

ATTACHMENT 1
PRELIMINARY LIGHT
POLE FOUNDATION
RECOMMENDATIONS

To: Matthew Woo, P.E., RCDD, LEED AP BD+C / Wood Harbinger
From: David S. Phelps, PE; Christopher R. Newton, PE  
Date: February 2, 2023
File: 0454-166-00
Subject: Preliminary Light Pole Foundation Recommendations for the Port of Tacoma Light Pole Replacement Project
Tacoma, Washington (Memorandum #1)

INTRODUCTION

This memorandum provides our preliminary foundation recommendations for the light pole replacement project at Port of Tacoma. Light poles at seven sites in the Port of Tacoma are listed for replacement. These sites include the Union Pacific (UP) Yard, South Intermodal (SIM), Terminal 7, North Intermodal (NIM), TOTE, EB1, and Log Yard.

POLE FOUNDATION DESIGN PARAMETERS

We reviewed our in-house files for subsurface information at the above seven sites. Based on our review, we developed preliminary foundation parameters for pole-type and conventional shallow foundations. Where subsurface information was limited and/or similar, design parameters were combined. Specifically, we combined parameters for the UP Yard with SIM and Terminal 7 with NIM. Parameters for TOTE, EB1, and Log Yard had stand-alone parameters.

Tables 1 through 5 below include pole-type foundation recommendations for the seven sites as categorized above.

TABLE 1. UP YARD AND SIM

Soil Type	Depth Range (feet)	WSDOT GDM CH. 17			Soldier Pile Method				LPILE Parameters			
		Unit Weight (pcf)	Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)	Unit Weight (pcf)	Friction Angle (deg)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	Unit Weight (pcf)	Friction Angle (deg)	LPILE Model Type	p-y Modulus, k (pci)
New Structural Fill (above groundwater)	TBD	130	36	4,500	130	36	0.26	3.85	130	36	Sand (Reese)	225
Loose Sand (above groundwater)	0 – 4	115	30	900	115	30	0.33	3.00	115	30	Sand (Reese)	25
Loose Sand (below groundwater)	4 – 10	52.6	30	900	52.6	30	0.33	3.00	52.6	30	Sand (Reese)	20
Very Soft Silt (below groundwater)	10 and below	47.6	26	750	47.6	26	0.39	2.56	47.6	26	Sand (Reese)	15

Notes: For Tables 1 through 5, "New Structural Fill" assumes WSDOT Gravel Borrow placed and compacted to 95% of the maximum dry density (MDD) per ASTM D 1557.

TABLE 2. TERMINAL 7 AND NIM

Soil Type	Depth Range (feet)	WSDOT GDM CH. 17			Soldier Pile Method				LPILE Parameters			
		Unit Weight (pcf)	Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)	Unit Weight (pcf)	Friction Angle (deg)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	Unit Weight (pcf)	Friction Angle (deg)	LPILE Model Type	p-y Modulus, k (pci)
New Structural Fill (above groundwater)	TBD	130	36	4,500	130	36	0.26	3.85	130	36	Sand (Reese)	225
Medium Dense Sand (above groundwater)	0 – 5	120	32	1,500	120	32	0.31	3.25	120	32	Sand (Reese)	90
Loose Sand (below groundwater)	5 and below	52.6	30	900	52.6	30	0.33	3.00	52.6	30	Sand (Reese)	20

TABLE 3. TOTE

Soil Type	Depth Range (feet)	WSDOT GDM CH. 17			Soldier Pile Method				LPILE Parameters			
		Unit Weight (pcf)	Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)	Unit Weight (pcf)	Friction Angle (deg)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	Unit Weight (pcf)	Friction Angle (deg)	LPILE Model Type	p-y Modulus, k (pci)
New Structural Fill (above groundwater)	TBD	130	36	4,500	130	36	0.26	3.85	130	36	Sand (Reese)	225
Very Loose to Loose Sand (above groundwater)	0 – 5	115	28	800	115	28	0.36	2.77	115	28	Sand (Reese)	20
Very Loose to Loose Sand (below groundwater)	5 – 20	52.6	28	800	52.6	28	0.36	2.77	52.6	28	Sand (Reese)	15
Soft Silt (below groundwater)	20 – 25	47.6	28	750	47.6	28	0.36	2.77	47.6	28	Sand (Reese)	15
Loose Sand (below groundwater)	25 and below	52.6	30	900	52.6	30	0.33	3.00	52.6	30	Sand (Reese)	20

TABLE 4. EB1

Soil Type	Depth Range (feet)	WSDOT GDM CH. 17			Soldier Pile Method				LPILE Parameters			
		Unit Weight (pcf)	Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)	Unit Weight (pcf)	Friction Angle (deg)	Active Earth Pressure Coefficient (K _a)	Passive Earth Pressure Coefficient (K _p)	Unit Weight (pcf)	Friction Angle (deg)	LPILE Model Type	p-y Modulus, k (pci)
New Structural Fill (above groundwater)	TBD	130	36	4,500	130	36	0.26	3.85	130	36	Sand (Reese)	225
Loose Sand (above groundwater)	0 – 5	120	30	900	120	30	0.33	3.00	120	30	Sand (Reese)	25
Very Soft Silt (below groundwater)	5 – 20	47.6	26	750	47.6	26	0.39	2.56	47.6	26	Sand (Reese)	15
Loose Sand (below groundwater)	20 and below	52.6	30	900	52.6	30	0.33	3.00	52.6	30	Sand (Reese)	20

TABLE 5. LOG YARD

Soil Type	Depth Range (feet)	WSDOT GDM CH. 17			Soldier Pile Method				LPILE Parameters			
		Unit Weight (pcf)	Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)	Unit Weight (pcf)	Friction Angle (deg)	Active Earth Pressure Coefficient (K _a)	Passive Earth Pressure Coefficient (K _p)	Unit Weight (pcf)	Friction Angle (deg)	LPILE Model Type	p-y Modulus, k (pci)
New Structural Fill (above groundwater)	TBD	130	36	4,500	130	36	0.26	3.85	130	36	Sand (Reese)	225
Loose Sand (above groundwater)	0 – 5	120	30	900	120	30	0.33	3.00	120	30	Sand (Reese)	25
Loose Sand (below groundwater)	5 – 20	52.6	30	900	52.6	30	0.33	3.00	52.6	30	Sand (Reese)	20
Medium Dense Sand (below groundwater)	20 – 25	57.6	32	1,500	57.6	32	0.31	3.25	57.6	32	Sand (Reese)	60
Loose Sand (below groundwater)	25 and below	52.6	30	900	52.6	30	0.33	3.00	52.6	30	Sand (Reese)	20

Following the same site categorization above, Figures 1 through 5 (attached) provide allowable bearing resistances versus footing width. We only considered square footings. These allowable bearing pressures apply to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes.

Consolidation settlement of the soil beneath the shallow foundation was not considered at this time and could be significant depending on proposed loading. We recommend that consolidation settlement and its effects be considered further.

Lastly, Table 6 below provides lateral resistance parameters for the shallow foundations.

TABLE 6. SHALLOW FOUNDATION LATERAL RESISTANCE PARAMETERS

Site ID	Allowable Coefficient of Base Friction (unitless)	Allowable Passive Resistance as Equivalent Fluid Density (pcf)
UP Yard and SIM	0.35	225
Terminal 7 and NIM	0.35	250
TOTE	0.35	200
EB1	0.35	225
Log Yard	0.35	225

Notes: The above values include a factor of safety of about 1.5.

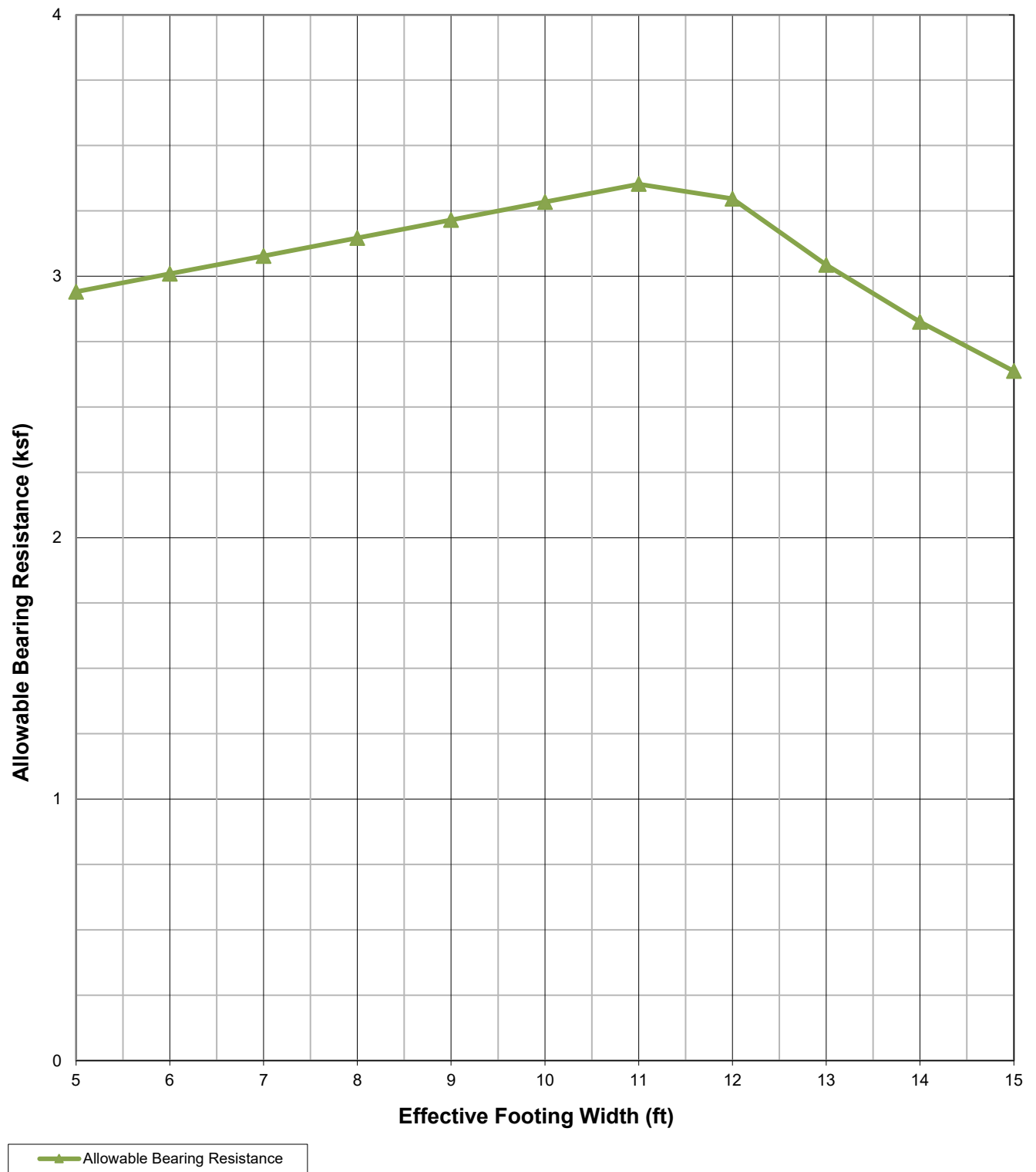
We trust that this memorandum meets your needs at this time. Please contact Christopher Newton or David Phelps at our Tacoma Office (253.383.4940) with any questions or concerns.

Attachments:
Figures 1 through 5. Shallow Foundation Design

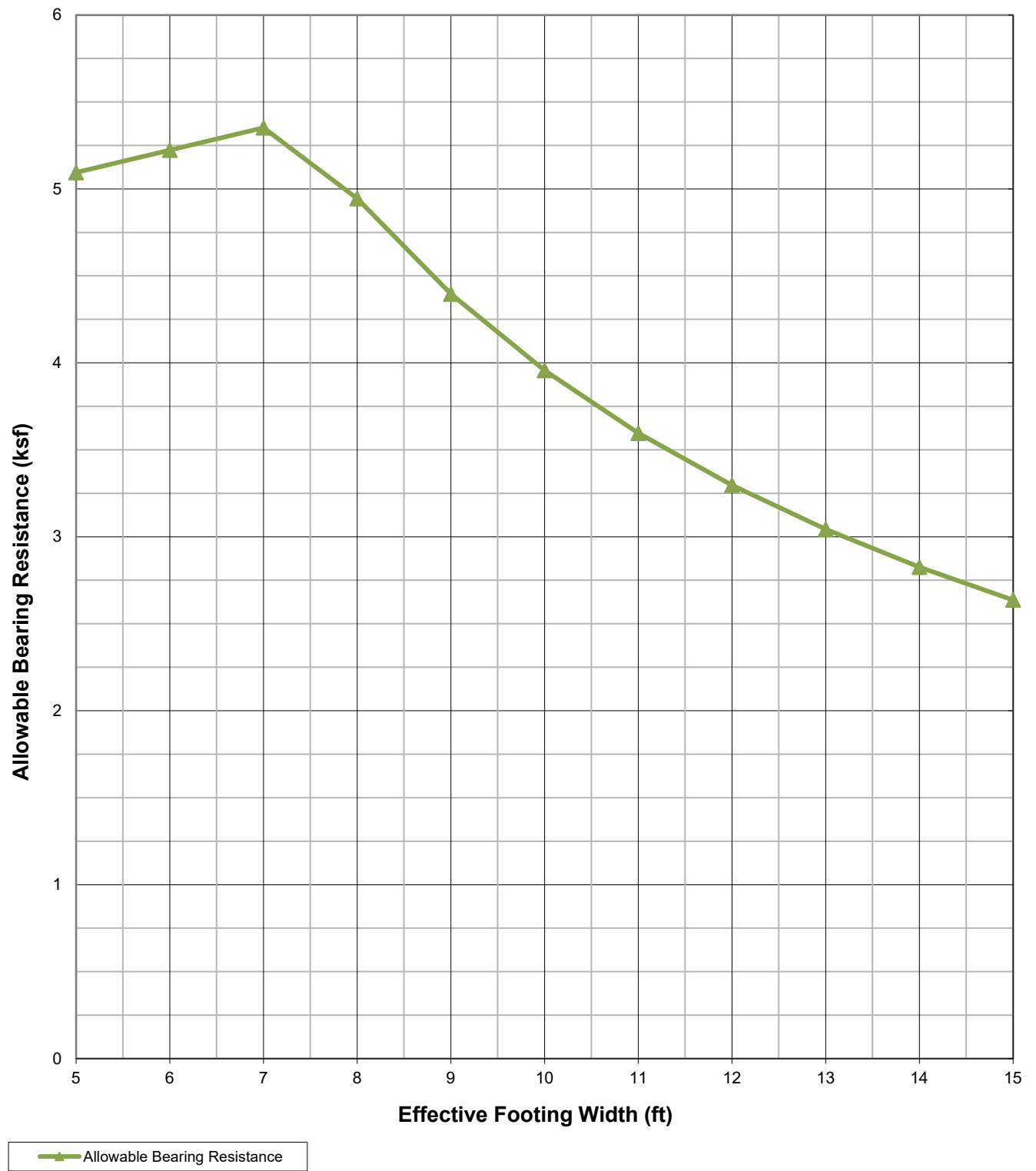
CRN:DSP:tjh

Disclaimer: Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

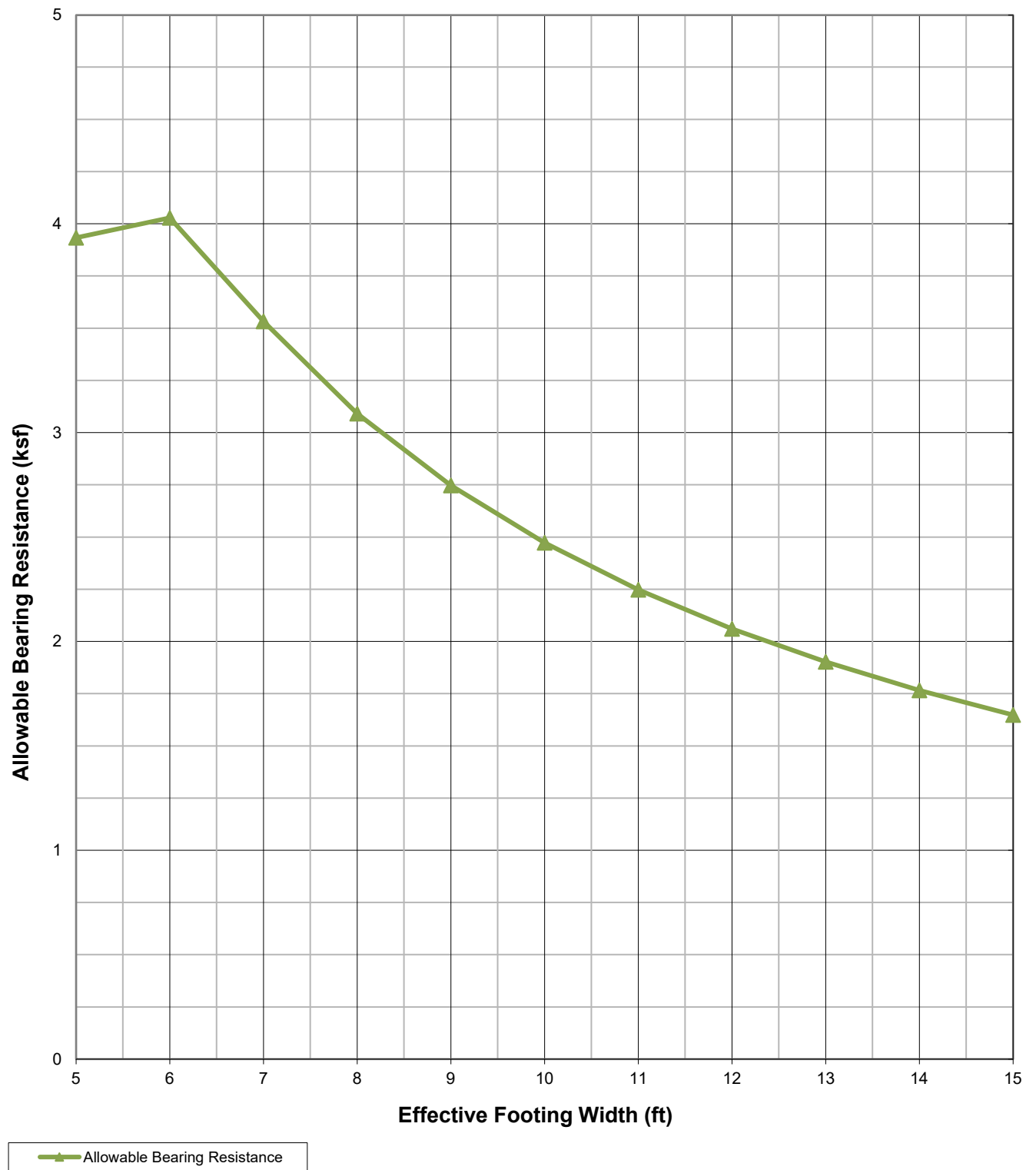
Port of Tacoma - Light Pole Replacement (UP Yard and SIM)



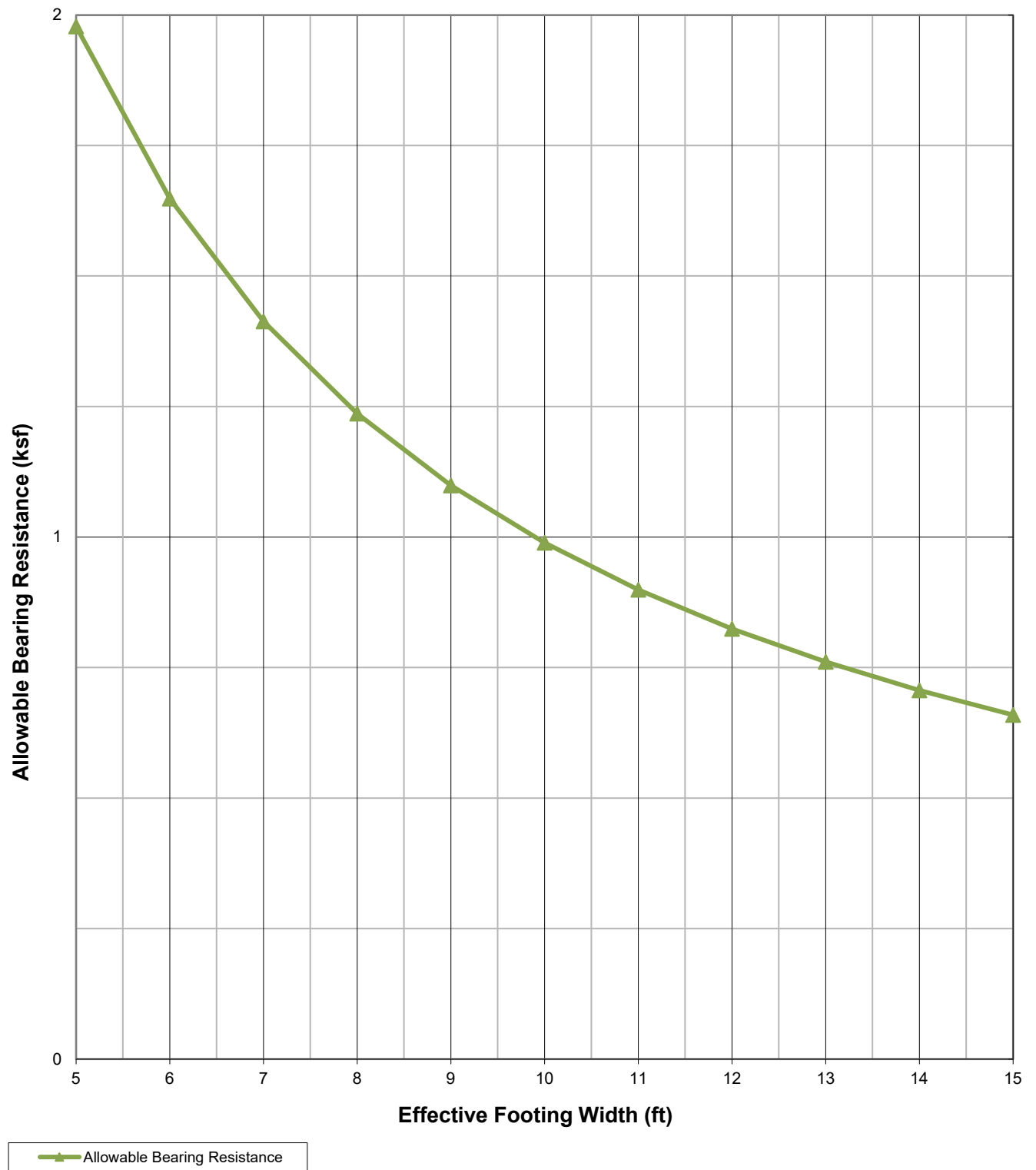
Port of Tacoma - Light Pole Replacement (Terminal 7 and NIM)



Port of Tacoma - Light Pole Replacement (TOTE)



Port of Tacoma - Light Pole Replacement (EB1)



Port of Tacoma - Light Pole Replacement (Log Yard)

