United Rentals (North America), Inc. Texas COA #F-4810
EGR230954 Loading Calculations
June 14, 2023

Customer: Kiewit Infra South Central
Project: Taylor Semiconductor Chip Manufacturing Plant Exp.
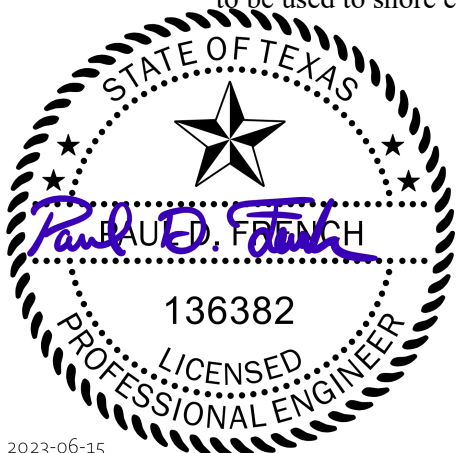Location: Taylor, TX

The phased excavation is to be approximately 7' wide x 20' long stacked trench shields with a maximum shored depth of 22' with an overall depth of 28'; then to incorporate a 12' wide x 12' long with a maximum shored depth of 22' deep and an overall depth of 28' octagon box shield. System to be leap-frogged for ~9,000 lf. Soils encountered are expected to be hard clay based on bore log D-15 by Raba Kistner dated 6-3-22. Edge of excavation will remain a minimum of 50' away from HS20-44 vehicular traffic. Edge of excavation will remain a minimum of 50' away from all structures. System must be dewatered to interior and exterior of the base of the excavation. System is specifically designed to comply with OSHA 29 CFR 1926 Subpart P Rules and Regulations.

System Description:

7' wide x 20' long x 22' maximum shored depth, 28' overall depth, stacked trench shield system with one closed end and one open end in phase one. Contractor to remove top 6' of soil creating a 8' wide workbench followed by a 1.5H:1V slope. System will consist of (3) stacked shields with 1" plate sheeting closing off the one end. Bottom shields will be held up 2'-0" above base of excavation with attached legs. Arch Spreaders are to be used on the lowest trench shield per manufacturer's tab data. System to be leap-frogged for 9,000 LF at a maximum shored depth of 22' and a maximum overall depth of 28' for the entire project length. System to be used to lay pipe and make connections with manholes and linear pipe sections. Shallower depths are allowed where applicable with use of two higher capacity trench shields, similar soil and dewatering as described herein, and no additional surcharges from those described below. Octagonal box sections and trench shields may have 2' legs on all bottom shield sections. Contractor shall continually monitor bottom 2' for sloughing and unraveling. Top shield may have 2' upstand, 4' with 2' legs.

Construction Notes:

Note A: When top of shoring is at the same elevation as the adjacent bench, the contractor shall provide roll-off protection or other means to ensure soils, equipment, or materials do not roll into trench.

Note B: Octagonal boxes and trench shields may be held 2' above base with legs. Bottom octagonal box is to have 6'x6' cutout for crossing utility.

Note C: Max 2' of exposed soil allowed. If sloughing or raveling occurs, 1" thick steel plates are to be used to shore exposed soil.

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General Construction Notes: (2) 8' tall trench shields with benching and sloping. Maximum depth not to exceed 20'. (3) 8' tall trench shields with benching and sloping. Maximum depth not to exceed 28'.

Soil type(s):

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Hard Clay	130.00	67.60	2500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Design Load(s) and Resulting Applied Pressures: (Use Rankine earth pressure theory)

Surcharge uniform strip load for equipment and materials = 250 psf at grade.

Pressure applied at 6' system = 211 psf   (reference attached SupportIt printout)

Pressure applied at 14' system = 491 psf   (reference attached SupportIt printout)

Maximum pressure applied to system = 770 psf   (reference attached SupportIt printout)

Check Steel Trench Shield Capacities:

Panel Size	Allowable Load (from Manufacturer's Tabulated Data)	Applied Load	Status
8' Tall x 20' Long Trench Shield	300 psf	211 psf	O.K.
8' Tall x 20' Long Trench Shield	550 psf	491 psf	O.K.
8' Tall x 20' Long Trench Shield	850 psf	770 psf	O.K.
8' Tall x 12' Wide x 12' Long Octagon Box Shield	850 psf	770 psf	O.K.

Arch spreader and typical spreaders per tab data.

Check 1" steel plate shoring at ends:

Applied pressure load is 770 psf.

Applied linear load to 1" plate = 770 psf *1' = 770 lb/ft per foot of sheeting width.

Unsupported length = 7'.

Applied moment to sheeting = $wl^2/8$ = 770*(7^2)/8 = 4,716 ft-lb/ft.

Allowable moment for 1" plate= 5,389 ft-lb/ft. (Reference SupportIT printout)

Applied moment = 4,716 ft-lb/ft < allowable moment 5,389 ft-lb/ft.   O.K.

| Client: Kiewit Infra South Central | |
| Site: Taylor, TX | |

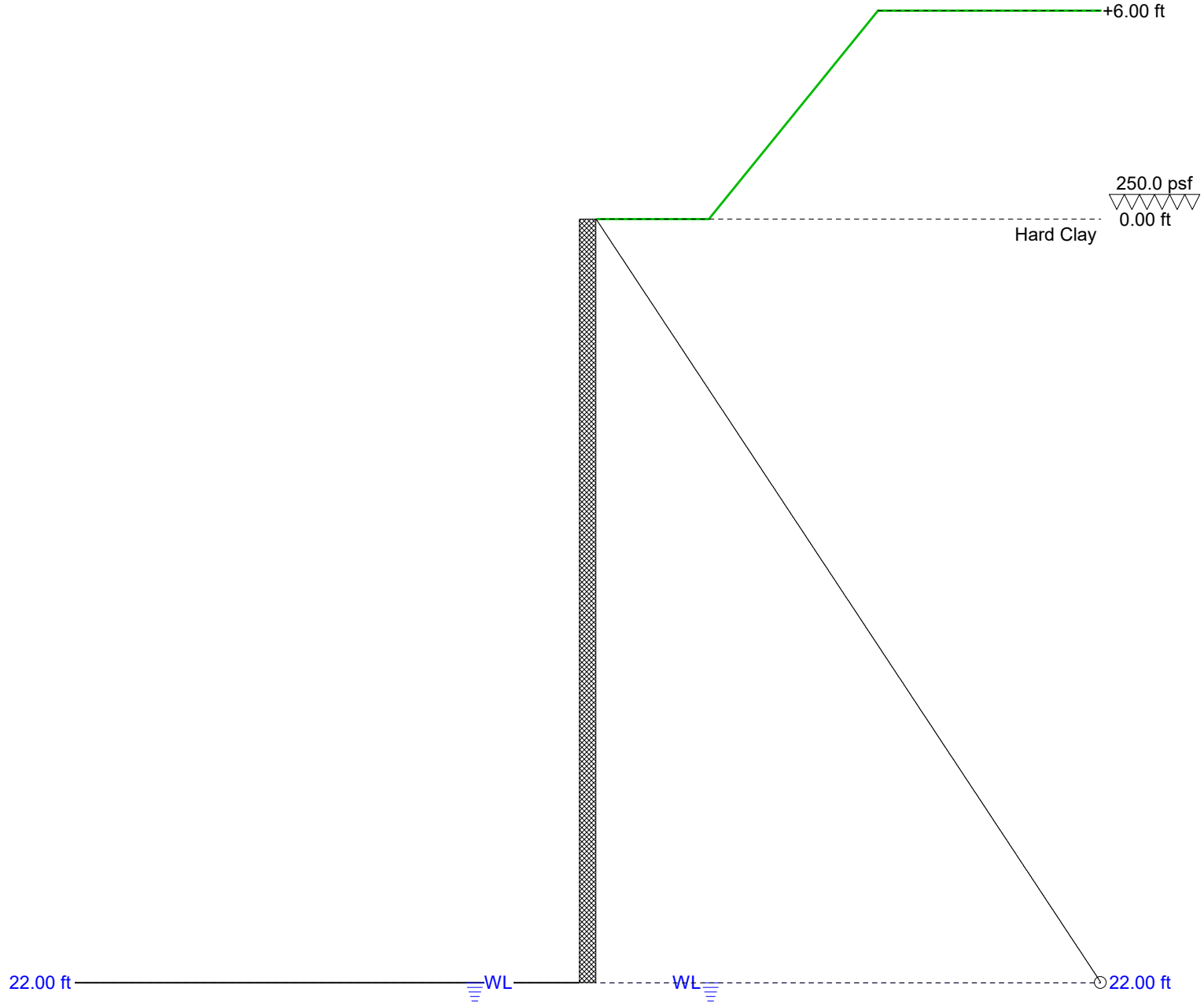Title: Taylor Semiconductor Chip
Manufacturing Plant Expansion,
Phase IX

Designer: BE
Date: 6.14.23

Works: Temporary
Pressure: Rankine
Toe: No Earth Support

Maximum	d (ft)
○ 770.0 psf	22.00

EGR230954

12x12x20 (28' overall depth)
trench shield and octagonal box shield
system

+6.00 ft

250.0 psf
0.00 ft
Hard Clay

22.00 ft

WL

WL

22.00 ft

United Rentals®

United Rentals Trench Safety Engineering

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SupportIT, v2.39

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Title: Taylor Semiconductor Chip Manufacturing Plant Expansion, Phase IX

Designer: BE

Date: 6.14.23

Works: Temporary

Pressure: Rankine

Toe: No Earth Support

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12x12x20 (28' overall depth) trench shield and octagonal box shield system

Input Data

Depth Of Excavation = 22.00ft
Surcharge = 250.0psf

Depth Of Active Water = 22.00ft
Depth Of Passive Water = 22.00ft

Water Density = 62.43pcf
Minimum Fluid Density = 35.00pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Hard Clay	130.00	67.60	2500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Maxima

	Maximum	Depth (ft)
Pressure	770.0 psf	22.00
Bending Moment	2516.0 ftlb/ft	21.96
Shear Force	189.7 lb/ft	3.28

depth (ft)	P (psf)	depth (ft)	P (psf)	depth (ft)	P (psf)
0.00	0.0	7.38	258.8	14.77	517.0
0.15	5.1	7.53	263.9	14.92	522.7
0.30	10.3	7.68	269.1	15.07	527.9
0.45	16.1	7.84	274.2	15.22	533.0
0.60	21.2	7.99	280.0	15.37	538.2
0.75	26.3	8.14	285.1	15.52	543.9
0.90	31.5	8.29	290.3	15.67	549.1
1.05	37.2	8.44	295.4	15.82	554.2
1.21	42.4	8.59	300.6	15.97	559.4
1.36	47.5	8.74	306.3	16.12	564.5
1.51	52.7	8.89	311.5	16.27	570.3
1.66	57.8	9.04	316.6	16.42	575.4
1.81	63.6	9.19	321.7	16.58	580.5
1.96	68.7	9.34	327.5	16.73	585.7
2.11	73.9	9.49	332.7	16.88	591.5
2.26	79.0	9.64	337.8	17.03	596.6
2.41	84.8	9.79	342.9	17.18	601.7
2.56	89.9	9.95	348.1	17.33	606.9
2.71	95.0	10.10	353.9	17.48	612.0
2.86	100.2	10.25	359.0	17.63	617.8
3.01	105.3	10.40	364.1	17.78	622.9
3.16	111.1	10.55	369.3	17.93	628.1
3.32	116.2	10.70	375.0	18.08	633.2
3.47	121.4	10.85	380.2	18.23	639.0
3.62	126.5	11.00	385.3	18.38	644.1
3.77	131.7	11.15	390.5	18.53	649.3
3.92	137.4	11.30	395.6	18.68	654.4
4.07	142.6	11.45	401.4	18.84	659.5
4.22	147.7	11.60	406.5	18.99	665.3
4.37	152.8	11.75	411.6	19.14	670.4
4.52	158.6	11.90	416.8	19.29	675.6
4.67	163.8	12.05	422.6	19.44	680.7
4.82	168.9	12.21	427.7	19.59	685.9
4.97	174.0	12.36	432.8	19.74	691.6
5.12	179.2	12.51	438.0	19.89	696.8
5.27	185.0	12.66	443.1	20.04	701.9
5.42	190.1	12.81	448.9	20.19	707.1
5.58	195.2	12.96	454.0	20.34	712.8
5.73	200.4	13.11	459.2	20.49	718.0
5.88	206.1	13.26	464.3	20.64	723.1
6.03	211.3	13.41	470.1	20.79	728.2
6.18	216.4	13.56	475.2	20.95	733.4
6.33	221.6	13.71	480.4	21.10	739.2
6.48	226.7	13.86	485.5	21.25	744.3
6.63	232.5	14.01	490.6	21.40	749.4
6.78	237.6	14.16	496.4	21.55	754.6
6.93	242.8	14.32	501.6	21.70	760.4
7.08	247.9	14.47	506.7	21.85	765.5
7.23	253.7	14.62	511.8	22.00	770.0

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