



DESIGN PACKAGE
PERMANENT SOLDIER PILE WALL DESIGN
LOT 44R, SUMMIT POWDER MOUNTAIN
8645 E. COPPER CREST
WEBER COUNTY, UTAH

TABLE OF CONTENTS

1. SHOP DRAWINGS
 - SHEET 1.1 - COVER SHEET
 - SHEET 1.2 - PLAN VIEWS
 - SHEET 1.3 - ELEVATION VIEWS
 - SHEET 1.4 - TYPICAL SECTION VIEWS
 - SHEET 1.5 - WALL DETAILS
 - SHEET 1.6 - GENERAL NOTES
 - SHEET 1.7 - TESTING DETAILS

2. DESIGN CALCULATION PACKAGE
 - 2.1 DESIGN CRITERIA
 - 2.2 ENGINEERING ANALYSIS
 - 2.3 DESIGN CALCULATIONS

PLAN REVIEW ACCEPTANCE

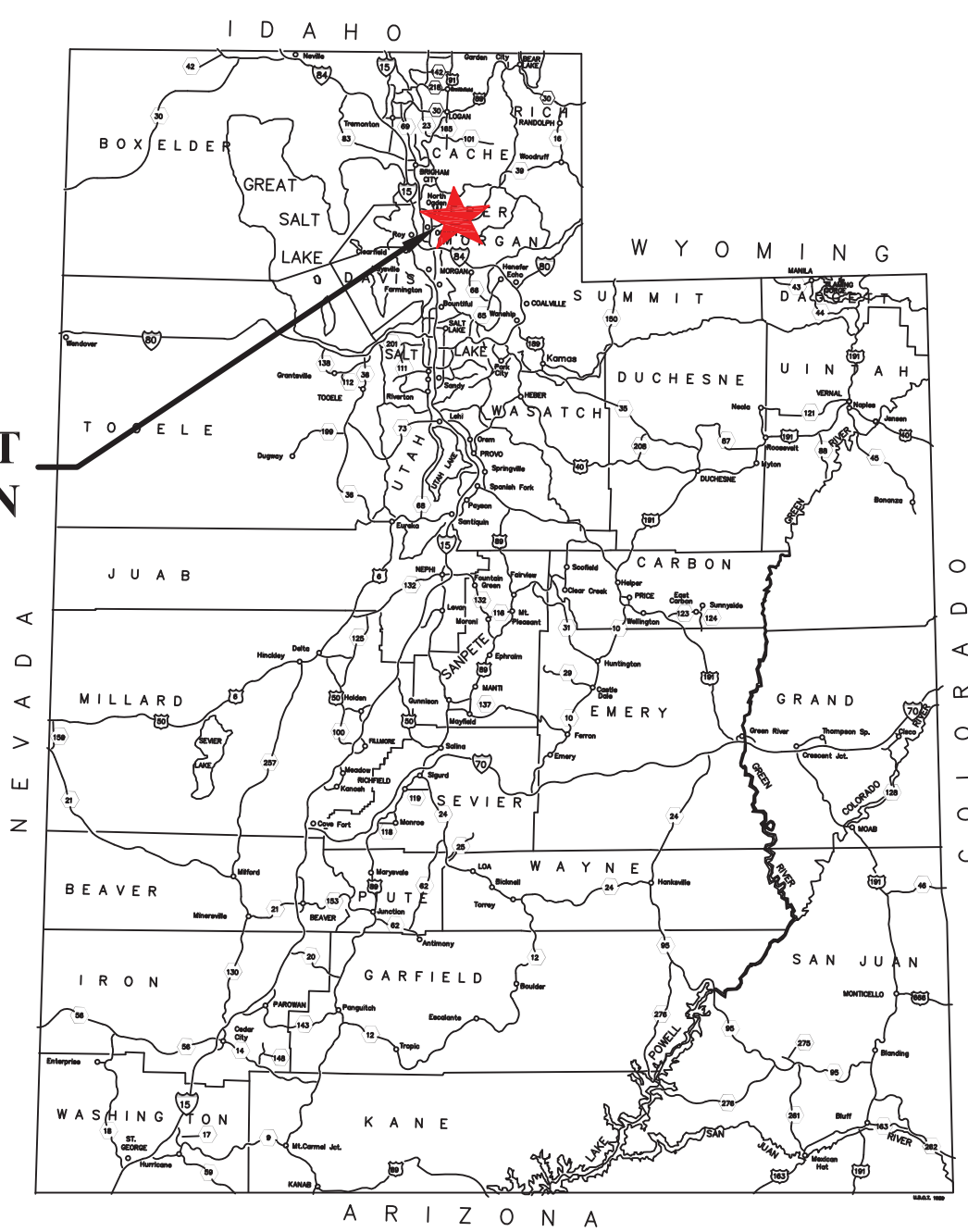
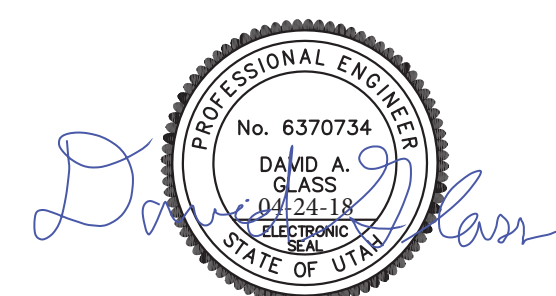
FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18

WEST COAST CODE CONSULTANTS, INC.



PROJECT LOCATION MAP

PROJECT LOCATION

PREPARED BY:
 DAVID A. GLASS, P.E.

REVIEWED BY:
 DAVEY L. BREINHOLT, P.E.

MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH
 COVER SHEET

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	NTS
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.1
		REV.	N/A

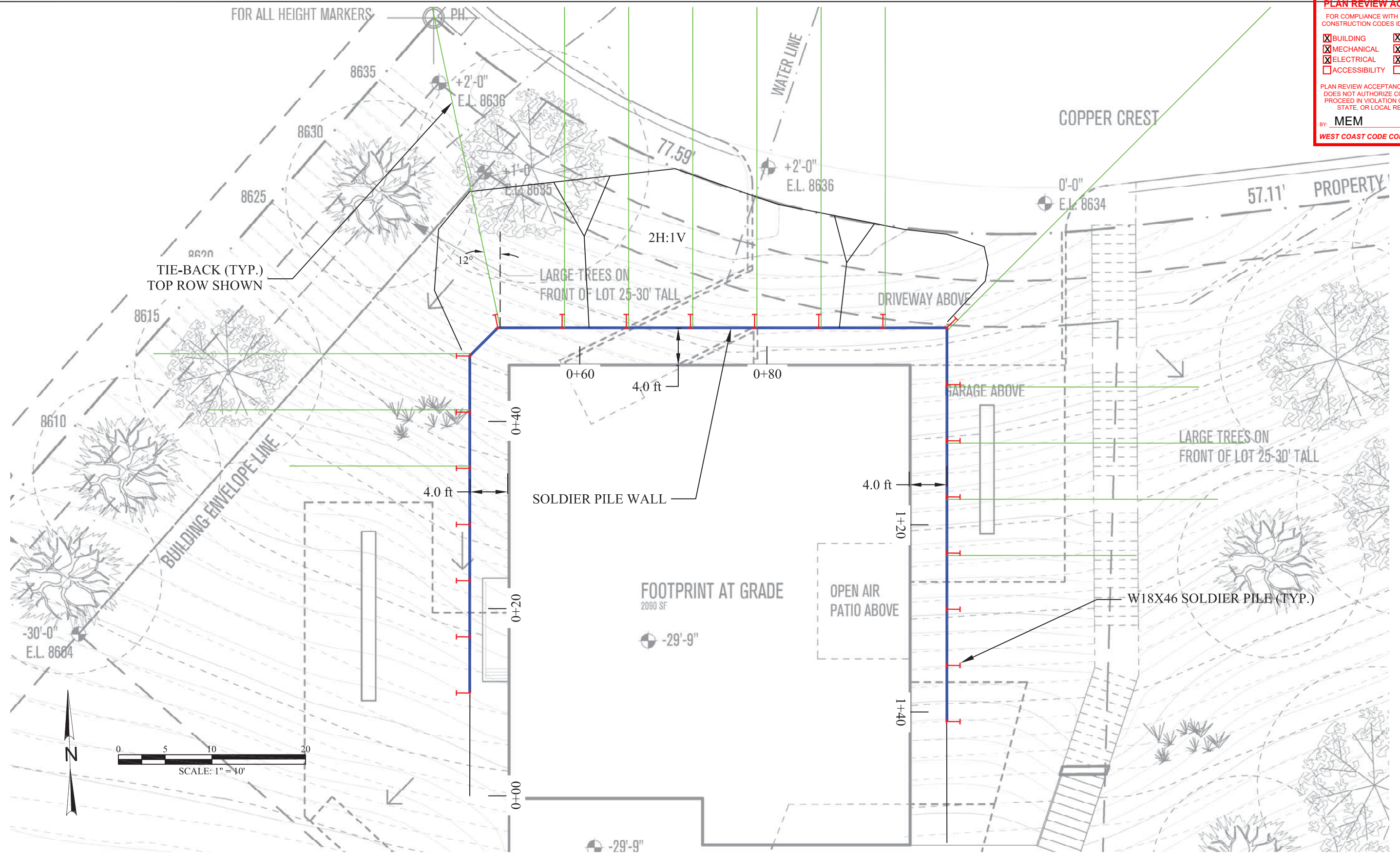
PLOT DATE: APR 24, 2018

PLAN REVIEW ACCEPTANCE
 FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18
WEST COAST CODE CONSULTANTS, INC.



BASEMAP: PLAN TITLED "FOOTPRINT PLAN" SHEET A1.5, PREPARED BY TOM WISCOMBE ARCHITECTRE, DATED APRIL 4, 2018

LOT 44R SUMMIT POWDER MTN.: PERMANENT SOLIDER PILE WALL

APPROXIMATE GRAPHICAL SCALE: 1 INCH = 10 FEET (11X17 ONLY)

PLOT DATE: APR 24, 2018

MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH

PLAN VIEW

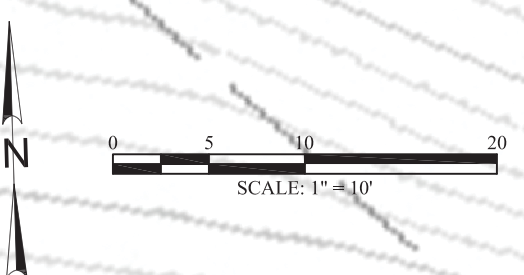
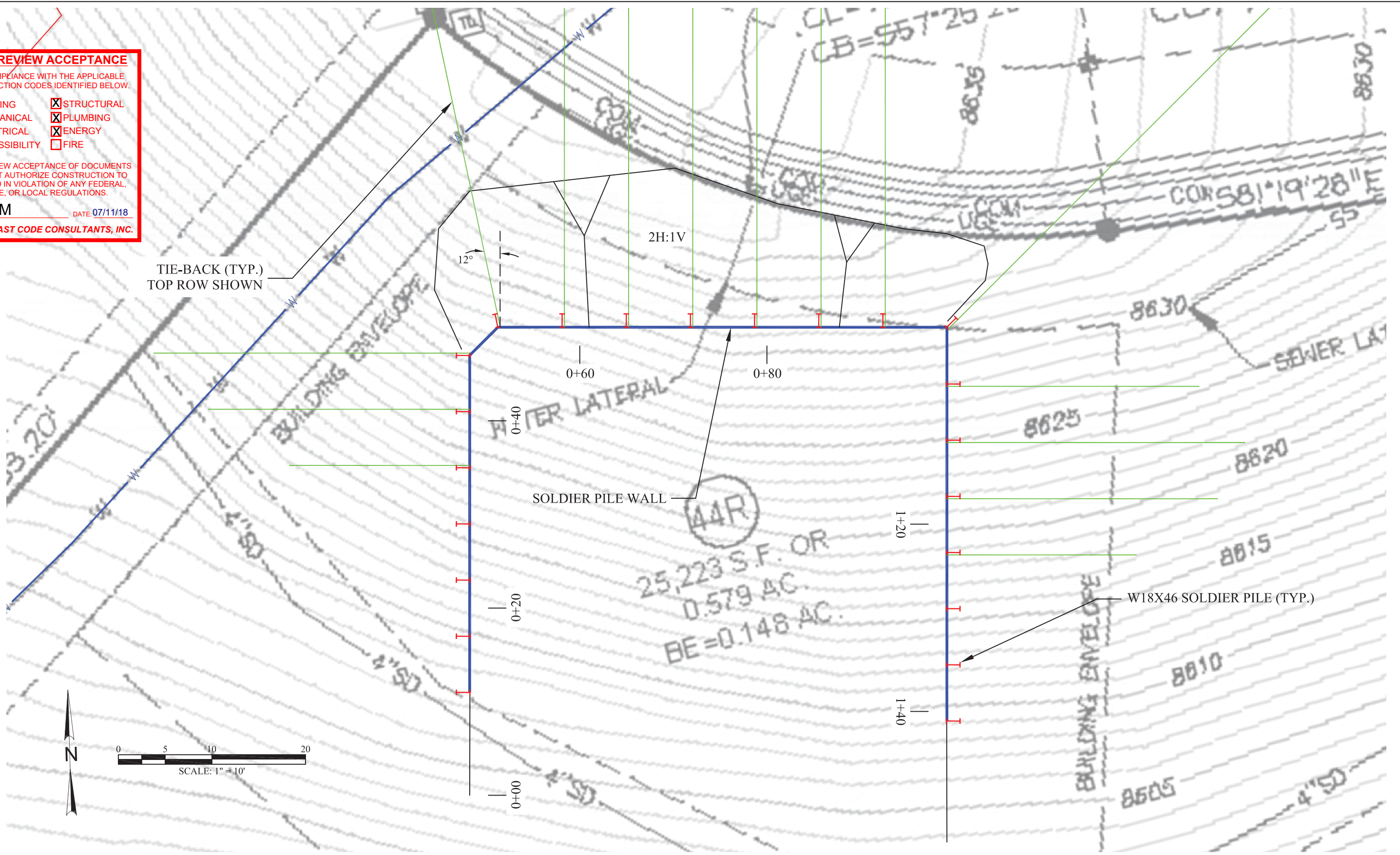
DESIGNED BY: DAG	APR 15, 2018	PLOT SCALE
DRAWN BY: DAG	APR 15, 2018	1=1
CHECKED BY: DLB	APR 23, 2018	DWG SCALE
APPROVED BY: DAG	APR 24, 2018	1"=10'
IGES PROJECT NO. 02732-002	SHEET NO. 1.2a	REV. N/A

PLAN REVIEW ACCEPTANCE
 FOR COMPLIANCE WITH THE APPLICABLE
 CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS
 DOES NOT AUTHORIZE CONSTRUCTION TO
 PROCEED IN VIOLATION OF ANY FEDERAL,
 STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18
WEST COAST CODE CONSULTANTS, INC.



BASEMAP: PLAN TITLED "EXISTING CONDITIONS SURVEY" SHEET
 ET01, PREPARED BY TALISMAN, DATED AUGUST 23, 2017

LOT 44R SUMMIT POWDER MTN.: PERMANENT SOLDIER PILE WALL

APPROXIMATE GRAPHICAL SCALE: 1 INCH = 10 FEET (11X17 ONLY)

MARK	REVISIONS	DATE	BY	CHK

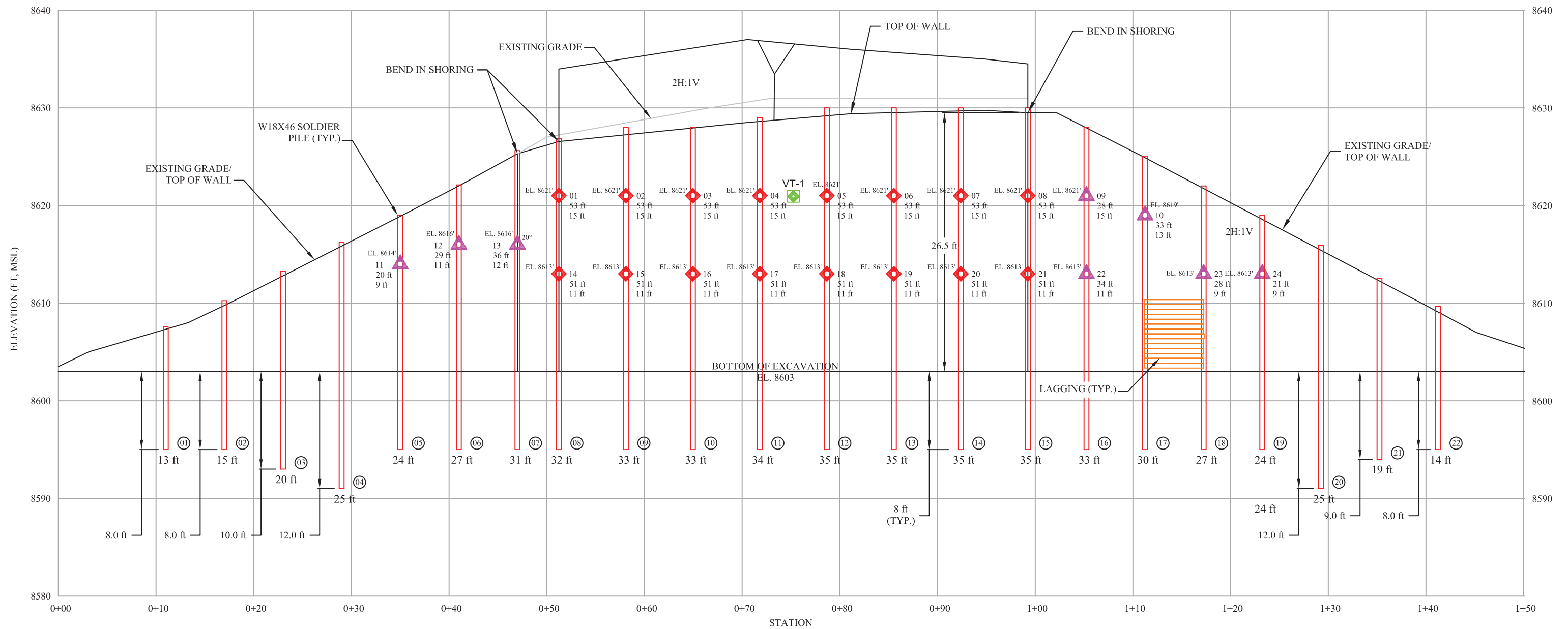


12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH
 PLAN VIEW

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	1"=10'
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.2b
		REV.	N/A

PLOT DATE: APR 24, 2018



**PERMANENT SOLDIER PILE WALL
ELEVATION VIEW
SCALE : 1"=10' 11X17 ONLY**

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE
CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS
DOES NOT AUTHORIZE CONSTRUCTION TO
PROCEED IN VIOLATION OF ANY FEDERAL,
STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: **07/11/18**

WEST COAST CODE CONSULTANTS, INC.

PLOT DATE: APR 24, 2018

MARK	REVISIONS	DATE	BY	CHK

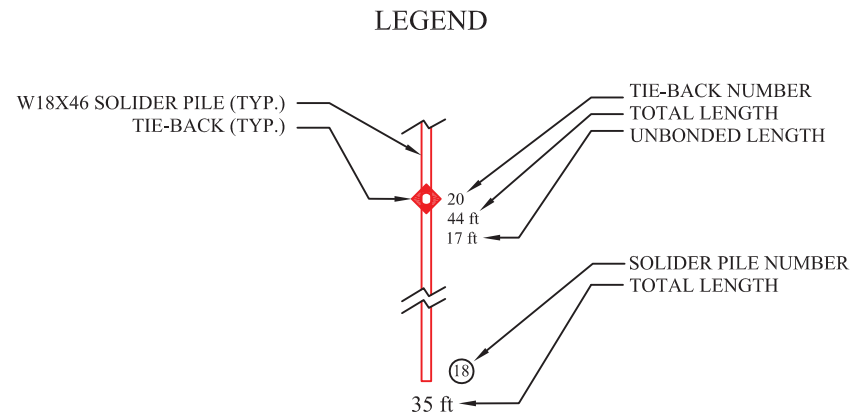


12429 SOUTH 300 EAST, STE. 100
DRAPER, UTAH 84020
(801) 748-4044 FAX: (801) 748-4045

**PERMANENT SOLDIER PILE WALL DESIGN
LOT 44R, SUMMIT POWDER MOUNTAIN
WEBER COUNTY, UTAH
ELEVATION VIEW**

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	1"=10'
CHECKED BY: DLB	APR 23, 2018		
APPROVED BY: DAG	APR 24, 2018		
IGES PROJECT NO. 02732-002	SHEET NO. 1.3a	REV.	N/A

All Piles are W18x46



- VT-1 VERIFICATION TEST LOCATION (TYP.)
- 3-STRAND TIE-BACK (OR #14 GRADE 75)
- 2-STRAND TIE-BACK (OR #11 GRADE 75)

Pile No.	Total Length (ft)	Min. Toe Length (ft)	Anchor Rows	First Row Elevation (ft)	Second Row Elevation (ft)
1	13	8	cant.	n/a	n/a
2	15	10	cant.	n/a	n/a
3	20	6	1	n/a	n/a
4	25	6	1	n/a	n/a
5	24	6	1	8614	n/a
6	27	6	2	8616	n/a
7	31	6	2	8616	n/a
8	32	6	2	8621	8613
9	33	6	2	8621	8609
10	33	6	2	8621	8609
11	34	6	2	8621	8609
12	35	6	2	8621	8609
13	35	6	2	8621	8609
14	35	6	2	8621	8609
15	35	6	2	8621	8609
16	33	8	2	8621	8609
17	30	8	2	8619	n/a
18	27	8	2	8613	n/a
19	24	8	2	8613	n/a
20	25	8	2	n/a	n/a
21	19	8	2	n/a	n/a
22	37	8	2	n/a	n/a

Tie-back No.	Strands	Total Length (ft)	Unbonded Length (ft)	DL (kips)	Install deg.
1	3-Strand	53	15	75.6	15
2	3-Strand	53	15	75.6	15
3	3-Strand	53	15	75.6	15
4	3-Strand	53	15	75.6	15
5	3-Strand	53	15	75.6	15
6	3-Strand	53	15	75.6	15
7	3-Strand	53	15	75.6	15
8	3-Strand	53	15	75.6	15
9	2-Strand	28	15	25.0	15
10	2-Strand	33	13	39.3	15
11	2-Strand	20	9	20.9	15
12	2-Strand	29	11	35.4	15
13	2-Strand	36	12	46.4	20
14	3-Strand	51	11	81.7	15
15	3-Strand	51	11	81.7	15
16	3-Strand	51	11	81.7	15
17	3-Strand	51	11	81.7	15
18	3-Strand	51	11	81.7	15
19	3-Strand	51	11	81.7	15
20	3-Strand	51	11	81.7	15
21	3-Strand	51	11	81.7	15
22	2-Strand	28	9	36.8	15
23	2-Strand	21	9	23.2	15

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: MEM DATE: 07/11/18

WEST COAST CODE CONSULTANTS, INC.

PLOT DATE: APR 24, 2018

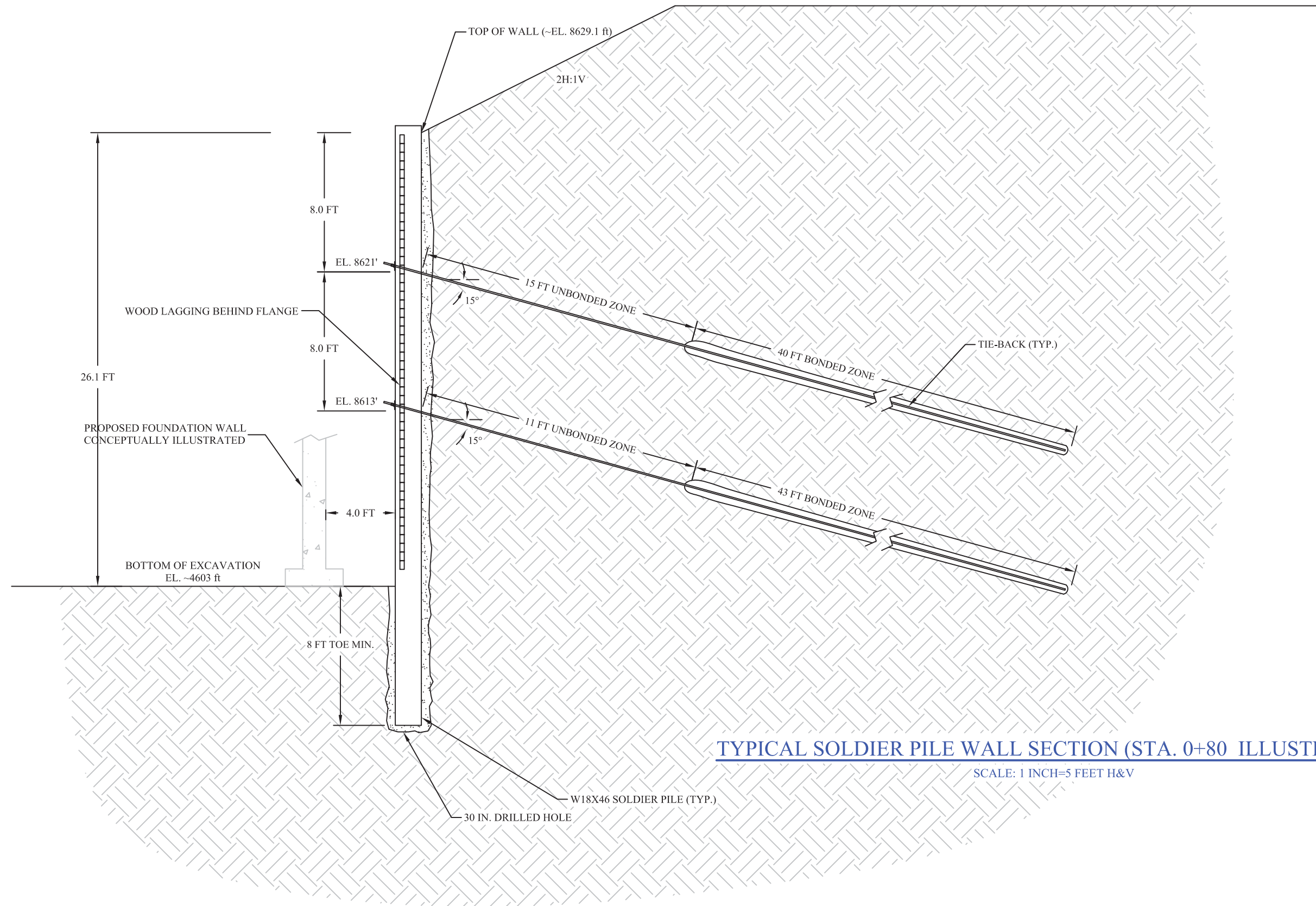
MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH
 ELEVATION VIEW LEGEND

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE
DRAWN BY: DAG	APR 20, 2018	1=1
CHECKED BY: DLB	APR 23, 2018	DWG SCALE
APPROVED BY: DAG	APR 24, 2018	1"=10'
IGES PROJECT NO. 02732-002	SHEET NO. 1.3b	REV. N/A



PLAN REVIEW ACCEPTANCE
 FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18
WEST COAST CODE CONSULTANTS, INC.

TYPICAL SOLDIER PILE WALL SECTION (STA. 0+80 ILLUSTRATED)

SCALE: 1 INCH=5 FEET H&V

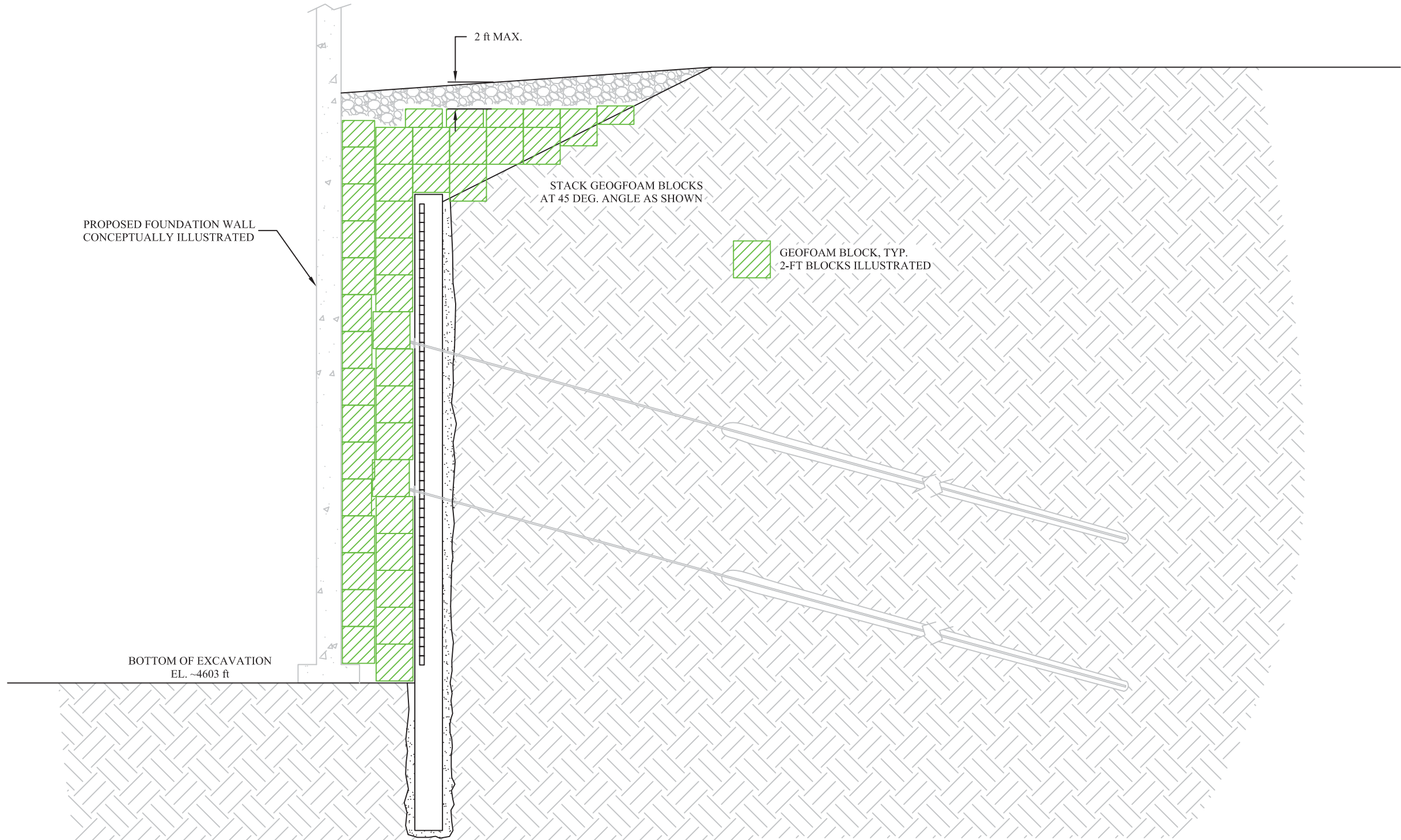
MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH
 TYPICAL SECTION VIEW

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	1"-6'
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.4a
PLOT DATE: APR 24, 2018			REV. N/A



PROPOSED FOUNDATION WALL
CONCEPTUALLY ILLUSTRATED

2 ft MAX.

STACK GEOFOAM BLOCKS
AT 45 DEG. ANGLE AS SHOWN

GEOFOAM BLOCK, TYP.
2-FT BLOCKS ILLUSTRATED

BOTTOM OF EXCAVATION
EL. ~4603 ft

PLAN REVIEW ACCEPTANCE
FOR COMPLIANCE WITH THE APPLICABLE
CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS
DOES NOT AUTHORIZE CONSTRUCTION TO
PROCEED IN VIOLATION OF ANY FEDERAL,
STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18
WEST COAST CODE CONSULTANTS, INC.

TYPICAL SOLDIER PILE WALL SECTION (STA. 0+80 ILLUSTRATED)

SCALE: 1 INCH=5 FEET H&V

MARK	REVISIONS	DATE	BY	CHK

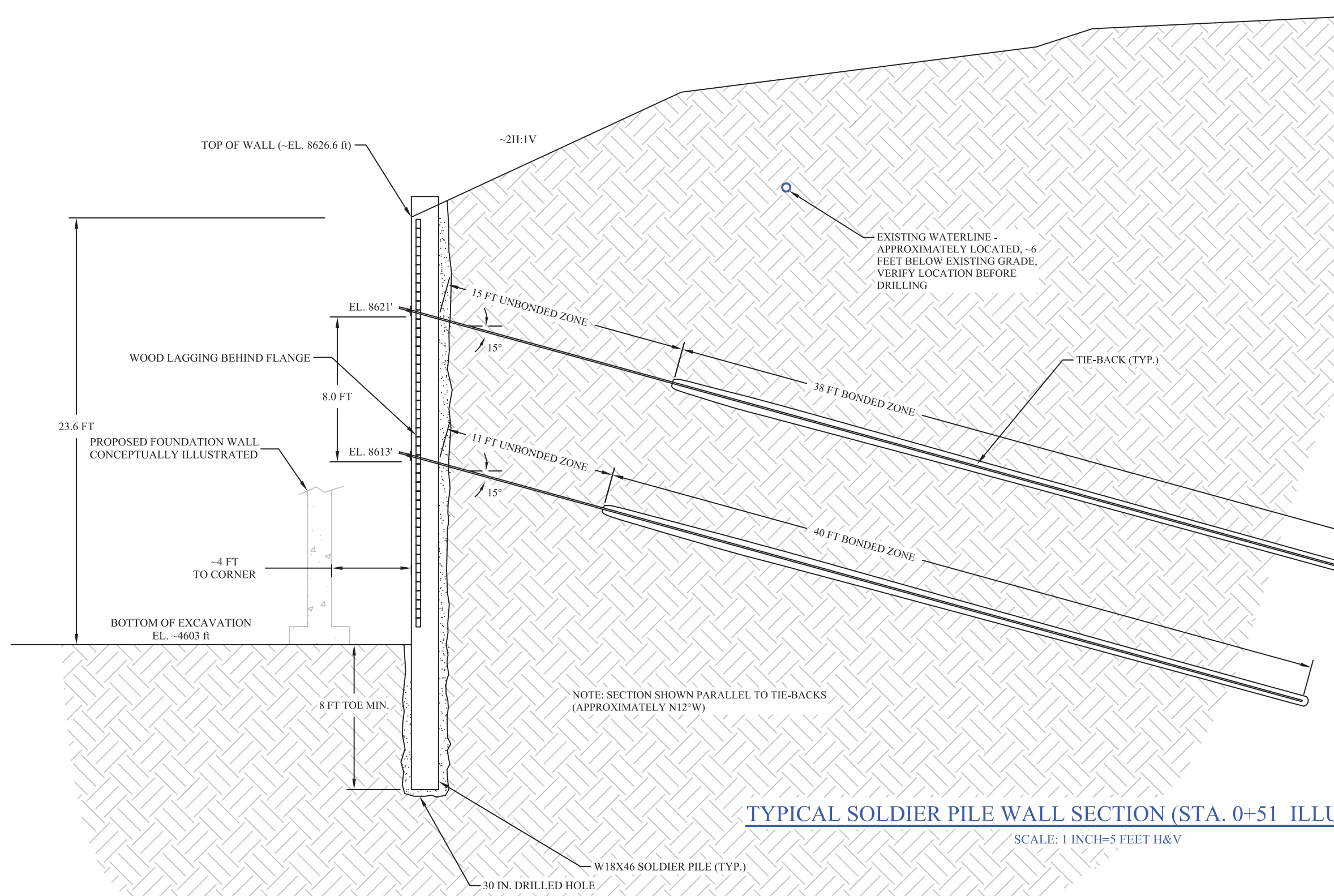


12429 SOUTH 300 EAST, STE. 100
DRAPER, UTAH 84020
(801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
LOT 44R, SUMMIT POWDER MOUNTAIN
WEBER COUNTY, UTAH
TYPICAL SECTION VIEW

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	1"-6'
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.4b
		REV.	N/A

PLOT DATE: APR 24, 2018



PLAN REVIEW ACCEPTANCE
 FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18
WEST COAST CODE CONSULTANTS, INC.

TYPICAL SOLDIER PILE WALL SECTION (STA. 0+51 ILLUSTRATED)

SCALE: 1 INCH=5 FEET H&V

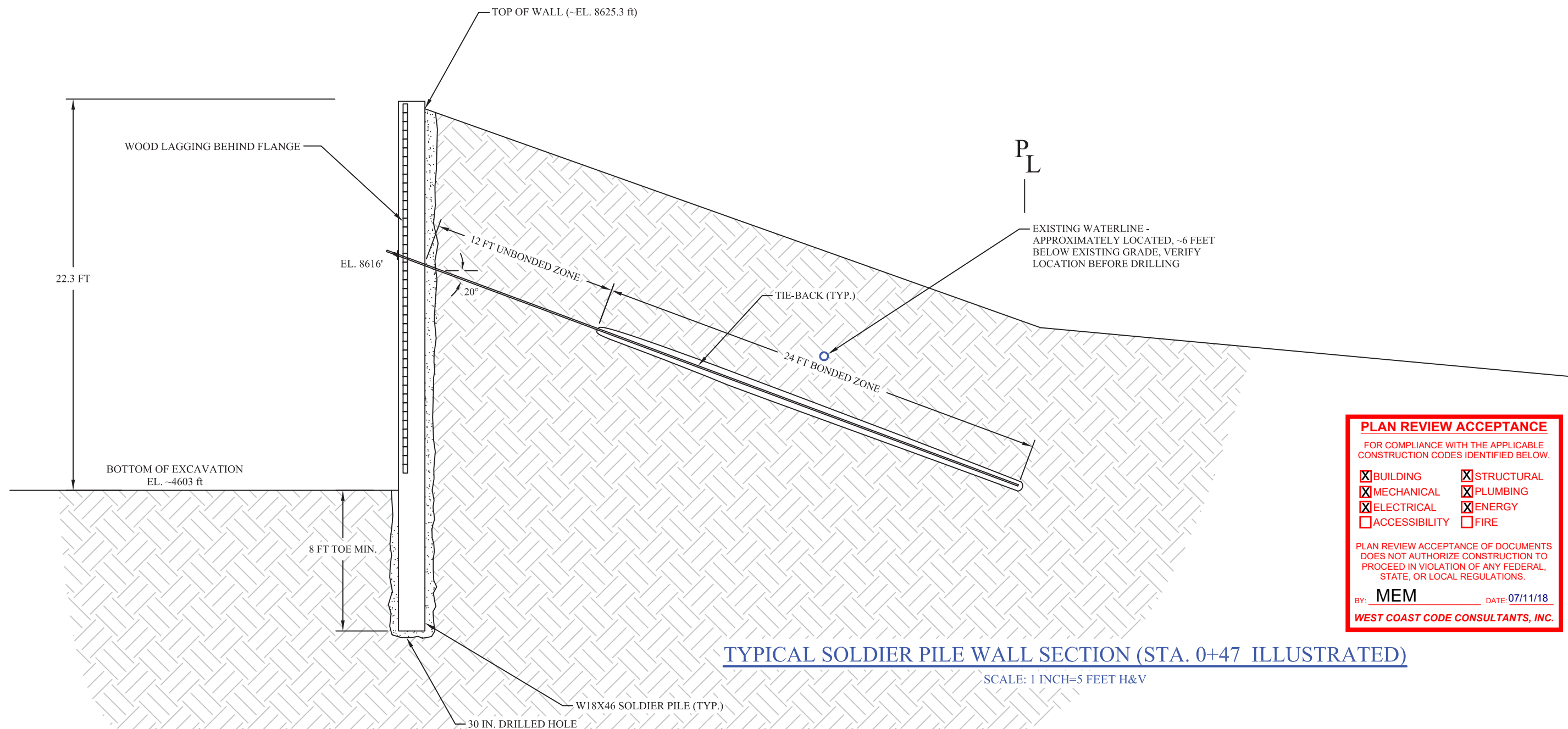
MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH
 TYPICAL SECTION VIEW

DESIGNED BY: DAG	APR 20, 2018	PLOT DATE: APR 24, 2018	PLOT SCALE
DRAWN BY: DAG	APR 20, 2018	1=1	1=1
CHECKED BY: DLB	APR 23, 2018	DWG SCALE	1"-6'
APPROVED BY: DAG	APR 24, 2018	IGES PROJECT NO. 02732-002	SHEET NO. 1.4c
			REV. N/A



PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18

WEST COAST CODE CONSULTANTS, INC.

TYPICAL SOLDIER PILE WALL SECTION (STA. 0+47 ILLUSTRATED)

SCALE: 1 INCH=5 FEET H&V

MARK	REVISIONS	DATE	BY	CHK

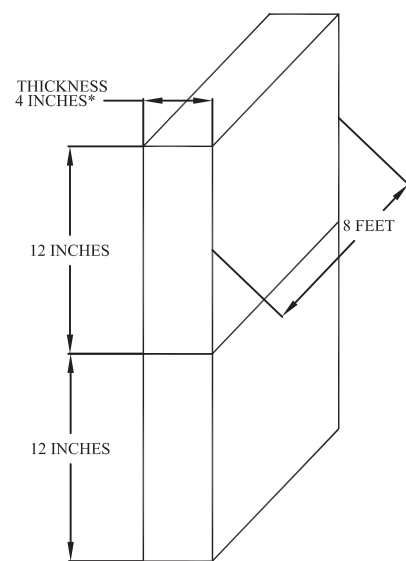


12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

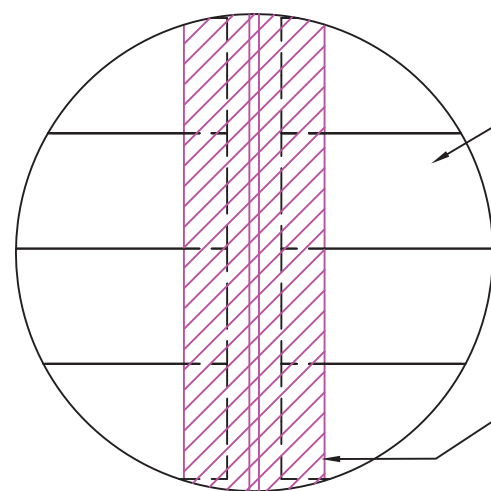
PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH
 TYPICAL SECTION VIEW

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	1"-6'
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.4d
		REV.	N/A

PLOT DATE: APR 24, 2018

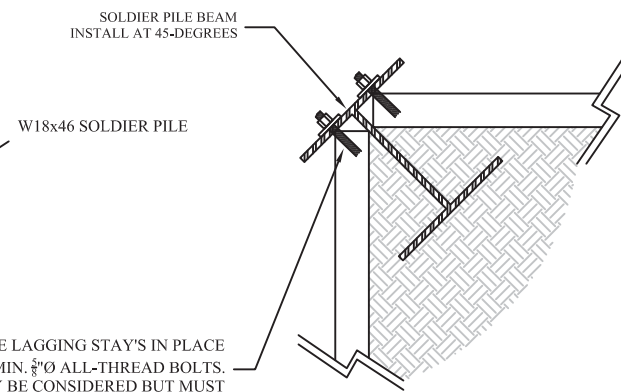


TYPICAL TIMBER LAGGING DIMENSIONS
(NOT TO SCALE)

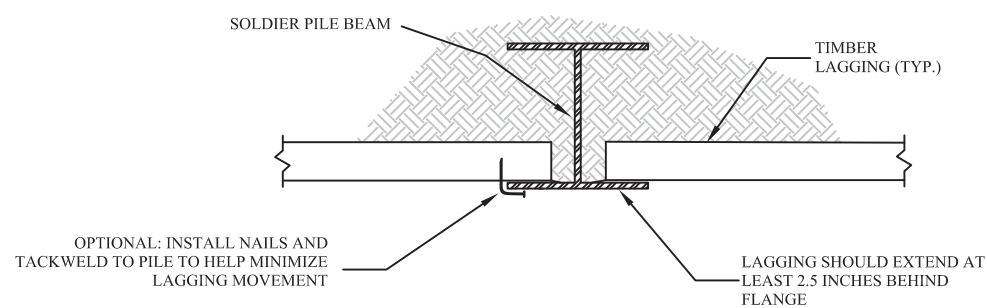
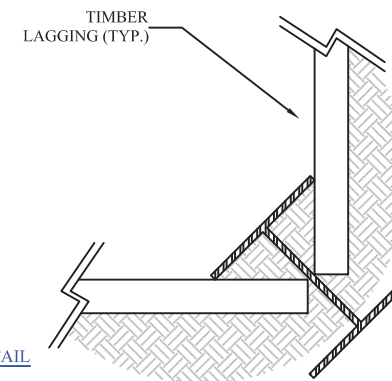


LAGGING DETAIL
ELEVATION VIEW
(NOT TO SCALE)

BOLT LAGGING TO ENSURE LAGGING STAY'S IN PLACE WITHOUT SLIPPING. USE MIN. $\frac{3}{8}$ " \varnothing ALL-THREAD BOLTS. ALTERNATE METHODS MAY BE CONSIDERED BUT MUST BE APPROVED BY IGES PRIOR TO USE.



90-DEGREE CORNER DETAIL
PLAN VIEW
(NOT TO SCALE)



LAGGING DETAIL
PLAN VIEW
(NOT TO SCALE)

PLAN REVIEW ACCEPTANCE
FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18
WEST COAST CODE CONSULTANTS, INC.

MARK	REVISIONS	DATE	BY	CHK

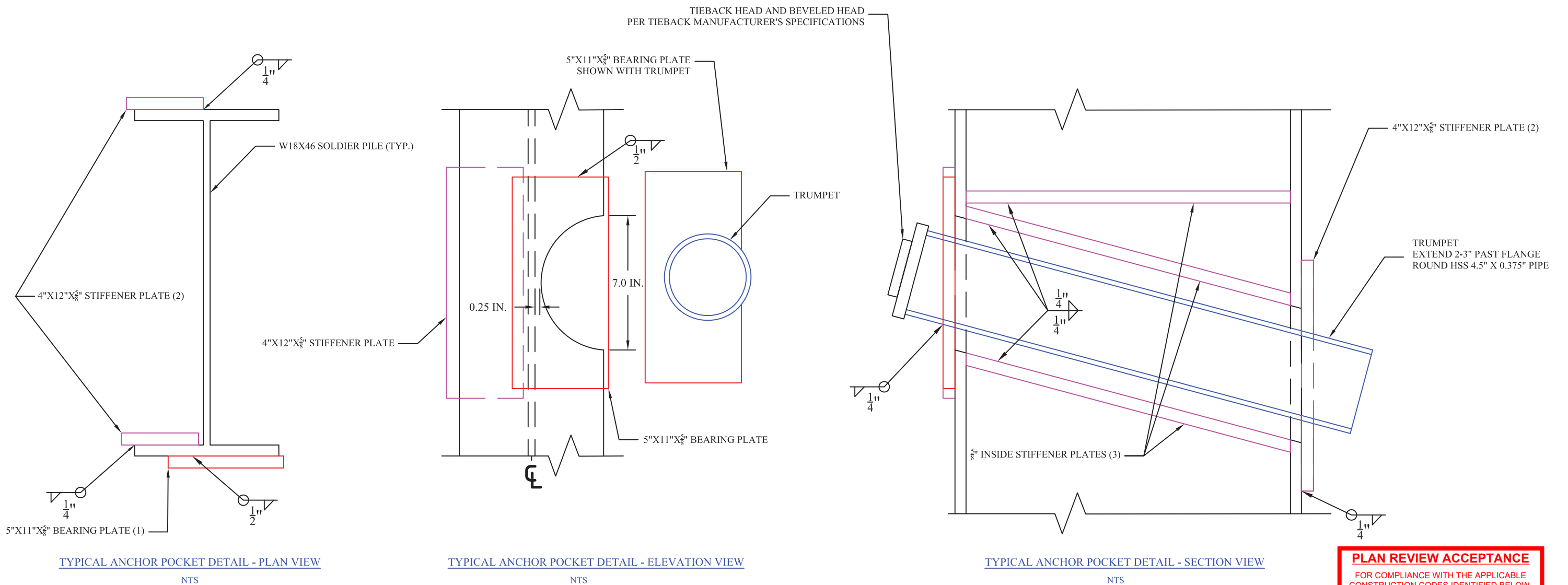


12429 SOUTH 300 EAST, STE. 100
DRAPER, UTAH 84020
(801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
LOT 44R, SUMMIT POWDER MOUNTAIN
WEBER COUNTY, UTAH
WALL DETAILS

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	n/a
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.5a
		REV.	N/A

PLOT DATE: APR 24, 2018



PLAN REVIEW ACCEPTANCE
FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: **07/11/18**
WEST COAST CODE CONSULTANTS, INC.

MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
DRAPER, UTAH 84020
(801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
LOT 44R, SUMMIT POWDER MOUNTAIN
WEBER COUNTY, UTAH
WALL DETAILS

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	n/a
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02732-002
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.5b
		REV.	N/A

PLOT DATE: APR 24, 2018

1.0 GENERAL

- 1.1 SOLDIER PILES AND TIE-BACKS TO BE INSTALLED AT THE LOCATIONS INDICATED IN THESE DRAWINGS SUBJECT TO FIELD VERIFICATION BY CONTRACTOR. ANY CHANGE WILL REQUIRE THE WRITTEN APPROVAL OF IGES.
- 1.2 ALL UTILITIES MUST BE VERIFIED BY CONTRACTOR PRIOR TO EXCAVATION OR INSTALLATION OF SOLDIER PILES OR TIE-BACKS. IGES, INC. SHALL BE NOTIFIED IMMEDIATELY IF THE SOLDIER PILES OR TIE-BACKS CONFLICT WITH UTILITY LOCATIONS.
- 1.3 THESE DOCUMENTS ARE INSTRUMENTS OF SERVICE AND SHALL REMAIN THE INTELLECTUAL PROPERTY OF IGES, INC. NO USE OR RE-USE OF THESE DOCUMENTS SHALL BE PERMITTED IN PART OR IN TOTAL UNLESS EXPRESSLY AUTHORIZED IN WRITING BY IGES, INC.

2.0 EXCAVATION

- 2.1 EXCAVATION SHALL BE PERFORMED TO PROVIDE A WORK AREA FOR THE INSTALLATION OF THE ROW OF TIE-BACKS AND SHALL NOT EXTEND MORE THAN IS NECESSARY FOR INSTALLATION.
- 2.2 EXCAVATION MAY BE EXTENDED ONLY AFTER THE TIE-BACKS HAVE BEEN TESTED AND LOCKED-OFF, SEE NOTE 3.9.

3.0 SOLDIER PILE WALL CONSTRUCTION & MATERIALS

- 3.1 ALL SOLDIER PILES SHALL BE W18X46 (MIN. 50 KSI STEEL) OR AN ENGINEER-APPROVED EQUIVALENT WITH A MINIMUM 8-FOOT EMBEDMENT BELOW THE BASE OF EXCAVATION, EXCEPT AS NOTED IN THE SHOP DRAWINGS.
- 3.2 SOLDIER PILE LAYOUT TO BE FIELD-DETERMINED BY SHORING CONTRACTOR AND/OR GENERAL CONTRACTOR.
- 3.3 MAXIMUM SOLDIER PILE SPACING SHALL BE 6 FEET ON-CENTER, EXCEPT AS NOTED ON THE PLANS.
- 3.4 FOR DRILLED SOLDIER PILES, BACKFILL WITH FLOWABLE FILL OR LEAN MIX CONCRETE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF BETWEEN 150 AND 300 PSI.
- 3.5 LAGGING
- 3.5.1 WALL LAGGING SHALL CONSIST OF 4-INCH THICK PRESSURE-TREATED TIMBER, DOUGLAS FIR OR AN ENGINEER-APPROVED EQUIVALENT.
- 3.5.2 SPACE BEHIND LAGGING TO BE BACKFILLED WITH 3/4" GRAVEL, 100 TO 200 PSI FLOWABLE FILL, OR ANOTHER MEDIUM APPROVED BY TO IGES.
- 3.6 EXCAVATE IN LIFTS NOT EXCEEDING 3 FEET BELOW THE LOWEST TIE-BACK ROW TO BE INSTALLED.
- 3.7 TIE-BACKS SHALL CONSIST OF WILLIAMS 2-STRAND OR 3-STRAND ANCHORS (AS INDICATED ON THE SHOP DRAWINGS), GROUT-BONDED WITH MULTIPLE CORROSION PROTECTION (MCP) PROTECTION 1 CLASS 2, OR AN ENGINEER-APPROVED EQUIVALENT.
- 3.8 TIE-BACKS SHALL HAVE A 6-INCH (NOMINAL) GROUTED DIAMETER. THE BONDED AND UNBONDED LENGTHS SHALL BE AS INDICATED IN THE DRAWINGS, EXCEPT AS ALLOWED IN WRITING BY IGES.
- 3.9 LOCK-OFF: EACH TIE-BACK SHALL BE TESTED TO 130% OF THE DESIGN LOAD, AND THEN LOCKED-OFF TO 50% OF THE DESIGN LOAD. USE A LOAD CELL TO DETERMINE LOADS.
- 3.10 DESIGN LOAD IS INDICATED IN THE TIE-BACK SCHEDULE.
- 3.11 TIE-BACK GROUT SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3,000 PSI AND A 3-DAY COMPRESSIVE STRENGTH OF 1,500 PSI. MAINTAIN A WATER-CEMENT RATIO BETWEEN 0.45 AND 0.55. GROUT MAY BE A NEAT CEMENT, OR CEMENT DEVELOPED USING A FINE AGGREGATE.
- 3.12 TIE-BACK HARDWARE
- 3.12.1 ALL POCKET PLATE STEEL SHALL BE A36 MILD STEEL OR BETTER.
- 3.12.2 ALL ANCILLARY COMPONENTS SHALL CONFORM TO TENDON MANUFACTURER'S SPECIFICATIONS.

4.0 TIE-BACK TESTING

- 4.1 ONE SACRIFICIAL VERIFICATION TEST SHOULD BE PERFORMED BY IGES TO 200 PERCENT OF THE DESIGN LOAD. THE MAXIMUM BONDED TIE-BACK LENGTH SHOULD BE 10 FEET TO ENSURE THE MAXIMUM BAR/STRAND YIELD STRENGTH IS NOT EXCEEDED AND TO ALLOW THE GROUT/SOIL BOND TO FAIL. VERIFICATION TEST LOAD SHALL BE DETERMINED BASED ON THE BONDED LENGTH AND THE ASSUMED DESIGN SOIL-GROUT ADHESION. ADDITIONAL VERIFICATION TESTS MAY BE REQUIRED IF SUBSURFACE CONDITIONS VARY GREATLY, WHICH MAY NOT BE EVIDENT UNTIL CONSTRUCTION. THE SUGGESTED VERIFICATION TEST LOCATION IS SHOWN ON SHEET 1.3 (ELEVATION VIEW).
- 4.2 A PROOF TESTS SHOULD BE PERFORMED EACH PRODUCTION TIE-BACK TO 130 PERCENT OF THE DL, PRIOR TO LOCK-OFF AT 50% OF DL. THE DL IS SHOWN ON THE TIE-BACK SCHEDULE ON SHEET 1.3b.

5.0 MONITORING

- 5.1 DAILY INSPECTION OF THE SOLDIER PILE WALL SHALL BE PERFORMED BY A QUALIFIED PERSON PRIOR TO ENTRY INTO EXCAVATION TO COMPLY WITH OSHA REGULATIONS. ADDITIONAL MONITORING AND/OR SURVEY MAY BE REQUIRED AS A PART OF THE PROJECT SPECIFICATIONS AND SHOULD BE FOLLOWED WHERE APPLICABLE.

6.0 CONSTRUCTION CONSIDERATIONS

- 6.1 IF SEEPAGE OR LOCALIZED SPRINGS ARE IDENTIFIED DURING EXCAVATION, EXCAVATION SHOULD CEASE AND IGES SHOULD BE ALLOWED TO EVALUATED THE SITE CONDITIONS FOR POTENTIALLY HAZARDOUS CONDITIONS. LOCALIZED DEWATERING MAY BE DEEMED APPROPRIATE IF CONDITIONS WARRANT.

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18

WEST COAST CODE CONSULTANTS, INC.

PLOT DATE: APR 24, 2018

MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
 DRAPER, UTAH 84020
 (801) 748-4044 FAX: (801) 748-4045

PERMANENT SOLDIER PILE WALL DESIGN
 LOT 44R, SUMMIT POWDER MOUNTAIN
 WEBER COUNTY, UTAH

GENERAL NOTES

DESIGNED BY: DAG APR 20, 2018	PLOT SCALE
DRAWN BY: DAG APR 20, 2018	1=1
CHECKED BY: DLB APR 23, 2018	DWG SCALE
APPROVED BY: DAG APR 24, 2018	n/a
IGES PROJECT NO. 02732-002	SHEET NO. 1.6 REV. N/A

VERIFICATION TEST SCHEDULE

LOAD	HOLD TIME
AL (0.05 DL MAXIMUM)	UNTIL STABLE
0.25 DL*	UNTIL STABLE
0.50 DL	10 MIN.**
0.75 DL	10 MIN.**
1.00 DL	10 MIN.**
1.25 DL	10 MIN.**
1.50 DL	10 MIN.**
1.75 DL	10 MIN.**
2.00 DL	10 MIN.**
>2.00DL	PULL TO FAILURE***

*DESIGN LOAD (DL) = 2.04 KIP/LF (BONDED ZONE)

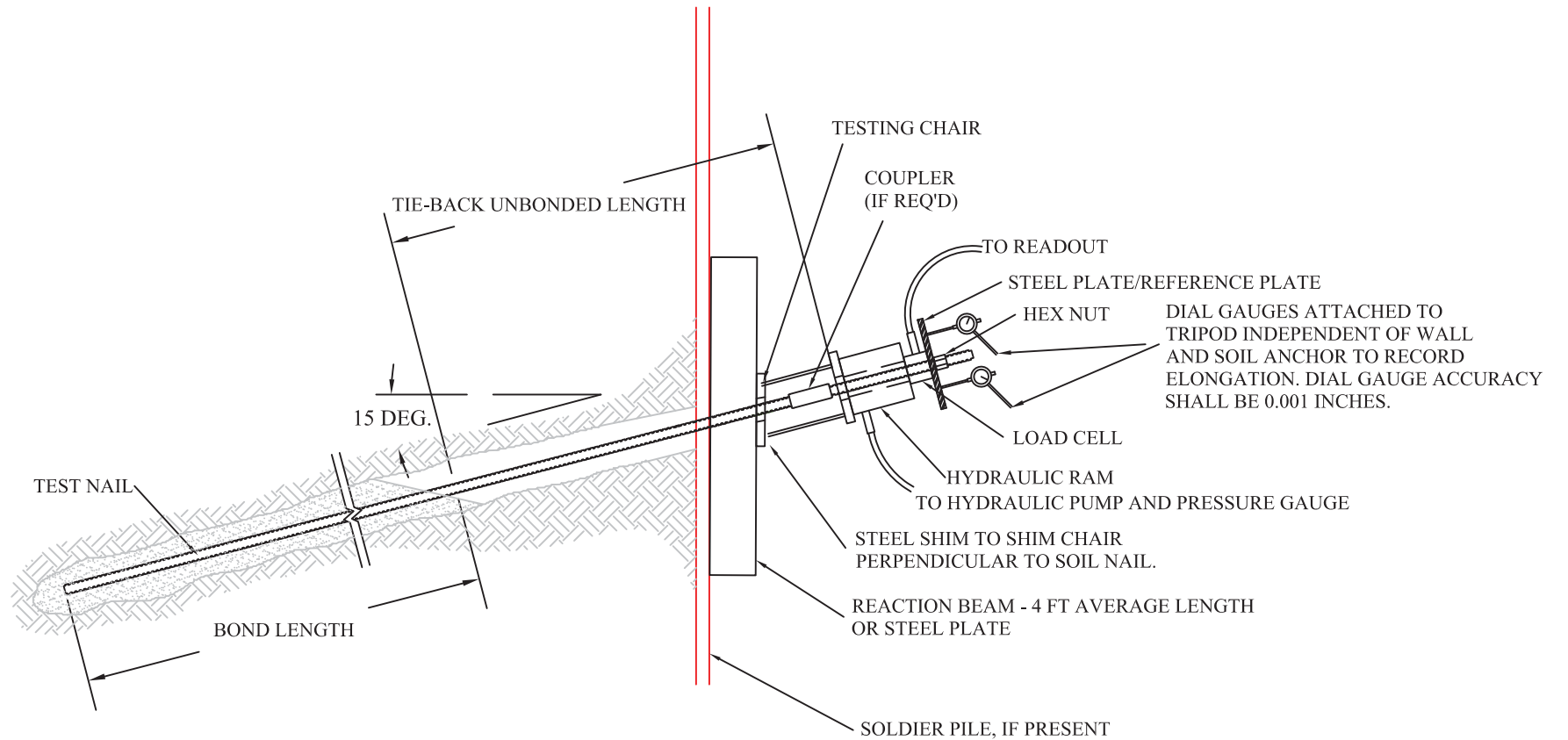
**CREEP TEST, 10 MIN. HOLD. NAIL MOVEMENTS SHALL BE MEASURED AND RECORDED AT THE FOLLOWING TIMES AFTER APPLICATION OF THE FULL CREEP TEST LOAD: 1 MINUTE, 2, 3, 4, 5, 6 AND 10 MINUTES. IF THE TIE-BACK MOVES MORE THAN 0.04 INCHES DURING THE 10 MINUTES HOLD, MAINTAIN LOAD FOR AN ADDITIONAL 50 MINUTES AND MOVEMENTS SHALL BE RECORDED AT 20, 30, 50 AND 60 MINUTES. THE LOAD DURING ALL LOAD INCREMENTS SHALL BE MAINTAINED WITHIN 5 PERCENT OF THE INTENDED LOAD. THE TIE-BACK SHOULD NOT MOVE MORE THAN 0.08 INCHES BETWEEN 6 AND 60 MINUTE READINGS.

***DO NOT EXCEED 90% OF YIELD STRESS FOR THE TENDON

PROOF TEST SCHEDULE

LOAD	HOLD TIME (MIN. 5 MINUTES)
AL (0.05 DL MAXIMUM)	UNTIL STABLE
0.25 DL*	UNTIL STABLE
0.50 DL	UNTIL STABLE
0.75 DL	UNTIL STABLE
1.00 DL	UNTIL STABLE
1.25 DL	UNTIL STABLE
1.30 DL CREEP TEST **	SEE ABOVE

DL=SEE TIE-BACK SCHEDULE, SHEET 1.3b



TIE-BACK TESTING
NOT TO SCALE

PLAN REVIEW ACCEPTANCE

FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

BY: **MEM** DATE: 07/11/18

WEST COAST CODE CONSULTANTS, INC.

MARK	REVISIONS	DATE	BY	CHK



12429 SOUTH 300 EAST, STE. 100
DRAPER, UTAH 84020
(801) 748-4044 FAX: (801) 748-4045

TEMPORARY SOLDIER PILE WALL DESIGN
ADOBE UTAH NEW CAMPUS - PHASE 2
LEHI, UTAH

TESTING DETAILS

DESIGNED BY: DAG	APR 20, 2018	PLOT SCALE	1=1
DRAWN BY: DAG	APR 20, 2018	DWG SCALE	n/a
CHECKED BY: DLB	APR 23, 2018	IGES PROJECT NO.	02130-008
APPROVED BY: DAG	APR 24, 2018	SHEET NO.	1.7
		REV.	N/A

PLOT DATE: APR 24, 2018

**Design Calculation Package
Lot 44R of Summit Eden Phase 1C
8645 E. Copper Crest
Weber County, Utah
Permanent Soldier Pile Wall**



PLAN REVIEW ACCEPTANCE
 FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.

<input checked="" type="checkbox"/> BUILDING	<input checked="" type="checkbox"/> STRUCTURAL
<input checked="" type="checkbox"/> MECHANICAL	<input checked="" type="checkbox"/> PLUMBING
<input checked="" type="checkbox"/> ELECTRICAL	<input checked="" type="checkbox"/> ENERGY
<input type="checkbox"/> ACCESSIBILITY	<input type="checkbox"/> FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.

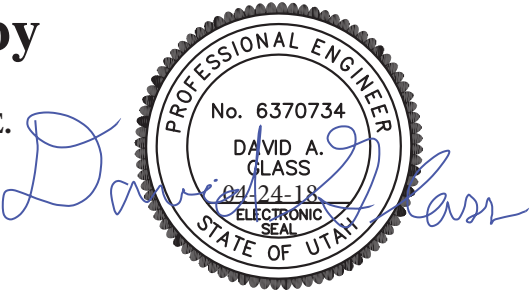
BY: MEM DATE: 07/11/18

WEST COAST CODE CONSULTANTS, INC.

Intermountain GeoEnvironmental Services, Inc.
12429 South 300 East, Suite 100
Draper, Utah 84020-8770
PH: 801-748-4044
FAX: 801-748-4045

Prepared by

David A. Glass, P.E.



Reviewed by

Davey L. Breinholt, P.E.



Table of Contents

- 2.1 Design Criteria**
- 2.2 Engineering Analysis**
- 2.3 Design Calculations**

2.1 Design Criteria

Project Description

Our understanding of the project is based on the plan set (180404 Powder Mountain House TWA) prepared by Tom Wiscombe Architecture (TWA), dated April 4, 2018, and other information provided by TWA. The project is located on Lot 44R of the Summit Powder Mountain resort, located near the town of Eden, in Weber County, Utah.

The proposed improvements to the lot is a multi-story single-family residence, ostensibly a high-end resort home. As a part of the project, significant excavations on the order of 27 feet will be required to construct the basement level. Due to space limitations, a lay-back is not practical; hence, the need for shoring during construction. It has been decided by the Client's design team that it would be beneficial to design the shoring as permanent, thus allowing the structural engineer to design the new home without having to take into account lateral earth pressures (the permanent shoring will be, in effect, a pressure relief wall). The permanent shoring will consist of a tied-back soldier pile wall. As currently planned, the shored area will be about 150 LF long, with heights ranging up to about 26.5 feet. On the north side of the excavation, a 2H:1V broke-back slope ascending to Copper Crest will be above the shoring; on the east and west, the topography will generally drop away (a reverse slope). We understand that geofoam will be placed between the permanent shoring and the home's foundation wall, with about 2 feet of soil overlying the geofoam to create final grade above the void between the home and the shoring.

Design Parameters

For our assessment of native site soils, IGES has reviewed soil data presented in the referenced geotechnical report by IGES (2018). Lot 44R is essentially located on a 2H:1V fill slope, constructed as a part of the embankment fill for Copper Crest. The report included two trenches excavated at the toe of the fill slope. Earth materials identified at the site consist primarily of undocumented fill consisting of mixtures of clay, sand, and gravel, colluvium consisting of clayey sand and silty sand with gravel, and bedrock consisting of the Wasatch Formation (unconsolidated conglomerate). Since the site is located on a slope, depth to the various strata varies with location; along the north side of the planned excavation, we anticipate approximately 15 feet of undocumented fill, about 10 feet of colluvium, which in turn will be underlain by conglomeratic bedrock. Soil strength parameters of the various strata were selected based on laboratory strength testing (direct shear), test results from nearby sites previously explored by IGES, and local experience. The design parameters selected are summarized in Table 1.

The tie-backs were designed assuming *ultimate* effective grout/soil bond of 18 psi; this value is based on the generalized material descriptions, correlations with published data by FHWA, and our engineering judgment. A factor-of-safety of 2.0 was applied to the ultimate soil-grout bond for design. Tie-backs are assumed to have a nominal grouted diameter of 6 inches.

Groundwater was not identified during the referenced geotechnical investigations and is not expected to impact the proposed shoring; however, it is possible that localized seepage could be encountered during the excavation, particularly during the spring months. If seepage or localized springs are identified during the excavation process, construction should cease and IGES should be allowed to evaluate the site for potentially hazardous conditions.

**Table 1
Soldier Pile Wall Design Parameters**

Soil Type	Unit Weight (pcf)	Friction Angle (Degrees)	Cohesion (psf)
Clayey Sand (Afu)	115.0	33	0
Silty Sand (Qc)	119.2	35	
Conglomerate (Tw)	143.0	40	

For the seismic (pseudo-static) assessment of the proposed wall, the seismic coefficient k_h is modeled as equal to 50% of the peak ground acceleration (PGA) resulting from a MCE seismic event (2PE50). From the referenced geotechnical report, the PGA resulting from a 2PE50 seismic event is taken as 0.350g. Therefore, for our wall design we have adopted a seismic coefficient of 0.175g.

2.2 Engineering Analysis

The soldier pile wall was modeled using the computer software *Shoring Suite v. 8* (CivilTech Software, 2013). Several sections were analyzed representing a range of shored heights anticipated for this project, ranging from the maximum shored height of 26.7 feet, down to about 9½ feet in height. Typical section views of the permanent wall are conceptually illustrated on Sheets 1.4a through 1.4d in the Shop Drawings. A surcharge of 250 psf was assumed along the north wall, with a 4-foot construction set-back from the top of shoring (this surcharge models both traffic and the surcharge from the >2 ft. thick cover soils that will be placed upon completion of the project). The analysis was performed to determine the required pile section modulus and toe length for pile spacing of 6.8 feet (north wall) and 6 feet (east and west walls). The soldier piles are assumed to be drilled and backfilled with 150-300 psi flowable fill or lean-mix concrete. Considering the available information and design assumptions, for static conditions a load multiplier of 1.7 was applied to the active and surcharge forces, and a factor-of-safety of 1.1 was applied to passive resistance. For seismic conditions, an active side load multiplier of 1.1 and a passive resistance factor-of-safety of 1.0 was applied. Selected results of the Shoring Suite analysis are included in Section 2.3.

Soldier piles will consist of W18x46 beams with a minimum of 50 ksi steel. Tiebacks are modeled as a Williams 2-strand or 3-strand anchor, depending on the loading conditions, and were designed assuming a 6-inch grouted diameter and an ultimate soil/grout bond of 17 psi. Verification testing should be performed during construction to validate the assumed ultimate soil/grout bond of 18 psi. All tie-backs are designed to be installed 15 degrees from the horizontal; with the exception of tie-back No. 13, which is preliminarily designed to be installed at a 20 degree angle to avoid an existing water line. With respect to installation angle, some field-fit is allowed (plus-minus 5 degrees) in order to avoid utilities. The water line is *conceptually illustrated* on selected section views (Sheets 1.4c and 1.4d), *all utilities must be located in the field prior to construction.*

As with any geotechnical project of this nature, variations in subsurface conditions, both laterally and vertically, may exist that may not be discovered until actual construction. If subsurface conditions encountered during construction differ significantly from those indicated in the referenced geotechnical report and used to develop our design, IGES must be notified immediately in order to evaluate any changed conditions and their potential impacts on our design.

References

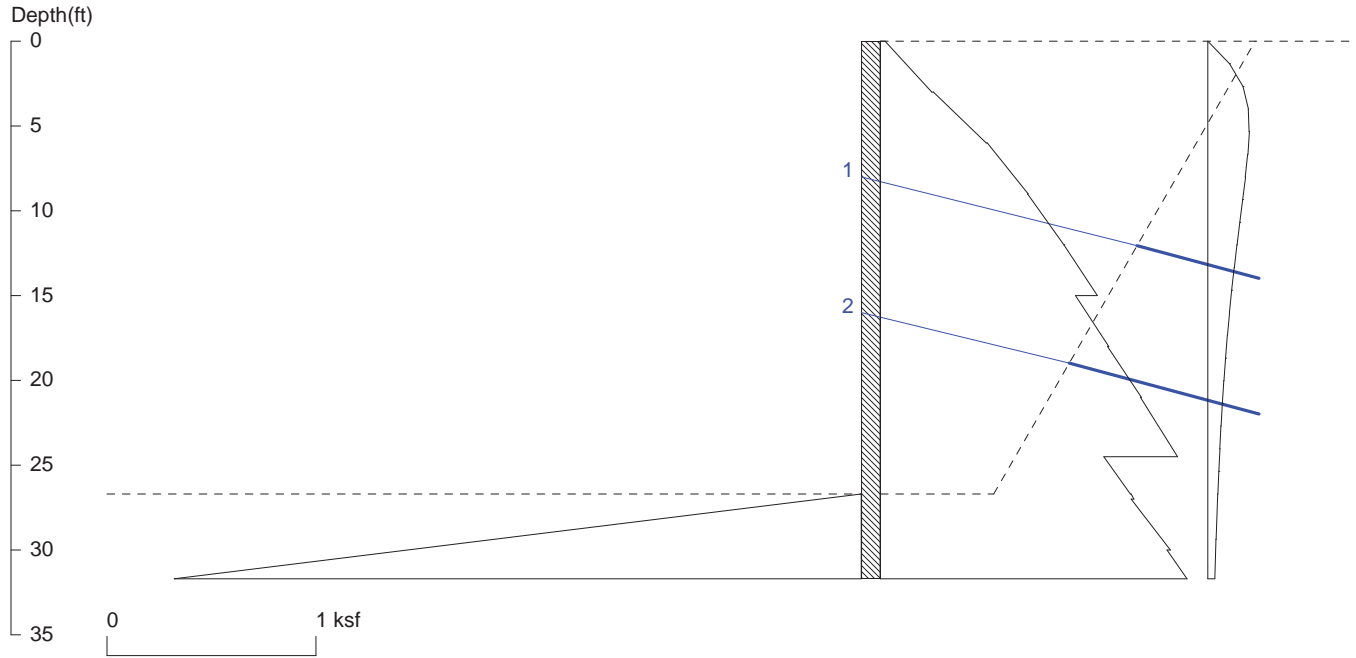
IGES, Inc., 2018, Geotechnical and Geologic Hazard Investigation, Lot 44R of Summit Eden Phase 1C, 8645 E. Copper Crest, Summit Powder Mountain Resort, Weber County, Utah, Project No. 02732-001, dated March 19, 2018.

2.3 Design Calculations

A: ShoringSuite Sample Design Calculations

Buttgenbach/Lot 44

North Wall Sta. 0+95



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltechsoftware.com

Licensed to 4324324234 3424343

Date: 4/24/2018

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.sh8

Wall Height=26.7 Pile Diameter=2.5 Pile Spacing=7.3 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=5.00 (8~10ft is recommended!!!) Min. Pile Length=31.70

MOMENT IN PILE: Max. Moment=172.96 per Pile Spacing=7.3 at Depth=23.21

PILE SELECTION:

Request Min. Section Modulus = 62.9 in³/pile=1030.63 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X40 has Section Modulus = 68.4 in³/pile=1120.87 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.14(in) based on E (ksi)=29000.00 and I (in⁴)/pile=612.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	8.0	15.0	6.9	75.6*	73.0	19.6	15.7	37.1
2. Tieback	16.0	15.0	6.9	79.5	76.8	20.6	11.5	39.1

* Top Brace increased by 15% (DM7.2-103)

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE): Pressures below will be multiplied by a Factor =1.7

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.013	3.000	0.144	0.043834
3.000	0.149	6.000	0.297	0.049528
6.000	0.301	9.000	0.416	0.038210
9.000	0.414	12.00	0.516	0.033995
12.00	0.516	15.00	0.611	0.031589
15.00	0.549	18.00	0.642	0.031214
18.00	0.639	21.00	0.735	0.031972
21.00	0.732	24.50	0.836	0.029810
24.50	0.629	26.70	0.703	0.033827
*	Below	Base		

26.70	0.706	27.00	0.714	0.025623
27.00	0.706	30.00	0.816	0.036735
30.00	0.807	33.00	0.905	0.032904
*	Sur-	charg		
0.000	0.000	1.335	0.061	0.045726
1.335	0.061	2.670	0.099	0.028456
2.670	0.099	4.005	0.114	0.011504
4.005	0.114	5.340	0.117	0.001652
5.340	0.117	6.675	0.112	-0.00307
6.675	0.112	8.010	0.106	-0.00514
8.010	0.106	9.345	0.098	-0.00592
9.345	0.098	10.68	0.090	-0.00607
10.68	0.090	12.01	0.082	-0.00590
12.01	0.082	13.35	0.074	-0.00558
13.35	0.074	14.68	0.067	-0.00519
14.68	0.067	16.02	0.061	-0.00476
16.02	0.061	17.35	0.055	-0.00434
17.35	0.055	18.69	0.050	-0.00393
18.69	0.050	20.02	0.045	-0.00355
20.02	0.045	21.36	0.041	-0.00319
21.36	0.041	22.69	0.037	-0.00287
22.69	0.037	24.03	0.034	-0.00257
24.03	0.034	25.36	0.031	-0.00230
25.36	0.031	26.70	0.028	-0.00206
26.70	0.028	29.37	0.023	-0.00175
29.37	0.023	32.04	0.019	-0.00141

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.1

Z1	P1	Z2	P2	Slope
26.7	0.00	200.0	113.90	0.658

ACTIVE SPACING:

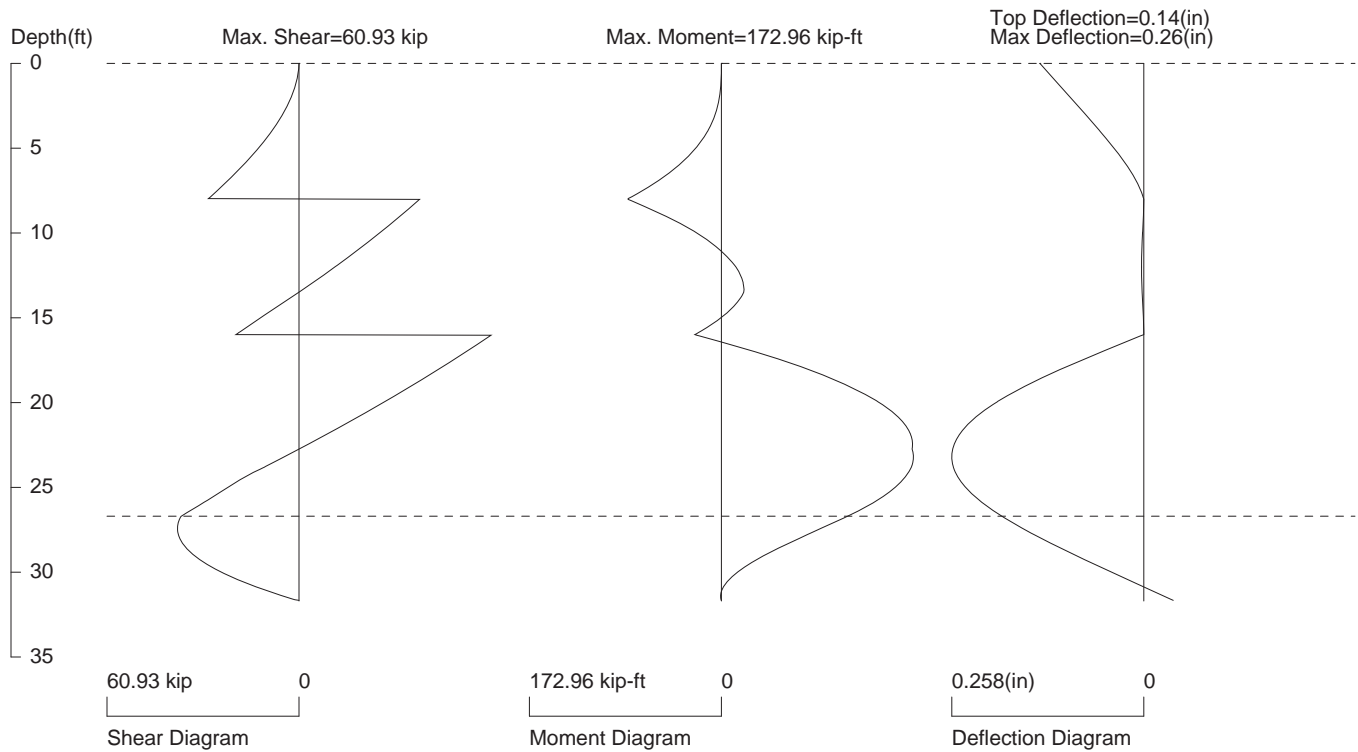
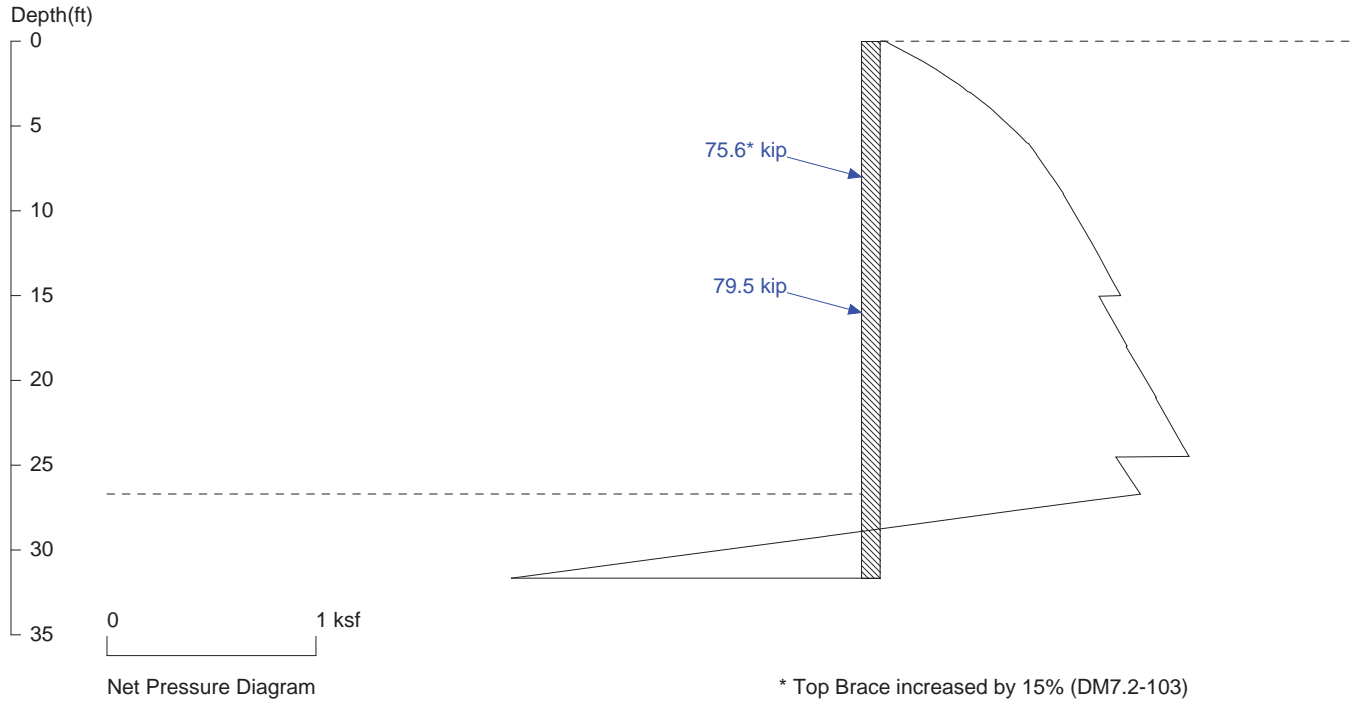
No.	Z depth	Spacing
1	0.00	7.30
2	26.70	2.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	26.70	7.30

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Buttgenbach/Lot 44 North Wall Sta. 0+95



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.3 foot or meter

User Input Pile, W18X40: E (ksi)=29000.0, I (in⁴)/pile=612.0

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.sh8

SHORING WALL CALCULATION SUMMARY
The leading shoring design and calculation software
Software Copyright by CivilTech Software
www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U. S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS: Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft, Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft³, Deflection - in

Licensed to 4324324234 3424343
Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.sh8

Title: Buttgenbach/Lot 44
Subtitle: North Wall Sta. 0+95

*****INPUT DATA*****

Wall Type: 2. Soldier Pile, Drilled
 Wall Height: 26.70
 Pile Diameter: 2.50
 Pile Spacing: 7.30
 Factor of Safety (F.S.): 1.10
 As Continuous Span Beam
 Lateral Support Type (Braces): 3. Tieback
 Top Brace Increase (Multi-Bracing): Add 15%*
 No-Load Zone:
 Vertical Depth for No-Load Zone: 26.70
 H-Distance (Input H/V ratio) for No-Load Zone: 0.25
 Angle from H. Line for No-Load Zone: 60.00
 Embedment Option: 1. Yes
 Friction at Pile Tip: No
 Pile Properties:
 Steel Strength, Fy: 50 ksi = 345 MPa
 Allowable Fb/Fy: 0.66
 Elastic Module, E: 29000.00
 Moment of Inertia, I: 612.00
 User Input Pile: W18X40

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
The pressures below will be multiplied by a Factor =1.7

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	*	Above	Base		
2	0.000	0.013	3.000	0.144	0.043834
3	3.000	0.149	6.000	0.297	0.049528
4	6.000	0.301	9.000	0.416	0.038210
5	9.000	0.414	12.00	0.516	0.033995

6	12.00	0.516	report. out	0.611	0.031589
7	15.00	0.549	15.00	0.642	0.031214
8	18.00	0.639	18.00	0.735	0.031972
9	21.00	0.732	21.00	0.836	0.029810
10	24.50	0.629	24.50	0.703	0.033827
11	*	Bel ow	Base		
12	26.70	0.706	27.00	0.714	0.025623
13	27.00	0.706	30.00	0.816	0.036735
14	30.00	0.807	33.00	0.905	0.032904
15	33.00	0.907	36.00	0.992	0.028442
16	36.00	0.988	39.00	1.092	0.034635
17	39.00	1.088	42.00	1.183	0.031467
18	42.00	1.183	45.00	1.277	0.031550
19	45.00	1.277	48.00	1.372	0.031607
20	48.00	1.372	51.00	1.467	0.031646
21	51.00	1.467	54.00	1.562	0.031674
22	54.00	1.562	57.00	1.657	0.031693
23	57.00	1.657	60.00	1.752	0.031707
24	60.00	1.752	63.00	1.848	0.031717
25	63.00	1.848	66.00	1.943	0.031724
26	66.00	1.943	69.00	2.038	0.031683
27	69.00	2.038	72.00	2.131	0.031010
28	72.00	2.131	75.00	2.224	0.031013
29	75.00	2.224	78.00	2.317	0.031014
30	78.00	2.317	81.00	2.410	0.031115
31	81.00	2.410	84.00	2.503	0.031116
32	84.00	2.503	87.00	2.597	0.031117
33	87.00	2.597	90.00	2.690	0.031117
34	90.00	2.690	93.00	2.783	0.031117
35	93.00	2.783	96.00	2.877	0.031118
36	96.00	2.877	99.00	2.970	0.031118
37	99.00	2.970	102.0	3.063	0.031118
38	102.0	3.065	105.0	3.151	0.028834
39	105.0	3.151	108.0	3.236	0.028515
40	108.0	3.236	111.0	3.322	0.028515
41	111.0	3.322	114.0	3.408	0.028515
42	114.0	3.408	117.0	3.493	0.028515
43	117.0	3.493	120.0	3.579	0.028515
44	120.0	3.579	123.0	3.664	0.028515
45	123.0	3.664	126.0	3.750	0.028515
46	126.0	3.750	129.0	3.835	0.028515
47	129.0	3.835	132.0	3.921	0.028515
48	132.0	3.921	135.0	4.006	0.028515
49	135.0	4.006	138.0	4.092	0.028515
50	138.0	4.092	141.0	4.177	0.028515
51	141.0	4.177	144.0	4.263	0.028515
52	144.0	4.268	147.0	4.355	0.028925
53	147.0	4.354	150.0	4.440	0.028553
54	150.0	4.440	153.0	4.526	0.028553
55	153.0	4.526	156.0	4.611	0.028553
56	156.0	4.611	159.0	4.697	0.028553
57	159.0	4.697	162.0	4.783	0.028553
58	162.0	4.783	165.0	4.868	0.028553
59	165.0	4.868	168.0	4.954	0.028553
60	168.0	4.954	171.0	5.040	0.028553
61	171.0	5.040	174.0	5.125	0.028553
62	174.0	5.125	177.0	5.211	0.028553
63	177.0	5.211	180.0	5.296	0.028553
64	180.0	5.296	183.0	5.382	0.028553
65	183.0	5.382	186.0	5.468	0.028553
66	186.0	5.468	189.0	5.553	0.028553
67	189.0	5.553	192.0	5.639	0.028553
68	192.0	5.639	195.0	5.725	0.028553

report. out

69	195.0	5.725	198.0	5.810	0.028553
70	198.0	5.810	200.0	5.868	0.028553
71	*	Sur-	charg		
72	0.000	0.000	1.335	0.061	0.045726
73	1.335	0.061	2.670	0.099	0.028456
74	2.670	0.099	4.005	0.114	0.011504
75	4.005	0.114	5.340	0.117	0.001652
76	5.340	0.117	6.675	0.112	-0.00307
77	6.675	0.112	8.010	0.106	-0.00514
78	8.010	0.106	9.345	0.098	-0.00592
79	9.345	0.098	10.68	0.090	-0.00607
80	10.68	0.090	12.01	0.082	-0.00590
81	12.01	0.082	13.35	0.074	-0.00558
82	13.35	0.074	14.68	0.067	-0.00519
83	14.68	0.067	16.02	0.061	-0.00476
84	16.02	0.061	17.35	0.055	-0.00434
85	17.35	0.055	18.69	0.050	-0.00393
86	18.69	0.050	20.02	0.045	-0.00355
87	20.02	0.045	21.36	0.041	-0.00319
88	21.36	0.041	22.69	0.037	-0.00287
89	22.69	0.037	24.03	0.034	-0.00257
90	24.03	0.034	25.36	0.031	-0.00230
91	25.36	0.031	26.70	0.028	-0.00206
92	26.70	0.028	29.37	0.023	-0.00175
93	29.37	0.023	32.04	0.019	-0.00141
94	32.04	0.019	34.71	0.016	-0.00114
95	34.71	0.016	37.38	0.014	-0.00093
96	37.38	0.014	40.05	0.012	-0.00076
97	40.05	0.012	42.72	0.010	-0.00062
98	42.72	0.010	45.39	0.009	-0.00051
99	45.39	0.009	48.06	0.008	-0.00043
100	48.06	0.008	50.73	0.007	-0.00036
101	50.73	0.007	53.40	0.006	-0.00030
102	53.40	0.006	58.74	0.004	-0.00023
103	58.74	0.004	64.08	0.004	-0.00017
104	64.08	0.004	69.42	0.003	-0.00013
105	69.42	0.003	74.76	0.002	-0.00009
106	74.76	0.002	80.10	0.002	-0.00007
107	80.10	0.002	85.44	0.002	-0.00006
108	85.44	0.002	90.78	0.001	-0.00004
109	90.78	0.001	96.12	0.001	-0.00003
110	96.12	0.001	101.4	0.001	-0.00003
111	101.4	0.001	106.8	0.000	-0.00018

* PASSIVE PRESSURE *

The pressures below will be divided by a Factor of Safety =1.1

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	SI ope
1	26.70	0.00	200.00	113.90	0.6576

* ACTIVE SPACE *

No.	Z depth	Spaci ng
1	0.00	7.30
2	26.70	2.50

* PASSIVE SPACE *

No.	Z depth	Spaci ng
1	26.70	7.30

No. Type	Z brace	Angle	OR DEADMAN Spacing	Input1*	Input2*
1 Tieback	8.00	15.0	6.90	0.50	1.30
2 Tieback	16.00	15.0	6.90	0.50	1.30

*For Tieback: Input1 = Diameter; Input2 = Bond Strength
 *For Plate: Input1 = Diameter; Input2 = Allowable Pressure
 *For Deaman: Input1 = Horz. Width; Input2 = Allowable Pressure; Angle = 0

*****CALCULATION*****

The calculated moment and shear are per pile spacing. Sheet piles are per one foot or meter; Soldier piles are per pile.

Top Pressures start at depth = 0.00

* CALCULATE REQUEST EMBEDMENT *

$\left. \begin{array}{l} <-- & D1=16.00 \\ == & D2=26.70 \\ & D3=31.70 \end{array} \right\}$

D1 - TOP DEPTH R1 - TOP REACTION
 D2 - EXCAVATION BASE
 D3 - PILE TIP

TOTAL REACTION: R1 = 61.18
 TOTAL PRESSURES ACTING ON WALL = 61.18
 Total Reactions = Total Pressures, OK!
 The Calculated Embedment, Yend = 5.00

-----MULTIPLE BRACE / TIEBACK CASE-----

** Use the calculated embedment, Yend = 5.00

NUMBER OF BRACE LEVEL= 2

* CANTILEVER SPAN, NO. 0 *

$\left. \begin{array}{l} & D1=0.00 \\ <-- & D2=8.00 \end{array} \right\}$ R2=28.86, with Cantilever Moment=84.67

D1 - TOP DEPTH
 D2 - BOTTOM DEPTH R2 - BOTTOM REACTION

TOTAL REACTION: R2 = 28.86
 TOTAL PRESSURES ACTING ON WALL = 28.86
 Total Reactions = Total Pressures, OK!

report.out

BRACE NO. 1 AT DEPTH = 8.00
R2 of Span No. 0
R1 of Last Span

} Sum of Reaction = Brace Load = 67.18

* LAST SPAN *

<-- D1=8.00 R1=38.33
<-- D2=16.00 R2=81.26
D3=31.70

D1 - TOP DEPTH R1 - TOP REACTION
D2 - LAST BRACE DEPTH R2 - LAST BRACE REACTION
D3 - BOTTOM DEPTH

TOTAL REACTION: R1+R2 = 119.59
TOTAL PRESSURES ACTING ON WALL = 119.59
Total Reactions >= Total Pressures, OK!

BRACE NO. 2 AT DEPTH = 16.00
R2 of Last Span = Brace Load = 81.26

*****RESULTS*****

* EMBEDMENT *

MINIMUM EMBEDMENT = 5.00 (8~10ft recommended!!!)
TOTAL MINIMUM PILE LENGTH = 31.70

* MOMENT IN PILE (per pile spacing)*

Pile Spacing: sheet piles are one foot or one meter; soldier piles are one pile.

No.	Depth	M @ Brace	Mmax in Span	Depth of Mmax
1	8.00	84.07	20.29	13.37
2	16.00	23.89	172.96	23.21

Overall Maximum Moment = 172.96 at 23.21
Maximum Shear = 60.93
Moment and Shear are per pile spacing: 7.3 foot or meter

-> Top Brace Increase 15%. (Horizontal) From 67.18 to 77.26

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

The calculated brace force are per brace spacing.

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
1	8.00	15.0	6.90	73.03	19.57
75.61					
2	16.00	15.0	6.90	76.81	20.58
79.52					

No. DEPTH Free length Type and Data
Page 5

1	8.00	15.66	Tieback, Bond length = 37.14
2	16.00	11.52	Tieback, Bond length = 39.06

* VERTICAL LOADING *

Vertical Loading from Braces = 42.48
 Vertical Loading from External Load = 0.00
 Total Vertical Loading = 42.48

*****SPECIFIED PILE *****

Overall Maximum Moment = 172.96 at 23.21
 The pile selection is based on the magnitude of the moment only. Axial force is neglected.

Request Min. Section Modulus = 62.89 in³/pile = 1030.63 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X40 has been found in Soldier Pile list!
 (English Units):
 Area= 11.8 in. Depth= 17.9 in. Width= 6.02 in. Height= 18 in.
 Flange thickness= 0.525 in. Web thickness= 0.315 in.
 Ix= 612 in⁴/pile Sx= 68.4 in³/pile Iy= 19.1 in⁴/pile Sy= 6.35 in³/pile
 (Metric Units):
 Ix= 254.71 x100cm⁴/pile Sx= 1120.87 cm³/pile Iy= 7.95 x100cm⁴/pile Sy= 104.06 cm³/pile

The pile selection is based on the magnitude of the moment only. Axial force is neglected.

W18X40 is capable to support the shoring!
 Top deflection = 0.140(in)
 Max. deflection = 0.258(in)

***** LAGGING SIZE ESTIMATION *****

Max. Pressure above base = 1.48
 Piles are more rigid than timber lagging, only portion of pressures are acting to lagging, 30-50% arching is suggested.
 If 50% arching is used for lagging design, Design Pressure = 0.74
 Pile Spacing =7.3, Max. Moment in lagging = 4.92
 For 4"x12" Timber, Section Modulus S=23.47 in³. The request allowable bending strength, fb=M/S=2.52
 For 6"x12" Timber, Section Modulus S=57.98 in³. The request allowable bending strength, fb=M/S=1.02

 If 30% arching is used for lagging design, Design Pressure = 0.44
 Pile Spacing =7.3, Max. Moment in lagging = 2.95
 For 4"x12" Timber, Section Modulus S=23.47 in³. The request allowable bending strength, fb=M/S=1.51
 For 6"x12" Timber, Section Modulus S=57.98 in³. The request allowable bending strength, fb=M/S=0.61

Unit: Pressure: ksf, Spacing: ft, Moment: kip-ft, Bending Strength, fb: ksi

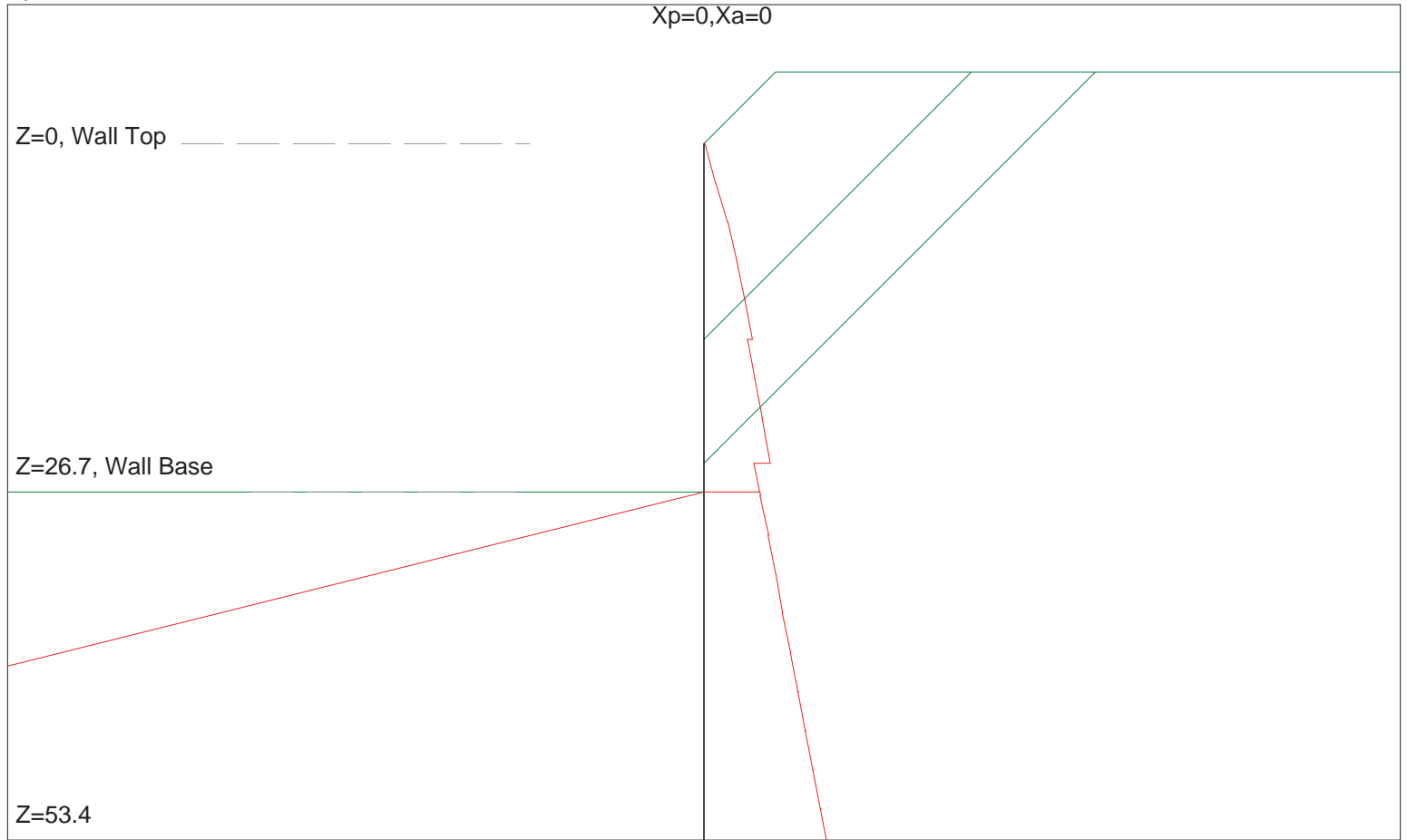
Buttgenbach/Lot 44

North Wall Sta. 0+95

Xp=106.8

Xa=106.8

Xp=0, Xa=0



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
 UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.ep8

* INPUT DATA *

Wall Height=26.7 Total Soil Types= 3

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	-5.5	11.0	1	Afu
2	-5.5	11.0	-5.5	800.0	1	Afu
3	15.0	0.0	-5.5	41.0	2	Qc
4	-5.5	41.0	-5.5	800.0	2	Qc
5	24.5	0.0	-5.5	60.0	3	Tw
6	-5.5	60.0	-5.5	800.0	3	Tw

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	26.7	0.0	26.7	800.0	3	Tw

Wall Friction Options: 2. Active only (for soldier pile)

Wall Friction = 26

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

*** OUTPUT RESULTS ***

Eae (Total Force above Base)= 13.11 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 13.11

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.01	3.00	0.14	0.0438	0.3065
3.00	0.15	6.00	0.30	0.0495	0.3463
6.00	0.30	9.00	0.42	0.0382	0.2672
9.00	0.41	12.00	0.52	0.0340	0.2377
12.00	0.52	15.00	0.61	0.0316	0.2209
15.00	0.55	18.00	0.64	0.0312	0.2183
18.00	0.64	21.00	0.74	0.0320	0.2236
21.00	0.73	24.50	0.84	0.0298	0.2085
24.50	0.63	26.70	0.70	0.0338	0.2366

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
26.70	0.71	27.00	0.71	0.0256	0.1792
27.00	0.71	30.00	0.82	0.0367	0.2569
30.00	0.81	33.00	0.91	0.0329	0.2301
33.00	0.91	36.00	0.99	0.0284	0.1989
36.00	0.99	39.00	1.09	0.0346	0.2422
39.00	1.09	42.00	1.18	0.0315	0.2200
42.00	1.18	45.00	1.28	0.0316	0.2206
45.00	1.28	48.00	1.37	0.0316	0.2210
48.00	1.37	51.00	1.47	0.0316	0.2213
51.00	1.47	53.40	1.54	0.0317	0.2215

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
26.70	0.00	53.40	17.56	0.658	4.5989

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 4/24/2018 File Name: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.ep8

EARTH PRESSURE ANALYSIS SUMMARY
<EarthPres>
Software Copyright by CivilTech Software
www.civiltechsoftware.com

Li censed to 4324324234 3424343
Date: 4/24/2018 File: X:\Offi ce\Proj ects\02732-Buttgenbach\002-Shori ng Lot
44\ENG\North\26.7H.ep8

Title 1: Buttgenbach/Lot 44
Title 2: North Wall Sta. 0+95

Input data: *****

Wall Height = 26.70
Depth of Ground at Active Side = 0.00
Depth of Ground at Passive Side = 26.70
Apparent Pressure Envelope: 1.* Actual Pressures (All walls, All soils)
Pressure Type: 1.* Active, Ka
Earthquake Loading Apply to: 1. No Earthq. Loads
Earthquake Horizontal Acceleration, Kh = 0.175
Earthquake Vertical Acceleration, Kv = 0.09
Calculation Methods: 1.* Numerical Solution (Wedge Analysis)
Wall Friction Options: 2. Active only (for soldier pile)
Wall Friction = 26
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*
Water Density = 62.4
Water Pressure: 1.* No seepage at wall tip

User's Settings
Ignore Passive from Depth = 0
Multiplier of Active Pressure = 1
Multiplier of Passive Pressure = 1
Multiplier of Water Pressure = 1
Multiplier of Earthq. Pressure = 1
Estimated Embedment: Very Shallow: 2H

Program's Settings
Max. Height, Hmax = 200.00
Analysis Segment, dz = 0.67
No. of Active Segment at H, nz0 = 9
No. of Active Segment at Hmax, nz = 68
No. of Passive Segment, nzp = 1
Active Depth at H, Zh = 26.70
Active Depth at Hmax, Z = 200.00
Passive Depth at Hmax, Zp = 200.00
Max. Pressure = 113.97

Total Soil Types= 3

Table with 8 columns: Soil, Weight, W(S), Phi, Cohesion, Nspt, Type, Description. Rows 1-3.

Ground Surface at Active Side:

Table with 6 columns: Line, Z1, Xa1, Z2, Xa2, Soil No. Rows 1-5.

6 -5.5 60.0 -5.5 800.0 report. out 3

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.
1	26.7	0.0	26.7	800.0	3

Output data: *****

Eae (Active/At-Rest Force above Base)= 13.11 per one linear foot (or meter) width along wall height
 Ea (Total Static Force above Base)= 13.11C:\Shoring8\report.out

Actual Pressure above Base - Output to Shoring

Active/At-Rest Force above Base, Ea = 13.11

No	Z1	P1	Z2	P2	Slope	Ka or Ko
0	0.0	0.01	3.0	0.14	0.0438	0.3065
1	3.0	0.15	6.0	0.30	0.0495	0.3463
2	6.0	0.30	9.0	0.42	0.0382	0.2672
3	9.0	0.41	12.0	0.52	0.0340	0.2377
4	12.0	0.52	15.0	0.61	0.0316	0.2209
5	15.0	0.55	18.0	0.64	0.0312	0.2183
6	18.0	0.64	21.0	0.74	0.0320	0.2236
7	21.0	0.73	24.5	0.84	0.0298	0.2085
8	24.5	0.63	26.7	0.70	0.0338	0.2366

Driving Pressure below Base - Output to Shoring

No Z1 P1 Z2 P2 Slope Ka or Ko

0	26.7	0.71	27.0	0.71	0.0256	0.1792
1	27.0	0.71	30.0	0.82	0.0367	0.2569
2	30.0	0.81	33.0	0.91	0.0329	0.2301
3	33.0	0.91	36.0	0.99	0.0284	0.1989
4	36.0	0.99	39.0	1.09	0.0346	0.2422
5	39.0	1.09	42.0	1.18	0.0315	0.2200
6	42.0	1.18	45.0	1.28	0.0316	0.2206
7	45.0	1.28	48.0	1.37	0.0316	0.2210
8	48.0	1.37	51.0	1.47	0.0316	0.2213
9	51.0	1.47	54.0	1.56	0.0317	0.2215
10	54.0	1.56	57.0	1.66	0.0317	0.2216
11	57.0	1.66	60.0	1.75	0.0317	0.2217
12	60.0	1.75	63.0	1.85	0.0317	0.2218
13	63.0	1.85	66.0	1.94	0.0317	0.2218
14	66.0	1.94	69.0	2.04	0.0317	0.2216
15	69.0	2.04	72.0	2.13	0.0310	0.2169
16	72.0	2.13	75.0	2.22	0.0310	0.2169
17	75.0	2.22	78.0	2.32	0.0310	0.2169
18	78.0	2.32	81.0	2.41	0.0311	0.2176
19	81.0	2.41	84.0	2.50	0.0311	0.2176
20	84.0	2.50	87.0	2.60	0.0311	0.2176
21	87.0	2.60	90.0	2.69	0.0311	0.2176
22	90.0	2.69	93.0	2.78	0.0311	0.2176
23	93.0	2.78	96.0	2.88	0.0311	0.2176
24	96.0	2.88	99.0	2.97	0.0311	0.2176
25	99.0	2.97	102.0	3.06	0.0311	0.2176
26	102.0	3.06	105.0	3.15	0.0288	0.2016
27	105.0	3.15	108.0	3.24	0.0285	0.1994
28	108.0	3.24	111.0	3.32	0.0285	0.1994
29	111.0	3.32	114.0	3.41	0.0285	0.1994
30	114.0	3.41	117.0	3.49	0.0285	0.1994
31	117.0	3.49	120.0	3.58	0.0285	0.1994
32	120.0	3.58	123.0	3.66	0.0285	0.1994
33	123.0	3.66	126.0	3.75	0.0285	0.1994

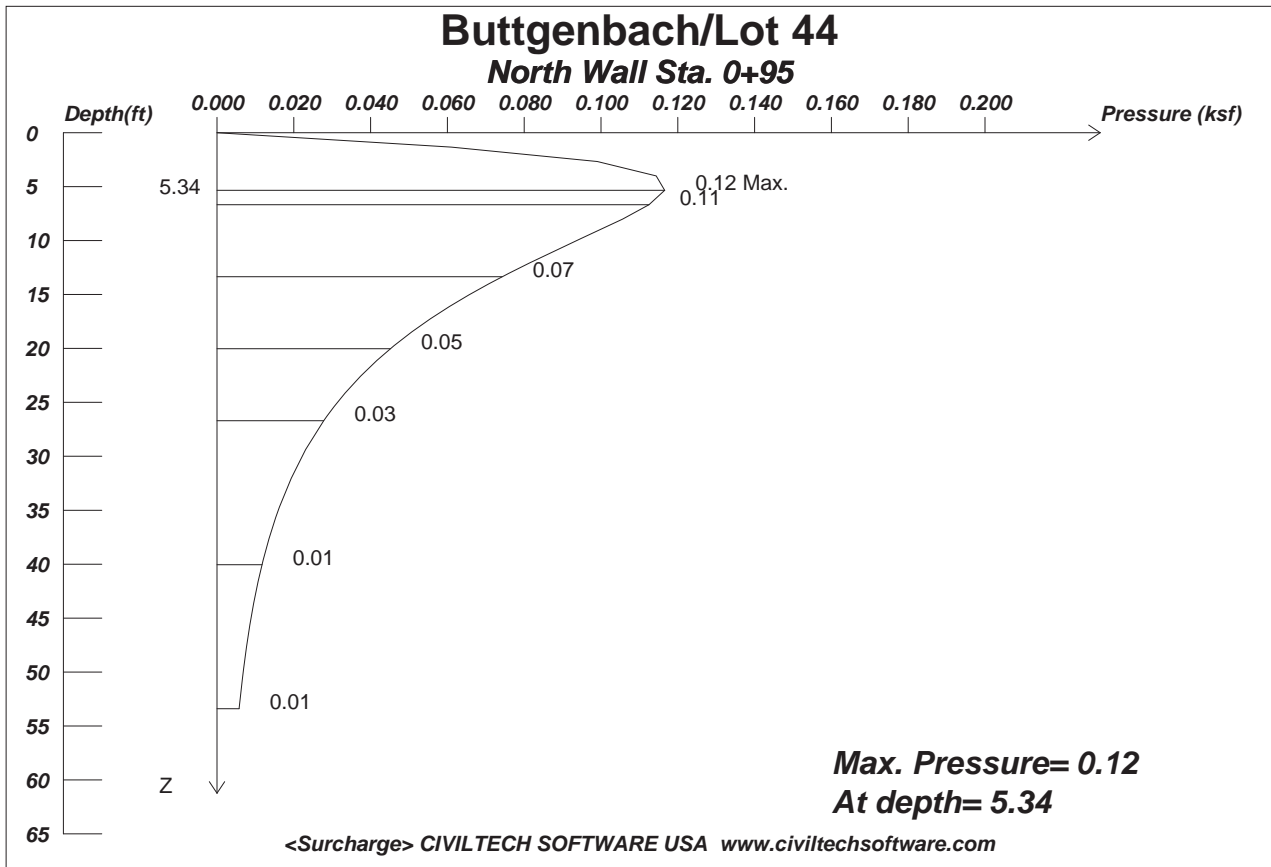
					report. out	
34	126.0	3.75	129.0	3.84	0.0285	0.1994
35	129.0	3.84	132.0	3.92	0.0285	0.1994
36	132.0	3.92	135.0	4.01	0.0285	0.1994
37	135.0	4.01	138.0	4.09	0.0285	0.1994
38	138.0	4.09	141.0	4.18	0.0285	0.1994
39	141.0	4.18	144.0	4.26	0.0285	0.1994
40	144.0	4.27	147.0	4.35	0.0289	0.2023
41	147.0	4.35	150.0	4.44	0.0286	0.1997
42	150.0	4.44	153.0	4.53	0.0286	0.1997
43	153.0	4.53	156.0	4.61	0.0286	0.1997
44	156.0	4.61	159.0	4.70	0.0286	0.1997
45	159.0	4.70	162.0	4.78	0.0286	0.1997
46	162.0	4.78	165.0	4.87	0.0286	0.1997
47	165.0	4.87	168.0	4.95	0.0286	0.1997
48	168.0	4.95	171.0	5.04	0.0286	0.1997
49	171.0	5.04	174.0	5.13	0.0286	0.1997
50	174.0	5.13	177.0	5.21	0.0286	0.1997
51	177.0	5.21	180.0	5.30	0.0286	0.1997
52	180.0	5.30	183.0	5.38	0.0286	0.1997
53	183.0	5.38	186.0	5.47	0.0286	0.1997
54	186.0	5.47	189.0	5.55	0.0286	0.1997
55	189.0	5.55	192.0	5.64	0.0286	0.1997
56	192.0	5.64	195.0	5.72	0.0286	0.1997
57	195.0	5.72	198.0	5.81	0.0286	0.1997
58	198.0	5.81	200.0	5.87	0.0286	0.1997

Passive Pressure below Base - Output to Shoring						
No	Z1	P1	Z2	P2	Slope	Kp
0	26.7	0.00	200.0	113.97	0.6576	4.5989

 DEPTH/DI STANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Z, Xa, Xp - Coordinates of ground lines
 Z- Depth measured from wall top
 Xa - Distance measure from wall to active side.
 Xp - Distance measure from wall to passive side

Z1, P1, Z2, P2 - Four values to define a pressure diagram
 Z1- Top depth of the diagram
 P1- Top pressure of the diagram
 Z2- Bottom depth of the diagram
 P2- Bottom pressure of the diagram
 Slope - $(P2-P1)/(Z2-Z1)$, Slope of the diagram. It also called
 Equivalent fluid density. It equals to $Ka*\Gamma$ or $Kp*\Gamma$
 Ka - Active Earth Pressure Coefficient
 Kp - Passive Earth Pressure Coefficient



Licensed to 4324324234 3424343

Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.lp8

Wall Height, H= 26.7

Load Depth at Surface, D= 0

Load Factor of Surcharge Loading = 1.0

Semi-flexible Wall Condition -- Small movement or deflection are allowed.

Max. Pressure = 0.117 at depth = 5.34

X	Width	Strip Load
4.0	20.0	.25

UNITS: LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

report.out

SURCHARGE LOADS CALCULATION SUMMARY
<Surcharge>
Software Copyright by CivilTech Software
www.civiltechsoftware.com

Reference: Foundation Design, Wayne C. Teng, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962

Licensed to 4324324234 3424343

Date: 4/24/2018 File:

X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.lp8

Buttgenbach/Lot 44
North Wall Sta. 0+95

Height of Wall = 26.7
Depth of Wall = 0
Load Factor of Surcharge Loading = 1.0

Wall Condition:
Semi-flexible Wall Condition -- Very small movement or deflection are allowed.

*****Loading*****

STRIP LOADING:

Xstrip	Width	Qstrip
4.0	20.0	0.3

*****Total Pressure Distribution*****

Max. Pressure =0.117 at depth =5.34

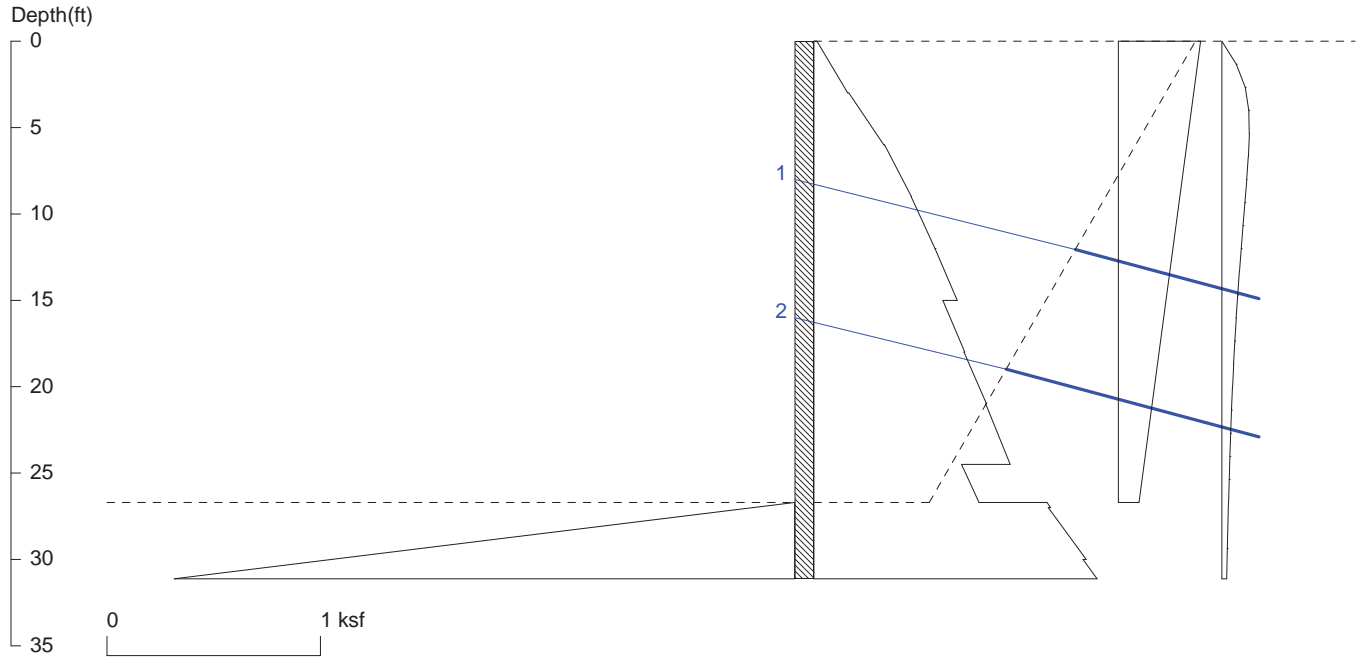
Depth	Pressure
0.00	0.000
1.34	0.061
2.67	0.099
4.01	0.114
5.34	0.117
6.68	0.112
8.01	0.106
9.35	0.098
10.68	0.090
12.02	0.082
13.35	0.074
14.69	0.067
16.02	0.061
17.35	0.055
18.69	0.050
20.02	0.045
21.36	0.041
22.69	0.037
24.03	0.034
25.36	0.031
26.70	0.028
29.37	0.023

	report. out
32.04	0.019
34.71	0.016
37.38	0.014
40.05	0.012
42.72	0.010
45.39	0.009
48.06	0.008
50.73	0.007
53.40	0.006
58.74	0.004
64.08	0.004
69.42	0.003
74.76	0.002
80.10	0.002
85.44	0.002
90.78	0.001
96.12	0.001
101.46	0.001
106.80	0.000

Depth Is Measured From Top of the Wall
LENGTH/DEPTH: ft, Qpoint: kip, Qline: kip/ft, Qstrip/Qarea/PRESSURE: ksf

Buttgenbach/Lot 44

North Wall Sta. 0+95 Seismic



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltechsoftware.com

Licensed to 4324324234 3424343

Date: 4/24/2018

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.sh8

Wall Height=26.7 Pile Diameter=2.5 Pile Spacing=7.3 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=4.42 (8~10ft is recommended!!!) Min. Pile Length=31.12

MOMENT IN PILE: Max. Moment=137.44 per Pile Spacing=7.3 at Depth=7.99

PILE SELECTION:

Request Min. Section Modulus = 50.0 in³/pile=818.99 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X40 has Section Modulus = 68.4 in³/pile=1120.87 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.31(in) based on E (ksi)=29000.00 and I (in⁴)/pile=612.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	8.0	15.0	6.9	91.9*	88.8	23.8	15.7	45.2
2. Tieback	16.0	15.0	6.9	55.3	53.4	14.3	11.5	27.2

* Top Brace increased by 15% (DM7.2-103)

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE): Pressures below will be multiplied by a Factor =1.1

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.013	3.000	0.144	0.043834
3.000	0.149	6.000	0.297	0.049528
6.000	0.301	9.000	0.416	0.038210
9.000	0.414	12.000	0.516	0.033995
12.000	0.516	15.000	0.611	0.031589
15.000	0.549	18.000	0.642	0.031214
18.000	0.639	21.000	0.735	0.031972
21.000	0.732	24.500	0.836	0.029810
24.500	0.629	26.700	0.703	0.033827
*	Below	Base		

26.700	0.993	27.000	1.008	0.048287
27.000	0.998	30.000	1.160	0.053786
30.000	1.146	33.000	1.307	0.053427
*	Earth	Queck		
0.000	0.350	26.700	0.087	-0.009823
*	Sur-	charge		
0.000	0.000	1.335	0.061	0.045726
1.335	0.061	2.670	0.099	0.028456
2.670	0.099	4.005	0.114	0.011504
4.005	0.114	5.340	0.117	0.001652
5.340	0.117	6.675	0.112	-0.003073
6.675	0.112	8.010	0.106	-0.005141
8.010	0.106	9.345	0.098	-0.005922
9.345	0.098	10.680	0.090	-0.006073
10.680	0.090	12.015	0.082	-0.005909
12.015	0.082	13.350	0.074	-0.005587
13.350	0.074	14.685	0.067	-0.005191
14.685	0.067	16.020	0.061	-0.004768
16.020	0.061	17.355	0.055	-0.004345
17.355	0.055	18.690	0.050	-0.003937
18.690	0.050	20.025	0.045	-0.003552
20.025	0.045	21.360	0.041	-0.003197
21.360	0.041	22.695	0.037	-0.002871
22.695	0.037	24.030	0.034	-0.002575
24.030	0.034	25.365	0.031	-0.002309
25.365	0.031	26.700	0.028	-0.002069
26.700	0.028	29.370	0.023	-0.001759
29.370	0.023	32.040	0.019	-0.001417

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.1

Z1	P1	Z2	P2	Slope
26.7	0.00	200.0	113.97	0.658

ACTIVE SPACING:

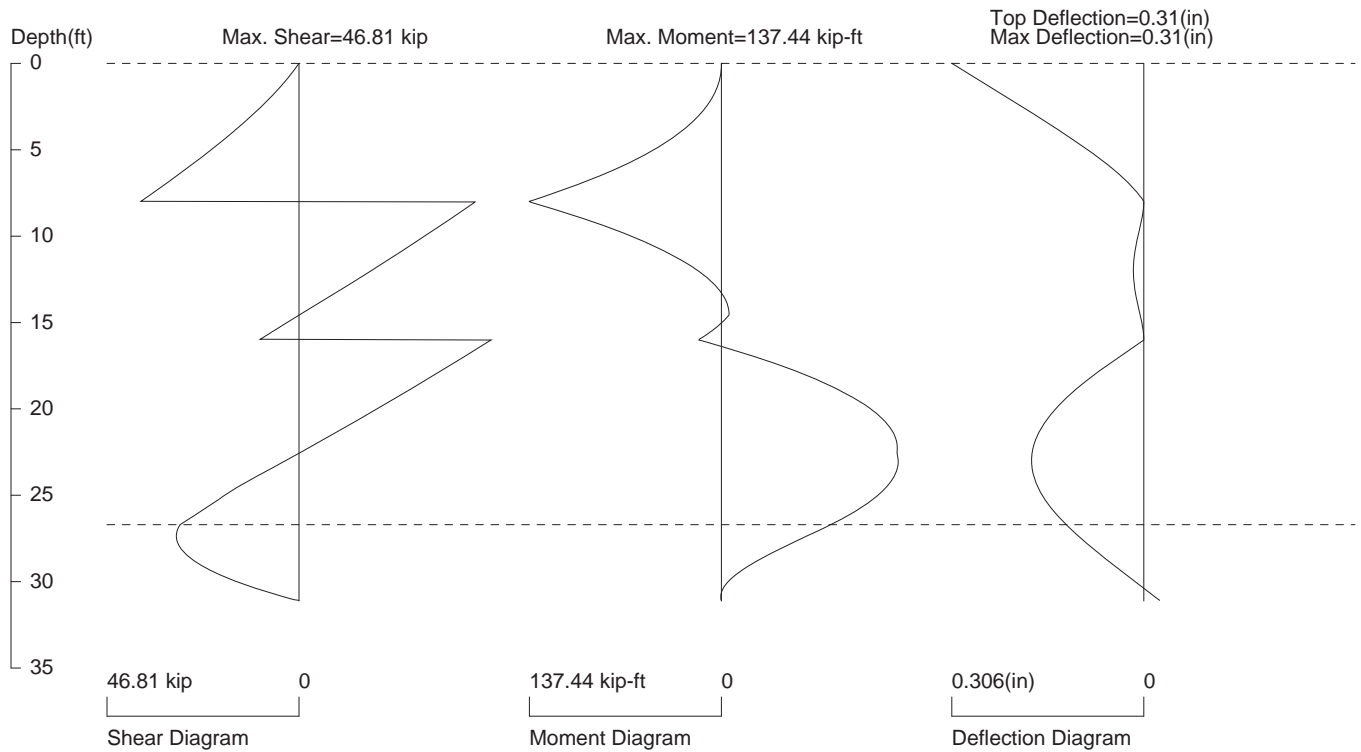
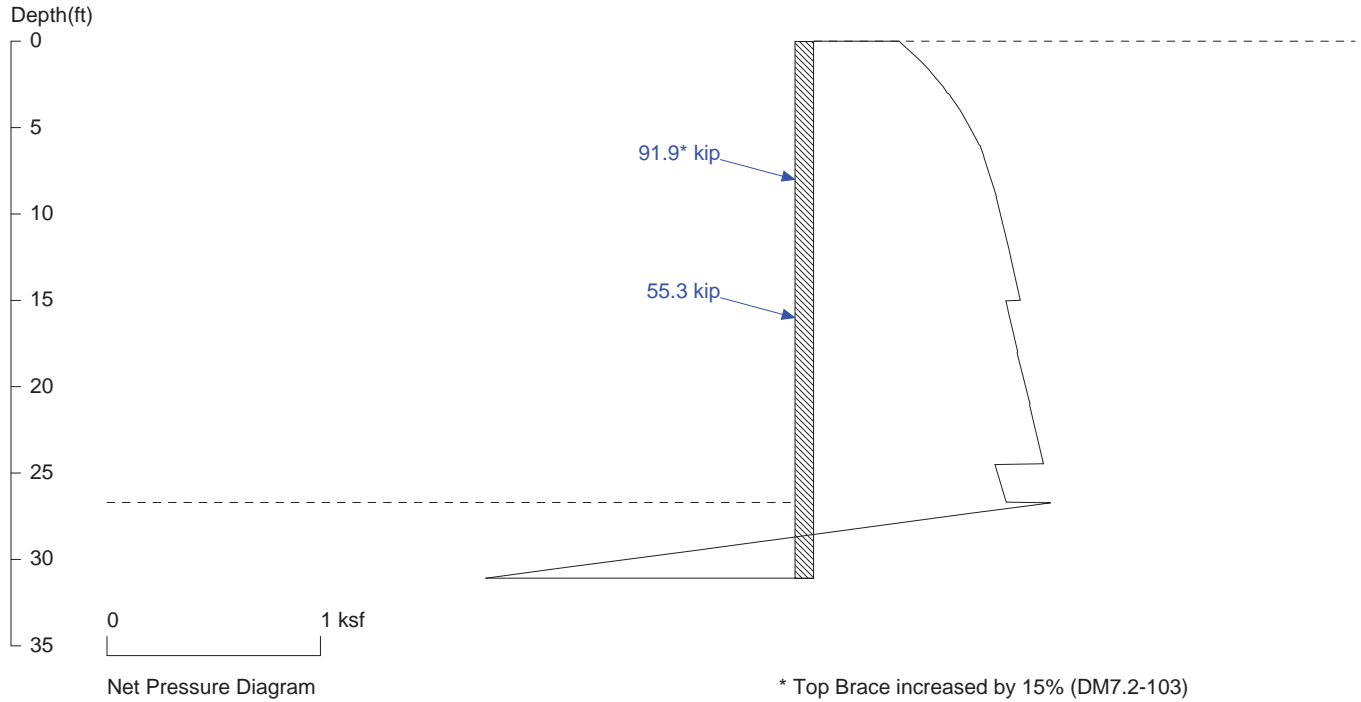
No.	Z depth	Spacing
1	0.00	7.30
2	26.70	2.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	26.70	7.30

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Buttgenbach/Lot 44 North Wall Sta. 0+95 Seismic



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.3 foot or meter

User Input Pile, W18X40: E (ksi)=29000.0, I (in⁴)/pile=612.0

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.sh8

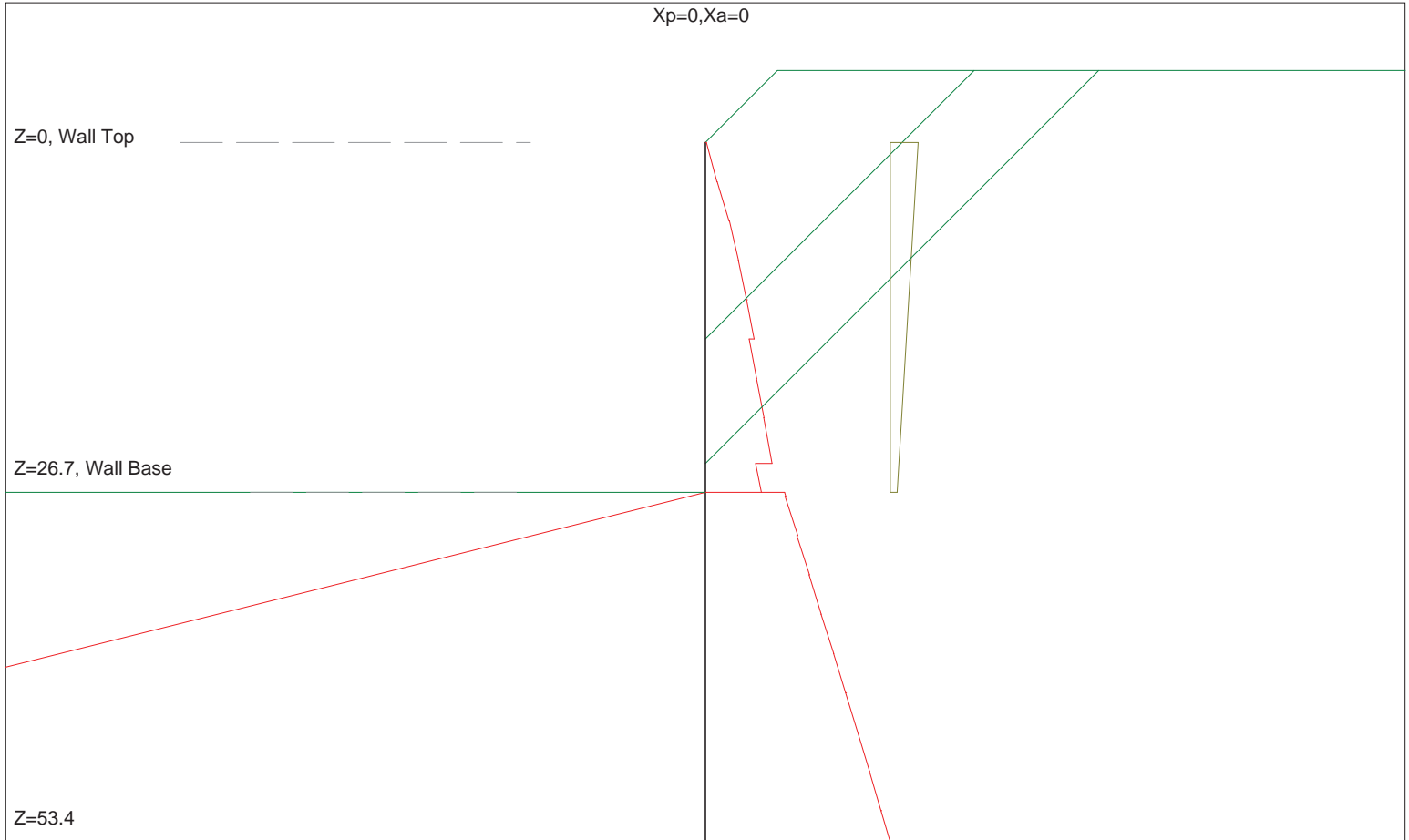
Buttgenbach/Lot 44

North Wall Sta. 0+95 Seismic

Xp=106.8

Xa=106.8

Xp=0, Xa=0



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
 UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.ep8

* INPUT DATA *

Wall Height=26.7 Total Soil Types= 3

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	-5.5	11.0	1	Afu
2	-5.5	11.0	-5.5	800.0	1	Afu
3	15.0	0.0	-5.5	41.0	2	Qc
4	-5.5	41.0	-5.5	800.0	2	Qc
5	24.5	0.0	-5.5	60.0	3	Tw
6	-5.5	60.0	-5.5	800.0	3	Tw

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	26.7	0.0	26.7	800.0	3	Tw

Wall Friction Options: 2. Active only (for soldier pile)

Wall Friction = 26

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

*** OUTPUT RESULTS ***

Eae (Total Force above Base)= 18.95 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 13.11

Ee (Total Earthquake Force above Base)= 5.84. Distributed in trapezoid. Total earthquake force acting at 0.4H of wall height

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.01	3.00	0.14	0.0438	0.3065
3.00	0.15	6.00	0.30	0.0495	0.3463
6.00	0.30	9.00	0.42	0.0382	0.2672
9.00	0.41	12.00	0.52	0.0340	0.2377
12.00	0.52	15.00	0.61	0.0316	0.2209
15.00	0.55	18.00	0.64	0.0312	0.2183
18.00	0.64	21.00	0.74	0.0320	0.2236
21.00	0.73	24.50	0.84	0.0298	0.2085
24.50	0.63	26.70	0.70	0.0338	0.2366

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
26.70	0.99	27.00	1.01	0.0483	0.3377
27.00	1.00	30.00	1.16	0.0538	0.3761
30.00	1.15	33.00	1.31	0.0534	0.3736
33.00	1.30	36.00	1.45	0.0504	0.3524
36.00	1.45	39.00	1.61	0.0533	0.3727
39.00	1.61	42.00	1.76	0.0500	0.3500
42.00	1.76	45.00	1.91	0.0502	0.3508
45.00	1.91	48.00	2.06	0.0498	0.3480
48.00	2.06	51.00	2.20	0.0483	0.3375
51.00	2.20	53.40	2.32	0.0483	0.3377

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
26.70	0.00	53.40	17.56	0.658	4.5989

Output Earthquake Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Total Earthq. Force, Ee = 5.84

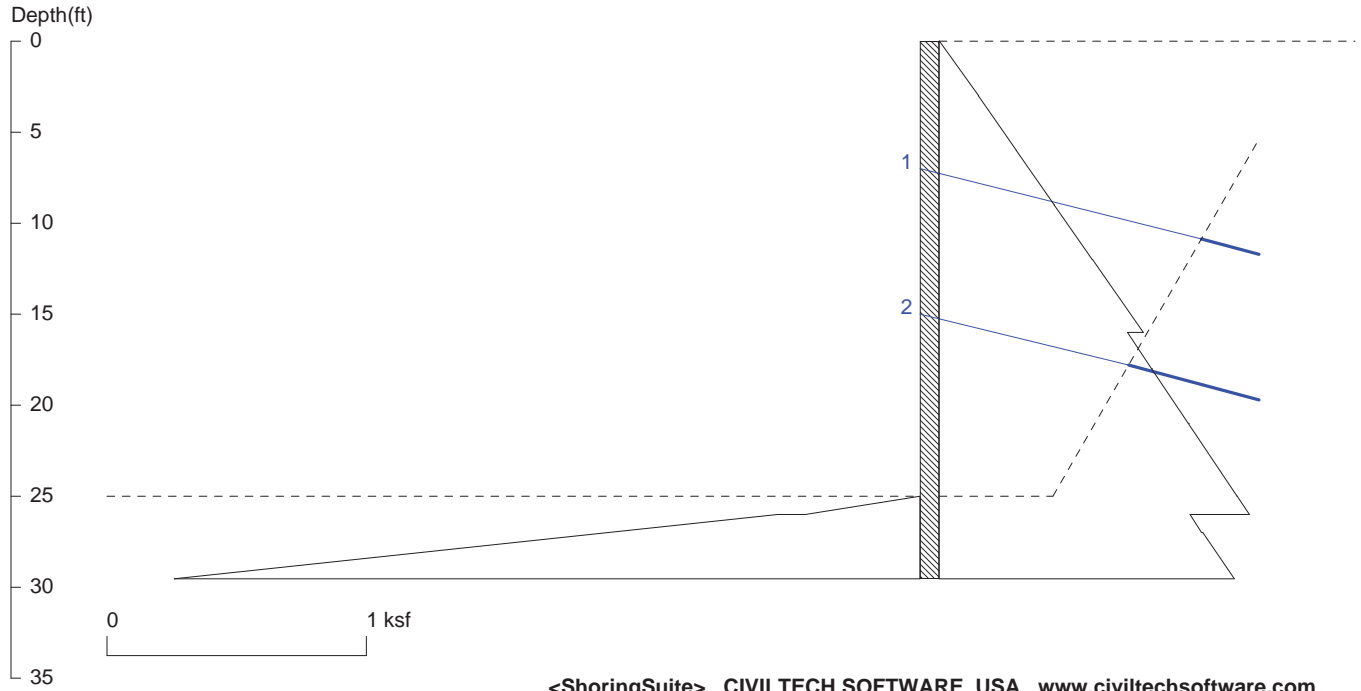
No	Zq1	Pq1	Zq2	Pq2	Slope
0	0.00	0.350	26.70	0.087	-0.010

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 4/24/2018 File Name: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\North\26.7H.ep8

Buttgenbach/Lot 44

East Wall Sta. 1+05



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltechsoftware.com

Licensed to 4324324234 3424343

Date: 4/24/2018

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.sh8

Wall Height=25.0 Pile Diameter=2.5 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=4.54 (8~10ft is recommended!!!) Min. Pile Length=29.54

MOMENT IN PILE: Max. Moment=92.38 per Pile Spacing=6.0 at Depth=22.04

PILE SELECTION:

Request Min. Section Modulus = 33.6 in³/pile=550.50 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X35 has Section Modulus = 57.6 in³/pile=943.89 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.01(in) based on E (ksi)=29000.00 and I (in⁴)/pile=510.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	7.0	15.0	6.0	25.0*	24.1	6.5	14.9	12.3
2. Tieback	15.0	15.0	6.0	47.2	45.6	12.2	10.8	23.2

* Top Brace increased by 15% (DM7.2-103)

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE): Pressures below will be multiplied by a Factor =1.7

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.001	3.000	0.089	0.029619
3.000	0.089	6.000	0.175	0.028755
6.000	0.175	9.000	0.261	0.028755
9.000	0.261	12.000	0.348	0.028755
12.000	0.348	16.000	0.463	0.028755
16.000	0.427	18.000	0.481	0.027402
18.000	0.482	21.000	0.566	0.027740
21.000	0.565	25.000	0.676	0.027644
*	Below	Base		
25.000	0.676	26.000	0.704	0.027654

26.00	0.569	27.00	0.595	0.026034
27.00	0.598	30.00	0.682	0.028173

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.1

Z1	P1	Z2	P2	Slope
25.0	0.00	26.0	0.44	0.441
26.0	0.55	200.0	114.90	0.658

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	6.00
2	25.00	2.50

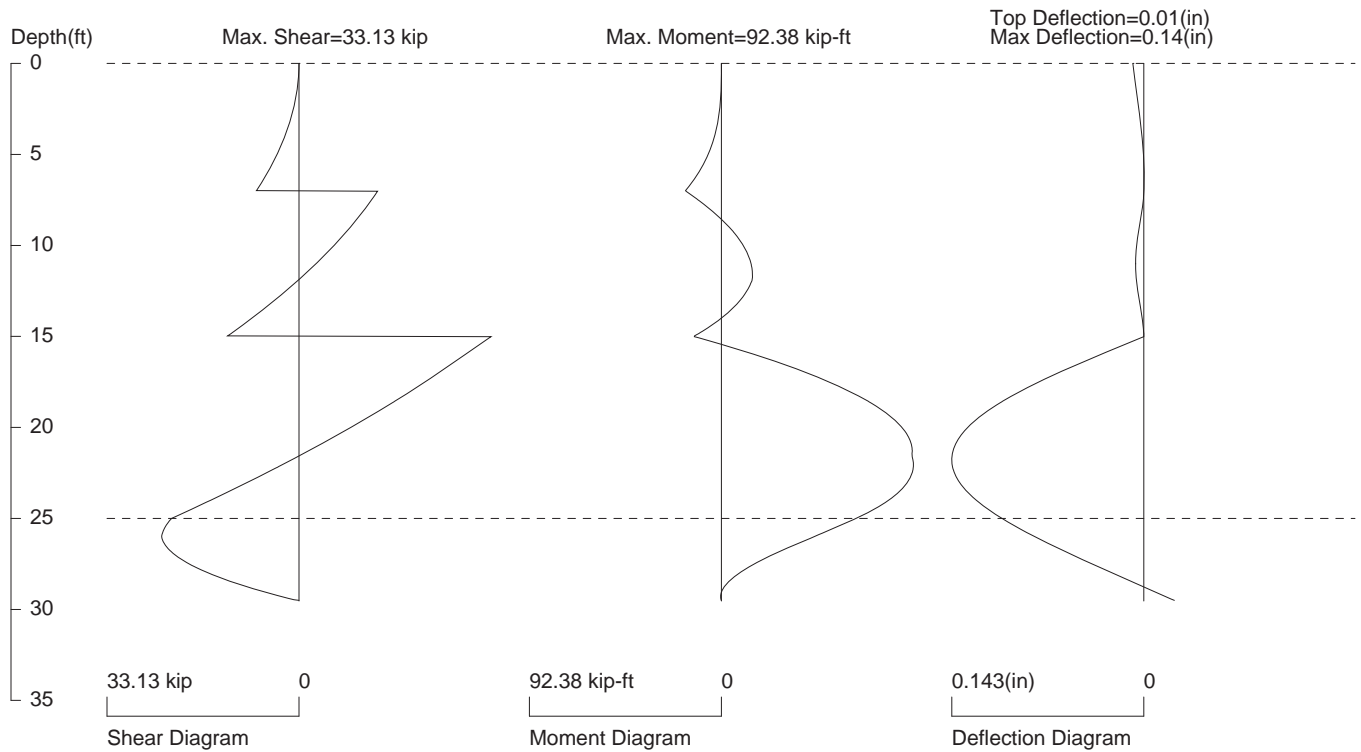
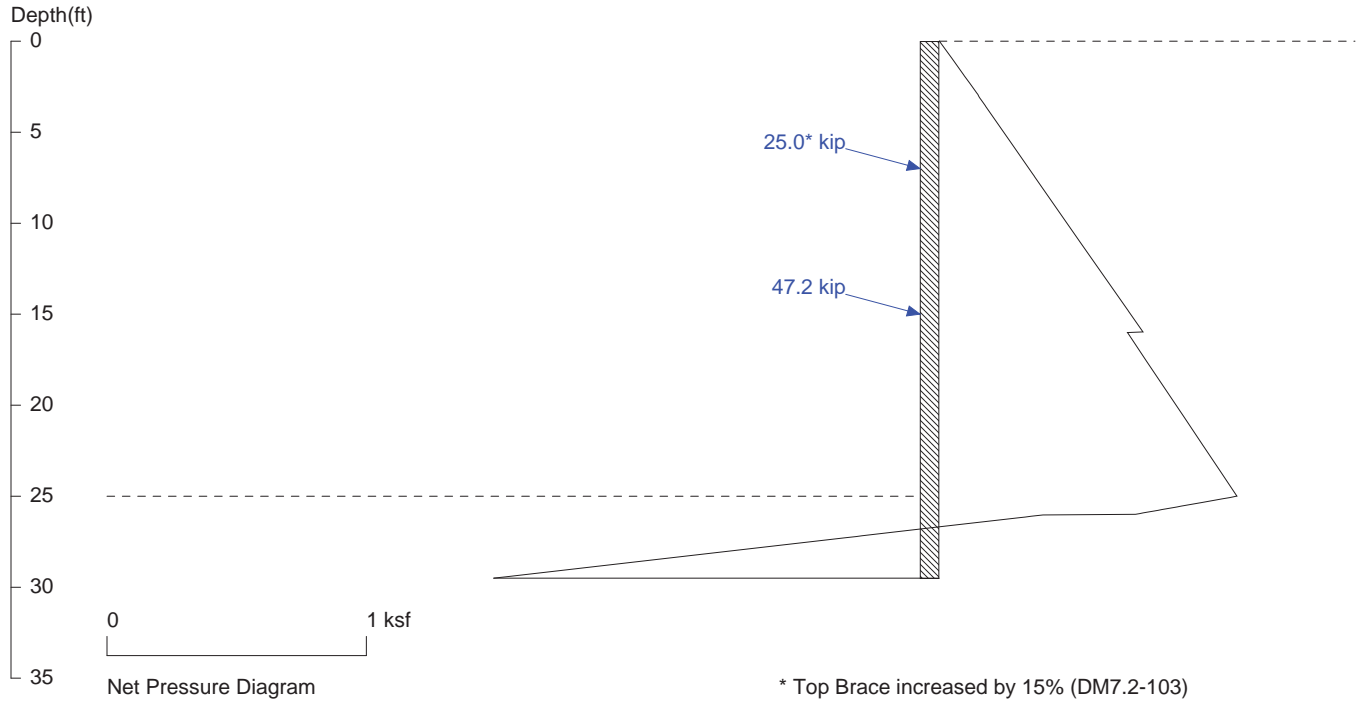
PASSIVE SPACING:

No.	Z depth	Spacing
1	25.00	6.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Buttgenbach/Lot 44

East Wall Sta. 1+05



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W18X35: E (ksi)=29000.0, I (in⁴)/pile=510.0

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.sh8

SHORING WALL CALCULATION SUMMARY
The leading shoring design and calculation software
Software Copyright by CivilTech Software
www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:

- 1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
5. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
6. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U. S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS: Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft, Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in

Licensed to 4324324234 3424343
Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.sh8

Title: Buttgenbach/Lot 44
Subtitle: East Wall Sta. 1+05

*****INPUT DATA*****

Wall Type: 2. Soldier Pile, Drilled
Wall Height: 25.00
Pile Diameter: 2.50
Pile Spacing: 6.00
Factor of Safety (F.S.): 1.10
As Continuous Span Beam
Lateral Support Type (Braces): 3. Tieback
Top Brace Increase (Multi-Bracing): Add 15%*
No-Load Zone:
Vertical Depth for No-Load Zone: 25.00
H-Distance (Input H/V ratio) for No-Load Zone: 0.25
Angle from H. Line for No-Load Zone: 60.00
Embedment Option: 1. Yes
Friction at Pile Tip: No
Pile Properties:
Steel Strength, Fy: 50 ksi = 345 MPa
Allowable Fb/Fy: 0.66
Elastic Module, E: 29000.00
Moment of Inertia, I: 510.00
User Input Pile: W18X35

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
The pressures below will be multiplied by a Factor =1.7

Table with 6 columns: No., Z1 top, Top Pres., Z2 bottom, Bottom Pres., Slope. Rows 1-5 showing pressure data at different depths.

6	12.00	0.348	report. out	16.00	0.463	0.028755
7	16.00	0.427		18.00	0.481	0.027402
8	18.00	0.482		21.00	0.566	0.027740
9	21.00	0.565		25.00	0.676	0.027644
10	*	Bel ow		Base		
11	25.00	0.676		26.00	0.704	0.027654
12	26.00	0.569		27.00	0.595	0.026034
13	27.00	0.598		30.00	0.682	0.028173
14	30.00	0.681		33.00	0.765	0.027982
15	33.00	0.767		36.00	0.849	0.027191
16	36.00	0.849		39.00	0.931	0.027269
17	39.00	0.931		42.00	1.013	0.027324
18	42.00	1.014		45.00	1.099	0.028632
19	45.00	1.099		48.00	1.180	0.027106
20	48.00	1.179		51.00	1.255	0.025298
21	51.00	1.255		54.00	1.331	0.025310
22	54.00	1.331		57.00	1.407	0.025318
23	57.00	1.404		60.00	1.491	0.029082
24	60.00	1.489		63.00	1.565	0.025428
25	63.00	1.565		66.00	1.642	0.025601
26	66.00	1.642		69.00	1.719	0.025605
27	69.00	1.719		72.00	1.796	0.025608
28	72.00	1.795		75.00	1.873	0.025894
29	75.00	1.873		78.00	1.951	0.026002
30	78.00	1.951		81.00	2.029	0.026004
31	81.00	2.029		84.00	2.107	0.026006
32	84.00	2.107		87.00	2.185	0.026008
33	87.00	2.185		90.00	2.263	0.026009
34	90.00	2.263		93.00	2.341	0.026010
35	93.00	2.341		96.00	2.419	0.026011
36	96.00	2.419		99.00	2.497	0.026012
37	99.00	2.497		102.0	2.575	0.026012
38	102.0	2.575		105.0	2.653	0.026013
39	105.0	2.653		108.0	2.731	0.026013
40	108.0	2.731		111.0	2.809	0.026014
41	111.0	2.809		114.0	2.888	0.026014
42	114.0	2.888		117.0	2.966	0.026014
43	117.0	2.966		120.0	3.044	0.026014
44	120.0	3.044		123.0	3.122	0.026015
45	123.0	3.122		126.0	3.200	0.026015
46	126.0	3.200		129.0	3.278	0.026015
47	129.0	3.278		132.0	3.356	0.026015
48	132.0	3.356		135.0	3.434	0.026015
49	135.0	3.434		138.0	3.512	0.026130
50	138.0	3.513		141.0	3.601	0.029372
51	141.0	3.601		144.0	3.689	0.029130
52	144.0	3.689		147.0	3.776	0.029109
53	147.0	3.776		150.0	3.863	0.029109
54	150.0	3.864		153.0	3.950	0.028850
55	153.0	3.950		156.0	4.035	0.028509
56	156.0	4.035		159.0	4.121	0.028509
57	159.0	4.121		162.0	4.207	0.028509
58	162.0	4.207		165.0	4.292	0.028509
59	165.0	4.292		168.0	4.378	0.028509
60	168.0	4.378		171.0	4.463	0.028509
61	171.0	4.463		174.0	4.549	0.028509
62	174.0	4.549		177.0	4.634	0.028509
63	177.0	4.634		180.0	4.720	0.028509
64	180.0	4.720		183.0	4.805	0.028509
65	183.0	4.805		186.0	4.891	0.028509
66	186.0	4.891		189.0	4.976	0.028509
67	189.0	4.976		192.0	5.062	0.028509
68	192.0	5.062		195.0	5.147	0.028509

69	195.0	5.147	report. out		
70	198.0	5.233	198.0	5.233	0.028509
			200.0	5.290	0.028509

* PASSIVE PRESSURE *

The pressures below will be divided by a Factor of Safety =1.1

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	25.00	0.00	26.00	0.44	0.4415
2	26.00	0.55	200.00	114.90	0.6576

* ACTIVE SPACE *

No.	Z depth	Spacing
1	0.00	6.00
2	25.00	2.50

* PASSIVE SPACE *

No.	Z depth	Spacing
1	25.00	6.00

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	Z brace	Angle	Spacing	Input1*	Input2*
1	7.00	15.0	6.00	0.50	1.30
2	15.00	15.0	6.00	0.50	1.30

*For Tieback: Input1 = Diameter; Input2 = Bond Strength

*For Plate: Input1 = Diameter; Input2 = Allowable Pressure

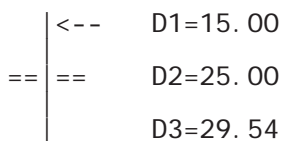
*For Deaman: Input1 = Horz. Width; Input2 = Allowable Pressure; Angle = 0

*****CALCULATION*****

The calculated moment and shear are per pile spacing. Sheet piles are per one foot or meter; Soldier piles are per pile.

Top Pressures start at depth = 0.00

* CALCULATE REQUEST EMBEDMENT *



D1 - TOP DEPTH R1 - TOP REACTION
D2 - EXCAVATION BASE
D3 - PILE TIP

TOTAL REACTION: R1 = 33.18
TOTAL PRESSURES ACTING ON WALL = 33.18
Total Reactions = Total Pressures, OK!

report.out
The Calculated Embedment, Yend = 4.54

-----MULTIPLE BRACE / TIEBACK CASE-----
** Use the calculated embedment, Yend = 4.54

NUMBER OF BRACE LEVEL= 2

* CANTILEVER SPAN, NO. 0 *

| D1=0.00
|<-- D2=7.00 R2=7.37, with Cantilever Moment=17.36

D1 - TOP DEPTH
D2 - BOTTOM DEPTH R2 - BOTTOM REACTION

TOTAL REACTION: R2 = 7.37
TOTAL PRESSURES ACTING ON WALL = 7.37
Total Reactions = Total Pressures, OK!

BRACE NO. 1 AT DEPTH = 7.00
R2 of Span No. 0 } Sum of Reaction = Brace Load = 20.97
R1 of Last Span

* LAST SPAN *

|<-- D1=7.00 R1=13.60
|<-- D2=15.00 R2=45.60
| D3=29.54

D1 - TOP DEPTH R1 - TOP REACTION
D2 - LAST BRACE DEPTH R2 - LAST BRACE REACTION
D3 - BOTTOM DEPTH

TOTAL REACTION: R1+R2 = 59.20
TOTAL PRESSURES ACTING ON WALL = 59.20
Total Reactions >= Total Pressures, OK!

BRACE NO. 2 AT DEPTH = 15.00
R2 of Last Span = Brace Load = 45.60

*****RESULTS*****

* EMBEDMENT *
MINIMUM EMBEDMENT = 4.54 (8~10ft recommended!!!)
TOTAL MINIMUM PILE LENGTH = 29.54

* MOMENT IN PILE (per pile spacing)*
Pile Spacing: sheet piles are one foot or one meter; soldier piles are one pile.
No. Depth M @ Brace Mmax in Span Depth of Mmax

report. out

1	7.00	17.27	14.97	11.65
2	15.00	12.98	92.38	22.04

Overall Maximum Moment = 92.38 at 22.04
 Maximum Shear = 33.13
 Moment and Shear are per pile spacing: 6.0 foot or meter

-> Top Brace Increase 15%. (Horizontal) From 20.97 to 24.11

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *
 The calculated brace force are per brace spacing.

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
1	7.00	15.0	6.00	24.11	6.46
2	15.00	15.0	6.00	45.60	12.22

No.	DEPTH	Free length	Type and Data
1	7.00	14.92	Tieback, Bond length = 12.26
2	15.00	10.78	Tieback, Bond length = 23.19

* VERTICAL LOADING *
 Vertical Loading from Braces = 18.68
 Vertical Loading from External Load = 0.00
 Total Vertical Loading = 18.68

*****SPECIFIED PILE *****

Overall Maximum Moment = 92.38 at 22.04
 The pile selection is based on the magnitude of the moment only. Axial force is neglected.

Request Min. Section Modulus = 33.59 in³/pile = 550.50 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X35 has been found in Soldier Pile list!
 (English Units):
 Area= 10.3 in. Depth= 17.7 in. Width= 6 in. Height= 18 in.
 Flange thickness= 0.425 in. Web thickness= 0.3 in.
 Ix= 510 in⁴/pile Sx= 57.6 in³/pile Iy= 15.3 in⁴/pile Sy= 5.12 in³/pile
 (Metric Units):
 Ix= 212.26 x100cm⁴/pile Sx= 943.89 cm³/pile Iy= 6.37 x100cm⁴/pile Sy= 83.90 cm³/pile

The pile selection is based on the magnitude of the moment only. Axial force is neglected.

W18X35 is capable to support the shoring!
 Top deflection = 0.008(in)
 Max. deflection = 0.143(in)

***** LAGGING SIZE ESTIMATION *****

Max. Pressure above base = 1.15

Piles are more rigid than timber lagging, only portion of pressures are acting to lagging, 30-50% arching is suggested.

If 50% arching is used for lagging design, Design Pressure = 0.57

Pile Spacing =6.0, Max. Moment in lagging = 2.58

For 4"x12" Timber, Section Modulus S=23.47 in³. The request allowable bending strength, fb=M/S=1.32

For 6"x12" Timber, Section Modulus S=57.98 in³. The request allowable bending strength, fb=M/S=0.53

If 30% arching is used for lagging design, Design Pressure = 0.34

Pile Spacing =6.0, Max. Moment in lagging = 1.55

For 4"x12" Timber, Section Modulus S=23.47 in³. The request allowable bending strength, fb=M/S=0.79

For 6"x12" Timber, Section Modulus S=57.98 in³. The request allowable bending strength, fb=M/S=0.32

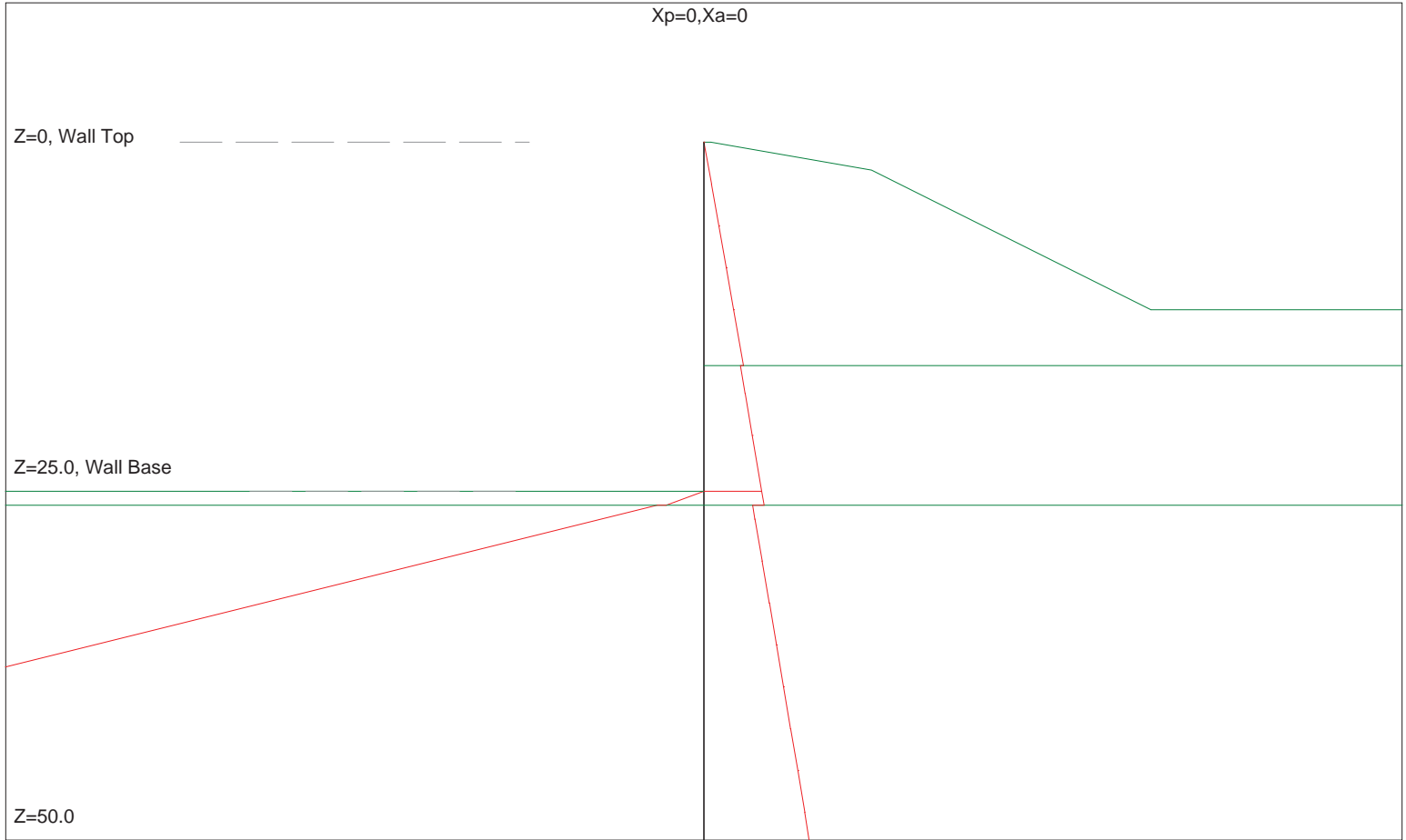
Unit: Pressure: ksf, Spacing: ft, Moment: kip-ft, Bending Strength, fb: ksi

Buttgenbach/Lot 44

East Wall Sta. 1+05

Xp=100.0

Xa=100.0



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
 UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.ep8

* INPUT DATA *

Wall Height=25.0 Total Soil Types= 3

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	1.0	1	Afu
2	0.0	1.0	2.0	24.0	1	Afu
3	2.0	24.0	12.0	64.0	1	Afu
4	12.0	64.0	12.0	800.0	1	Afu
5	16.0	0.0	16.0	800.0	2	Qc
6	26.0	0.0	26.0	800.0	3	Tw

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	25.0	0.0	25.0	800.0	2	Qc
2	26.0	0.0	26.0	800.0	3	Tw

Wall Friction Options: 2. Active only (for soldier pile)

Wall Friction = 26

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

*** OUTPUT RESULTS ***

Eae (Total Force above Base)= 8.68 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 8.68

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.00	3.00	0.09	0.0296	0.2576
3.00	0.09	6.00	0.18	0.0288	0.2500
6.00	0.18	9.00	0.26	0.0288	0.2500
9.00	0.26	12.00	0.35	0.0288	0.2500
12.00	0.35	16.00	0.46	0.0288	0.2500
16.00	0.43	18.00	0.48	0.0274	0.2299
18.00	0.48	21.00	0.57	0.0277	0.2327
21.00	0.57	25.00	0.68	0.0276	0.2319

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
25.00	0.68	26.00	0.70	0.0277	0.2320
26.00	0.57	27.00	0.60	0.0260	0.1821
27.00	0.60	30.00	0.68	0.0282	0.1970
30.00	0.68	33.00	0.76	0.0280	0.1957
33.00	0.77	36.00	0.85	0.0272	0.1901
36.00	0.85	39.00	0.93	0.0273	0.1907
39.00	0.93	42.00	1.01	0.0273	0.1911
42.00	1.01	45.00	1.10	0.0286	0.2002
45.00	1.10	48.00	1.18	0.0271	0.1896
48.00	1.18	50.00	1.23	0.0253	0.1769

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
25.00	0.00	26.00	0.44	0.441	3.7036
26.00	0.55	50.00	16.33	0.658	4.5992

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 4/24/2018 File Name: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.ep8

EARTH PRESSURE ANALYSIS SUMMARY
<EarthPres>
Software Copyright by CivilTech Software
www.civiltechsoftware.com

Li censed to 4324324234 3424343
Date: 4/24/2018 File: X:\Offi ce\Proj ects\02732-Buttgenbach\002-Shori ng Lot
44\ENG\East\25.0H.ep8

Title 1: Buttgenbach/Lot 44
Title 2: East Wall Sta. 1+05

Input data: *****

Wall Height = 25.00
Depth of Ground at Active Side = 0.00
Depth of Ground at Passive Side = 25.00
Apparent Pressure Envelope: 1.* Actual Pressures (All walls, All soils)
Pressure Type: 1.* Active, Ka
Earthquake Loading Apply to: 1. No Earthq. Loads
Earthquake Horizontal Acceleration, Kh = 0.175
Earthquake Vertical Acceleration, Kv = 0.0
Calculation Methods: 1.* Numerical Solution (Wedge Analysis)
Wall Friction Options: 2. Active only (for soldier pile)
Wall Friction = 26
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*
Water Density = 62.4
Water Pressure: 1.* No seepage at wall tip

User's Settings
Ignore Passive from Depth = 0
Multiplier of Active Pressure = 1
Multiplier of Passive Pressure = 1
Multiplier of Water Pressure = 1
Multiplier of Earthq. Pressure = 1
Estimated Embedment: Very Shallow: 2H

Program's Settings
Max. Height, Hmax = 200.00
Analysis Segment, dz = 0.63
No. of Active Segment at H, nz0 = 8
No. of Active Segment at Hmax, nz = 68
No. of Passive Segment, nzp = 2
Active Depth at H, Zh = 25.00
Active Depth at Hmax, Z = 200.00
Passive Depth at Hmax, Zp = 200.00
Max. Pressure = 114.98

Total Soil Types= 3

Soil	Weight	W(S)	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.
1	0.0	0.0	0.0	1.0	1
2	0.0	1.0	2.0	24.0	1
3	2.0	24.0	12.0	64.0	1
4	12.0	64.0	12.0	800.0	1
5	16.0	0.0	16.0	800.0	2

6 26.0 0.0 26.0 800.0 report. out 3

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.
1	25.0	0.0	25.0	800.0	2
2	26.0	0.0	26.0	800.0	3

Output data: *****

Eae (Active/At-Rest Force above Base)= 8.68 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 8.68C:\Shoring8\report.out

Actual Pressure above Base - Output to Shoring

Active/At-Rest Force above Base, Ea = 8.68

No	Z1	P1	Z2	P2	Slope	Ka or Ko
0	0.0	0.00	3.0	0.09	0.0296	0.2576
1	3.0	0.09	6.0	0.18	0.0288	0.2500
2	6.0	0.18	9.0	0.26	0.0288	0.2500
3	9.0	0.26	12.0	0.35	0.0288	0.2500
4	12.0	0.35	16.0	0.46	0.0288	0.2500
5	16.0	0.43	18.0	0.48	0.0274	0.2299
6	18.0	0.48	21.0	0.57	0.0277	0.2327
7	21.0	0.57	25.0	0.68	0.0276	0.2319

Driving Pressure below Base - Output to Shoring

No Z1 P1 Z2 P2 Slope Ka or Ko

0	25.0	0.68	26.0	0.70	0.0277	0.2320
1	26.0	0.57	27.0	0.60	0.0260	0.1821
2	27.0	0.60	30.0	0.68	0.0282	0.1970
3	30.0	0.68	33.0	0.76	0.0280	0.1957
4	33.0	0.77	36.0	0.85	0.0272	0.1901
5	36.0	0.85	39.0	0.93	0.0273	0.1907
6	39.0	0.93	42.0	1.01	0.0273	0.1911
7	42.0	1.01	45.0	1.10	0.0286	0.2002
8	45.0	1.10	48.0	1.18	0.0271	0.1896
9	48.0	1.18	51.0	1.25	0.0253	0.1769
10	51.0	1.25	54.0	1.33	0.0253	0.1770
11	54.0	1.33	57.0	1.41	0.0253	0.1770
12	57.0	1.40	60.0	1.49	0.0291	0.2034
13	60.0	1.49	63.0	1.57	0.0254	0.1778
14	63.0	1.57	66.0	1.64	0.0256	0.1790
15	66.0	1.64	69.0	1.72	0.0256	0.1791
16	69.0	1.72	72.0	1.80	0.0256	0.1791
17	72.0	1.80	75.0	1.87	0.0259	0.1811
18	75.0	1.87	78.0	1.95	0.0260	0.1818
19	78.0	1.95	81.0	2.03	0.0260	0.1818
20	81.0	2.03	84.0	2.11	0.0260	0.1819
21	84.0	2.11	87.0	2.19	0.0260	0.1819
22	87.0	2.19	90.0	2.26	0.0260	0.1819
23	90.0	2.26	93.0	2.34	0.0260	0.1819
24	93.0	2.34	96.0	2.42	0.0260	0.1819
25	96.0	2.42	99.0	2.50	0.0260	0.1819
26	99.0	2.50	102.0	2.58	0.0260	0.1819
27	102.0	2.58	105.0	2.65	0.0260	0.1819
28	105.0	2.65	108.0	2.73	0.0260	0.1819
29	108.0	2.73	111.0	2.81	0.0260	0.1819
30	111.0	2.81	114.0	2.89	0.0260	0.1819
31	114.0	2.89	117.0	2.97	0.0260	0.1819
32	117.0	2.97	120.0	3.04	0.0260	0.1819
33	120.0	3.04	123.0	3.12	0.0260	0.1819

report. out

34	123.0	3.12	126.0	3.20	0.0260	0.1819
35	126.0	3.20	129.0	3.28	0.0260	0.1819
36	129.0	3.28	132.0	3.36	0.0260	0.1819
37	132.0	3.36	135.0	3.43	0.0260	0.1819
38	135.0	3.43	138.0	3.51	0.0261	0.1827
39	138.0	3.51	141.0	3.60	0.0294	0.2054
40	141.0	3.60	144.0	3.69	0.0291	0.2037
41	144.0	3.69	147.0	3.78	0.0291	0.2036
42	147.0	3.78	150.0	3.86	0.0291	0.2036
43	150.0	3.86	153.0	3.95	0.0289	0.2017
44	153.0	3.95	156.0	4.04	0.0285	0.1994
45	156.0	4.04	159.0	4.12	0.0285	0.1994
46	159.0	4.12	162.0	4.21	0.0285	0.1994
47	162.0	4.21	165.0	4.29	0.0285	0.1994
48	165.0	4.29	168.0	4.38	0.0285	0.1994
49	168.0	4.38	171.0	4.46	0.0285	0.1994
50	171.0	4.46	174.0	4.55	0.0285	0.1994
51	174.0	4.55	177.0	4.63	0.0285	0.1994
52	177.0	4.63	180.0	4.72	0.0285	0.1994
53	180.0	4.72	183.0	4.81	0.0285	0.1994
54	183.0	4.81	186.0	4.89	0.0285	0.1994
55	186.0	4.89	189.0	4.98	0.0285	0.1994
56	189.0	4.98	192.0	5.06	0.0285	0.1994
57	192.0	5.06	195.0	5.15	0.0285	0.1994
58	195.0	5.15	198.0	5.23	0.0285	0.1994
59	198.0	5.23	200.0	5.29	0.0285	0.1994

Passive No	Pressure Z1	below P1	Base Z2	- Output P2	to Shoring Slope	Kp
0	25.0	0.00	26.0	0.44	0.4415	3.7036
1	26.0	0.55	200.0	114.98	0.6576	4.5989

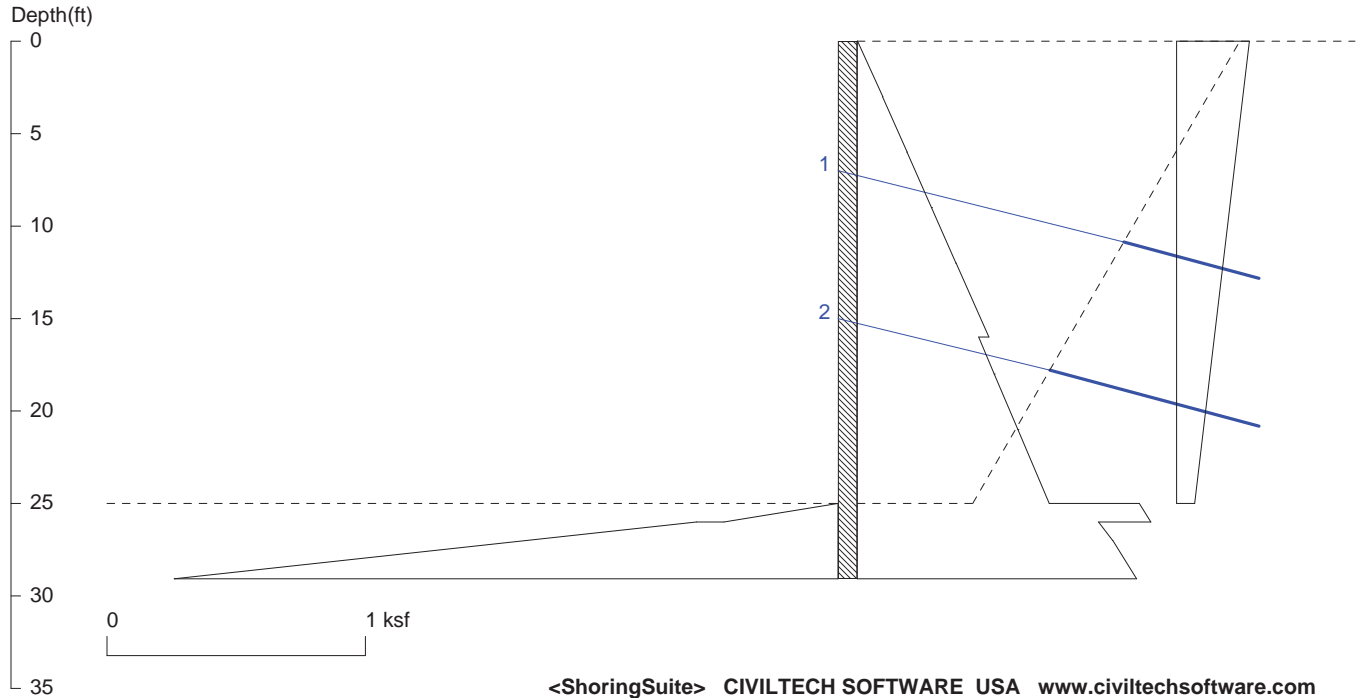
 DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Z, Xa, Xp - Coordinates of ground lines
 Z- Depth measured from wall top
 Xa - Distance measure from wall to active side.
 Xp - Distance measure from wall to passive side

Z1, P1, Z2, P2 - Four values to define a pressure diagram
 Z1- Top depth of the diagram
 P1- Top pressure of the diagram
 Z2- Bottom depth of the diagram
 P2- Bottom pressure of the diagram
 Slope - $(P2-P1)/(Z2-Z1)$, Slope of the diagram. It also called
 Equivalent fluid density. It equals to $Ka \cdot \gamma$ or $Kp \cdot \gamma$
 Ka - Active Earth Pressure Coefficient
 Kp - Passive Earth Pressure Coefficient

Buttgenbach/Lot 44

East Wall Sta. 1+05 Seismic



Licensed to 4324324234 3424343

Date: 4/24/2018

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.sh8

Wall Height=25.0 Pile Diameter=2.5 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=4.07 (8~10ft is recommended!!!) Min. Pile Length=29.07

MOMENT IN PILE: Max. Moment=67.84 per Pile Spacing=6.0 at Depth=21.87

PILE SELECTION:

Request Min. Section Modulus = 24.7 in³/pile=404.25 cm³/pile, F_y= 50 ksi = 345 MPa, F_b/F_y=0.66

W18X35 has Section Modulus = 57.6 in³/pile=943.89 cm³/pile. It is greater than Min. Requirements!

Top Deflection = 0.10(in) based on E (ksi)=29000.00 and I (in⁴)/pile=510.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	7.0	15.0	6.0	40.2*	38.8	10.4	14.9	19.7
2. Tieback	15.0	15.0	6.0	34.3	33.1	8.9	10.8	16.9

* Top Brace increased by 15% (DM7.2-103)

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE): Pressures below will be multiplied by a Factor =1.1

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.001	3.000	0.089	0.029619
3.000	0.089	6.000	0.175	0.028755
6.000	0.175	9.000	0.261	0.028755
9.000	0.261	12.000	0.348	0.028755
12.000	0.348	16.000	0.463	0.028755
16.000	0.427	18.000	0.481	0.027402
18.000	0.482	21.000	0.566	0.027740
21.000	0.565	25.000	0.676	0.027644
*	Below	Base		
25.000	0.992	26.000	1.032	0.040615

26.000	0.849	27.000	0.898	0.049025
27.000	0.899	30.000	1.021	0.040469
*	Earth	Queck		
0.000	0.256	25.000	0.064	-0.007690

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.1

Z1	P1	Z2	P2	Slope
25.0	0.00	26.0	0.44	0.441
26.0	0.55	200.0	114.98	0.658

ACTIVE SPACING:

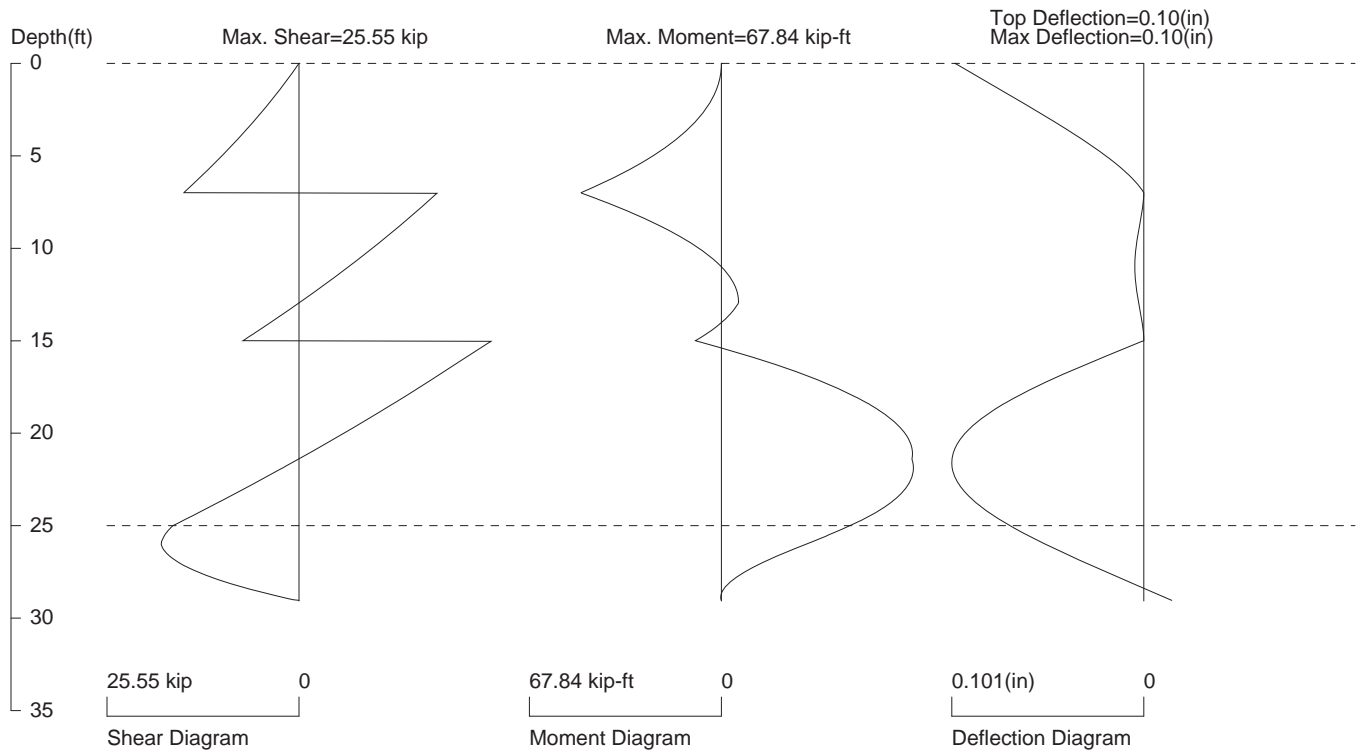
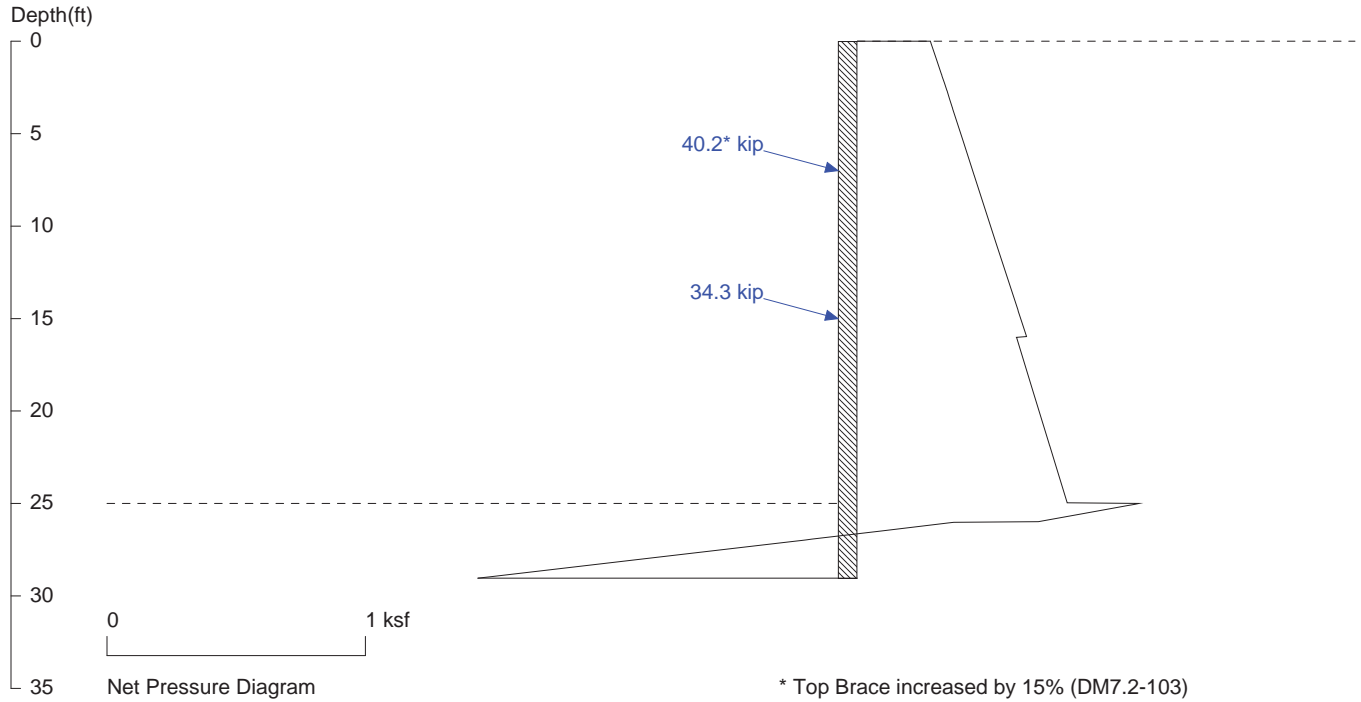
No.	Z depth	Spacing
1	0.00	6.00
2	25.00	2.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	25.00	6.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Buttgenbach/Lot 44 East Wall Sta. 1+05 Seismic



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W18X35: E (ksi)=29000.0, I (in⁴)/pile=510.0

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.sh8

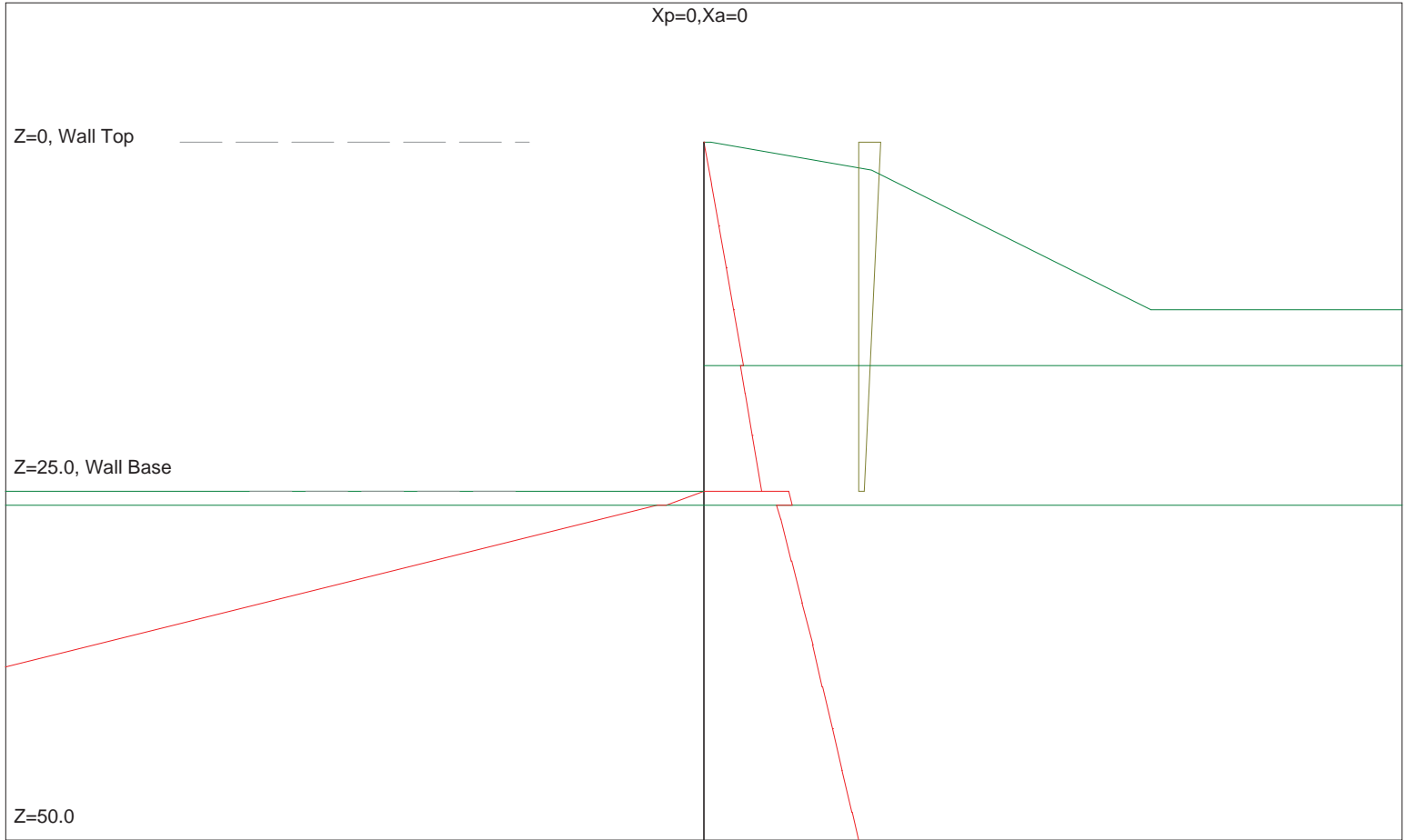
Buttgenbach/Lot 44

East Wall Sta. 1+05 Seismic

Xp=100.0

Xa=100.0

Xp=0, Xa=0



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
 UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.ep8

* INPUT DATA *

Wall Height=25.0 Total Soil Types= 3

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	1.0	1	Afu
2	0.0	1.0	2.0	24.0	1	Afu
3	2.0	24.0	12.0	64.0	1	Afu
4	12.0	64.0	12.0	800.0	1	Afu
5	16.0	0.0	16.0	800.0	2	Qc
6	26.0	0.0	26.0	800.0	3	Tw

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	25.0	0.0	25.0	800.0	2	Qc
2	26.0	0.0	26.0	800.0	3	Tw

Wall Friction Options: 2. Active only (for soldier pile)

Wall Friction = 26

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

*** OUTPUT RESULTS ***

Eae (Total Force above Base)= 12.69 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 8.68

Ee (Total Earthquake Force above Base)= 4.00. Distributed in trapezoid. Total earthquake force acting at 0.4H of wall height

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.00	3.00	0.09	0.0296	0.2576
3.00	0.09	6.00	0.18	0.0288	0.2500
6.00	0.18	9.00	0.26	0.0288	0.2500
9.00	0.26	12.00	0.35	0.0288	0.2500
12.00	0.35	16.00	0.46	0.0288	0.2500
16.00	0.43	18.00	0.48	0.0274	0.2299
18.00	0.48	21.00	0.57	0.0277	0.2327
21.00	0.57	25.00	0.68	0.0276	0.2319

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
25.00	0.99	26.00	1.03	0.0406	0.3407
26.00	0.85	27.00	0.90	0.0490	0.3428
27.00	0.90	30.00	1.02	0.0405	0.2830
30.00	1.03	33.00	1.15	0.0409	0.2857
33.00	1.15	36.00	1.28	0.0433	0.3026
36.00	1.27	39.00	1.38	0.0370	0.2591
39.00	1.39	42.00	1.50	0.0388	0.2713
42.00	1.50	45.00	1.62	0.0374	0.2614
45.00	1.61	48.00	1.73	0.0388	0.2714
48.00	1.74	50.00	1.81	0.0376	0.2627

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
25.00	0.00	26.00	0.44	0.441	3.7036
26.00	0.55	50.00	16.33	0.658	4.5992

Output Earthquake Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Total Earthq. Force, Ee = 4.00

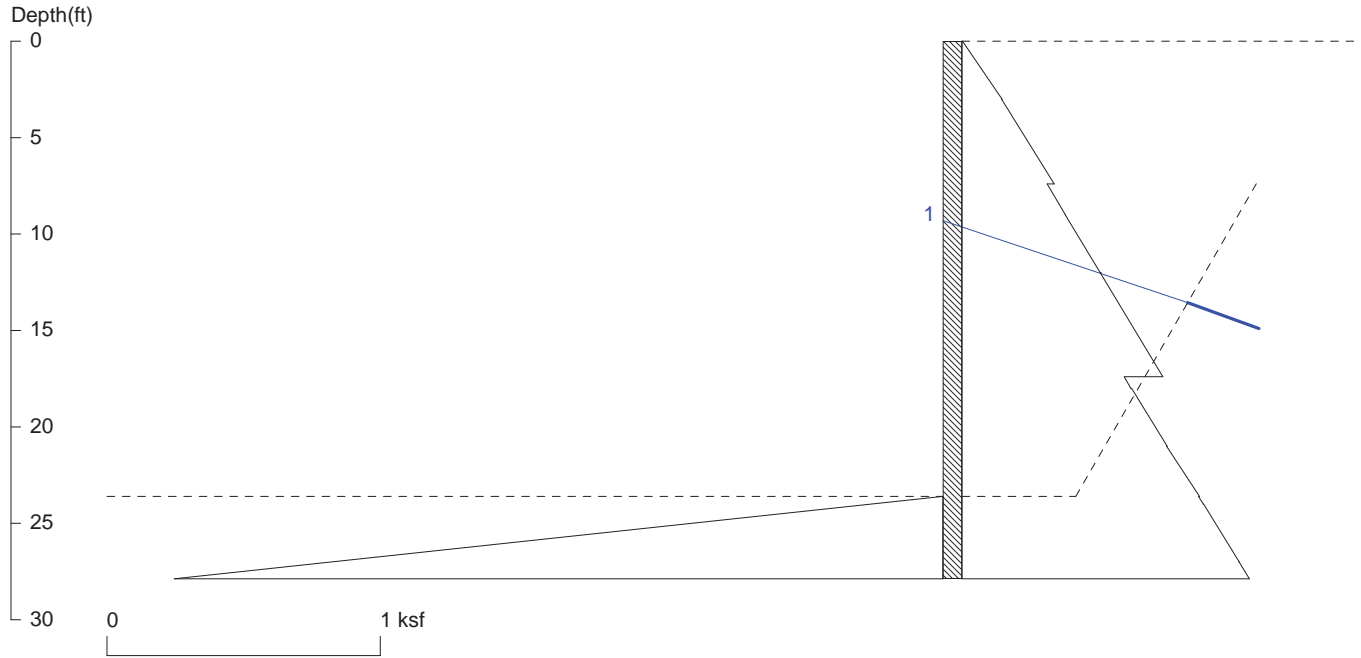
No	Zq1	Pq1	Zq2	Pq2	Slope
0	0.00	0.256	25.00	0.064	-0.008

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 4/24/2018 File Name: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\East\25.0H.ep8

Buttgenbach/Lot 44

West Wall Sta. 0+47



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltechsoftware.com

Licensed to 4324324234 3424343

Date: 4/24/2018

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.sh8

Wall Height=23.6 Pile Diameter=2.5 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=4.28 (8~10ft is recommended!!!) Min. Pile Length=27.88

MOMENT IN PILE: Max. Moment=124.26 per Pile Spacing=6.0 at Depth=18.63

PILE SELECTION:

Request Min. Section Modulus = 45.2 in³/pile=740.48 cm³/pile, F_y= 50 ksi = 345 MPa, F_b/F_y=0.66

W18X35 has Section Modulus = 57.6 in³/pile=943.89 cm³/pile. It is greater than Min. Requirements!

Top Deflection = -0.58(in) based on E (ksi)=29000.00 and I (in⁴)/pile=510.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L _{free}	Fixed Length
1. Tieback	9.3	20.0	6.0	46.4	43.6	15.9	12.4	22.8

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE): Pressures below will be multiplied by a Factor =1.7

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.001	3.000	0.087	0.028338
3.000	0.085	7.400	0.198	0.025749
7.400	0.183	9.000	0.222	0.024551
9.000	0.222	12.00	0.297	0.025054
12.00	0.297	17.40	0.432	0.025014
17.40	0.349	18.00	0.363	0.023960
18.00	0.365	21.00	0.441	0.025422
21.00	0.440	23.60	0.511	0.027250
*	Below	Base		
23.60	0.509	24.00	0.520	0.025416
24.00	0.520	27.00	0.596	0.025471
27.00	0.596	30.00	0.673	0.025536

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.1

Z1	P1	Z2	P2	Slope
23.6	0.00	200.0	116.00	0.658

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	6.00
2	23.60	2.50

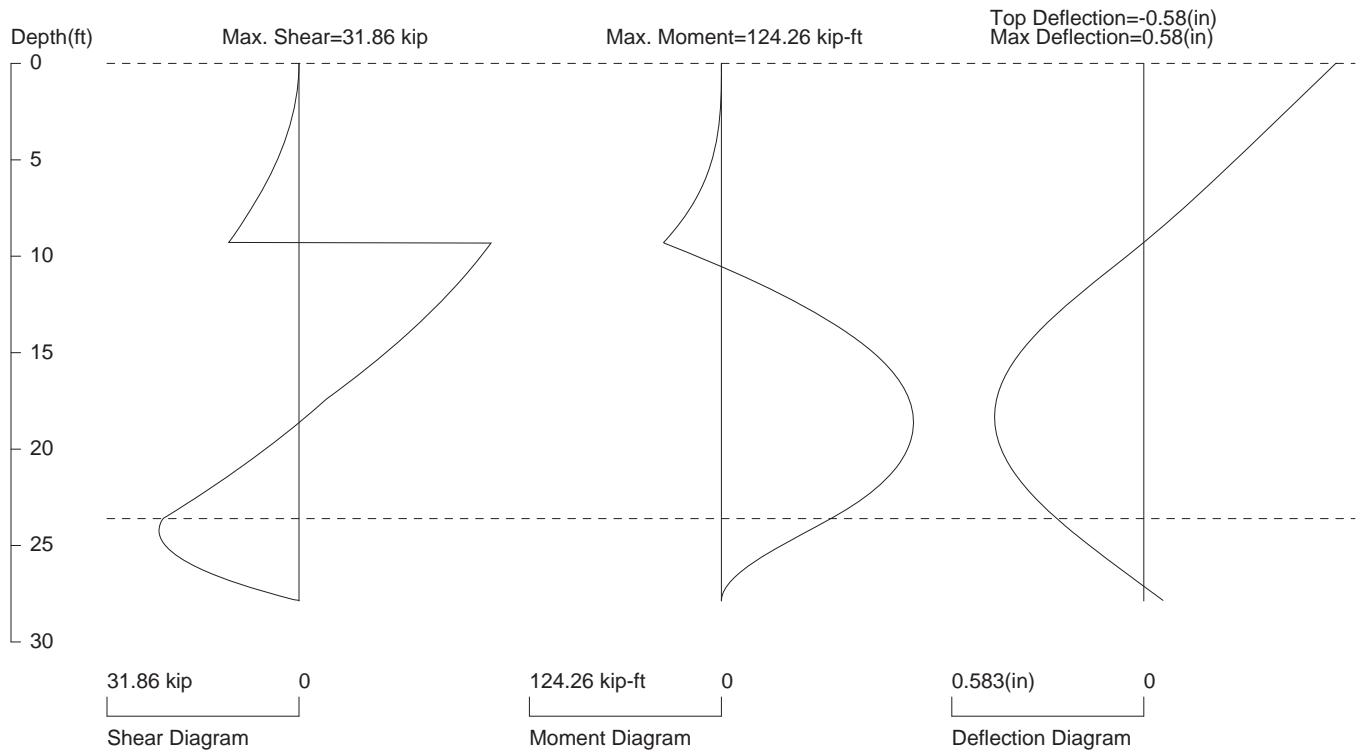
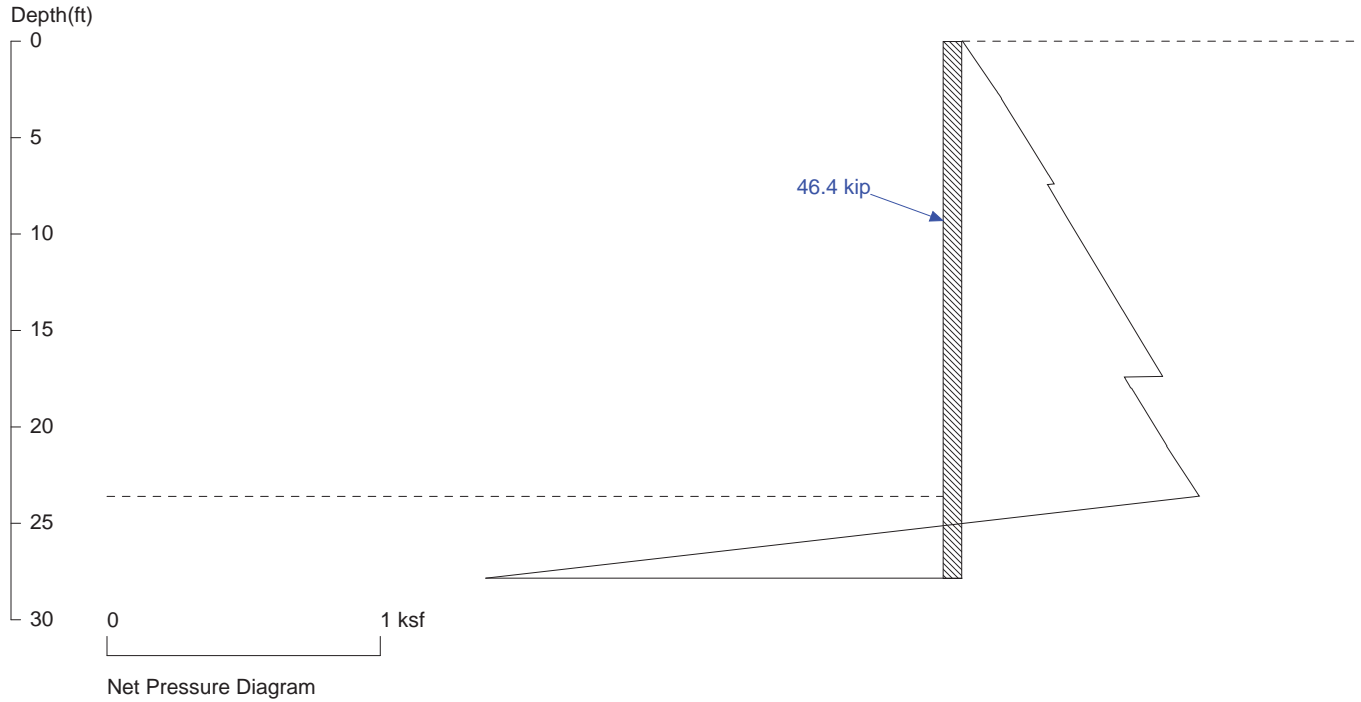
PASSIVE SPACING:

No.	Z depth	Spacing
1	23.60	6.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Buttgenbach/Lot 44

West Wall Sta. 0+47



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W18X35: E (ksi)=29000.0, I (in⁴)/pile=510.0

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.sh8

SHORING WALL CALCULATION SUMMARY
 The leading shoring design and calculation software
 Software Copyright by CivilTech Software
 www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
 The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U. S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS: Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft, Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft³, Deflection - in

 Licensed to 4324324234 3424343
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.sh8

Title: Buttgenbach/Lot 44
 Subtitle: West Wall Sta. 0+47

*****INPUT DATA*****

Wall Type: 2. Soldier Pile, Drilled
 Wall Height: 23.60
 Pile Diameter: 2.50
 Pile Spacing: 6.00
 Factor of Safety (F. S.): 1.10
 Lateral Support Type (Braces): 3. Tieback
 Top Brace Increase (Multi-Bracing): Add 15%*
 Brace Position (One Brace Case): Normal Brace*
 No-Load Zone:
 Vertical Depth for No-Load Zone: 23.60
 H-Distance (Input H/V ratio) for No-Load Zone: 0.25
 Angle from H. Line for No-Load Zone: 60.00
 Embedment Option: 1. Yes
 Friction at Pile Tip: No
 Pile Properties:
 Steel Strength, Fy: 50 ksi = 345 MPa
 Allowable Fb/Fy: 0.66
 Elastic Module, E: 29000.00
 Moment of Inertia, I: 510.00
 User Input Pile: W18X35

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
 The pressures below will be multiplied by a Factor =1.7

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	*	Above	Base		
2	0.000	0.001	3.000	0.087	0.028338
3	3.000	0.085	7.400	0.198	0.025749
4	7.400	0.183	9.000	0.222	0.024551
5	9.000	0.222	12.00	0.297	0.025054

6	12.00	0.297	report. out	0.432	0.025014
7	17.40	0.349	17.40	0.363	0.023960
8	18.00	0.365	18.00	0.441	0.025422
9	21.00	0.440	21.00	0.511	0.027250
10	*	Bel ow	Base		
11	23.60	0.509	24.00	0.520	0.025416
12	24.00	0.520	27.00	0.596	0.025471
13	27.00	0.596	30.00	0.673	0.025536
14	30.00	0.673	33.00	0.749	0.025574
15	33.00	0.749	36.00	0.828	0.026335
16	36.00	0.827	39.00	0.904	0.025599
17	39.00	0.904	42.00	0.981	0.025608
18	42.00	0.981	45.00	1.058	0.025614
19	45.00	1.058	48.00	1.134	0.025618
20	48.00	1.134	51.00	1.211	0.025621
21	51.00	1.211	54.00	1.288	0.025623
22	54.00	1.288	57.00	1.365	0.025624
23	57.00	1.365	60.00	1.442	0.025625
24	60.00	1.442	63.00	1.519	0.025607
25	63.00	1.519	66.00	1.595	0.025577
26	66.00	1.595	69.00	1.672	0.025577
27	69.00	1.672	72.00	1.749	0.025577
28	72.00	1.749	75.00	1.826	0.025577
29	75.00	1.826	78.00	1.902	0.025578
30	78.00	1.902	81.00	1.979	0.025602
31	81.00	1.979	84.00	2.056	0.025619
32	84.00	2.056	87.00	2.133	0.025619
33	87.00	2.133	90.00	2.210	0.025610
34	90.00	2.210	93.00	2.287	0.025610
35	93.00	2.287	96.00	2.363	0.025610
36	96.00	2.363	99.00	2.440	0.025610
37	99.00	2.440	102.0	2.517	0.025610
38	102.0	2.517	105.0	2.594	0.025610
39	105.0	2.594	108.0	2.671	0.025610
40	108.0	2.671	111.0	2.748	0.025610
41	111.0	2.748	114.0	2.824	0.025610
42	114.0	2.824	117.0	2.901	0.025610
43	117.0	2.901	120.0	2.978	0.025610
44	120.0	2.978	123.0	3.055	0.025610
45	123.0	3.055	126.0	3.132	0.025610
46	126.0	3.126	129.0	3.240	0.037868
47	129.0	3.232	132.0	3.318	0.028500
48	132.0	3.318	135.0	3.403	0.028500
49	135.0	3.403	138.0	3.489	0.028500
50	138.0	3.489	141.0	3.574	0.028500
51	141.0	3.574	144.0	3.660	0.028500
52	144.0	3.660	147.0	3.745	0.028500
53	147.0	3.745	150.0	3.831	0.028500
54	150.0	3.831	153.0	3.916	0.028500
55	153.0	3.916	156.0	4.002	0.028500
56	156.0	4.002	159.0	4.087	0.028500
57	159.0	4.087	162.0	4.173	0.028500
58	162.0	4.173	165.0	4.258	0.028500
59	165.0	4.258	168.0	4.344	0.028500
60	168.0	4.344	171.0	4.429	0.028500
61	171.0	4.429	174.0	4.515	0.028500
62	174.0	4.515	177.0	4.600	0.028500
63	177.0	4.600	180.0	4.686	0.028500
64	180.0	4.686	183.0	4.771	0.028500
65	183.0	4.771	186.0	4.857	0.028500
66	186.0	4.857	189.0	4.942	0.028500
67	189.0	4.942	192.0	5.028	0.028500
68	192.0	5.028	195.0	5.113	0.028500

69	195.0	5.113	report. out	5.199	0.028500
70	198.0	5.199	198.0	5.256	0.028500
			200.0		

* PASSIVE PRESSURE *

The pressures below will be divided by a Factor of Safety =1.1

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Sl ope
1	23.60	0.00	200.00	116.00	0.6576

* ACTIVE SPACE *

No.	Z depth	Spaci ng
1	0.00	6.00
2	23.60	2.50

* PASSIVE SPACE *

No.	Z depth	Spaci ng
1	23.60	6.00

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	Z brace	Angl e	Spaci ng	Input1*	Input2*
1	9.30	20.0	6.00	0.50	1.30

 Type Ti eback

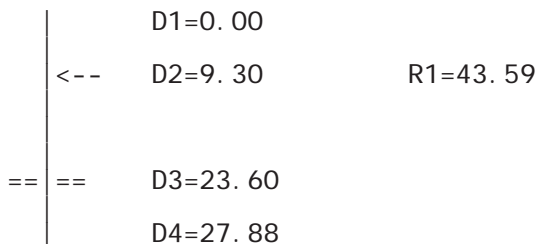
*For Tieback: Input1 = Di ameter; Input2 = Bond Stength
 *For Plate: Input1 = Di ameter; Input2 = Al lowabl e Pressure
 *For Deaman: Input1 = Horz. Wi dth; Input2 = Al lowabl e Pressure; Angl e = 0

*****CALCULATI ON*****

The calculated moment and shear are per pile spacing. Sheet piles are per one foot or meter; Sol dier piles are per pile.

Top Pressures start at depth = 0.00

NUMBER OF BRACE LEVEL = 1



D1 - TOP DEPTH
 D2 - BRACE DEPTH
 D3 - EXCAVATI ON BASE
 D4 - PILE TIP
 R1 - REACTI ON

report.out

TOTAL REACTION: R1 = 43.59
TOTAL PRESSURES ACTING ON WALL = 43.59
Total Reactions = Total Pressures, OK!

BRACE NO. 1 AT DEPTH = 9.30
R1 = Brace Load = 43.59

*****RESULTS*****

* EMBEDMENT *
MINIMUM EMBEDMENT = 4.28 (8~10ft recommended!!!)
TOTAL MINIMUM PILE LENGTH = 27.88

* MOMENT IN PILE (per pile spacing)*
Pile Spacing: sheet piles are one foot or one meter; soldier piles are one pile.
No. Depth M @ Brace Mmax in Span Depth of Mmax

1 9.30 37.38 124.26 18.63

Overall Maximum Moment = 124.26 at 18.63
Maximum Shear = 31.86
Moment and Shear are per pile spacing: 6.0 foot or meter

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *
The calculated brace force are per brace spacing.

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
1	9.30	20.0	6.00	43.59	15.86

46.39

No.	DEPTH	Free length	Type and Data
1	9.30	12.45	Tieback, Bond length = 22.79

* VERTICAL LOADING *
Vertical Loading from Braces = 15.86
Vertical Loading from External Load = 0.00
Total Vertical Loading = 15.86

*****SPECIFIED PILE *****

Overall Maximum Moment = 124.26 at 18.63
The pile selection is based on the magnitude of the moment only. Axial force is neglected.

Request Min. Section Modulus = 45.19 in³/pile = 740.48 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X35 has been found in Soldier Pile list!
(English Units):
Area= 10.3 in. Depth= 17.7 in. Width= 6 in. Height= 18 in.
Flange thickness= 0.425 in. Web thickness= 0.3 in.
Ix= 510 in⁴/pile Sx= 57.6 in³/pile Iy= 15.3 in⁴/pile Sy= 5.12 in³/pile

report.out

(Metric Units):

$I_x = 212.26 \times 100 \text{ cm}^4/\text{pile}$ $S_x = 943.89 \text{ cm}^3/\text{pile}$ $I_y = 6.37 \times 100 \text{ cm}^4/\text{pile}$ $S_y = 83.90 \text{ cm}^3/\text{pile}$

The pile selection is based on the magnitude of the moment only. Axial force is neglected.

W18X35 is capable to support the shoring!

Top deflection = -0.583(in)

Max. deflection = 0.583(in)

***** LAGGING SIZE ESTIMATION *****

Max. Pressure above base = 0.87

Piles are more rigid than timber lagging, only portion of pressures are acting to lagging, 30-50% arching is suggested.

If 50% arching is used for lagging design, Design Pressure = 0.43

Pile Spacing = 6.0, Max. Moment in lagging = 1.95

For 4"x12" Timber, Section Modulus $S = 23.47 \text{ in}^3$. The request allowable bending strength, $fb = M/S = 1.00$

For 6"x12" Timber, Section Modulus $S = 57.98 \text{ in}^3$. The request allowable bending strength, $fb = M/S = 0.40$

If 30% arching is used for lagging design, Design Pressure = 0.26

Pile Spacing = 6.0, Max. Moment in lagging = 1.17

For 4"x12" Timber, Section Modulus $S = 23.47 \text{ in}^3$. The request allowable bending strength, $fb = M/S = 0.60$

For 6"x12" Timber, Section Modulus $S = 57.98 \text{ in}^3$. The request allowable bending strength, $fb = M/S = 0.24$

Unit: Pressure: ksf, Spacing: ft, Moment: kip-ft, Bending Strength, fb: ksi

Buttgenbach/Lot 44

West Wall Sta. 0+47

Xp=94.4

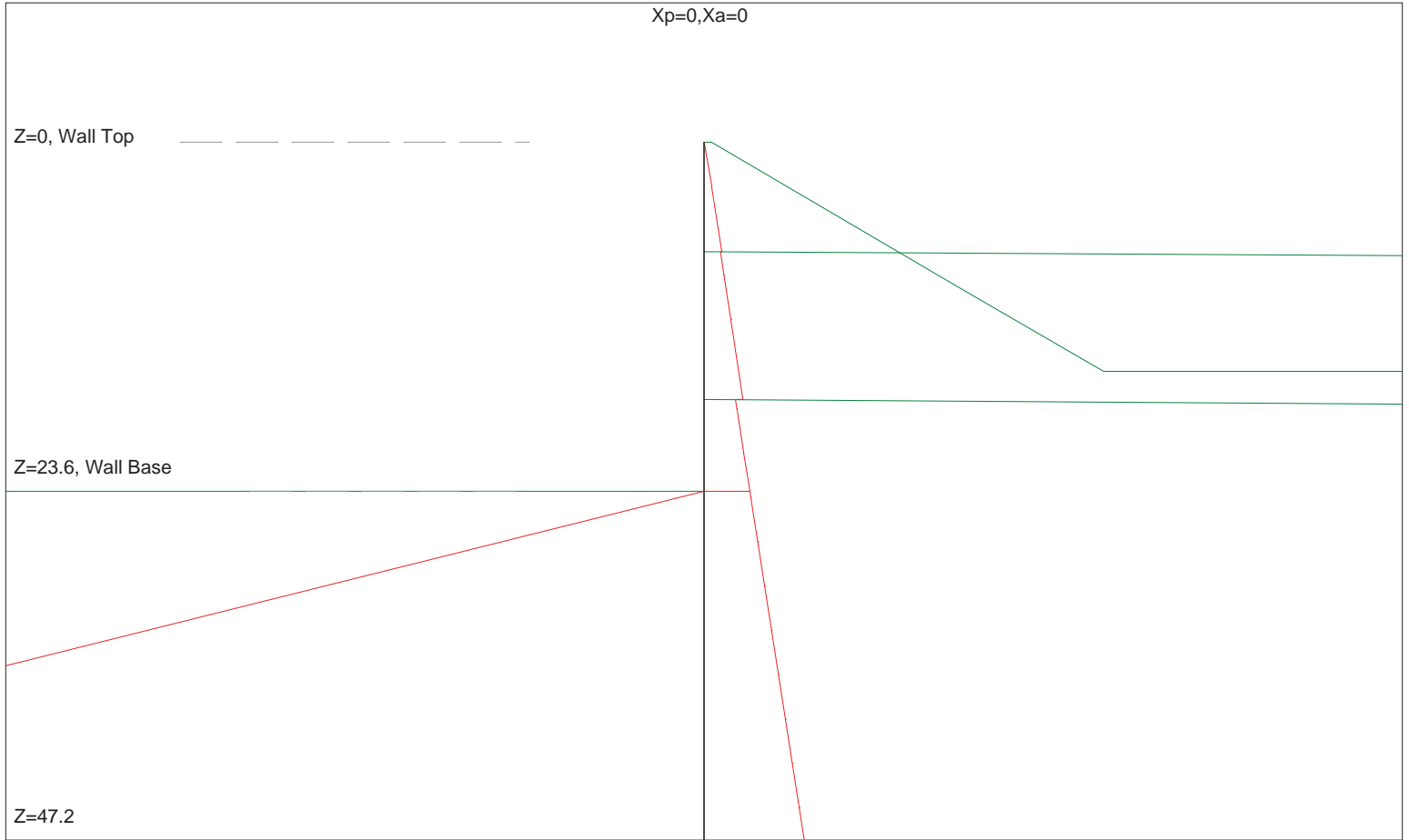
Xa=94.4

Xp=0, Xa=0

Z=0, Wall Top

Z=23.6, Wall Base

Z=47.2



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
 UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.ep8

* INPUT DATA *

Wall Height=23.6 Total Soil Types= 3

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	1.0	1	Afu
2	0.0	1.0	9.7	34.0	1	Afu
3	9.7	34.0	15.5	54.0	1	Afu
4	15.5	54.0	15.5	800.0	1	Afu
5	7.4	0.0	9.7	800.0	2	Qc
6	17.4	0.0	20.0	800.0	3	Tw

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	23.6	0.0	23.6	800.0	3	Tw

Wall Friction Options: 2. Active only (for soldier pile)

Wall Friction = 26

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Eae (Total Force above Base)= 6.48 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 6.48

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.00	3.00	0.09	0.0283	0.2464
3.00	0.08	7.40	0.20	0.0257	0.2239
7.40	0.18	9.00	0.22	0.0246	0.2060
9.00	0.22	12.00	0.30	0.0251	0.2102
12.00	0.30	17.40	0.43	0.0250	0.2099
17.40	0.35	18.00	0.36	0.0240	0.1676
18.00	0.36	21.00	0.44	0.0254	0.1778
21.00	0.44	23.60	0.51	0.0273	0.1906

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
23.60	0.51	24.00	0.52	0.0254	0.1777
24.00	0.52	27.00	0.60	0.0255	0.1781
27.00	0.60	30.00	0.67	0.0255	0.1786
30.00	0.67	33.00	0.75	0.0256	0.1788
33.00	0.75	36.00	0.83	0.0263	0.1842
36.00	0.83	39.00	0.90	0.0256	0.1790
39.00	0.90	42.00	0.98	0.0256	0.1791
42.00	0.98	45.00	1.06	0.0256	0.1791
45.00	1.06	47.20	1.11	0.0256	0.1791

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
23.60	0.00	47.20	15.52	0.658	4.5989

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 4/24/2018 File Name: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.ep8

EARTH PRESSURE ANALYSIS SUMMARY
<EarthPres>
Software Copyright by CivilTech Software
www.civiltechsoftware.com

Li censed to 4324324234 3424343
Date: 4/24/2018 File: X:\Offi ce\Proj ects\02732-Buttgenbach\002-Shori ng Lot
44\ENG\West\23.6H.ep8

Title 1: Buttgenbach/Lot 44
Title 2: West Wall Sta. 0+47

Input data: *****

Wall Height = 23.60
Depth of Ground at Active Side = 0.00
Depth of Ground at Passive Side = 23.60
Apparent Pressure Envelope: 1.* Actual Pressures (All walls, All soils)
Pressure Type: 1.* Active, Ka
Earthquake Loading Apply to: 1. No Earthq. Loads
Earthquake Horizontal Acceleration, Kh = 0.175
Earthquake Vertical Acceleration, Kv = 0.09
Calculation Methods: 1.* Numerical Solution (Wedge Analysis)
Wall Friction Options: 2. Active only (for soldier pile)
Wall Friction = 26
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*
Water Density = 62.4
Water Pressure: 1.* No seepage at wall tip

User's Settings
Ignore Passive from Depth = 0
Multiplier of Active Pressure = 1
Multiplier of Passive Pressure = 1
Multiplier of Water Pressure = 1
Multiplier of Earthq. Pressure = 1
Estimated Embedment: Very Shallow: 2H

Program's Settings
Max. Height, Hmax = 200.00
Analysis Segment, dz = 0.59
No. of Active Segment at H, nz0 = 8
No. of Active Segment at Hmax, nz = 68
No. of Passive Segment, nzp = 1
Active Depth at H, Zh = 23.60
Active Depth at Hmax, Z = 200.00
Passive Depth at Hmax, Zp = 200.00
Max. Pressure = 116.01

Total Soil Types= 3

Table with 8 columns: Soil, Weight, W(S), Phi, Cohesion, Nspt, Type, Description. Rows 1-3 with values for Afu, Qc, Tw.

Ground Surface at Active Side:

Table with 6 columns: Line, Z1, Xa1, Z2, Xa2, Soil No. Rows 1-5 with numerical values.

6 17.4 0.0 20.0 800.0 report. out 3

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.
1	23.6	0.0	23.6	800.0	3

Output data: *****

Eae (Active/At-Rest Force above Base)= 6.48 per one linear foot (or meter) width along wall height
 Ea (Total Static Force above Base)= 6.48C:\Shoring8\report.out

Actual Pressure above Base - Output to Shoring

Active/At-Rest Force above Base, Ea = 6.48

No	Z1	P1	Z2	P2	Slope	Ka or Ko
0	0.0	0.00	3.0	0.09	0.0283	0.2464
1	3.0	0.08	7.4	0.20	0.0257	0.2239
2	7.4	0.18	9.0	0.22	0.0246	0.2060
3	9.0	0.22	12.0	0.30	0.0251	0.2102
4	12.0	0.30	17.4	0.43	0.0250	0.2099
5	17.4	0.35	18.0	0.36	0.0240	0.1676
6	18.0	0.36	21.0	0.44	0.0254	0.1778
7	21.0	0.44	23.6	0.51	0.0273	0.1906

Driving Pressure below Base - Output to Shoring

No Z1 P1 Z2 P2 Slope Ka or Ko

0	23.6	0.51	24.0	0.52	0.0254	0.1777
1	24.0	0.52	27.0	0.60	0.0255	0.1781
2	27.0	0.60	30.0	0.67	0.0255	0.1786
3	30.0	0.67	33.0	0.75	0.0256	0.1788
4	33.0	0.75	36.0	0.83	0.0263	0.1842
5	36.0	0.83	39.0	0.90	0.0256	0.1790
6	39.0	0.90	42.0	0.98	0.0256	0.1791
7	42.0	0.98	45.0	1.06	0.0256	0.1791
8	45.0	1.06	48.0	1.13	0.0256	0.1791
9	48.0	1.13	51.0	1.21	0.0256	0.1792
10	51.0	1.21	54.0	1.29	0.0256	0.1792
11	54.0	1.29	57.0	1.37	0.0256	0.1792
12	57.0	1.37	60.0	1.44	0.0256	0.1792
13	60.0	1.44	63.0	1.52	0.0256	0.1791
14	63.0	1.52	66.0	1.60	0.0256	0.1789
15	66.0	1.60	69.0	1.67	0.0256	0.1789
16	69.0	1.67	72.0	1.75	0.0256	0.1789
17	72.0	1.75	75.0	1.83	0.0256	0.1789
18	75.0	1.83	78.0	1.90	0.0256	0.1789
19	78.0	1.90	81.0	1.98	0.0256	0.1790
20	81.0	1.98	84.0	2.06	0.0256	0.1792
21	84.0	2.06	87.0	2.13	0.0256	0.1792
22	87.0	2.13	90.0	2.21	0.0256	0.1791
23	90.0	2.21	93.0	2.29	0.0256	0.1791
24	93.0	2.29	96.0	2.36	0.0256	0.1791
25	96.0	2.36	99.0	2.44	0.0256	0.1791
26	99.0	2.44	102.0	2.52	0.0256	0.1791
27	102.0	2.52	105.0	2.59	0.0256	0.1791
28	105.0	2.59	108.0	2.67	0.0256	0.1791
29	108.0	2.67	111.0	2.75	0.0256	0.1791
30	111.0	2.75	114.0	2.82	0.0256	0.1791
31	114.0	2.82	117.0	2.90	0.0256	0.1791
32	117.0	2.90	120.0	2.98	0.0256	0.1791
33	120.0	2.98	123.0	3.05	0.0256	0.1791
34	123.0	3.05	126.0	3.13	0.0256	0.1791

					report. out	
35	126.0	3.13	129.0	3.24	0.0379	0.2648
36	129.0	3.23	132.0	3.32	0.0285	0.1993
37	132.0	3.32	135.0	3.40	0.0285	0.1993
38	135.0	3.40	138.0	3.49	0.0285	0.1993
39	138.0	3.49	141.0	3.57	0.0285	0.1993
40	141.0	3.57	144.0	3.66	0.0285	0.1993
41	144.0	3.66	147.0	3.75	0.0285	0.1993
42	147.0	3.75	150.0	3.83	0.0285	0.1993
43	150.0	3.83	153.0	3.92	0.0285	0.1993
44	153.0	3.92	156.0	4.00	0.0285	0.1993
45	156.0	4.00	159.0	4.09	0.0285	0.1993
46	159.0	4.09	162.0	4.17	0.0285	0.1993
47	162.0	4.17	165.0	4.26	0.0285	0.1993
48	165.0	4.26	168.0	4.34	0.0285	0.1993
49	168.0	4.34	171.0	4.43	0.0285	0.1993
50	171.0	4.43	174.0	4.51	0.0285	0.1993
51	174.0	4.51	177.0	4.60	0.0285	0.1993
52	177.0	4.60	180.0	4.69	0.0285	0.1993
53	180.0	4.69	183.0	4.77	0.0285	0.1993
54	183.0	4.77	186.0	4.86	0.0285	0.1993
55	186.0	4.86	189.0	4.94	0.0285	0.1993
56	189.0	4.94	192.0	5.03	0.0285	0.1993
57	192.0	5.03	195.0	5.11	0.0285	0.1993
58	195.0	5.11	198.0	5.20	0.0285	0.1993
59	198.0	5.20	200.0	5.26	0.0285	0.1993

Passive Pressure below Base - Output to Shoring						
No	Z1	P1	Z2	P2	Slope	Kp
0	23.6	0.00	200.0	116.01	0.6576	4.5989

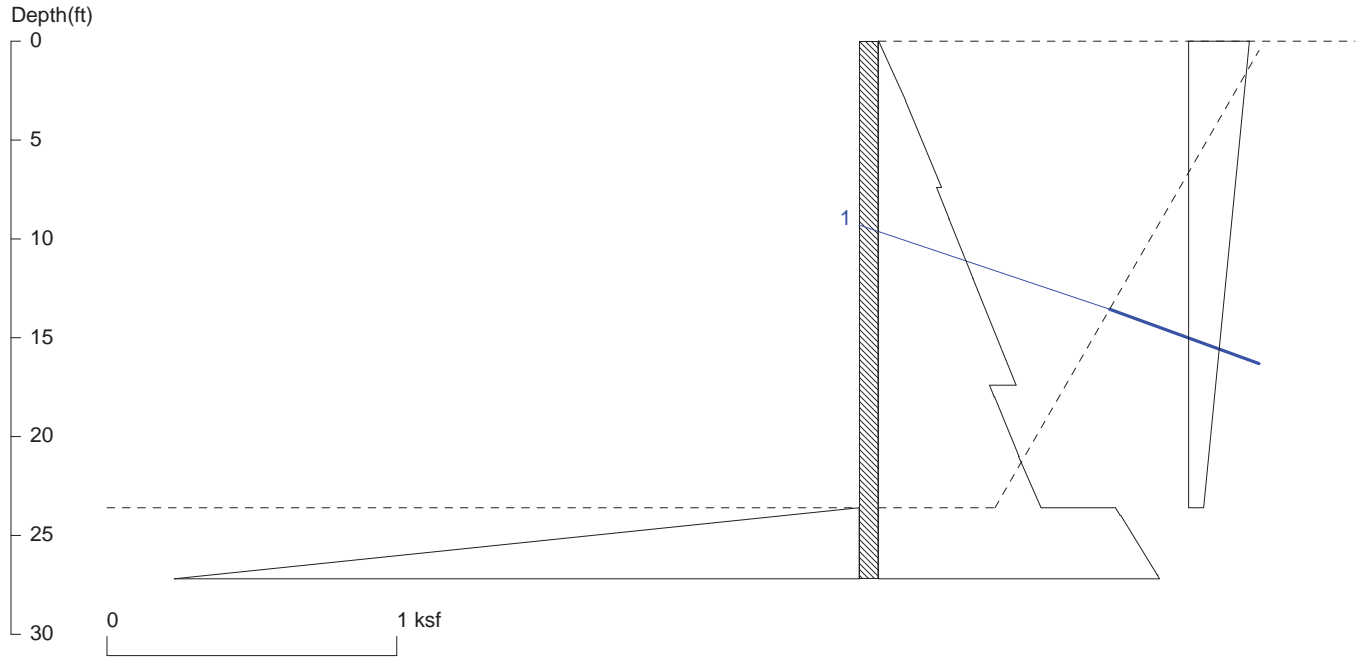
 DEPTH/DI STANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Z, Xa, Xp - Coordinates of ground lines
 Z- Depth measured from wall top
 Xa - Distance measure from wall to active side.
 Xp - Distance measure from wall to passive side

Z1, P1, Z2, P2 - Four values to define a pressure diagram
 Z1- Top depth of the diagram
 P1- Top pressure of the diagram
 Z2- Bottom depth of the diagram
 P2- Bottom pressure of the diagram
 Slope - $(P2-P1)/(Z2-Z1)$, Slope of the diagram. It also called
 Equivalent fluid density. It equals to $Ka*\Gamma$ or $Kp*\Gamma$
 Ka - Active Earth Pressure Coefficient
 Kp - Passive Earth Pressure Coefficient

Buttgenbach/Lot 44

West Wall Sta. 0+47 Seismic



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltechsoftware.com

Licensed to 4324324234 3424343

Date: 4/24/2018

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.sh8

Wall Height=23.6 Pile Diameter=2.5 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=3.59 (8~10ft is recommended!!!) Min. Pile Length=27.19

MOMENT IN PILE: Max. Moment=73.57 per Pile Spacing=6.0 at Depth=19.13

PILE SELECTION:

Request Min. Section Modulus = 26.8 in³/pile=438.39 cm³/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

W18X35 has Section Modulus = 57.6 in³/pile=943.89 cm³/pile. It is greater than Min. Requirements!

Top Deflection = -0.03(in) based on E (ksi)=29000.00 and I (in⁴)/pile=510.0

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	9.3	20.0	6.0	49.2	46.2	16.8	12.4	24.2

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE): Pressures below will be multiplied by a Factor =1.1

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.001	3.000	0.087	0.028338
3.000	0.085	7.400	0.198	0.025749
7.400	0.183	9.000	0.222	0.024551
9.000	0.222	12.000	0.297	0.025054
12.000	0.297	17.400	0.432	0.025014
17.400	0.349	18.000	0.363	0.023960
18.000	0.365	21.000	0.441	0.025422
21.000	0.440	23.600	0.511	0.027250
*	Below	Base		
23.600	0.744	24.000	0.759	0.037643
24.000	0.761	27.000	0.875	0.038022
27.000	0.875	30.000	0.989	0.037811

*	Earth	Queck		
0.000	0.191	23.600	0.048	-0.006076

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.1

Z1	P1	Z2	P2	Slope
23.6	0.00	200.0	116.01	0.658

ACTIVE SPACING:

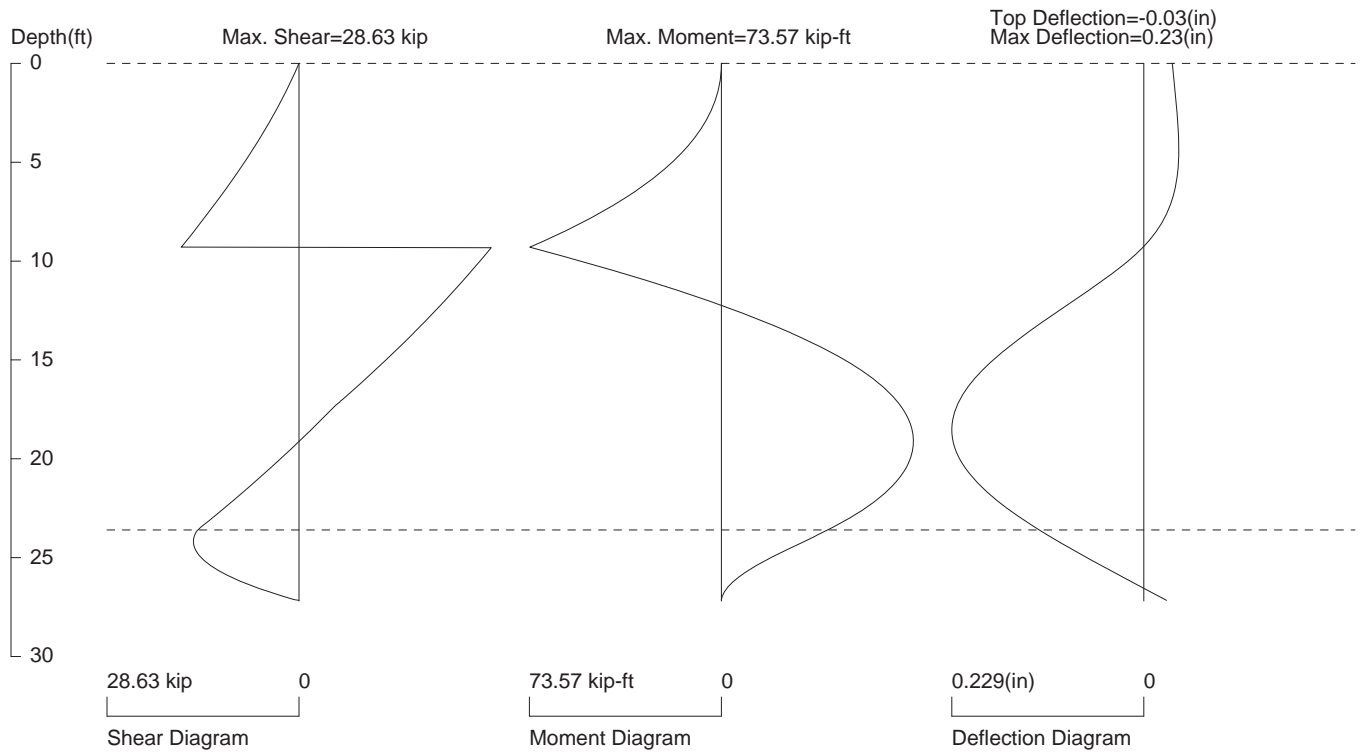
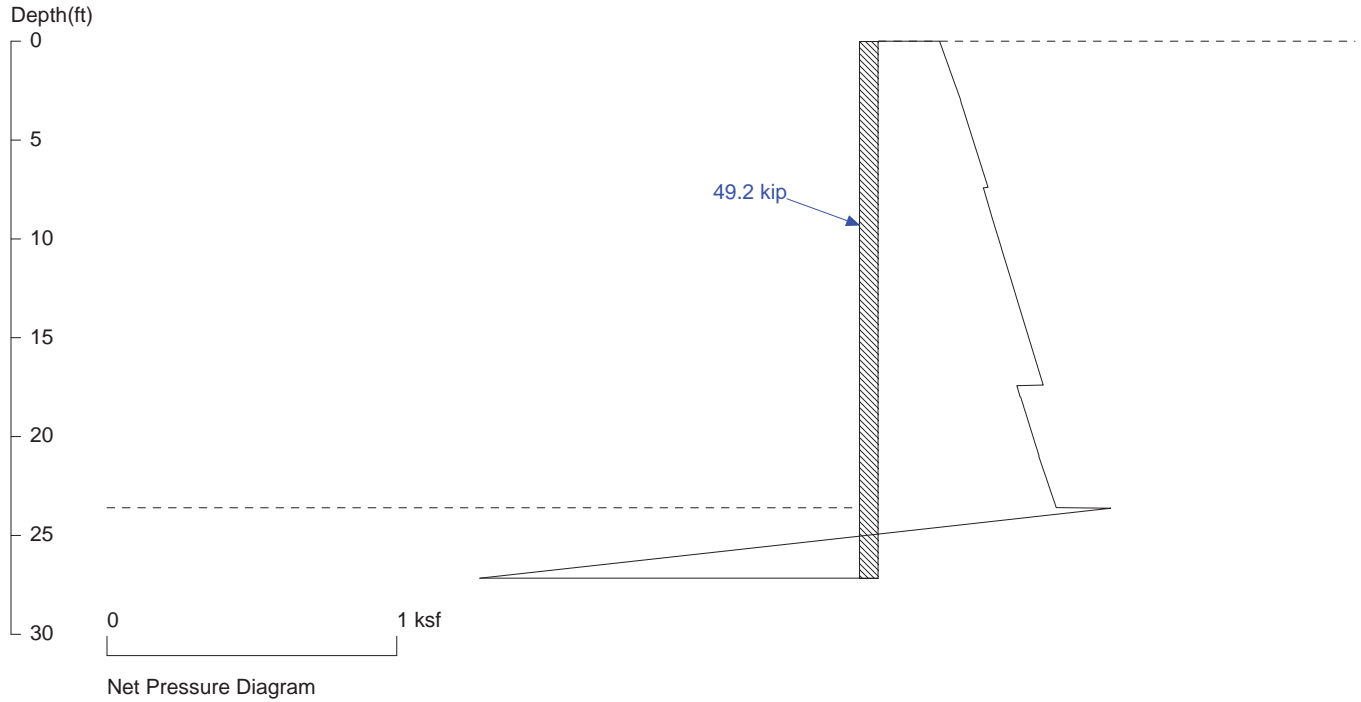
No.	Z depth	Spacing
1	0.00	6.00
2	23.60	2.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	23.60	6.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

Buttgenbach/Lot 44 West Wall Sta. 0+47 Seismic



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W18X35: E (ksi)=29000.0, I (in⁴)/pile=510.0

File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.sh8

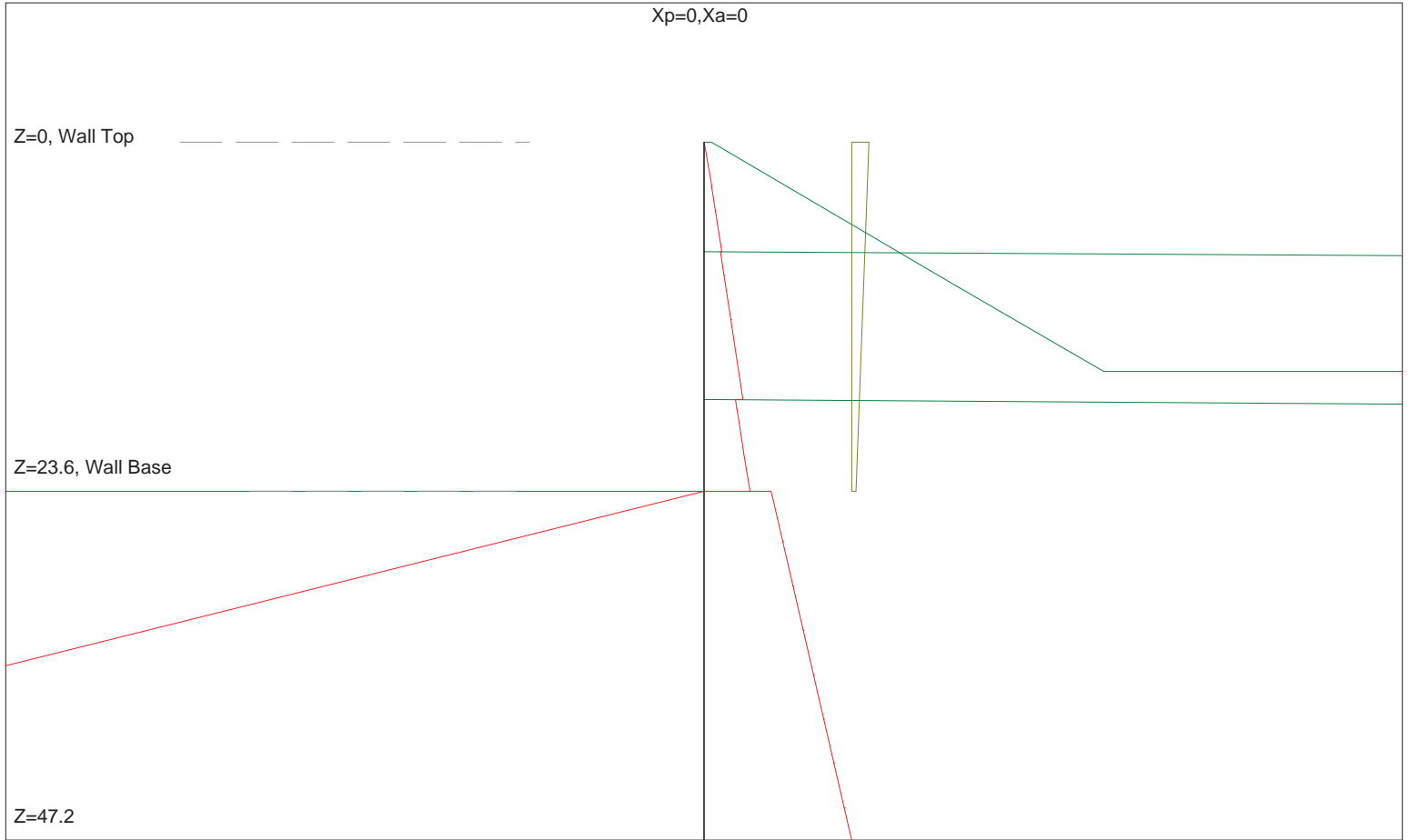
Buttgenbach/Lot 44

West Wall Sta. 0+47 Seismic

Xp=94.4

Xa=94.4

Xp=0, Xa=0



<EarthPres> CIVILTECH SOFTWARE www.civiltechsoftware.com * Licensed to 4324324234 3424343
 UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf
 Date: 4/24/2018 File: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.ep8

* INPUT DATA *

Wall Height=23.6 Total Soil Types= 3

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	115.0	126.5	33.0	0.00	10	4	Afu
2	119.2	131.1	35.1	0.00	15	4	Qc
3	143.0	157.3	40.0	0.00	50	5	Tw

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	1.0	1	Afu
2	0.0	1.0	9.7	34.0	1	Afu
3	9.7	34.0	15.5	54.0	1	Afu
4	15.5	54.0	15.5	800.0	1	Afu
5	7.4	0.0	9.7	800.0	2	Qc
6	17.4	0.0	20.0	800.0	3	Tw

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	23.6	0.0	23.6	800.0	3	Tw

Wall Friction Options: 2. Active only (for soldier pile)

Wall Friction = 26

Wall Batter Angle = 0

Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*

Water Density = 62.4

Water Pressure: 1.* No seepage at wall tip

*** OUTPUT RESULTS ***

Eae (Total Force above Base)= 9.30 per one linear foot (or meter) width along wall height

Ea (Total Static Force above Base)= 6.48

Ee (Total Earthquake Force above Base)= 2.82. Distributed in trapezoid. Total earthquake force acting at 0.4H of wall height

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
0.00	0.00	3.00	0.09	0.0283	0.2464
3.00	0.08	7.40	0.20	0.0257	0.2239
7.40	0.18	9.00	0.22	0.0246	0.2060
9.00	0.22	12.00	0.30	0.0251	0.2102
12.00	0.30	17.40	0.43	0.0250	0.2099
17.40	0.35	18.00	0.36	0.0240	0.1676
18.00	0.36	21.00	0.44	0.0254	0.1778
21.00	0.44	23.60	0.51	0.0273	0.1906

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pa1	Z2	Pa2	Slope	Ka or Ko
23.60	0.74	24.00	0.76	0.0376	0.2632
24.00	0.76	27.00	0.88	0.0380	0.2659
27.00	0.88	30.00	0.99	0.0378	0.2644
30.00	0.99	33.00	1.10	0.0379	0.2647
33.00	1.10	36.00	1.22	0.0379	0.2649
36.00	1.22	39.00	1.33	0.0379	0.2650
39.00	1.33	42.00	1.44	0.0379	0.2651
42.00	1.44	45.00	1.56	0.0379	0.2652
45.00	1.56	47.20	1.64	0.0379	0.2651

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 1

Z1	Pp1	Z2	Pp2	Slope	Kp
23.60	0.00	47.20	15.52	0.658	4.5989

Output Earthquake Pressure above Base - Output to Shoring - Multiplier of Pressure = 1

Total Earthq. Force, Ee = 2.82

No	Zq1	Pq1	Zq2	Pq2	Slope
0	0.00	0.191	23.60	0.048	-0.006

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 4/24/2018 File Name: X:\Office\Projects\02732-Buttgenbach\002-Shoring Lot 44\ENG\West\23.6H.ep8