DEEP SOIL MIXING
NEWPORT BEACH, CALIFORNIA

SHEET INDEX

DSM-1	COVER **SHEET**
DSM-2	GENERAL NOTES AND DETAILS
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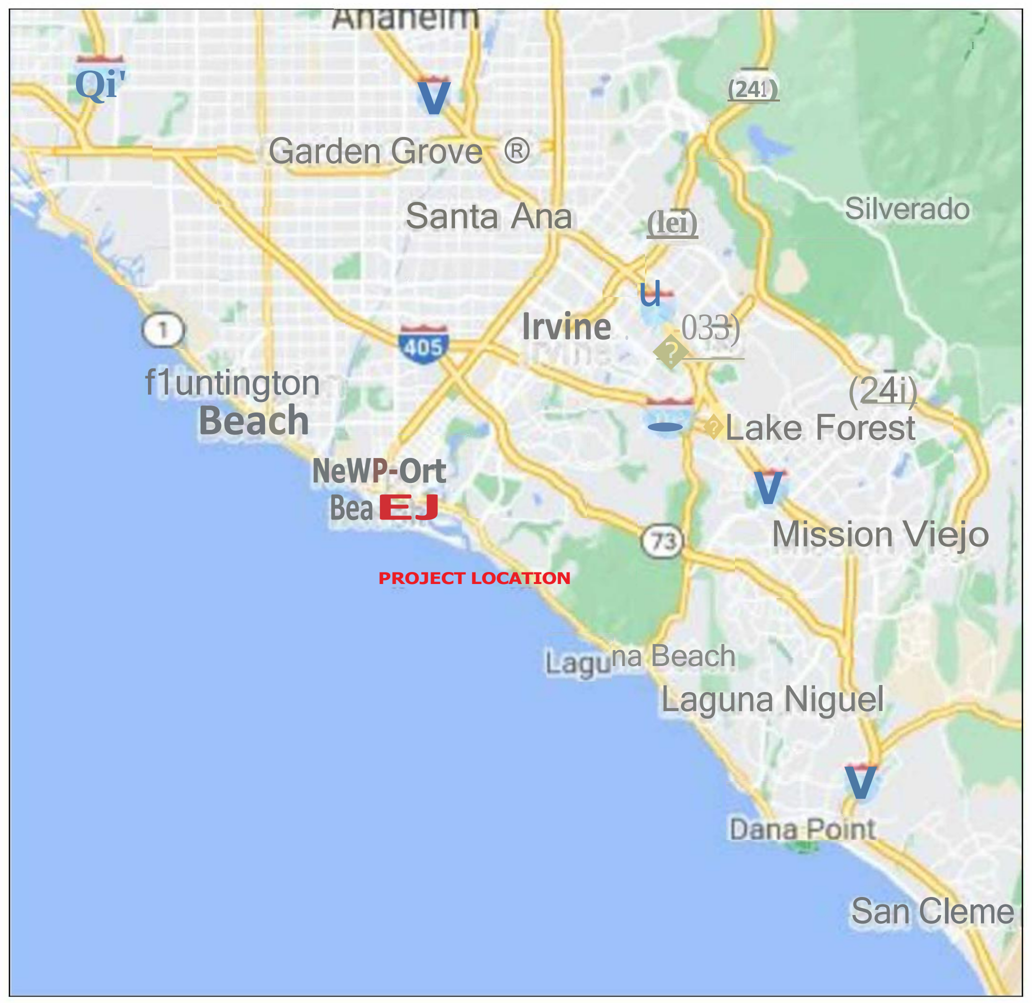
VICINITY MAP



MAP DATA: GOOGLE 2021

LOCATION MAP

MAP DATA: GOOGLE 2021

PROJECT SPECIFIC NOTES:

1. ADVANCED GEOSOLUTIONS, INC. (AGI) SCOPE OF WORK INVOLVES CONSTRUCTION OF THE GROUND IMPROVEMENT BY DEEP SOIL MIXING AS DEFINED ON **THESE** PLANS AND IN THE APPROVED DESIGN SUBMITTAL.
2. DSM LAYOUT AND ELEVATION ARE IN ACCORDANCE WITH DESIGN SUBMITTAL REPORT PREPARED BY AGI DATED MM/DD/YYYY. THE DESIGN OBJECTIVE IS TO TRANSFER **BUILDING** LOADS TO COMPETENT SOILS BELOW LIQUEFIABLE SOILS, REDUCE **STATIC SETTLEMENT,** AND REDUCE GROUNDWATER FLOW **INTO** EXCAVATIONS.
3. A LICENSED SURVEYOR, PROVIDED BY OTHERS, WILL STAKE AND IDENTIFY ALL DSM COLUMNS AT THE **LOCATIONS** SHOWN ON THESE PLANS. ALL DSM COLUMNS SHALL BE INSTALLED WITHIN 6 INCHES OF THE STAKED LOCATION.
4. ALL DSM COLUMNS SHALL BE INSTALLED TO DESIGN TIP ELEVATION OR TO PRACTICAL REFUSAL, **WHICHEVER** OCCURS FIRST. DESIGN TIP IS ELEVATION -13 FT.
5. BACKGROUND DRAWING: CIVIL PRECISE GRADING PLAN (RECEIVED 03/11/2021). SHOWN FOR ILLUSTRATION ONLY. REFER TO LATEST PLANS FOR FOUNDATION LOCATION AND DIMENSIONS.

GENERAL NOTES:

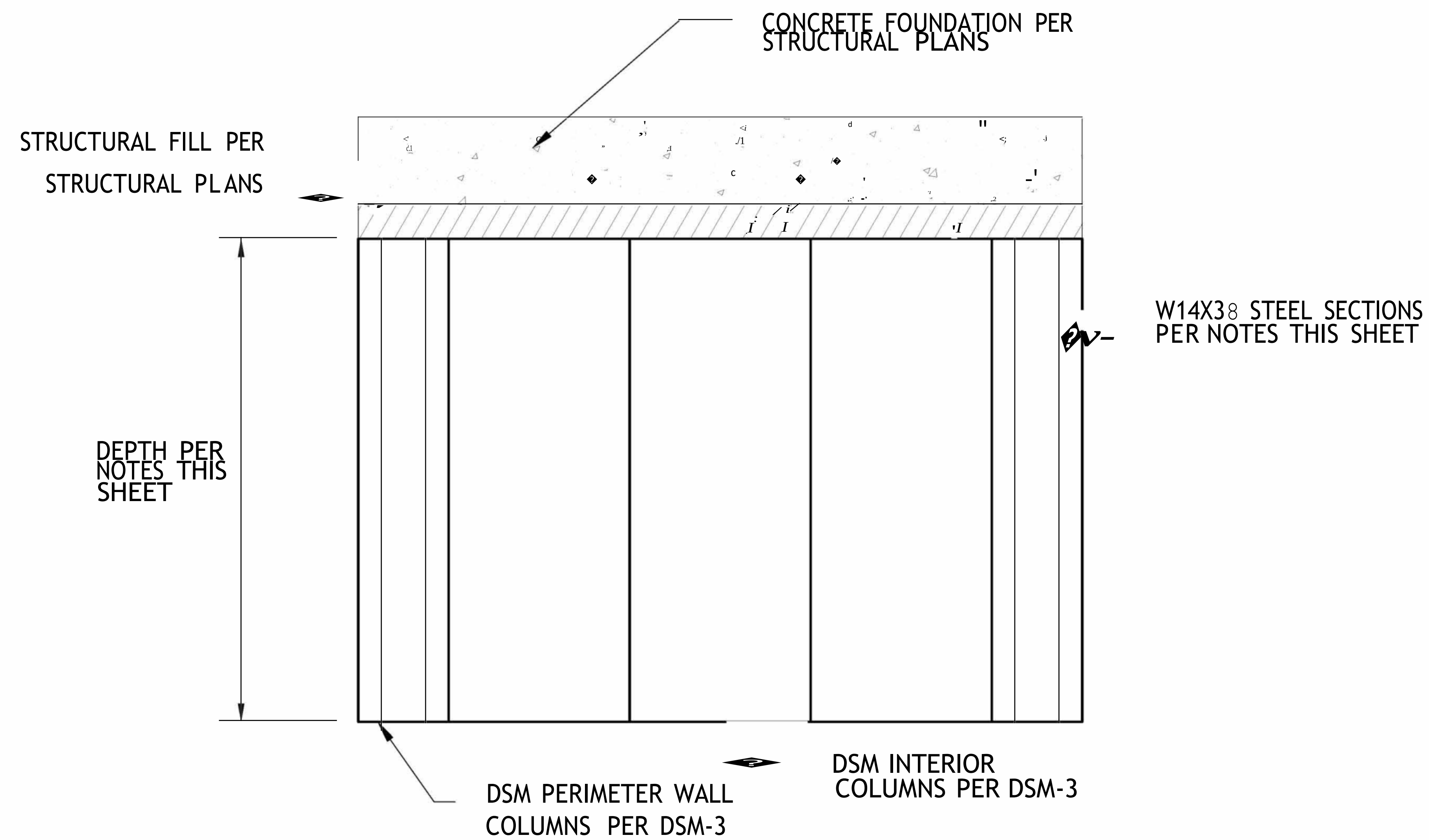
1. A STABLE AND RELATIVELY LEVEL WORKING PAD SHALL BE PROVIDED BY OTHERS.
2. AGI WILL PROVIDE A QUALIFIED FULL **TIME** QUALITY CONTROL (QA) REPRESENTATIVE. **THIS** REPRESENTATIVE IS A TITLED AGI SUPERINTENDENT, FOREMAN, OR FIELD ENGINEER. THIRD PARTY TESTING OR INSPECTION SHALL BE PROVIDED BY OTHERS.
3. ALL ABOVE AND BELOW GROUND UTILITIES AND/OR OBSTRUCTIONS ARE TO BE REMOVED, RELOCATED AND/OR MARKED BY **OTHERS.**
4. AFTER COMPLETION OF GROUND IMPROVEMENT WORK, OTHERS ARE RESPONSIBLE FOR PROTECTION OF THE WORK. PROPER SITE DRAINAGE TO PREVENT WATER PONDING AT DSM COLUMN AREAS AND COORDINATION OF EARTHWORK ACTIVITIES SHALL BE MANAGED SUCH THAT EXISTING DSM COLUMNS ARE NOT DAMAGED.
5. DSM CONSTRUCTION **LOGS** WILL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE ON A DAILY BASIS.

SOIL MIX COLUMN VERIFICATION NOTES:

1. ACCEPTANCE OF THE DSM WORK WILL BE BASED ON GEOMETRY AND STRENGTH. THE GEOMETRY CONSISTS OF THE COLUMN DIAMETER AND INSTALLATION DEPTH AS EVIDENCED BY THE CONSTRUCTION LOGS AND OBSERVED BY THE ENGINEER. THE STRENGTH WILL BE TESTED USING THE METHODS DESCRIBED BELOW TO VERIFY THAT DESIGN STRENGTH HAS BEEN ACHIEVED.
2. THE DSM DESIGN STRENGTH FOR THIS PROJECT IS 100 PSI AND 150 PSI AT 28 DAYS FOR **THE** INTERIOR COLUMNS AND PERIMETER RESPECTIVELY. TESTS PERFORMED AT OTHER CURING AGES WILL BE CORRELATED TO 28-DAY STRENGTH USING THE FOLLOWING FACTORS AS DESCRIBED IN THE DESIGN SUBMITTAL:
   3 DAYS TO 28 DAYS: MULTIPLY BY 2.5
   7 DAYS TO 28 DAYS: MULTIPLY BY 1.5
   14 DAYS TO 28 DAYS: MULTIPLY BY 1.25
3. AGI WILL RETRIEVE WET GRAB SAMPLES FROM THE MIXED COLUMN FOR STRENGTH TESTING. THE FREQUENCY OF WET GRAB SAMPLE IS ONE PER RIG PER SHIFT. A SECOND SAMPLE WILL BE COLLECTED PER RIG SHIFT IF THE VOLUME MIXED EXCEEDS 600 CY FOR THAT RIG SHIFT.
4. EACH WET GRAB SAMPLE WILL BE CAST INTO EIGHT (8) CYLINDERS EACH MEASURING 3" DIAMETER BY 6" HIGH. A 3/8" SIEVE WILL BE USED TO SCREEN THE MATERIAL.
5. THE SAMPLES WILL BE TESTED FOR UNCONFINED COMPRESSIVE **STRENGTH** (UCS) IN ACCORDANCE WITH ASTM D1633.
6. AGI WILL STORE THE CYLINDERS ON-SITE TO AVOID DISTURBANCE FOR AT LEAST 1 DAY, AND **THEY** WILL BE PICKED UP BY THE THE OWNER'S THIRD PART LAB FOR BREAKING AT 7, 14, AND 28 DAYS (TWO CYLINDERS EACH). THE SPARE CYLINDERS CAN BE USED FOR 3-DAY OR 56-DAY BREAK IF NECESSARY.
7. TESTS WILL BE CONSIDERED PASSING IF THEY ARE WITHIN 10% OF THE STRENGTH REQUIREMENT PROVIDED THAT NO MORE THAN 10% OF **ALL** TESTS FALL **BELOW** THE REQUIREMENT AND THE OVERALL AVERAGE STRENGTH EXCEEDS THE REQUIREMENT.
7. UNIFORMITY OF MIXING WITH DEPTH WILL BE EVALUATED BY CONE PENETRATION TEST (CPT) ON TWO PERCENT OF THE PRODUCTION DSM COLUMNS. CPT SHOULD BE PERFORMED AFTER 3 DAYS BUT NO MORE THAN 7 DAYS AFTER THE DSM **COLUMN** IS **INSTALLED.**

STEEL NOTES

1. SHORING ELEMENTS SHALL BE PROVIDED AT **LOCATIONS** SHOWN ON THESE PLANS.
2. **STEEL** SHALL BE Fy = 50 KSI OR BETTER.
3. EACH **SECTION WILL** CONSIST OF A W14X26, WET SET INTO A DSM COLUMN SHORTLY AFTER MIXING.
4. CONSTRUCTION TOLERANCE FOR **STEEL** SECTION IS PLUS MINUS 3 INCHES FROM THE PLAN **LOCATION.**



TYPICAL SECTION
SCALE: NTS

LEGENDS:

0 PERIMETER DEEP SOIL MIXING COLUMN 3' r/J

0 INTERIOR DEEP SOIL MIXING COLUMN 6' r/J

I WIDE FLANGE SECTION W14X26

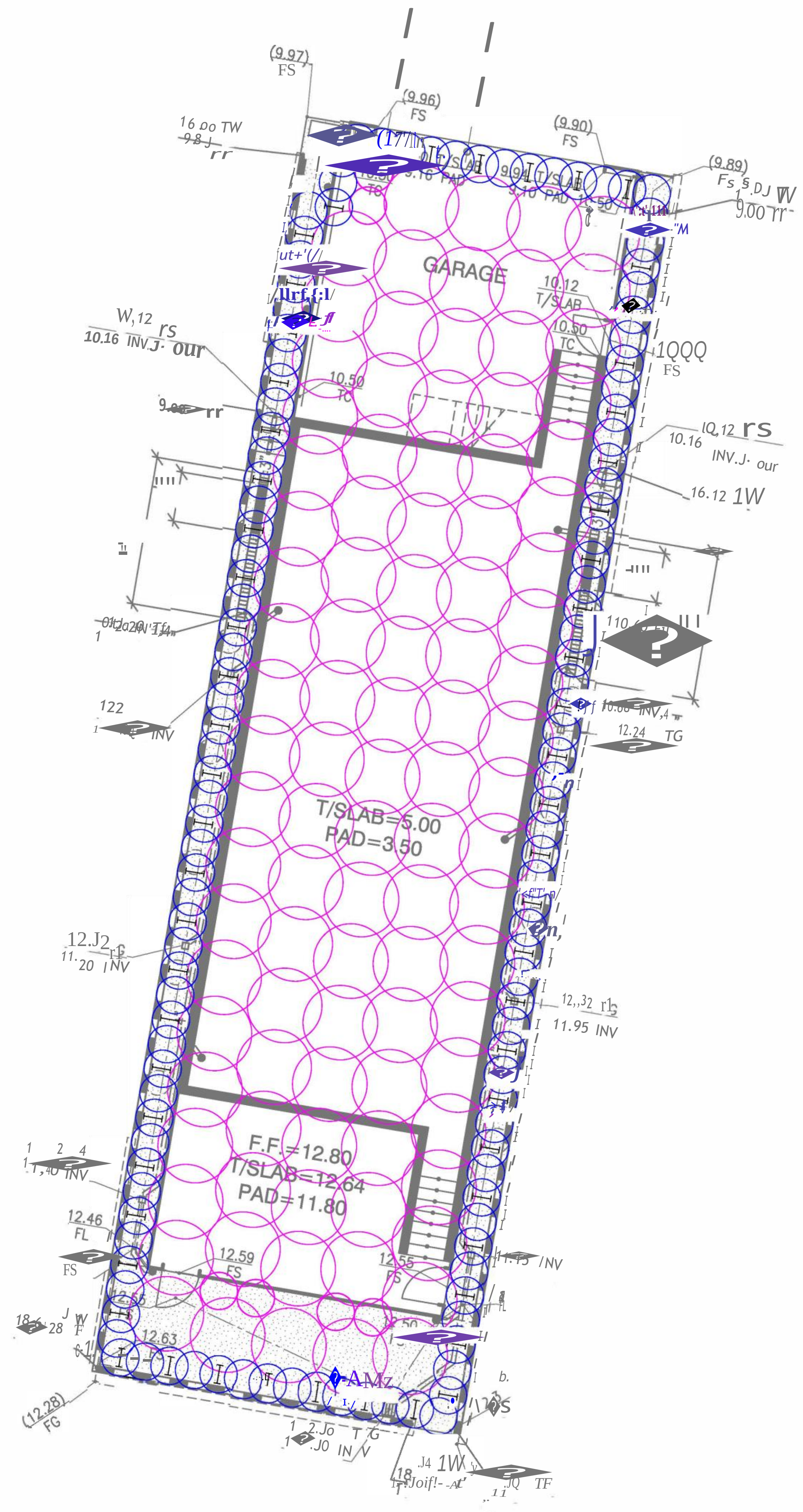
0 INTERIOR DEEP SOIL MIXING COLUMN 3' r/J

GROUND IMPROVEMENT NOTES:

1. ALL DSM COLUMNS SHALL EXTEND TO DESIGN TIP ELEVATION = -13' OR TO REFUSAL, WHICHEVER OCCURS FIRST.
2. DRAWING BACKGROUND SHOWN PROVIDED BY TOAL ENGINEERING INC. AND SHOWN FOR INFORMATION ONLY. REFER TO LATEST FOUNDATION PLANS FOR DIMENSIONS AND LOCATIONS OF FOOTINGS.
3. SEE GEOTECHNICAL REPORT BY AMERICAN GEOTECHNICAL INC DATED 5/05/2020 FOR LOGS OF BORINGS AND CPTS

WIDE FLANGE SECTION NOTES:

1. ALL SECTIONS SHALL EXTEND TO DESIGN TIP ELEVATION = -13'.
2. DRAWING BACKGROUND SHOWN PROVIDED BY TOAL ENGINEERING INC. AND SHOWN FOR INFORMATION ONLY. REFER TO LATEST FOUNDATION PLANS FOR DIMENSIONS AND LOCATIONS OF FOOTINGS.
3. STE E LSHALL BE W14X38 Fy = 50 KSI OR BETTER.



CDSM COLUMN LAYOUT

SCALE: 1:72

N

0' 6' 12'

Results for Design Section 0: Base model

ANALYSIS AND CHECKING SUMMARY

The following tables summarize critical resuls for all design sections. These results may include wall moments, shears, displacements, stress checks, wall embedment safety factors, basal & slope stability safety factors, etc.

Summary vs Design Section

Base model	Wall Moment	Wall Shear	Wall Displace	Max Support	Critical Support	Embedment	Comments
	(k-ft/ft)	(k/ft)	(in)	Reaction (k/ft)	Check	Wall FS	
Base model	35.69	14.74	3.3	No supports	No supports	1.215	Calculation successful,

Extended Summary

Table: Extended summary for all design sections.

Design Section	Calculation Result	Wall Displacement	Settlement
Name		(in)	(in)
Base model	Calculation successful, however items may be unsafe	3.3	0.42

Table: Extended summary for wall moments and shears for all design sections.

Design Section	Wall Moment	Wall Moment	Wall Shear	Wall Shear
Name	(k-ft/ft)	(k-ft)	(k/ft)	(k)
Base model	35.69	142.76	14.74	58.95

Table: Extended summary for wall stress checks for all design sections.

Design Section	STR Combined	STR Moment	STR Shear	Wall Concrete Service
Name	Wall Ratio	Wall Ratio	Wall Ratio	Stress Ratio FIC
Base model	0.93	0.93	1.523	N/A

Table notes:

STR Combined: Combined stress check, along eccentricity line considering axial load and moment (demand/capacity).
STR Moment : Moment stress check, assuming constant axial load on wall (demand/capacity).
STR Shear : Shear stress check (shear force demand/wall shear capacity).

Table: Extended summary for support results for all design sections

Design Section	Max Support	Max Support	Critical	STR Support	Support Geotech
Name	Reaction (k/ft)	Reaction (k)	Support Check	Ratio	Capacity Ratio (pull
Base model	No supports	No supports	No supports	No supports	No supports

Table notes:

STR Support ratio: Critical structural stress check for support (force demand/structural capacity).
Support geotech capacity ratio: Critical geotechnical capacity stress check (demand/geotechnical capacity).
Critical support check: Critical demand/design capacity ratio (structural or geotechnical).

Table: Summary for basal stability and wall embedment safety factors from conventional analyses.

Design Section	FS	Toe FS	Toe FS	Toe FS
Name	Basal	Passive	Rotation	Length
Base model	2.803	2.332	1.308	1.215

Table notes:

FSbasal : Critical basal stability safety factor (relevant only when soft clays are present beneath the excavation).
TOE FS Passive : Safety factor for wall embedment based on FS= Available horizontal thrust resistance/Driving hor. thrust.
TOE FS Rotation: Safety factor for wall embedment based on FS= Available resisting moment/Driving moment.
TOE FS Length : Safety factor for wall embedment based on FS= Available wall embedment/Required embedment for FS=1.0

Table: Summary for wall embedment safety factors from elastoplastic analyses.

Design Section	FS Mobilized	FS
Name	Passive	True/Active
Base model	N/A	N/A

Table notes:

FS Mobilized Passive : Safety factor= Available horizontal passive resistance/Mobilized passive thrust.
FS True/Active : Soil thrust on retained wall side/Minimum theoretically horizontal active force thrust.

Table: Summary for hydraulic safety factors, water flow, and slope stability

Design Section	Hydraulic	Qflow	FSslope
Name	Heave FS	(ft3/hr)	
Base model	2.284	N/A	N/A

Max. Moment vs Stage

	Base Model
M stg0 (k-ft/ft)	DS: 0

Max. Shear vs Stage

	Base Model
V stg0 (k/ft)	DS: 0

Max. Support F vs Stage

	Base Model
Rmax Stage 0 (k/ft)	DS: 0

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(ksi)	(ksi)	(ksi)	(pcf)
A36	36	58	29000	0.49
A50	50	72.5	29000	0.49

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength Ft
	(ksi)	(ksi)	(pcf)	(ksi)
200psi DSM	0.2	70	0.1	15
Fc 4ksi	4	3605	0.15	10
Fc 5ksi	5	4031	0.15	10
Fc 6ksi	6	4415	0.15	10

Steel rebar

Name	Strength Fy	Elastic E
	(ksi)	(ksi)
Grade 60	60	29000
Grade 75	75	29000
Grade 80	80	29000
Grade 150	150	29000
Strands 270 ksi	270	29000
S410	59.4	30434.8
S500	72.5	30434.8
B450C	65.2	30434.8

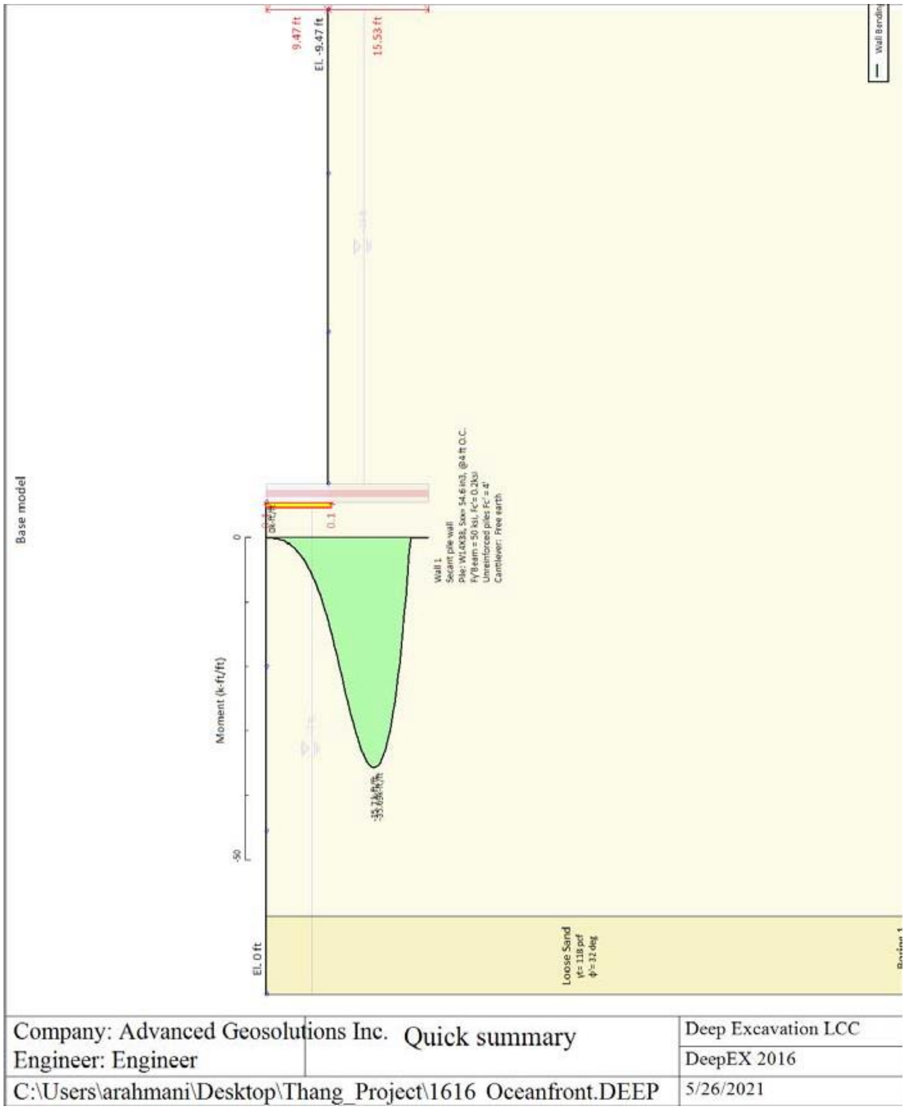
Wood

Name	Ultimate Bending Srtength Fbu	Ultimate Tensile Strength Ftu	Ultimate Shear Strength Fvu	Density g	Elastic E
	(ksi)	(ksi)	(ksi)	(pcf)	(ksi)
Construction Timb	1.6	1.4	0.8	0.05	1000
Regular grade	1	1	0.6	0.05	800

STEEL
Name=material name
fy=fyk= characteristc resistance for steel (for all the codes)
Fu=fuk= ultimate resistence for steel (for all the codes)
Elastic E= Elastic modulus

Density g= specific weight
CONCRETE
Name=material name
f'c=fck= cylindrical resistance for concrete (for all the codes)
Elastic E= Elastic modulus
Density g= specific weight
Tension strength=ft=fctk= characteristic tension resistance for concrete
STEEL REBARS
Name=material name
fy=fyk= characteristic resistance for steel (for all the codes)
Fu=fuk= ultimate resistence for steel (for all the codes)
Elastic E= Elastic modulus
Density g= specific weight
WOOD
Name=material name
Fb=fbk= Ultimate bending strength
Ftu=ftuk= Ultimate tensile strength
Fvu=fvuk= Ultimate shear strength
Density g= specific weight
Elastic E= Elastic modulus

ANALYSIS AND CHECKING SUMMARY



Summary of Wall Moments and Toe Requirements

Top Wall	Wall	L-Wall	H-Exc.	Max+M/Cap	Max-M/Cap	FS Toe	FS Toe	FS Toe	FS 1 Toe EL.	Slope
(ft)	Section	(ft)	(ft)	(k-ft/ft)	(k-ft/ft)	Passive	Rotation	Embedment	(ft)	Stab. FS
0	Wall 1	25	9.47	0/38.36	35.69/38.36	2.332	1.308	1.215	-22.25	N/A

Summary of Basal Stability and Predicted Wall Movements According to Clough 1989 Method Wall: W

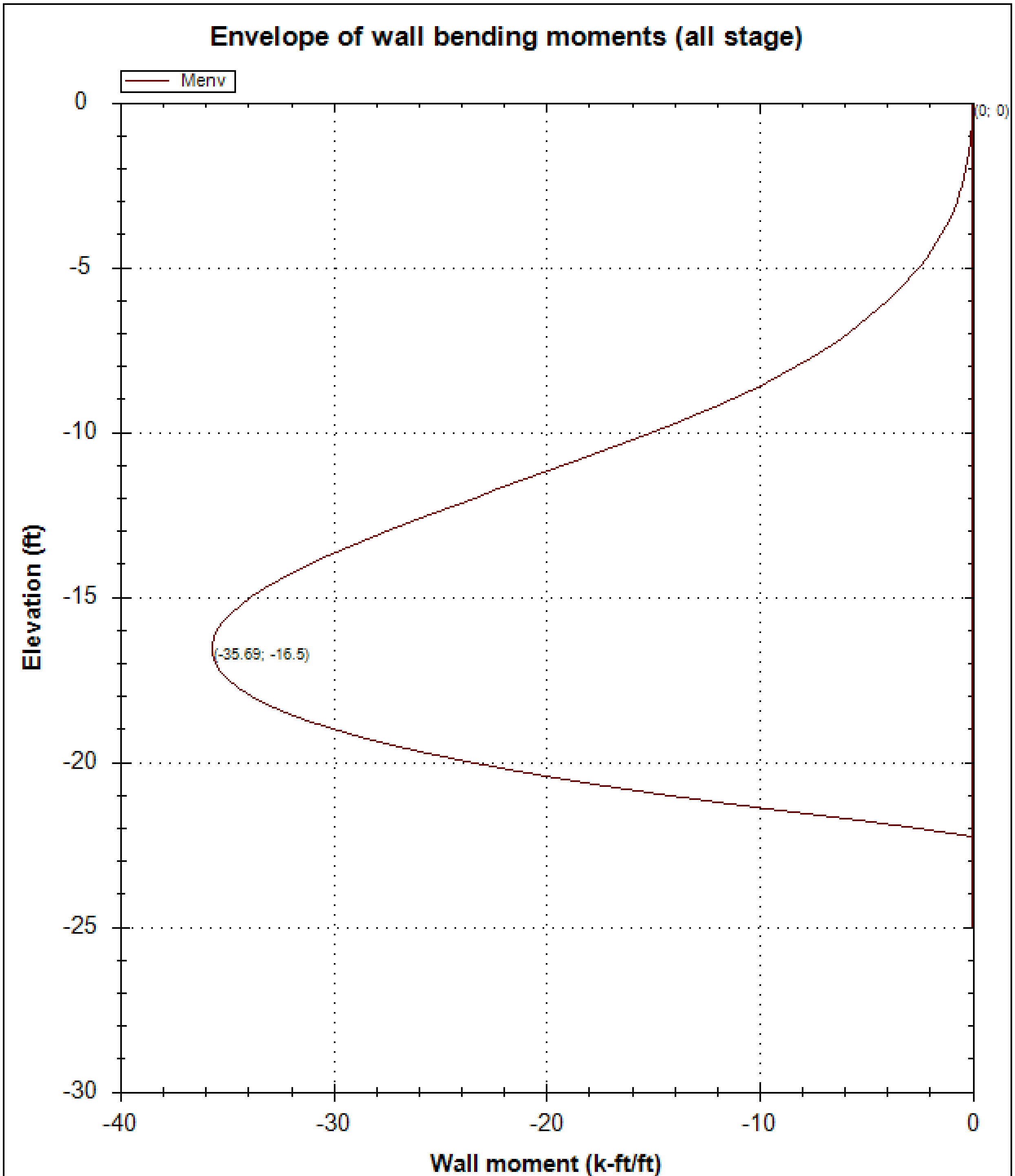
1. FSmin	2. DxMax (in)	2. Stiffness	2. FSbasal	3. Dx/H (%)	3. Stiffness	3. FSbasal
@ stage 0	@ stage 0	@ DxMax	@ DxMax	@ stage 0	@ Dx/H max	@ Dx/H max
2.803	0.143	39.1	2.803	0.126	39.092	2.803

General assumptions for last stage: Stage 0

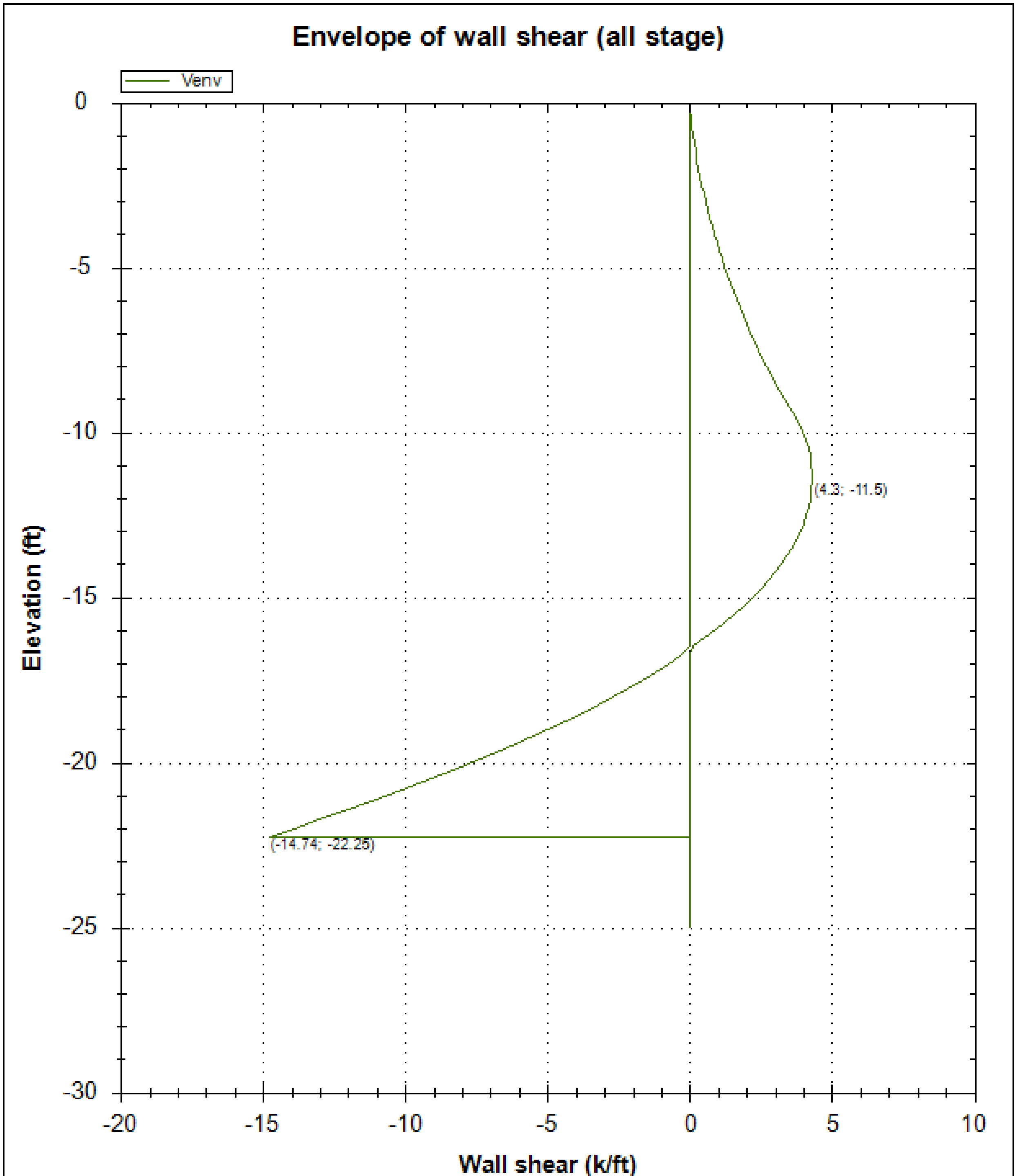
Concrete Code:	ACI 318-11/1.6
Steel Code:	AISC 360-10 ALL.
1st Wall Limit Equilibrium	Assume: Blum's method
Drain State Clays	Default
Water γ= 62.4 pcf	Simple flow
Drive	Ko
Resist from 0ft	po= 0ksf
Pass. slope above water m1	0.4k/ft3
Pass. slope below water m2	0.33k/ft3

Envelope of results

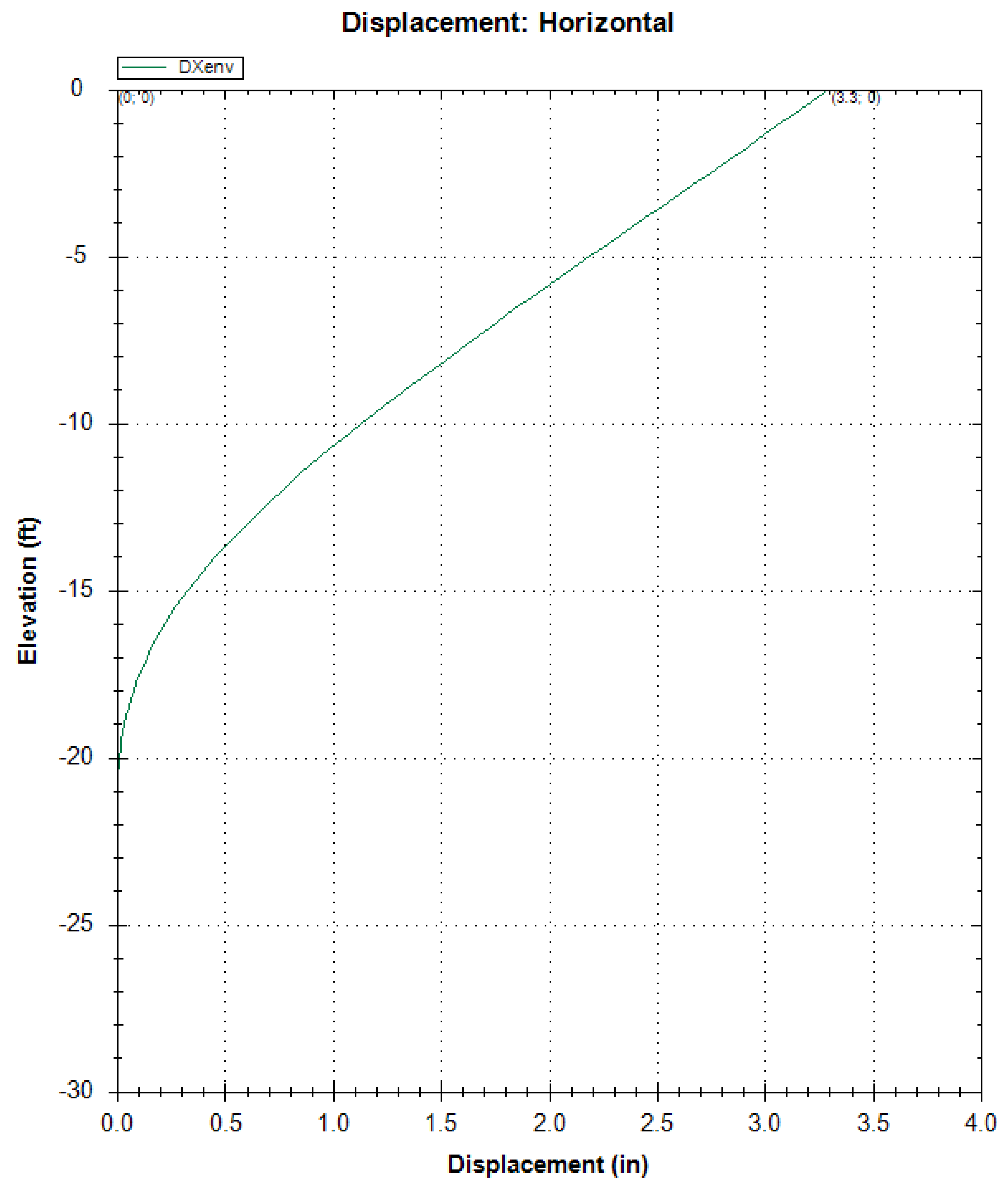
A sequence of result diagrams for each excavation stage is reported



Company: Advanced Geosolutions Inc. Engineer: Engineer	DS: 0 (left wall) Envelope of results	Deep Excavation LCC DeepEX 2016
C:\Users\arahmani\Desktop\Thang_Project\1616 Oceanfront.DEEP		5/26/2021



Company: Advanced Geosolutions Inc. Engineer: Engineer	DS: 0 (left wall) Envelope of results	Deep Excavation LCC DeepEX 2016
C:\Users\arahmani\Desktop\Thang_Project\1616 Oceanfront.DEEP		5/26/2021



Company: Advanced Geosolutions Inc. Engineer: Engineer	DS: 0 (left wall) Envelope of results	Deep Excavation LCC DeepEX 2016
C:\Users\arahmani\Desktop\Thang_Project\1616 Oceanfront.DEEP		5/26/2021

Extended vs Stage

	Calculation Result	Wall Displaceme	Settlement	Wall Moment	Wall Moment
		(in)	(in)	(k-ft/ft)	(k-ft)
Stage 0	Calculated	3.3	0.42	35.69	142.76

	Wall Shear	Wall Shear	STR Combined	STR Moment	STR Shear
	(k/ft)	(k)	Wall Ratio	Wall Ratio	Wall Ratio
Stage 0	14.74	58.95	0.93	0.93	1.523

Table notes:

STR Combined: Combined stress check, along eccentricity line considering axial load and moment (demand/capacity).
STR Moment : Moment stress check, assuming constant axial load on wall (demand/capacity).
STR Shear : Shear stress check (shear force demand/wall shear capacity).

	Max Support	Max Support	Critical	STR Support	Support Geotech
	Reaction (k/ft)	Reaction (k)	Support Check	Ratio	Capacity Ratio (pull out
Stage 0	No supports	No supports	No supports	No supports	No supports

Table notes:

STR Support ratio: Critical structural stress check for support (force demand/structural capacity).
Support geotech capacity ratio: Critical geotechnical capacity stress check (demand/geotechnical capacity).
Critical support check: Critical demand/design capacity ratio (structural or geotechnical).

	FS	Toe FS	Toe FS	Toe FS	Zcut	FS Mobilized	FS
	Basal	Passive	Rotation	Length	(nonlinear)	Passive	True/Active
Stage 0	2.803	2.332	1.308	1.215	N/A	N/A	N/A

	Hydraulic	Qflow	FSslope
	Heave FS	(ft3/hr)	
Stage 0	2.284	N/A	N/C

Support Force/S vs Stage

	No Supports
0:Stage 0	No support

Support Force vs Stage

Support Force vs Stage

	No Supports
0:Stage 0	No support

Embedment FS vs Stage

	Min Toe FS	FS1 Passive	FS2 Rotation	FS3 Length (from FS1, FS2)	FS4 Mobilized Passive	FS5 Actual Drive Thrust / Theory
Stage 0	1.215	2.332	1.308	1.215	N/A	N/A

Table notes:

FSbasal : Critical basal stability safety factor (relevant only when soft clays are present beneath the excavation).
Wall embedment safety factors from conventional analysis (limit-equilibrium):
FS1 Passive : Safety factor for wall embedment based on FS= Available horizontal thrust resistance/Driving hor. thrust.
FS2 Rotation: Safety factor for wall embedment based on FS= Available resisting moment/Driving moment.
FS3 Length : Safety factor for wall embedment based on FS= Available wall embedment/Required embedment for FS=1.0
Wall embedment safety factors from non-linear analysis:
FS4 Mobilized Passive : Safety factor= Available horizontal passive resistance/Mobilized passive thrust.
FS5 True/Active : Soil thrust on retained wall side/Minimum theoretically horizontal active force thrust.

Tables for stress checks follow: Support force/Design capacity

Support Check vs Stage

	No Supports
0:Stage 0	No support

Forces (Res. F, M/Drive F, M)

	FS1 Passive	FS2 Rotation	FS3 Length	FS4 Mobilized Passive	FS5 Actual Drive	Fh EQ Soil	Fh EQ Water
	(FxResist/FxDrive)	(Mresist/Mdrive)	(Embedment/ToeFS=1)	(FxPassive/FxPas_Mobili	/ Theory Active		
Stage 0	176.189/75.559	952.14/448.78	15.53/12.78	N/A	N/A	N/A	N/A

Reinforcement Requirements

	Parameter Description
Note:	Wall does not use steel reinforcement. Section does not apply.

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'= safety factor on effective cohesion (Eurocode 7 methods)
F Su'= safety factof for undrained shear strength (Eurocode 7 methods)
F EQ= Load factor for seismic loads
F perm load= Load factor for permanent loads (dead load, etc)
F temp load= Load factor on live loads and other temporary loads
F perm supp= Reduction factor for resistance for pull out checking of permanent tiebacks
F temp supp= Reduction factor for resistance for pull out checking of temporary tiebacks
F earth Dstab= Load factor for driving earth pressures, unfavorable (on retained side)
F earth stab= Safety factor for passive pressures, favorable (on excavation side)
F GWT Dstab (ground water)= Load factor for driving water pressures, unfavorable
F GWT stab (ground water)= Load factor for resisting water pressure, favorable
F HYD Dstab= Load factor for hydraulic heave, unfavorable (hydraulic checking)
F HYD stab= Resistance factor for hydraulic heave, favorable (hydraulic checking)
F UPL Dstab= Load factor for uplift check, unfavorable
F UPL stab= Resistance factor for uplift check, favorable

Stage	Design Code	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	Default	Service Factors	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	rEur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(pcf)	(pcf)	(deg)	(psf)	(psf)	(deg)	(deg)	(ksf)	(-)	NL	NL	NL	NL		Model	
Loose Sand	118	118	32	0	N/A	N/A	N/A	300	3	0.31	3.26	N/A	N/A	True	EXP	

Name	Poisson	Min Ka	Min sh	ko.NC	nOCR	aH.EXP	aV.EXP	qSkin	qNails	kS.nails	PL
	v	(clays)	(clays)	-	-	(0 to 1)	(0 to 1)	(psi)	(psi)	(k/ft3)	(ksi)
Loose Sand	0.35	-	-	0.47	0.5	1	0	7.2	4.8	20	-

gtot = total soil specific weight
gdry = dry weigth of the soil
Frict = friction angle
C' = effective cohesion
Su = Undrained shear strength (only for CLAY soils in undrained conditions, used as a cutoff strength in NL analysis)
Evc = Virgin compression elastic modulus
Eur = unloading/reloading elastic modulus
Kap = Peak active thrust coefficient (initial value, may be modified on each stage according to analysis settings).
Kpp = Peak passive thrust coefficient (initial value, may be modified on each stage according to analysis settings).
Kacv = Constant volume active thrust coeff (only for clays, initial value)
Kpcv = Constant volume passive thrust coeff (only for clays, initial value).
Spring models= spring model (LIN= constant E over the soil layer height , EXP=exponential , SIMC=simplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,

EXP: Exponential, SUB: Modulus of Subgrade Reaction
SIMC= Simplified Clay mode

SOIL BORINGS

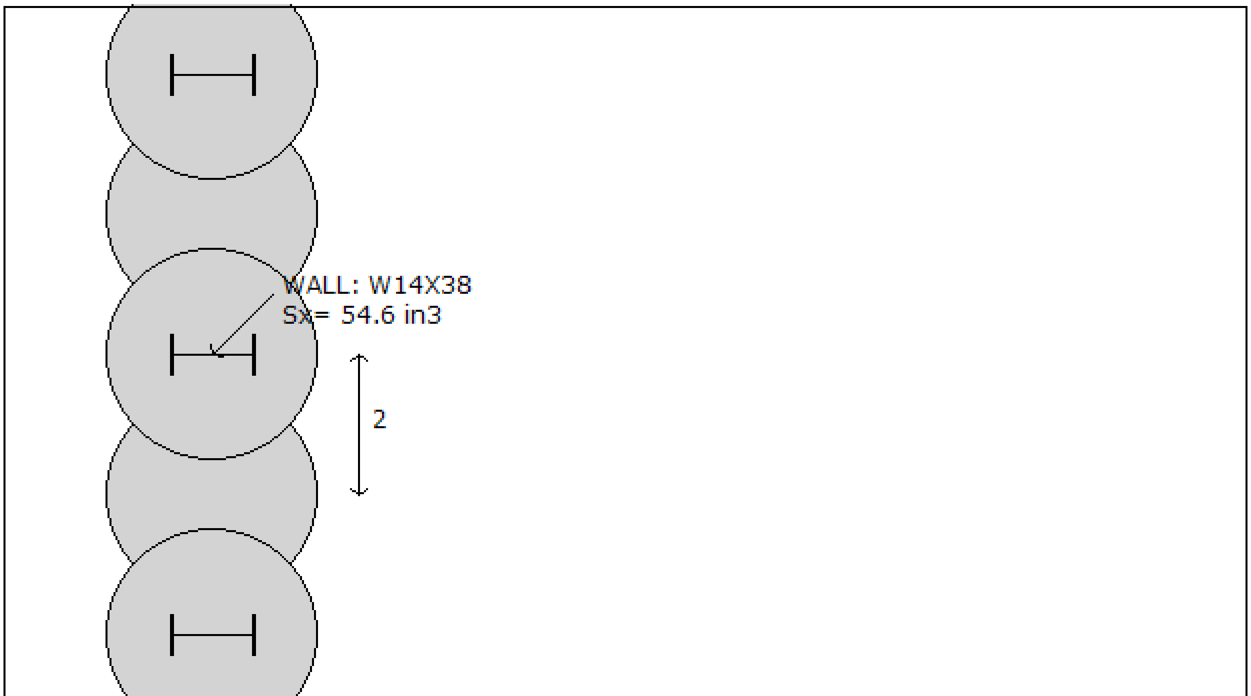
Top Elev= superior SOil level
Soil type= type of the soil (sand , clay , etc)
OCR= overconsolidation ratio
K0= at rest coefficient

Name: Boring 1, pos: (-65.617, 0)

Top elev.	Soil type	OCR	Ko
0	Loose Sand	1	0.5

WALL DATA

Wall section 0: Wall 1



Company: Advanced Geosolutions Inc. Engineer: Engineer	Wall sketch	Deep Excavation LCC DeepEX 2016
C:\Users\arahmani\Desktop\Thang_Project\1616 Oceanfront.DEEP		5/26/2021

Wall uses wall section 0: Wall 1
Wall type: Secant pile wall
Top wall El: 0 ft Bottom wall El: -25 ft
Hor. wall spacing: 4 ft Wall thickness = 3 ft
Passive width below exc: 4 ft Active width below exc: 4 ft Swater= 4 ft
Steel members fy = 50 ksi Esteel = 29000 ksi
Wall friction: Ignored
Steel wall capacities are calculated with AISC 360-10 ALL.
Concrete capacities are calculated with ACI 318-11
Note: With ultimate capacities you may have to use a structural safety factor.
Secant pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or t	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(plf)	(in^2)	(in)	(in)	(in)	(in)	(in)	(in^4)	(in^3)	(in)	(in^4)	(in^3)	(in)	(in)	(in^6)	(ksi)
W14X38	W14X3	38	11.2	14.1	0.31	6.77	0.515	0.915	385	54.6	5.87	27	7.9	1.55	1.55	1230	50

GENERAL WALL DATA
Hor wall spacing= Wall horizontal spacing
Passive width below exc= spacing for passive thrust pressure for classic analysis
f'c=fck= cylindrical concrete resistance
fyk=fy= steel rebar characteristic resistance
Econc= Concrete Elastic modulus
fctk= characteristic Concrete tension
Esteel= steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall thickness
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=width per unit of length
A=area
h=height
t=horizontal part thickness
b=width of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soldier piles and timber lagging
W=weight per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf= flange thickness
k= flange thickness+stem base height
Ixx= strong axis inertia modulus (per unit of length)
Sxx= strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw= warping constant

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

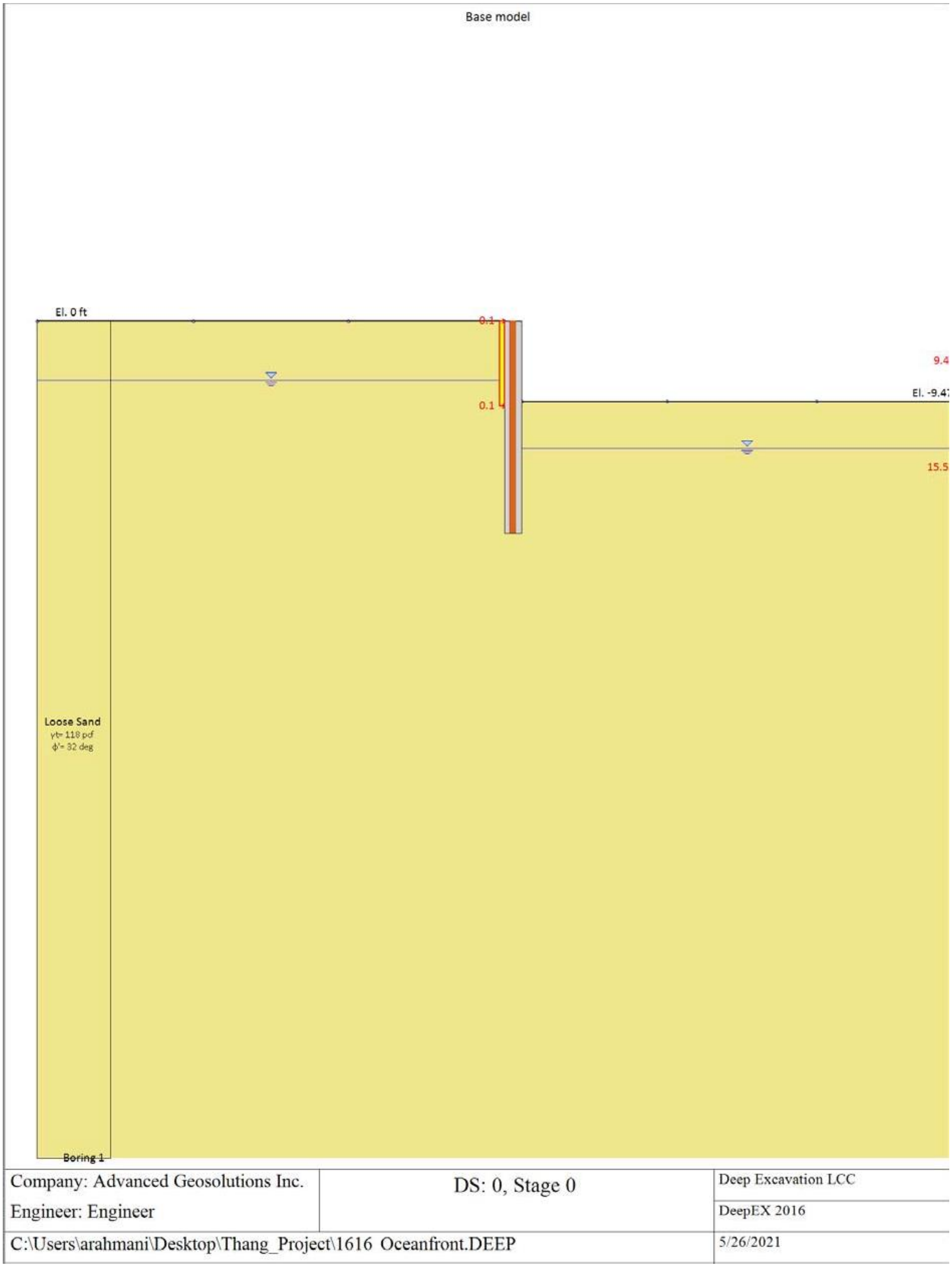
Name	Analysis	Drive	ka-Mult	Htr T/B	Resist	Res	Contle
	Method	Press		(%)	Press	Mult	Method
Stage 0	Conventional	Ko	N/A	N/A	Pres. slope	N/A	Free Earth

Name	Support	Axial	Used	Min Toe	Toe	Toe
	Model	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Simple span	N/A	1.6	1.215	1.308	2.332

Name=excavation stage name
Analysis method
springs = Elastoplastic spring analysis used
DR = Drained condition for CLAY model
U = Undrained condition for CLAY model for all the soils
Up = Undrained condition just for selected soil
Limit equilibrium analysis settings
Drive press:
Ka (Active pressure diagram), Ka-Trap = Trapezoid apparent diagram from active pressures x multiplier,
FHWA= Federal Highway Administration apparent pressure diagrams.
Ko = At-rest lateral earth pressures.
Peck = Peck 1969 Apparent earth pressure diagrams.
2 Step rect = Two step rectangular apparent earth pressure diagram.
User def. = User defined apparent earth pressure diagram.
Ka+d (and so on) indicates that wall friction is applied
ka mult = multiplication factor for Ka when Ka-Trap is selected
Htr T/B (%) = trapezoidal pressure scheme, top and bottom triangular percentage of excavation depth H
Resit press = Kp (passive earth pressures)
Res Mult = Safety factor applied directly on resisting pressures (
COntle Method = cantilever analysis method for limit equilibrium analysis.
Support Model: Method for calculating support reactions in limit-equlibrium analysis.
Beam= support reactions beam analysis (uses Blum's method).
Trib= support reactions from tributary height calculations (Can be applied with apparent diagrams).
Axial Incl = Axial loads included for structural design
Used FS wall = Safety factor for axial+bending wall resistance to divide ultimate wall capacities.
Min FD Toe= embedded minimum safety factor (for limit equilibrium analysis)
Toe FS rot= rotation safety factor (classic for limit equilibrium analysis)
Toe FSpas= driving/resisting pressure safety factor (for limit equilibrium analysis)

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported



Toe stability

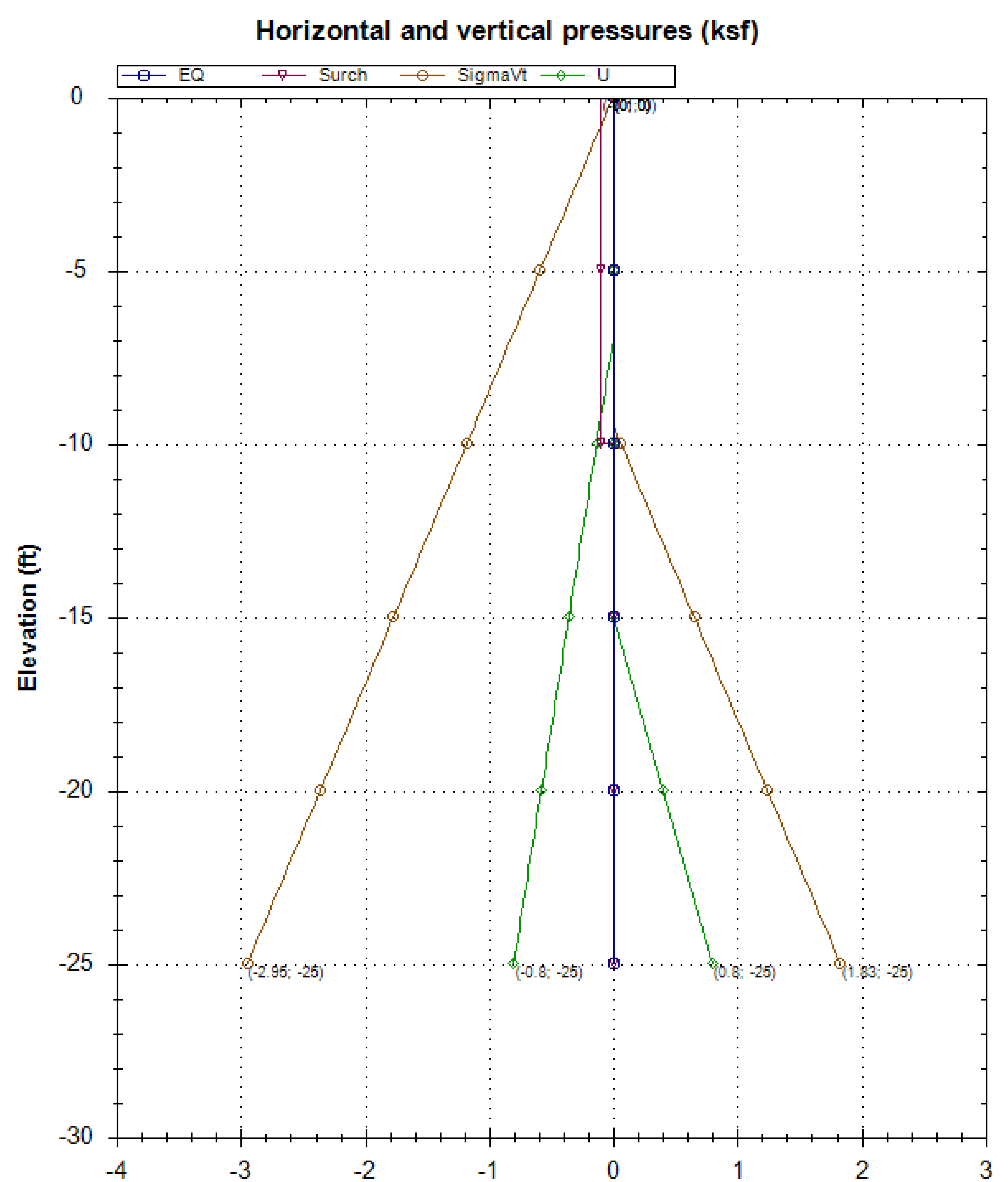
Embedment FS vs Stage

	Min Toe FS	FS1 Passive	FS2 Rotation	FS3 Length (from FS1, FS2)	FS4 Mobilized Passive	FS5 Actual Drive Thrust / Theory
Stage 0	1.215	2.332	1.308	1.215	N/A	N/A

Legend: Wall embedment safety factors (toe)
Min Toe FS= Minimum wall embedment safety factor (from all analysis methods)
Limit-equilibrium analysis methods: The following safety factors may not be applicable for all stages.
FS1 Passive: Horizontal force safety factor, FS1= Resisting/Driving force
FS2 Rotation: Rotational safety factor about lowest support, FS2= Resisting moment/Driving moment
FS3 Length (from FS1, FS2): Program determines maximum required wall embedment for safety factor of 1 for methods FS1 and FS2 (say length LFS1). Then FS length= Provided wall embedment/LFS1.
Non-linear elastoplastic analysis safety factors:
FS4 Mobilized Passive: Safety factor on mobilized passive resistance, FS4= Available passive soil resistance/Mobilized passive soil force on excavation side.
FS5 Active Drive Thrust/Theory Active: Ratio of soil thrust on retained side/ Active condition theoretical minimum thrust. This factor is not as critical, and indicates how close to active conditions the model is.
General recommendations on wall embedment (excluding FS5):
When then excavation is designed with allowable standards, engineers generally use minimum safety factors from 1.2 to 1.5 depending on the level of confidence. A minimum safety factor of 1.2 is generally applied on FS3.
With ultimate limit state designs (such as Eurocode 7, and LRFD) the required safety factor must generally be greater than 1.0. In non-linear solutions it might be impossible to achieve exactly 1 on FS4 as this would likely trigger overall failure.

Result diagrams (for walls)

A sequence of result diagrams for each excavation stage is reported



Company: Advanced Geosolutions Inc. Engineer: Engineer	DS: 0 (left wall) Stage 0	Deep Excavation LCC DeepEX 2016
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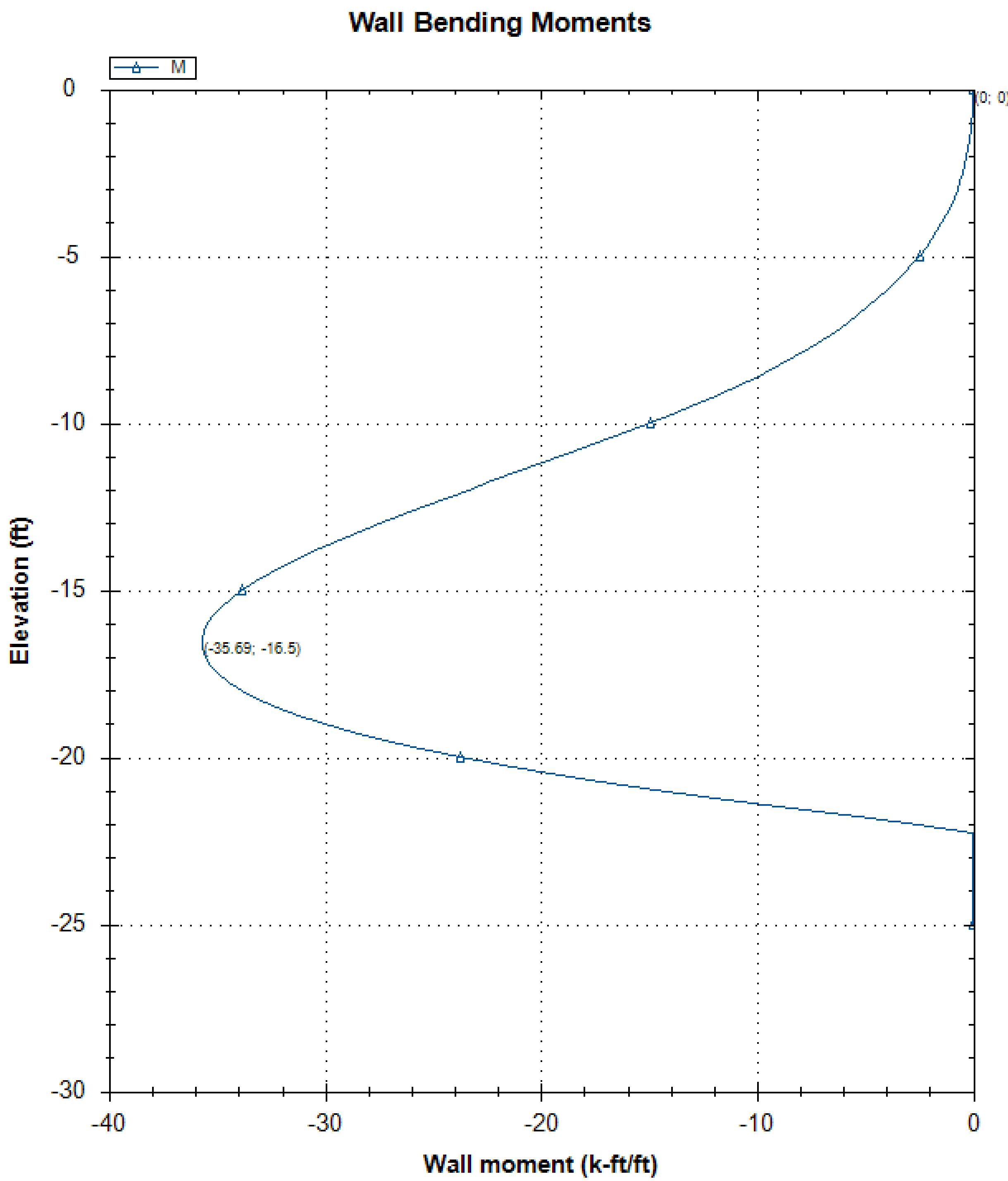

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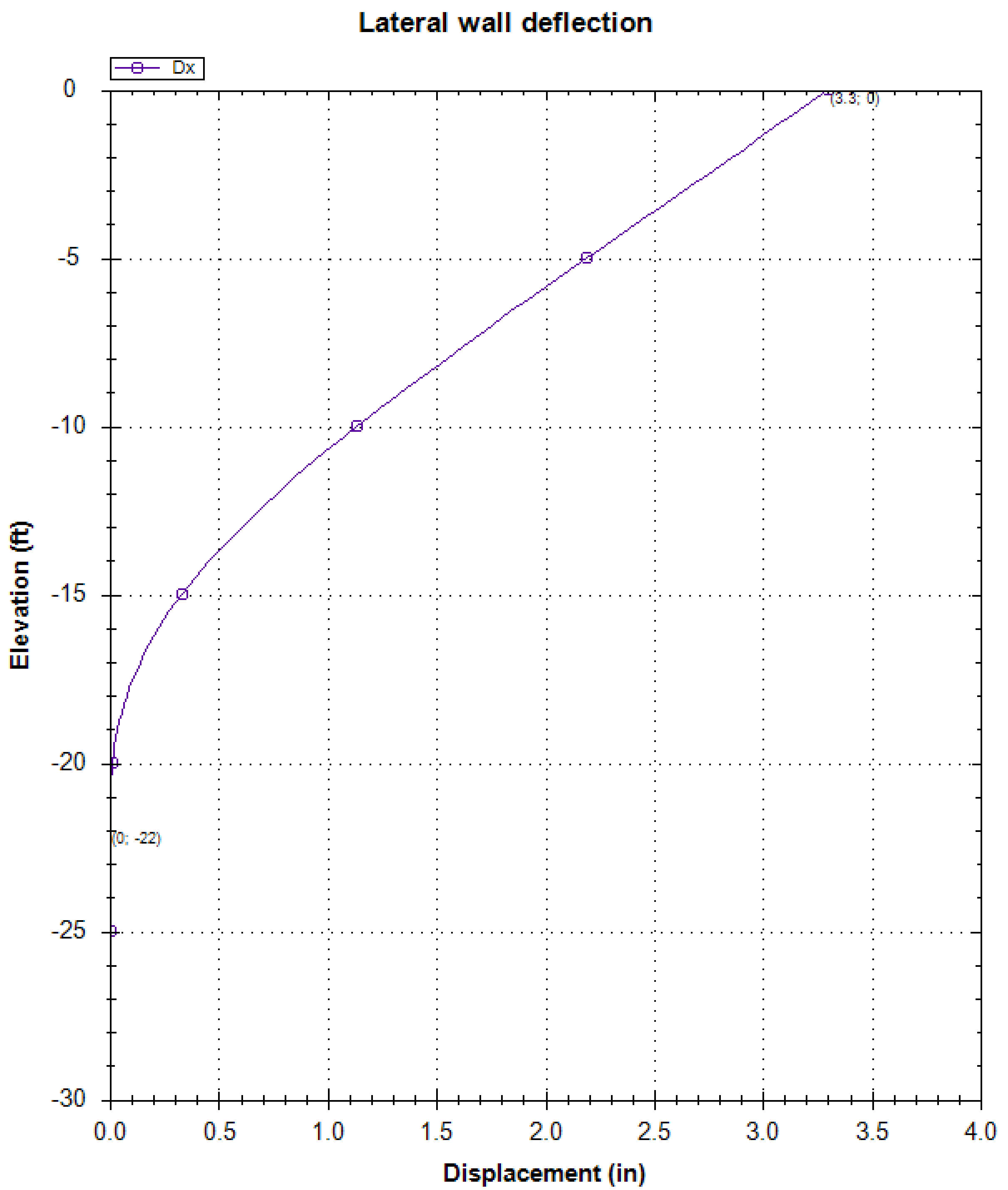

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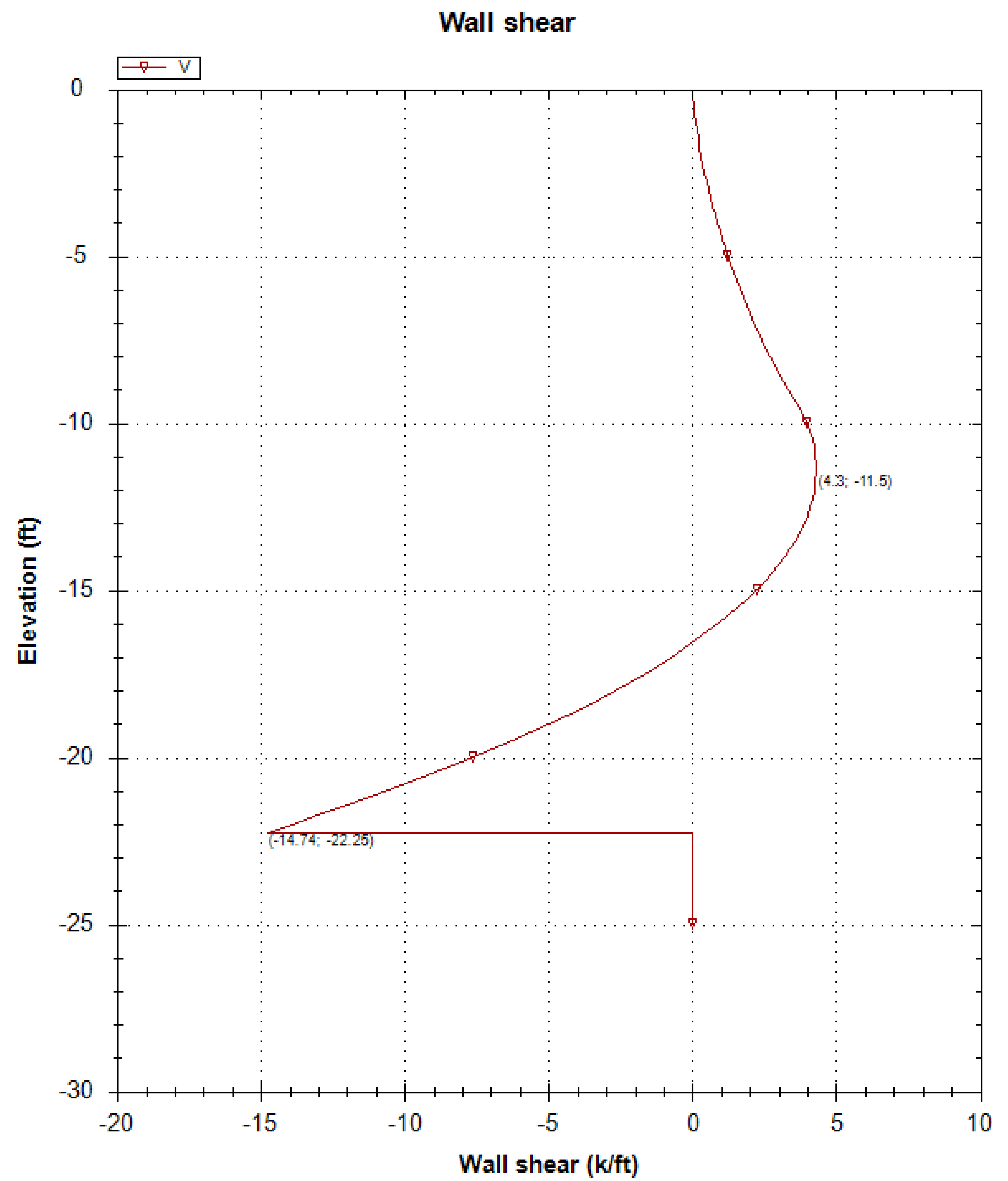

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