Design Development – Retaining Wall Stabilization Scope Narrative

Saint Louis Zoo – Elephant Management Facility

March 21, 2025

Overview:

This report is issued to convey the appropriate scope to stabilize the existing concrete retaining wall at the rear (south) of the Saint Louis Zoo's Elephant Management Facility.

Existing Conditions:

At the eastern end of the existing retaining wall, there are several large diagonal cracks in the concrete. The wall near the existing steel swing door is visibly out of plane, likely due to the added weight of the steel and hydrostatic pressure build-up on the retained earth side of the wall.

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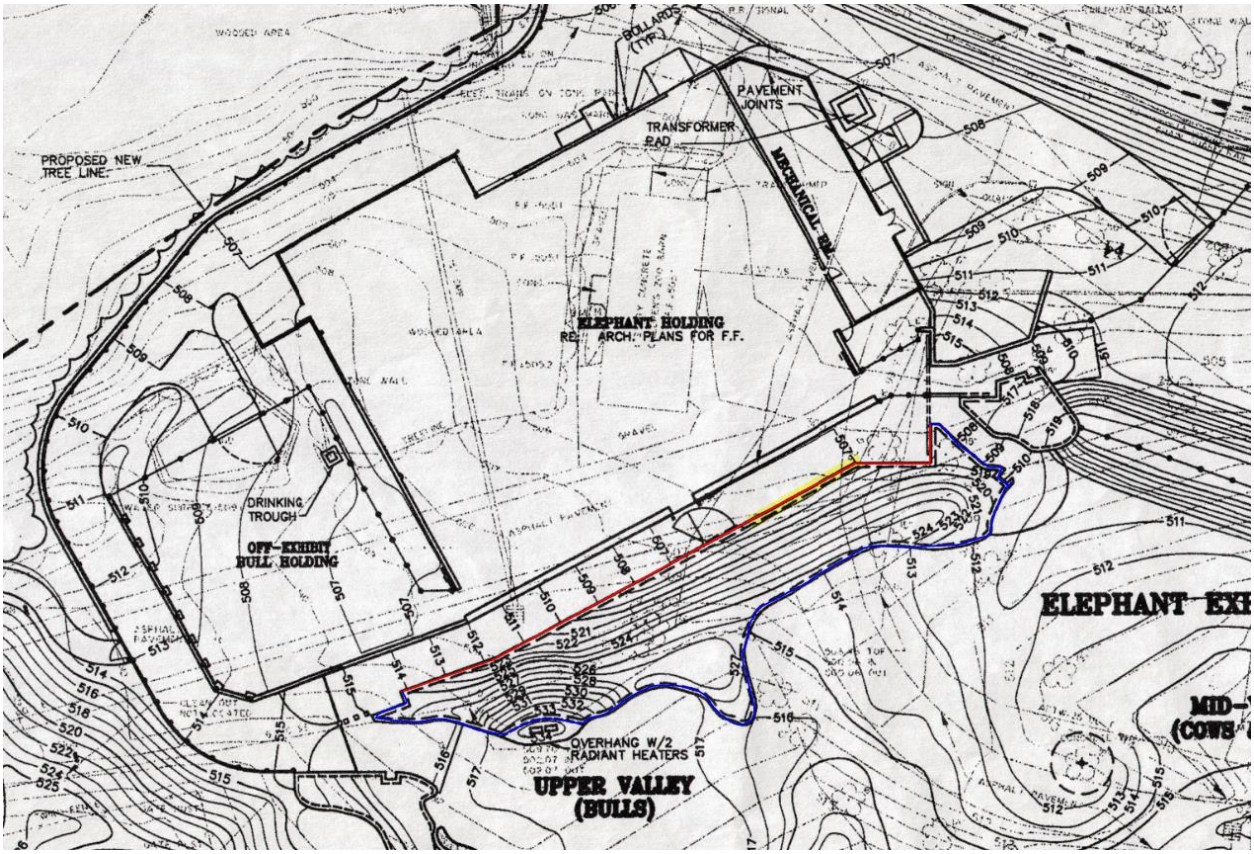
Behind / on top of this retaining wall is the public-facing Elephant exhibit. There are many plants and trees in this area, and there is another gunite retaining wall in the elephant exhibit to the south.

Below is the existing civil drawings of this facility. The red wall below is the concrete retaining wall in need of stabilization. The highlighted yellow portion is the part that is cracking and experiencing out-of-plane movement. The blue wall is the gunite retaining wall in the public-facing Elephant exhibit.



The distance between these two retaining walls are +/- 20’-0” at the area in need of stabilization.

Proposed Stabilization Scope:

The architect and structural engineer sought the expertise of a contractor specializing in retaining walls and stabilization of existing retaining walls to confirm the appropriate stabilization scope. The retaining wall will require fifteen (15) turnbuckle anchors of varying depths depending on the actual layout of gunite retaining wall beyond.

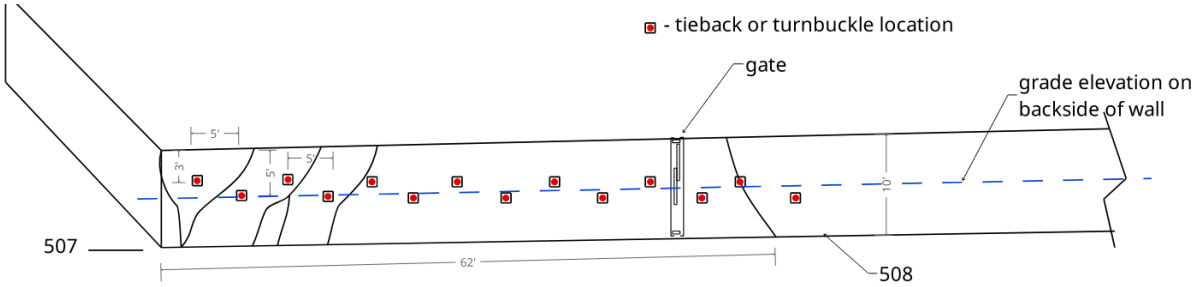
The contractor shall install the turnbuckle anchors in the configuration detailed in the exhibits below. Staggered up and down, starting at 3 feet from the top of the wall and dropping to 5 feet

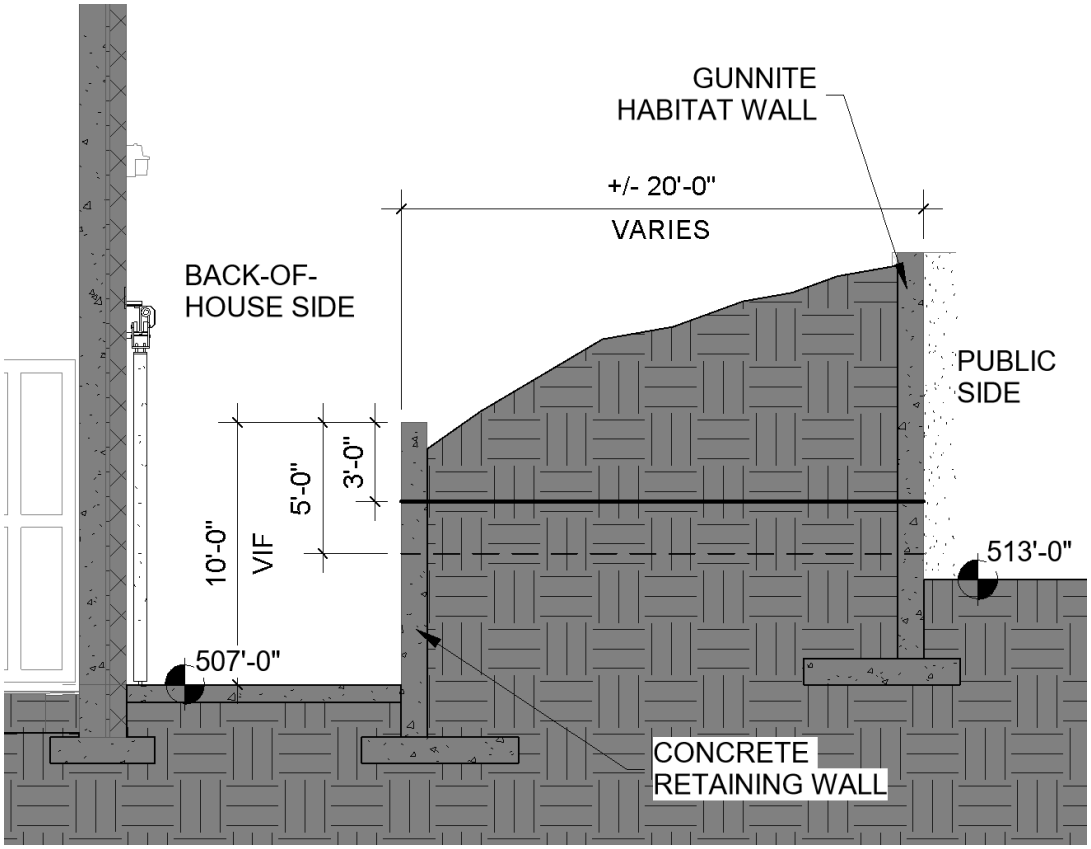
from the top of the wall. All anchors should be 5 feet on center and installed perpendicular to the face of the existing retaining wall.

The basis of design for these anchors is Ischebeck Titan 52/26 geotechnical turnbuckle anchors. The contractor shall provide this product or another product of equal performance value. Any substitutions must be approved by the structural engineer.

The configuration of these turnbuckle anchors should be staggered up and down, starting at 3' from the top of the wall and dropping to 5' from the top of the wall. All anchors should be 5' oc.

All turnbuckle anchors shall be installed from the back-of-house side of the two retaining walls. When the anchor is drilled through the earth and emerges on the public-facing side of the gunite wall, the contractor should chip off +/- 3 inches of gunite to allow for the installation of a 12 inch by 12 inch baseplate to tie off the turnbuckle.

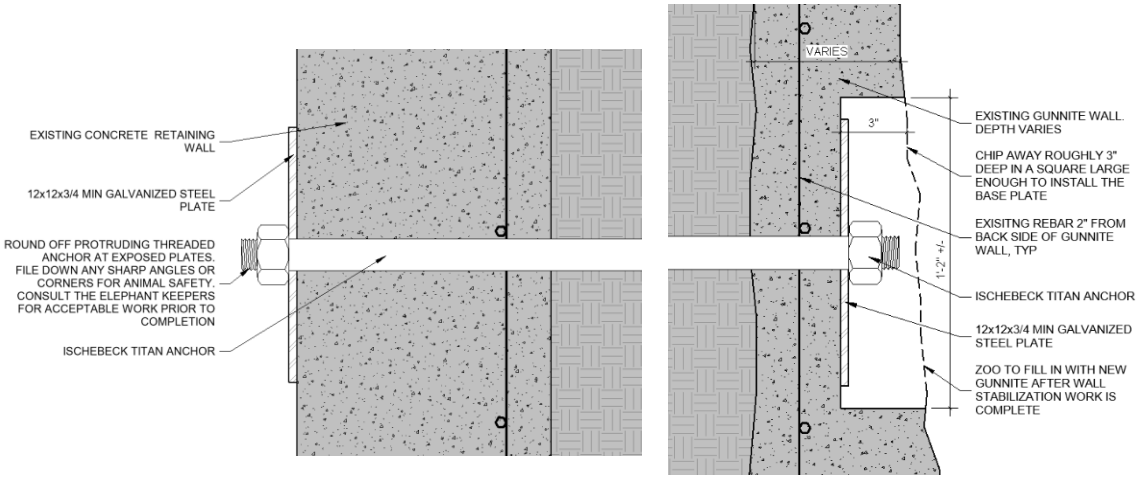




Designation		Unit	TITAN 30/16	TITAN 30/11	TITAN 40/27	TITAN 40/20	TITAN 40/16	TITAN 52/29	TITAN 52/26	TITAN 73/56	TITAN 73/53	TITAN 73/45
Outside Diameter	OD_{steel}	in (mm)	1.18 (30)	1.18 (30)	1.57 (40)	1.57 (40)	1.57 (40)	2.05 (52)	2.05 (52)	2.87 (73)	2.87 (73)	2.87 (73)
Inside Diameter	ID_{steel}	in (mm)	0.63 (16)	0.43 (11)	1.06 (27)	0.79 (20)	0.63 (16)	1.14 (29)	1.02 (26)	2.20 (56)	2.09 (53)	1.77 (45)
Cross Sectional Area	A_{eff}	in^2 (mm^2)	0.52 (336)	0.64 (415)	0.87 (560)	1.13 (730)	1.40 (900)	1.63 (1,050)	1.94 (1,250)	2.26 (1,460)	2.50 (1,615)	3.47 (2,239)
Yield Load (Force at .2% Proportionality Limit)	$P_{0.2,k}$	kip (kN)	42.7 (190)	57.3 (255)	73.3 (325)	96.7 (430)	119.2 (530)	142.8 (635)	159.6 (710)	194.5 (865)	219.2 (975)	274.3 (1,220)
Ultimate Load	P_u	kip (kN)	53.1 (236)	73.3 (326)	94.4 (420)	117.6 (523)	151.3 (673)	182.8 (813)	202.1 (899)	237.4 (1,056)	282.8 (1,258)	353.8 (1,574)
Strain Stiffness	E*A	10^3 kip (10^3 kN)	13.9 (62)	18.7 (83)	21.0 (95)	30.3 (135)	37.5 (167)	43.8 (195)	51.9 (231)	61.1 (272)	67.2 (299)	93.1 (414)
Bending Stiffness	E*I	kip•in^2 (10^6 kN•mm^2)	1,289 (3.7)	1,603 (4.6)	4,181 (12)	5,227 (15)	5,924 (17)	12,893 (37)	14,635 (42)	48,087 (138)	49,829 (143)	62,025 (178)
Weight		lb/ft (kg/m)	1.81 (2.7)	2.22 (3.3)	3.09 (4.6)	4.10 (6.1)	4.84 (7.2)	5.78 (8.6)	7.2 (10.7)	7.5 (11.2)	9.34 (13.9)	11.96 (17.8)
Length		ft (m)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)	9.8 (3.0)
Left/Right Thread			Left	Left	Left	Left	Left	Left	Left	Right	Right	Right
Origin			Germany	Germany	Germany	USA Germany	USA Germany	Germany	USA Germany	Germany	USA Germany	USA Germany
USA Stock Status			Stocked	Stocked	Stocked	Stocked	Stocked	Stocked	Stocked	Non-Stocked	Stocked	Stocked

1) The utilization of the yield load (characteristic load-carrying capacity, 5% fractile) depends on the cement grout cover according to approval Z-34.14-209.
2) In the case of deformation calculations, the specified values shall be used. The values are determined from testing. It is not possible to calculate the moduls of elasticity, cross-section or moment of inertia from these values.
3) Fy = Specified yield stress of hollow bar, or stress in hollow bar at a strain of .003 x 29,000 ksi (87 ksi) , whichever is less.
4) Material origin and USA stock status subject to change without notice. Inquire for most up-to-date information.
5) USA Domestic material meets Buy America, Build America (BABA) requirements.

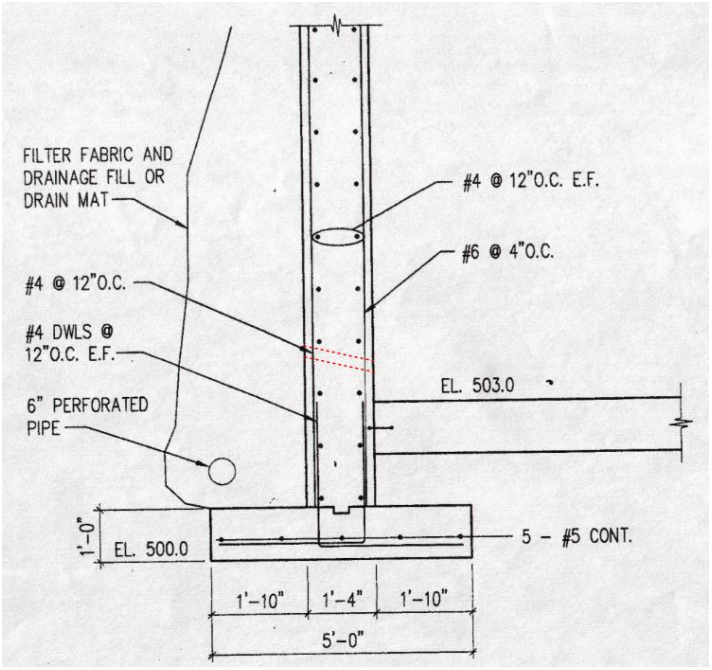
The detail below shows the desired base plate condition at the public-facing gunite wall in the habitat. The Zoo's maintenance staff will then patch the hole over the baseplate with new gunite and paint for a seamless finish.



Both sides of this installation will be in animal-accessible areas. Any sharp edges caused by the new work at the back-of-house side of the work, in the elephant gangway, shall be filed down for animal safety.

Proposed Scope to Relieve Hydrostatic Pressure:

The design team also noted that there are no weep holes in this existing concrete retaining wall. In order to relieve any hydrostatic pressure that may be gathering behind the wall, the contractor shall drill weep holes (min 1" in diameter) at 6'-0" oc, angling down toward the ground. These holes shall be installed 9" above the concrete floor. Weep hole shown in the photo below with red dashed lines.



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