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Structural
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STRUCTURAL CALCULATIONS

MISSION ROCK LCC ANALYSIS

SUBMITTAL No.: LCC Buttress
Plans and Calculations

This submittal has been reviewed for the Geotechnical aspects of the design only. Contractor is responsible for all corrections indicated hereon, for dimensions quantities, fabrications, construction techniques, and coordination with other contractors, subcontractors and suppliers. This review does not authorize changes to the contract requirements unless stated in a separate letter or change order.

☒ REVIEWED SEE COMMENTS ☐ AMEND & RESUBMIT
☐ EXCEPTIONS NOTED ☐ REJECTED-SEE COMMENTS

Checked By: P. Brady **Date:** 16 December 2020

LANGAN
135 Main Street
Suite 1500, S.F. CA 94105

DECEMBER 16, 2020

Langan comments:

The temporary LCC buttress walls are means and methods for retaining the building pads while the roads are constructed, but appears to be in general conformance with our recommendations.

SFPW-EST 12-17-20 -
Approved as Noted.
See comments below.

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38 Mason St., 2nd Fl.
San Francisco
California 94102
T. 415.931.8460
F. 415.931.8461
www.ftfengineering.com

Calculation Summary

Blocks of lightweight cellular concrete (LCC) will be used as lateral excavation support (shoring) during excavation and construction of utilities in the streets in Mission Rock development.

The LCC blocks will resist the lateral pressure from adjacent soils and lateral surcharge loads produced by equipment and materials placed on the surface adjacent to the LCC blocks. The LCC blocks function much like old-fashioned gravity retaining walls with the overturning load resisting by the self-weight of the block and lateral sliding resisted by the friction between the base of the block and the soil below.

Four independent design cases were evaluated for square LCC ranging in size from 3.5 feet by 3.5 feet to 8.5 feet by 8.5 feet.

Attached is a spreadsheet with one load case for various sizes of square LCC blocks with no shear key at base (i.e. no passive resistance).

Loading Criteria

As described in the load case below. A coefficient of friction of 0.5 was used between the LCC block and the soil below. Safety factor against sliding 1.25 (min.) and against overturning 1.5 (min.).

Load Case

Case 2A: Active soil pressures (17.5 pcf per foot of wall assuming a 20 degree back slope) and lateral surcharge pressures (40 psf per foot of wall from 100 psf vertical load). One K-Rail.

FTF ENGINEERING

38 Mason St. 2nd Floor
San Francisco, CA 94102
Tel. 415.931.8460
Fax. 415.931.8461

PROJECT:	Mission Rock LCC Shoring
JOB # :	20-023
ENGINEER :	BM
PAGE # :	

CASE 2A

Surcharge load is 0.04 H
Topped with K-Rail
Active pressure is 0.0175 pcf (20 degree cut back of slope)
Ignore extra LCC weight

SAFETY FACTORS:
1.25 FOR SLIDING
1.5 FOR OVERTURNING

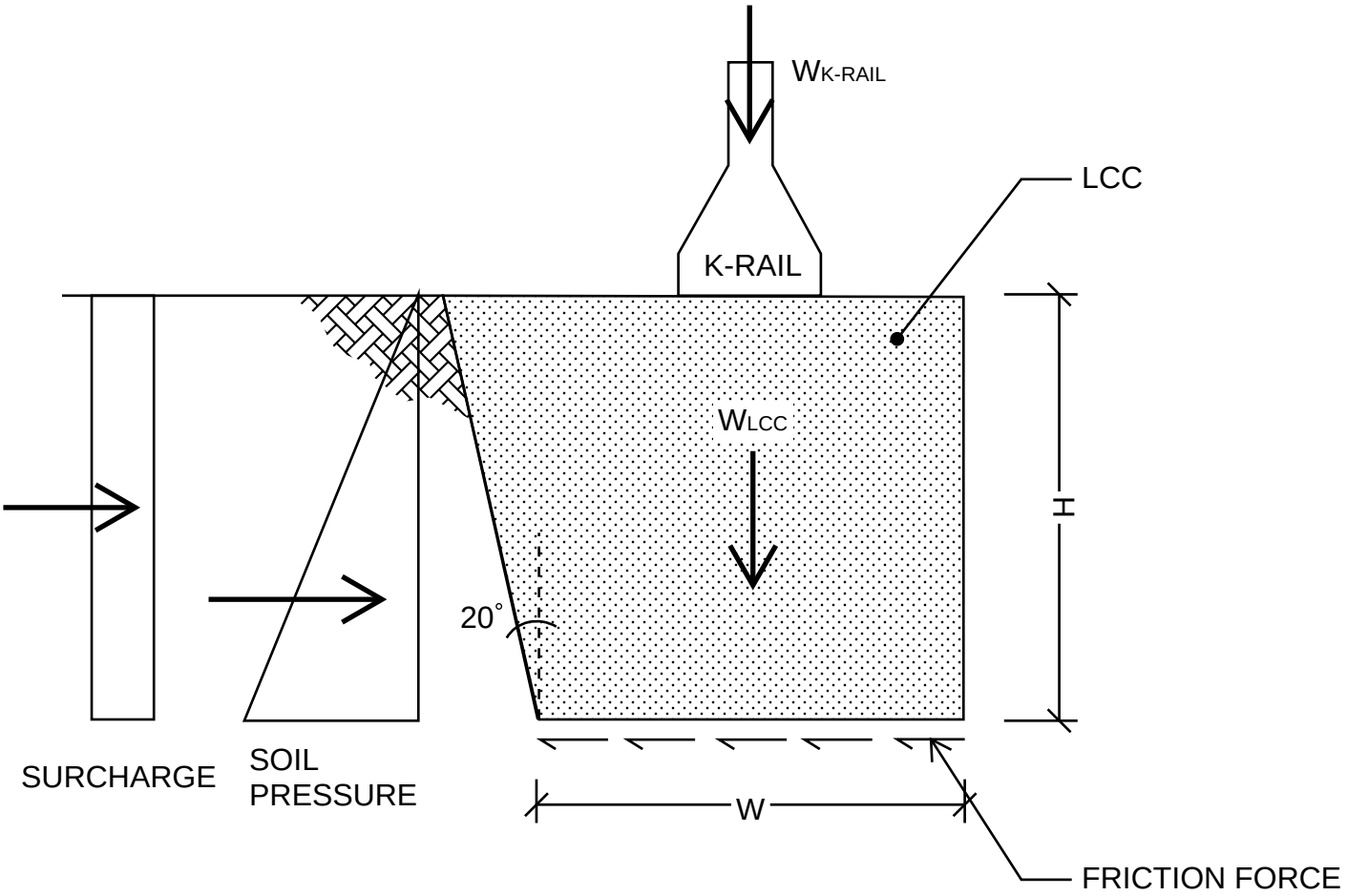
LCC Dimensions	3.5 x 3.5	3.75 x 3.75	5.5 x 5.5	6 x 6	6.5 x 6.5	8.5 x 8.5
H	3.5	3.75	5.5	6	6.5	8.5
W	3.5	3.75	5.5	6	6.5	8.5
$W_{LCC\ Block}$ (28 pcf)	0.34	0.39	0.85	1.01	1.18	2.02
$W_{K\text{-}rail}$ (390 lb each)	0.39	0.39	0.39	0.39	0.39	0.39
Lateral soil load (.0175*H^2/2)	0.11	0.12	0.26	0.32	0.37	0.63
Lateral load surcharge (0.4*H)	0.14	0.15	0.22	0.24	0.26	0.34
Total lateral load	0.25	0.27	0.48	0.56	0.63	0.97
Sliding resistance (0.5*(weight LCC+K-rails))	0.37	0.39	0.62	0.70	0.79	1.21
sliding safety factor	**1.48**	**1.44**	**1.28**	**1.26**	**1.25**	**1.24**

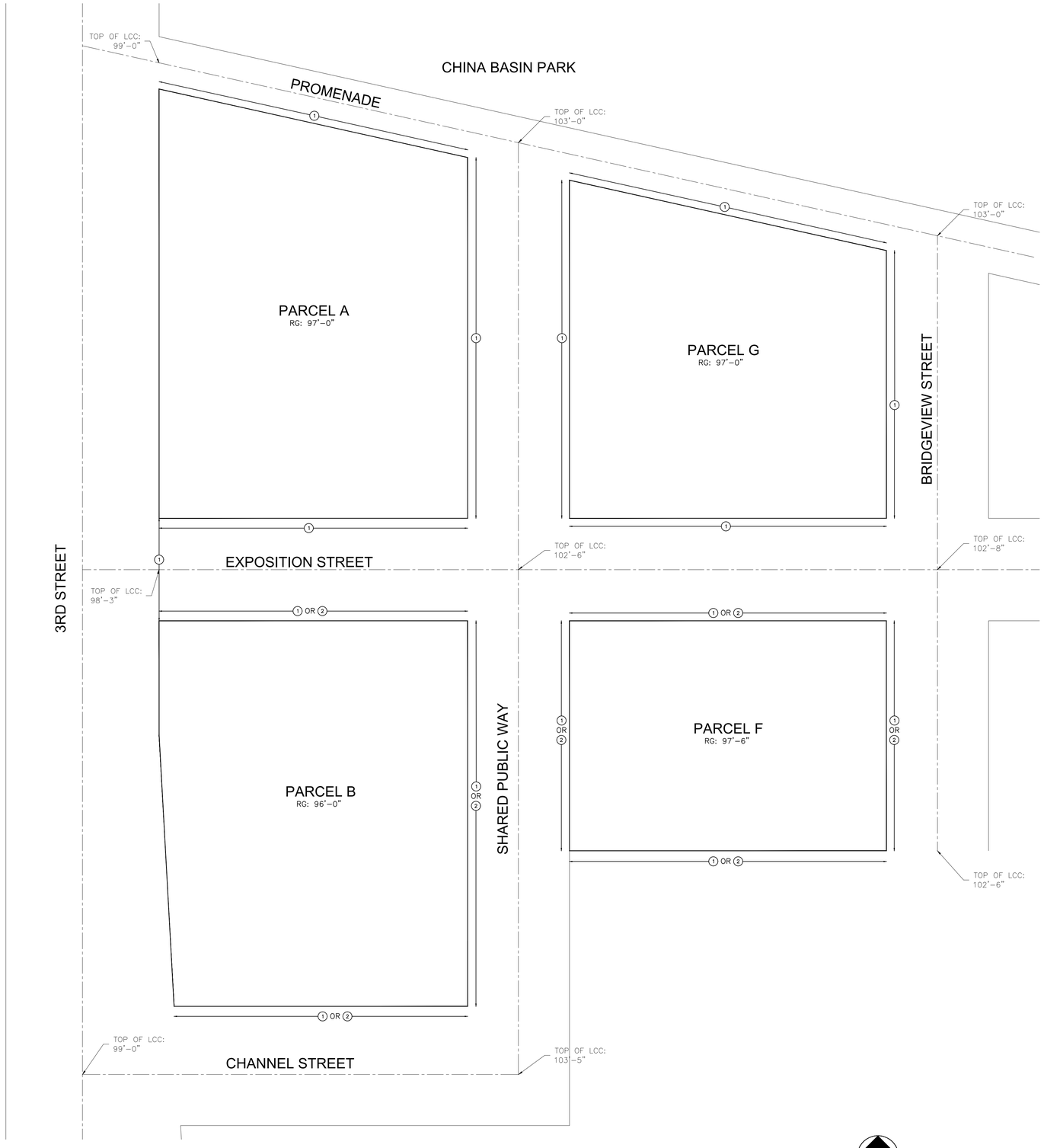
8.5 block is close, but allowable

OTM (lateral load*H/3 + surcharge*H/2)	0.37	0.44	1.09	1.35	1.65	3.24
RM ((W_{LCC} + $L_{K\text{-}rail}$)*W/2)	1.28	1.47	3.40	4.19	5.11	10.26
overturning safety factor	**3.47**	**3.38**	**3.12**	**3.11**	**3.11**	**3.17**

all have adequate safety factor

SFPW-EST 12-17-20 - Sliding safety factors of the LCC gravity wall drop below 1 for most cases without the weight of K-rail. Contractor to coordinate placement of K-rail until the gravity wall incorporated into the LCC roadway.





1 MISSION ROCK PHASE 1 PLAN

SCALE: 1/16" = 4'-0"

N

LEGEND
(#) REFERS TO NOTE #
SHEET NOTES:
(1) LCC BRACING, CONTRACTOR'S CHOICE BETWEEN CONDITIONS 1 AND 2/S-300.
(2) NO LCC BRACING OR CONCRETE K-RAIL (OR EQUIVALENT)
GENERAL NOTES:
1. ALL ELEVATIONS ARE BASED OFF SAN FRANCISCO CITY DATUM PLUS 100'.
DESIGN CRITERIA:
ACTIVE PRESSURE – 35 PCF (EQUIVALENT FLUID)
PASSIVE PRESSURE – 300 PCF (EQUIVALENT FLUID)
CONSTRUCTION SURCHARGE – 25 PSF (HORIZONTAL)
LCC WEIGHT – 30 PCF

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38 Mason Street, 2nd Floor
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Tel.: 415-931-8460
Fax: 415-931-8461
www.ftfengineering.com

Mission Rock LCC Barrier Wall

San Francisco, CA 94158

REGISTERED PROFESSIONAL ENGINEER
JUSTIN A. DAL PRO
STRUCTURAL
STATE OF CALIFORNIA

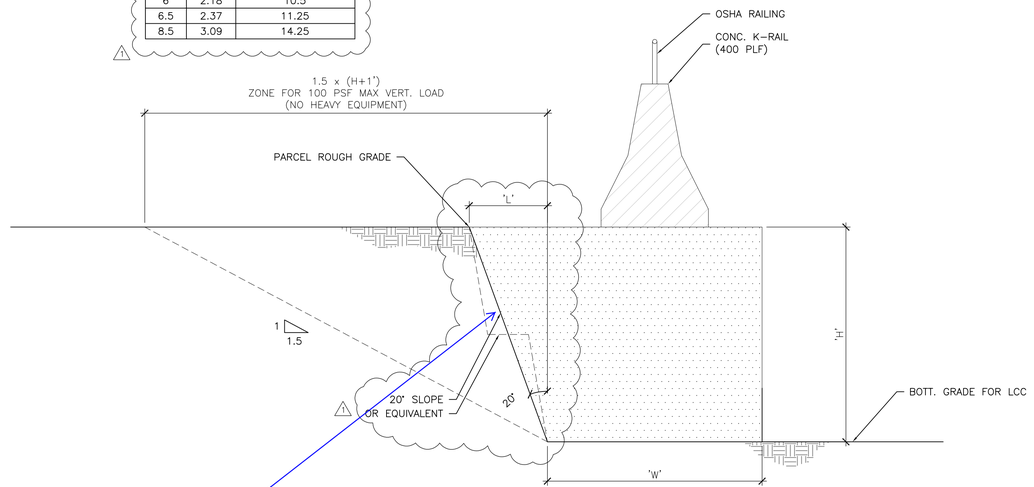
Issue:	Date:
Final Set	06.17.2020
Revision 1	12.15.2020

Scale: SCALE

Job No. 20-023.1

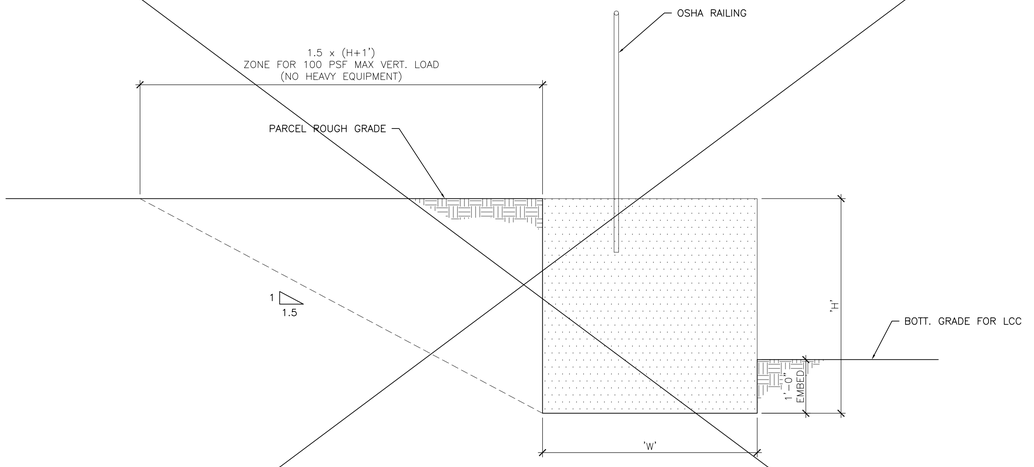
S-200

GRADE SETBACK		
H (FT)	L (FT)	SETBACK ZONE (FT)
3.75	1.36	7.125
5.5	2.00	9.75
6	2.18	10.5
6.5	2.37	11.25
8.5	3.09	14.25



2 CONDITION 2

SCALE: 3/4" = 1'-0"



1 CONDITION 1

SCALE: 3/4" = 1'-0"

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Mission Rock
LCC Barrier Wall
San Francisco, CA 94158

REGISTERED PROFESSIONAL ENGINEER
TONY T. DAI PHD
STRUCTURAL
STATE OF CALIFORNIA

Issue:	Date:
Final Set	06.17.2020
1 Revision 1	12.15.2020

Scale: SCALE

Job No. 20-023.1

S-300

16 December 2020

Mr. Steve Minden
Mission Rock Partners, LLC
c/o Tishman Speyer
One Bush Street, Suite 450
San Francisco, California 94104

Re: LCC Buttress Earth Pressures
Mission Rock Phase 1 Development
San Francisco, California
Langan Project No. 750604203

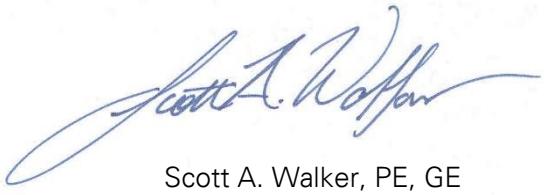
Dear Mr. Minden:

This letter is to presents updated earth pressures for the design of temporary LCC buttresses to be constructed at the Mission Rock Development in San Francisco, California. We previously prepared a report for the Phase 1 Vertical Development dated 14 October 2019, in which we provided recommended earth pressures for below grade and retaining walls. After discussions with the project team, we understand that LCC buttresses will be installed within the planned permanent LCC section within the public right of way. These buttresses will temporarily support the soil on the individual parcels when the main LCC excavation is performed.

The current version of the LCC buttress design includes sloping back of the cut slopes (on the building parcels) a minimum of 20 degrees from vertical which allows for a reduction in the active earth pressures that will be imparted on the buttresses. For a back slope of 20 degrees, we recommend checking the stability of the LCC buttress using an equivalent fluid pressure equal to 17.5 pounds per cubic foot (pcf) for the active case, instead of the 35 pcf that was provided in our geotechnical report for a vertical wall.

If you have any questions, please call.

Sincerely,
Langan Engineering and Environmental Services, Inc.



Peter D. Brady, PE
Project Engineer

Scott A. Walker, PE, GE
Senior Associate

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