*
Moment in the post at grade	*Mg*	1,029	lb-ft	*M_s + P·t; Mg symbol per 1807.3.2.2*
Distance from ground surface to point of application of P	*h*	3.73	ft	*Eq. 18-1 h = Mg / P*

6. CODE CHECK — 2025 CBC 1807.3.2.1, EQUATION 18-1 (nonconstrained)

d = 0.5A{1 + [1 + (4.36h/A)]^1/2} (Equation 18-1), where A = 2.34P/(S_1b)

b = diameter of round post or footing or diagonal dimension of square post or footing, ft · P = applied lateral force, lb

d = depth of embedment in earth, ft, but not over 12 ft for purpose of computing lateral pressure · h = distance from ground surface to point of application of P, ft

S_1 = allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment, psf

Applies where lateral constraint is not provided at the ground surface (rigid floor/pavement) nor above it (structural diaphragm).

Ground surface = top of firm soil. Top of footing is at or below it (c ≥ 0); finish surface is above it by t. Mg per 1807.3.2.2; other symbols are sheet variables.

Item	Symbol	Value	Units	Reference / note
Minimum depth of embedment (exact solution of Eq. 18-1)	*d_min*	3.14	ft	*S_1 = s·min(d,12)/3 substituted*
Rounded up to specification increment		3.50	ft	
Depth of embedment provided, below ground surface	*d_prov*	3.50	ft	*Greater of calc and manufacturer minimum*
Embedment governed by		Calculation		
d for computing lateral pressure (≤ 12 ft)	*d*	3.50	ft	*1807.3.2.1 definition of d*
S_1 at one-third the depth of embedment = s·d/3	*S_1*	350	psf	*1806.2 / 1806.3.4*
A = 2.34P/(S_1b)	*A*	1.228	ft	*1807.3.2.1*
d = 0.5A{1 + [1 + (4.36h/A)]^1/2}	*d_req*	2.93	ft	*Equation 18-1*
d_req / d_prov		0.84		*≤ 1.00 → OK*
Bottom of footing below finish surface		4.15	ft	*t + d_prov (call out on plans)*
Footing length (concrete)		3.50	ft	*d_prov − c (top of footing at or below ground surface)*

7. VERTICAL BEARING & UPLIFT CHECKS

Item	Symbol	Value	Units	Reference / note
Footing base area	*A_β*	1.767	ft²	*πb²/4*
Concrete weight (footing length)	*Wc*	897	lb	*A_β × (d_prov − c) × γc; surfacing/soil above footing neglected*
Bearing pressure	*q*	856	psf	*(C + Wc) / A_β — conservative (gross)*
Bearing demand / capacity ratio		0.43		*≤ 1.00 OK*
Skin friction resistance		0	lb	*f_s × πb × (d_prov − c), firm soil only*
Uplift resistance		667	lb	*0.6(D + Wc) + friction*
Uplift demand / capacity ratio		0.06		*≤ 1.00 OK*
Diameter vs. manufacturer minimum		1.00		*≤ 1.00 OK*

8. RESULTS SUMMARY

Check	Ratio	Status
Eq. 18-1 embedment, d_req / d_prov	0.84	**OK**
Vertical bearing	0.43	**OK**
Uplift	0.06	**OK**
Manufacturer minimum diameter	1.00	**OK**

USE: 18" Ø footing, bottom 3'-6" below ground surface (4'-2" below finish surface), top at ground surface, f'c = 2,500 psi

All checks OK



PLAYGROUND POST FOOTING — NONCONSTRAINED EMBEDMENT CALCULATION

2025 CBC (2024 IBC) 1807.3.2.1, Eq. 18-1 (nonconstrained); 1806.2 / 1806.3.4. ASD loads.

Project	Bob Kildee Park Playground
Location / Jurisdiction	Camarillo, CA
Footing ID / Equipment	Footing B
Prepared by / Date	DG - 11/04/2026
Checked by / Date	TA - 11/05/2026
Building code	2025 California Building Code (Cal. Code of Regs. Title 24, Part 2), effective 1/1/2026 — based on the 2024 IBC
Referenced standards	ASCE 7-22 (incl. Supplement 1) for loads · ACI 318-19 for concrete · ASTM F1487 / manufacturer installation detail
Local amendments to CBC Ch. 18	None identified for City of Camarillo

1. LOADS AT FOOTING — Governing ASD combination

Item	Symbol	Value	Units	Reference / note
Applied lateral force (Eq. 18-1 P)	P	82	lb	*Governing: 6. D + 0.7Ev + 0.7Eh*
Moment at finish surface	M_s	163	lb-ft	*Same combination as P*
Maximum axial compression	C	125	lb	*Max vertical over all ASD combinations*
Structure dead load on footing	D	105	lb	*Uplift resistance, factored 0.6D*
Uplift demand (excl. dead load)	T	20	lb	*Max over all combinations (Footing Calc resists with 0.6D)*

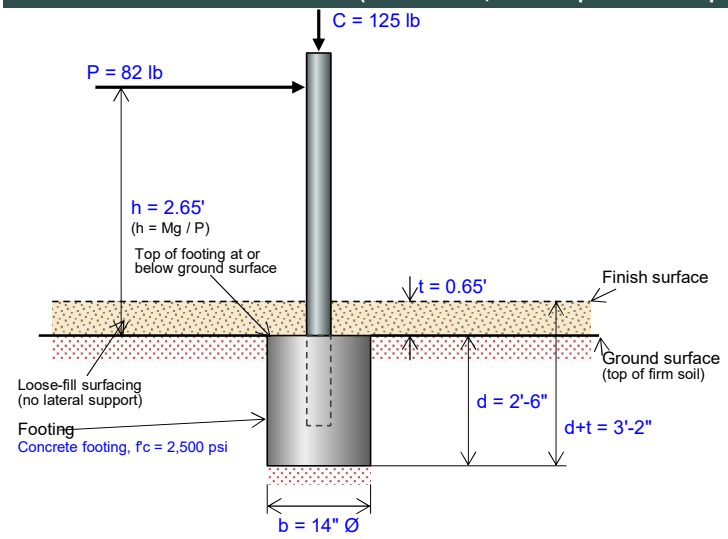
2. INPUTS — SOIL

Item	Symbol	Value	Units	Reference / note
Allowable lateral soil-bearing pressure, per ft of depth	s_0	150	psf/ft	*Table 1806.2 or geotech report*
Apply 1806.3.4 isolated-pole doubling?		Yes	Y/N	*Isolated poles tolerating ½" motion; presumptive values only unless geotech allows*
Allowable vertical bearing	q_a	2,000	psf	*Table 1806.2 or geotech report*
Allowable skin friction for uplift	f_s	0	psf	*Use 0 unless provided by geotech report*
Surfacing / disturbed soil above ground surface	t	0.65	ft	*Sheet variable; finish surface is always above top of footing*

3. INPUTS — FOOTING

Item	Symbol	Value	Units	Reference / note
Diameter of round footing (Eq. 18-1 b)	b	14	in	*Trial size; converted to ft below*
Top of footing below ground surface	c	0.00	ft	*≥ 0 (top of footing never above ground surface); keep ≤ 0.5 ft*
Concrete unit weight	γc	145	pcf	*Normal-weight concrete*
Concrete design strength	$f'c$	2,500	psi	*Verify exposure class (ACI 318 Table 19.3.2.1)*
Manufacturer minimum embedment		2.50	ft	*From manufacturer footing detail*
Manufacturer minimum diameter		14	in	*From manufacturer footing detail*
Round embedment up to nearest		6	in	*Specification increment*

4. SKETCH — NOMENCLATURE (not to scale; labels update with inputs and results)



Nomenclature

Not to scale. Values update with inputs.

KEY VALUES	
Lateral load, P	82 lb
Moment at grade, Mg	216 lb-ft
Height of P, h	2.65 ft
Surfacing depth, t	0.65 ft
Lat. bearing rate, s	300 psf/ft
Min. embedment, d_min	2.00 ft
Embedment, d_prov	**2'-6"**
Bottom below finish surf.	**3'-2"**
Footing diameter, b	14"
Governed by	Calculation
d_req / d_prov	0.70
Bearing ratio	0.24
Uplift ratio	0.07
Overall	**OK**

CODE BASIS: 2025 California Building Code (Cal. Code of Regs. Title 24, Part 2), effective 1/1/2026 — based on the 2024 IBC. ASCE 7-22 (incl. Supplement 1) for loads · ACI 318-19 for concrete · ASTM F1487 / manufacturer installation detail. Local amendments: None identified for City of Camarillo

5. DERIVED VALUES

Item	Symbol	Value	Units	Reference / note
Lateral bearing factor		2		*1806.3.4*
Design lateral soil-bearing pressure, per ft of depth	*s*	300	psf/ft	*s_0 × factor*
Maximum lateral bearing, 15 × s		4,500	psf	*1806.3.3 (cannot govern with 12-ft limit on d)*
Diameter of round footing	*b*	1.167	ft	*Eq. 18-1 b, in feet*
Moment in the post at grade	*Mg*	216	lb-ft	*$M_s + P·t$; Mg symbol per 1807.3.2.2*
Distance from ground surface to point of application of P	*h*	2.65	ft	*Eq. 18-1 h = Mg / P*

6. CODE CHECK — 2025 CBC 1807.3.2.1, EQUATION 18-1 (nonconstrained)

d = 0.5A{1 + [1 + (4.36h/A)]^1/2} (Equation 18-1), where A = 2.34P/(S_1b)

b = diameter of round post or footing or diagonal dimension of square post or footing, ft · P = applied lateral force, lb

d = depth of embedment in earth, ft, but not over 12 ft for purpose of computing lateral pressure · h = distance from ground surface to point of application of P, ft

S_1 = allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment, psf

Applies where lateral constraint is not provided at the ground surface (rigid floor/pavement) nor above it (structural diaphragm).

Ground surface = top of firm soil. Top of footing is at or below it (c ≥ 0); finish surface is above it by t. Mg per 1807.3.2.2; other symbols are sheet variables.

Item	Symbol	Value	Units	Reference / note
Minimum depth of embedment (exact solution of Eq. 18-1)	*d_min*	2.00	ft	*S_1 = s·min(d,12)/3 substituted*
Rounded up to specification increment		2.50	ft	
Depth of embedment provided, below ground surface	*d_prov*	2.50	ft	*Greater of calc and manufacturer minimum*
Embedment governed by		Calculation		
d for computing lateral pressure (≤ 12 ft)	*d*	2.50	ft	*1807.3.2.1 definition of d*
S_1 at one-third the depth of embedment = s·d/3	*S_1*	250	psf	*1806.2 / 1806.3.4*
A = 2.34P/(S_1b)	*A*	0.656	ft	*1807.3.2.1*
d = 0.5A{1 + [1 + (4.36h/A)]^1/2}	*d_req*	1.74	ft	*Equation 18-1*
d_req / d_prov		0.70		*≤ 1.00 → OK*
Bottom of footing below finish surface		3.15	ft	*t + d_prov (call out on plans)*
Footing length (concrete)		2.50	ft	*d_prov − c (top of footing at or below ground surface)*

7. VERTICAL BEARING & UPLIFT CHECKS

Item	Symbol	Value	Units	Reference / note
Footing base area	*A_β*	1.069	ft²	*$\pi b^2/4$*
Concrete weight (footing length)	*Wc*	388	lb	*A_β × (d_prov − c) × γc; surfacing/soil above footing neglected*
Bearing pressure	*q*	480	psf	*(C + Wc) / A_β — conservative (gross)*
Bearing demand / capacity ratio		0.24		*≤ 1.00 OK*
Skin friction resistance		0	lb	*f_s × πb × (d_prov − c), firm soil only*
Uplift resistance		296	lb	*0.6(D + Wc) + friction*
Uplift demand / capacity ratio		0.07		*≤ 1.00 OK*
Diameter vs. manufacturer minimum		1.00		*≤ 1.00 OK*

8. RESULTS SUMMARY

Check	Ratio	Status
Eq. 18-1 embedment, d_req / d_prov	0.70	OK
Vertical bearing	0.24	OK
Uplift	0.07	OK
Manufacturer minimum diameter	1.00	OK

USE: 14" Ø footing, bottom 2'-6" below ground surface (3'-2" below finish surface), top at ground surface, f'c = 2,500 psi

All checks OK



PLAYGROUND POST FOOTING — NONCONSTRAINED EMBEDMENT CALCULATION

2025 CBC (2024 IBC) 1807.3.2.1, Eq. 18-1 (nonconstrained); 1806.2 / 1806.3.4. ASD loads.

Project	Bob Kildee Park Playground
Location / Jurisdiction	Camarillo, CA
Footing ID / Equipment	Footing C
Prepared by / Date	DG - 11/04/2026
Checked by / Date	TA - 11/05/2026
Building code	2025 California Building Code (Cal. Code of Regs. Title 24, Part 2), effective 1/1/2026 — based on the 2024 IBC
Referenced standards	ASCE 7-22 (incl. Supplement 1) for loads · ACI 318-19 for concrete · ASTM F1487 / manufacturer installation detail
Local amendments to CBC Ch. 18	None identified for City of Camarillo

1. LOADS AT FOOTING — Governing ASD combination

Item	Symbol	Value	Units	Reference / note
Applied lateral force (Eq. 18-1 P)	P	606	lb	*Governing: 7. D + 0.525Ev + 0.525Eh + 0.75L*
Moment at finish surface	M_s	3,054	lb-ft	*Same combination as P*
Maximum axial compression	C	860	lb	*Max vertical over all ASD combinations*
Structure dead load on footing	D	460	lb	*Uplift resistance, factored 0.6D*
Uplift demand (excl. dead load)	T	90	lb	*Max over all combinations (Footing Calc resists with 0.6D)*

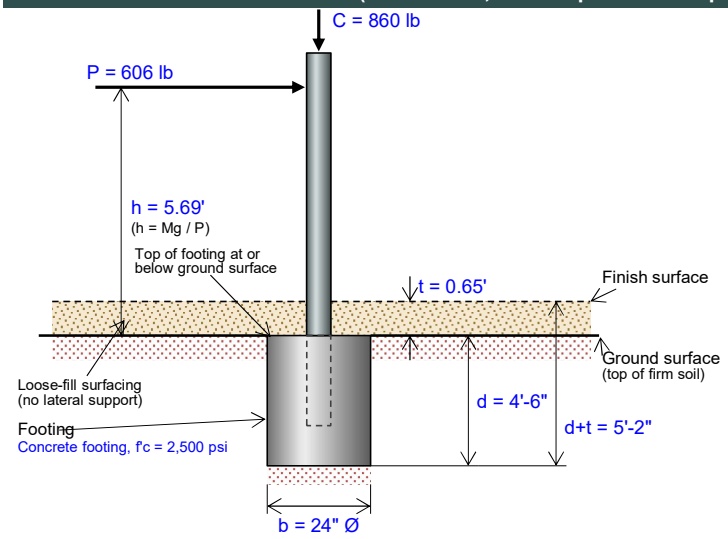
2. INPUTS — SOIL

Item	Symbol	Value	Units	Reference / note
Allowable lateral soil-bearing pressure, per ft of depth	s_0	150	psf/ft	*Table 1806.2 or geotech report*
Apply 1806.3.4 isolated-pole doubling?		Yes	Y/N	*Isolated poles tolerating ½" motion; presumptive values only unless geotech allows*
Allowable vertical bearing	q_a	2,000	psf	*Table 1806.2 or geotech report*
Allowable skin friction for uplift	f_s	0	psf	*Use 0 unless provided by geotech report*
Surfacing / disturbed soil above ground surface	t	0.65	ft	*Sheet variable; finish surface is always above top of footing*

3. INPUTS — FOOTING

Item	Symbol	Value	Units	Reference / note
Diameter of round footing (Eq. 18-1 b)	b	24	in	*Trial size; converted to ft below*
Top of footing below ground surface	c	0.00	ft	*≥ 0 (top of footing never above ground surface); keep ≤ 0.5 ft*
Concrete unit weight	γc	145	pcf	*Normal-weight concrete*
Concrete design strength	$f'c$	2,500	psi	*Verify exposure class (ACI 318 Table 19.3.2.1)*
Manufacturer minimum embedment		4.00	ft	*From manufacturer footing detail*
Manufacturer minimum diameter		24	in	*From manufacturer footing detail*
Round embedment up to nearest		6	in	*Specification increment*

4. SKETCH — NOMENCLATURE (not to scale; labels update with inputs and results)



Nomenclature

Not to scale. Values update with inputs.

KEY VALUES	
Lateral load, P	606 lb
Moment at grade, Mg	3,446 lb-ft
Height of P, h	5.69 ft
Surfacing depth, t	0.65 ft
Lat. bearing rate, s	300 psf/ft
Min. embedment, d_min	4.19 ft
Embedment, d_prov	**4'-6"**
Bottom below finish surf.	**5'-2"**
Footing diameter, b	24"
Governed by	Calculation
d_req / d_prov	0.89
Bearing ratio	0.46
Uplift ratio	0.06
Overall	**OK**

5. DERIVED VALUES

Item	Symbol	Value	Units	Reference / note
Lateral bearing factor		2		*1806.3.4*
Design lateral soil-bearing pressure, per ft of depth	*s*	300	psf/ft	*s_0 × factor*
Maximum lateral bearing, 15 × s		4,500	psf	*1806.3.3 (cannot govern with 12-ft limit on d)*
Diameter of round footing	*b*	2.000	ft	*Eq. 18-1 b, in feet*
Moment in the post at grade	*Mg*	3,446	lb-ft	*$M_s + P·t$; Mg symbol per 1807.3.2.2*
Distance from ground surface to point of application of P	*h*	5.69	ft	*Eq. 18-1 h = Mg / P*

6. CODE CHECK — 2025 CBC 1807.3.2.1, EQUATION 18-1 (nonconstrained)

d = 0.5A{1 + [1 + (4.36h/A)]^1/2} (Equation 18-1), where A = 2.34P/(S_1b)

b = diameter of round post or footing or diagonal dimension of square post or footing, ft · P = applied lateral force, lb

d = depth of embedment in earth, ft, but not over 12 ft for purpose of computing lateral pressure · h = distance from ground surface to point of application of P, ft

S_1 = allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment, psf

Applies where lateral constraint is not provided at the ground surface (rigid floor/pavement) nor above it (structural diaphragm).

Ground surface = top of firm soil. Top of footing is at or below it (c ≥ 0); finish surface is above it by t. Mg per 1807.3.2.2; other symbols are sheet variables.

Item	Symbol	Value	Units	Reference / note
Minimum depth of embedment (exact solution of Eq. 18-1)	*d_min*	4.19	ft	*S_1 = s·min(d,12)/3 substituted*
Rounded up to specification increment		4.50	ft	
Depth of embedment provided, below ground surface	*d_prov*	4.50	ft	*Greater of calc and manufacturer minimum*
Embedment governed by		Calculation		
d for computing lateral pressure (≤ 12 ft)	*d*	4.50	ft	*1807.3.2.1 definition of d*
S_1 at one-third the depth of embedment = s·d/3	*S_1*	450	psf	*1806.2 / 1806.3.4*
A = 2.34P/(S_1b)	*A*	1.576	ft	*1807.3.2.1*
d = 0.5A{1 + [1 + (4.36h/A)]^1/2}	*d_req*	4.01	ft	*Equation 18-1*
d_req / d_prov		0.89		*≤ 1.00 → OK*
Bottom of footing below finish surface		5.15	ft	*t + d_prov (call out on plans)*
Footing length (concrete)		4.50	ft	*d_prov − c (top of footing at or below ground surface)*

7. VERTICAL BEARING & UPLIFT CHECKS

Item	Symbol	Value	Units	Reference / note
Footing base area	*A_β*	3.142	ft²	*$\pi b^2/4$*
Concrete weight (footing length)	*Wc*	2,050	lb	*A_β × (d_prov − c) × γc; surfacing/soil above footing neglected*
Bearing pressure	*q*	926	psf	*(C + Wc) / A_β — conservative (gross)*
Bearing demand / capacity ratio		0.46		*≤ 1.00 OK*
Skin friction resistance		0	lb	*f_s × πb × (d_prov − c), firm soil only*
Uplift resistance		1,506	lb	*0.6(D + Wc) + friction*
Uplift demand / capacity ratio		0.06		*≤ 1.00 OK*
Diameter vs. manufacturer minimum		1.00		*≤ 1.00 OK*

8. RESULTS SUMMARY

Check	Ratio	Status
Eq. 18-1 embedment, d_req / d_prov	0.89	OK
Vertical bearing	0.46	OK
Uplift	0.06	OK
Manufacturer minimum diameter	1.00	OK

USE: 24" Ø footing, bottom 4'-6" below ground surface (5'-2" below finish surface), top at ground surface, f'c = 2,500 psi

All checks OK



PLAYGROUND POST FOOTING — NONCONSTRAINED EMBEDMENT CALCULATION

2025 CBC (2024 IBC) 1807.3.2.1, Eq. 18-1 (nonconstrained); 1806.2 / 1806.3.4. ASD loads.

Project	Bob Kildee Park Playground
Location / Jurisdiction	Camarillo, CA
Footing ID / Equipment	Footing D
Prepared by / Date	DG - 11/04/2026
Checked by / Date	TA - 11/05/2026
Building code	2025 California Building Code (Cal. Code of Regs. Title 24, Part 2), effective 1/1/2026 — based on the 2024 IBC
Referenced standards	ASCE 7-22 (incl. Supplement 1) for loads · ACI 318-19 for concrete · ASTM F1487 / manufacturer installation detail
Local amendments to CBC Ch. 18	None identified for City of Camarillo

1. LOADS AT FOOTING — Governing ASD combination

Item	Symbol	Value	Units	Reference / note
Applied lateral force (Eq. 18-1 P)	P	213	lb	*Governing: 7. D + 0.525Ev + 0.525Eh + 0.75L*
Moment at finish surface	M_s	0	lb-ft	*Same combination as P*
Maximum axial compression	C	148	lb	*Max vertical over all ASD combinations*
Structure dead load on footing	D	124	lb	*Uplift resistance, factored 0.6D*
Uplift demand (excl. dead load)	T	313	lb	*Max over all combinations (Footing Calc resists with 0.6D)*

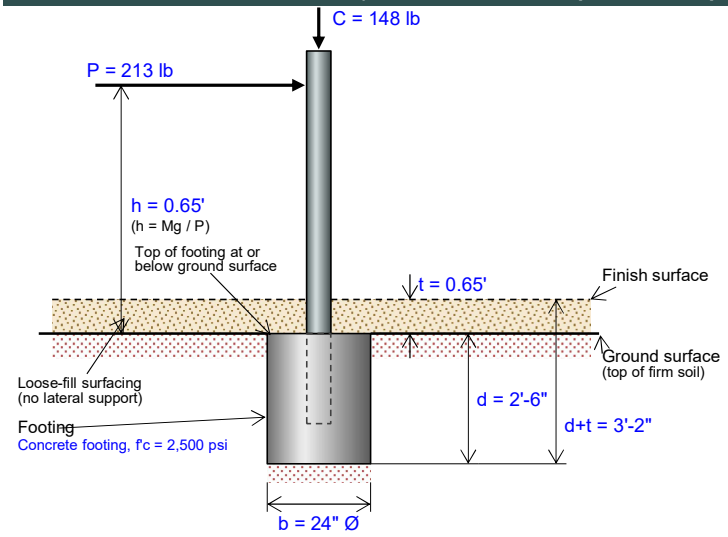
2. INPUTS — SOIL

Item	Symbol	Value	Units	Reference / note
Allowable lateral soil-bearing pressure, per ft of depth	s_0	150	psf/ft	*Table 1806.2 or geotech report*
Apply 1806.3.4 isolated-pole doubling?		Yes	Y/N	*Isolated poles tolerating ½" motion; presumptive values only unless geotech allows*
Allowable vertical bearing	q_a	2,000	psf	*Table 1806.2 or geotech report*
Allowable skin friction for uplift	f_s	0	psf	*Use 0 unless provided by geotech report*
Surfacing / disturbed soil above ground surface	t	0.65	ft	*Sheet variable; finish surface is always above top of footing*

3. INPUTS — FOOTING

Item	Symbol	Value	Units	Reference / note
Diameter of round footing (Eq. 18-1 b)	b	24	in	*Trial size; converted to ft below*
Top of footing below ground surface	c	0.00	ft	*≥ 0 (top of footing never above ground surface); keep ≤ 0.5 ft*
Concrete unit weight	γc	145	pcf	*Normal-weight concrete*
Concrete design strength	$f'c$	2,500	psi	*Verify exposure class (ACI 318 Table 19.3.2.1)*
Manufacturer minimum embedment		2.50	ft	*From manufacturer footing detail*
Manufacturer minimum diameter		24	in	*From manufacturer footing detail*
Round embedment up to nearest		6	in	*Specification increment*

4. SKETCH — NOMENCLATURE (not to scale; labels update with inputs and results)



Nomenclature

Not to scale. Values update with inputs.

KEY VALUES	
Lateral load, P	213 lb
Moment at grade, Mg	138 lb-ft
Height of P, h	0.65 ft
Surfacing depth, t	0.65 ft
Lat. bearing rate, s	300 psf/ft
Min. embedment, d_min	1.85 ft
Embedment, d_prov	**2'-6"**
Bottom below finish surf.	**3'-2"**
Footing diameter, b	24"
Governed by	Manufacturer minimum
d_req / d_prov	0.59
Bearing ratio	0.20
Uplift ratio	0.41
Overall	**OK**

5. DERIVED VALUES

Item	Symbol	Value	Units	Reference / note
Lateral bearing factor		2		*1806.3.4*
Design lateral soil-bearing pressure, per ft of depth	*s*	300	psf/ft	*s_0 × factor*
Maximum lateral bearing, 15 × s		4,500	psf	*1806.3.3 (cannot govern with 12-ft limit on d)*
Diameter of round footing	*b*	2.000	ft	*Eq. 18-1 b, in feet*
Moment in the post at grade	*Mg*	138	lb-ft	*$M_s + P·t$; Mg symbol per 1807.3.2.2*
Distance from ground surface to point of application of P	*h*	0.65	ft	*Eq. 18-1 h = Mg / P*

6. CODE CHECK — 2025 CBC 1807.3.2.1, EQUATION 18-1 (nonconstrained)

d = 0.5A{1 + [1 + (4.36h/A)]^1/2} (Equation 18-1), where A = 2.34P/(S_1b)

b = diameter of round post or footing or diagonal dimension of square post or footing, ft · P = applied lateral force, lb

d = depth of embedment in earth, ft, but not over 12 ft for purpose of computing lateral pressure · h = distance from ground surface to point of application of P, ft

S_1 = allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment, psf

Applies where lateral constraint is not provided at the ground surface (rigid floor/pavement) nor above it (structural diaphragm).

Ground surface = top of firm soil. Top of footing is at or below it (c ≥ 0); finish surface is above it by t. Mg per 1807.3.2.2; other symbols are sheet variables.

Item	Symbol	Value	Units	Reference / note
Minimum depth of embedment (exact solution of Eq. 18-1)	*d_min*	1.85	ft	*S_1 = s·min(d,12)/3 substituted*
Rounded up to specification increment		2.00	ft	
Depth of embedment provided, below ground surface	*d_prov*	2.50	ft	*Greater of calc and manufacturer minimum*
Embedment governed by		Manufacturer minimum		
d for computing lateral pressure (≤ 12 ft)	*d*	2.50	ft	*1807.3.2.1 definition of d*
S_1 at one-third the depth of embedment = s·d/3	*S_1*	250	psf	*1806.2 / 1806.3.4*
A = 2.34P/(S_1b)	*A*	0.997	ft	*1807.3.2.1*
d = 0.5A{1 + [1 + (4.36h/A)]^1/2}	*d_req*	1.47	ft	*Equation 18-1*
d_req / d_prov		0.59		*≤ 1.00 → OK*
Bottom of footing below finish surface		3.15	ft	*t + d_prov (call out on plans)*
Footing length (concrete)		2.50	ft	*d_prov − c (top of footing at or below ground surface)*

7. VERTICAL BEARING & UPLIFT CHECKS

Item	Symbol	Value	Units	Reference / note
Footing base area	*A_β*	3.142	ft²	*$\pi b^2/4$*
Concrete weight (footing length)	*Wc*	1,139	lb	*A_β × (d_prov − c) × γc; surfacing/soil above footing neglected*
Bearing pressure	*q*	410	psf	*(C + Wc) / A_β — conservative (gross)*
Bearing demand / capacity ratio		0.20		*≤ 1.00 OK*
Skin friction resistance		0	lb	*f_s × πb × (d_prov − c), firm soil only*
Uplift resistance		758	lb	*0.6(D + Wc) + friction*
Uplift demand / capacity ratio		0.41		*≤ 1.00 OK*
Diameter vs. manufacturer minimum		1.00		*≤ 1.00 OK*

8. RESULTS SUMMARY

Check	Ratio	Status
Eq. 18-1 embedment, d_req / d_prov	0.59	OK
Vertical bearing	0.20	OK
Uplift	0.41	OK
Manufacturer minimum diameter	1.00	OK

USE: 24" Ø footing, bottom 2'-6" below ground surface (3'-2" below finish surface), top at ground surface, f'c = 2,500 psi

All checks OK

