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March 2, 2017

Mr. Paul Loete
Illinois Department of Transportation
Attn: Michael Short
700 East Norris Drive
Ottawa, IL 61350

PTB 146/19 Work Order 22
SN 050-0258, IL 170 over BNSF Railroad in Ransom
Geotechnical Design Memorandum (#2) for SN050-0258
Region 2/District 3

Mr. Short:

As requested, we addressed 3 items related to the Abbreviated SGR for SN 050-0258.

1. Add MS16 piles to the Pile Design Tables for the North and South Abutments: To perform this analysis, we used the IDOT Pile Length spreadsheet, but changed the pile shape dimensions to that of the MS16 as we discussed for the previous GDM. See Table 1 for a summary of changes made. The drive stress and the drive stress factor remained unchanged at 45 ksi and 0.85, respectively. The attached North Abutment Pile Design Table reflects pre-coring the top 10 ft. of soil below the abutment cap, the South Abutment table does not.

Table 1, Summary of Pile Dimensions

Pile Type & Size	Plug Perimeter, ft.	Plug End Area, sqft.	Drive Area, sqin.
MS 16, with 0.312" walls	4.189	1.396	15.379
MS 16, with 0.375" walls	4.189	1.396	18.41

Enclosed please find the resulting pile length/resistance table for your use.

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2. The BBS is developing new integral abutment criteria: Based on a draft copy of the Integral Abutment Pile Selection chart, it appears almost all piles shown are permissible for use in an integral abutment, without having to pre-core 10 ft. below the bottom of the pile cap as recommended in the SGR. We have included the draft chart and revised Pile Design Tables (including MS16 piles) for the North Abutment. Design tables do not reflect pre-coring at the north abutment.

3. The North Abutment Pile Design Table (in the revised March 23, 2016 SGR) reflects the reduction in capacity due to pre-coring 10 ft. below the abutment cap. The South Abutment Design Tables in the SGR do not reflect pre-coring.

If you have any questions please don't hesitate to contact me at your convenience.

Respectfully submitted,

Terrence L. McCleary

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Using DRAFT BBS Integral Abutment Pile Selection chart…

Using input data from Integral Abutment Feasibility Analysis for "IL 170 over BNSF Railroad w/o precore" spreadsheet (see Abbreviated SGR for SN 050-0258, revised 3-23-16)
EEL = 119.23 ft.
Skew = 11°

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IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== N Abut
REFERENCE BORING ========== 6
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 718.55 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 706.55 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 1322 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 35.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.71 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.77 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.375" walls
Pile Perimeter========== 4.189 FT.
Pile End Bearing Area========== 1.396 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
704 KIPS	**698** KIPS	**384** KIPS	**77** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
704.52	2.03	2.00	7		15.5		***50.7***	51	0	0	28	14
702.02	2.50	2.30	8		20.9	35.2	***105.3***	105	0	0	58	17
699.52	2.50	4.50	12		34.1	68.9	***139.4***	139	0	0	77	19
697.02	2.50	4.50	13		34.1	68.9	***173.4***	173	0	0	95	22
694.52	2.50	4.50	14		34.1	68.9	***207.5***	208	0	0	114	24
692.02	2.50	4.50	14		34.1	68.9	***241.6***	242	0	0	133	27
689.52	2.50	4.50	30		34.1	68.9	***245.0***	245	0	0	135	29
687.02	2.50	2.50	7		22.1	38.3	***270.2***	270	0	0	149	32
684.52	2.50	2.70	10		23.3	41.3	***469.6***	470	0	0	258	34
682.02	2.50		33	Hard Till	19.1	217.5	***428.9***	429	0	0	236	37
679.52	2.50	10.30	25		34.1	157.7	***368.1***	368	0	0	202	39
677.02	2.50	4.10	14		31.7	62.8	***375.3***	375	0	0	206	42
674.52	2.50	2.50	8		22.1	38.3	***394.3***	394	0	0	217	44
672.02	2.50	2.30	8		20.9	35.2	***418.2***	418	0	0	230	47
669.52	2.50	2.50	8		22.1	38.3	***440.3***	440	0	0	242	49
667.02	2.50	2.50	8		22.1	38.3	***465.4***	465	0	0	256	52
664.52	2.50	2.70	9		23.3	41.3	***488.7***	489	0	0	269	54
662.02	2.50	2.70	9		23.3	41.3	***512.0***	512	0	0	282	57
659.52	2.50	2.70	9		23.3	41.3	***535.3***	535	0	0	294	59
657.02	2.50	2.70	9		23.3	41.3	***555.5***	555	0	0	306	62
654.52	2.50	2.50	8		22.1	38.3	***577.6***	578	0	0	318	64
652.02	2.50	2.50	8		22.1	38.3	***602.7***	603	0	0	331	67
649.52	2.50	2.70	9		23.3	41.3	***626.0***	626	0	0	344	69
647.02	2.50	2.70	9		23.3	41.3	***652.3***	652	0	0	359	72
644.52	2.50	2.90	10		24.5	44.4	***676.8***	677	0	0	372	74
642.02	2.50	2.90	10		24.5	44.4	***698.2***	698	0	0	384	77
639.52	2.50	2.70	9		23.3	41.3	***721.5***	~~722~~	~~0~~	~~0~~	~~397~~	~~79~~
637.02	2.50	2.70	9		23.3	41.3	***744.8***	~~745~~	~~0~~	~~0~~	~~410~~	~~82~~
634.52	2.50	2.70	9		23.3	41.3	***768.1***	~~768~~	~~0~~	~~0~~	~~422~~	~~84~~
632.02	2.50	2.70	9		23.3	41.3	***791.4***	~~791~~	~~0~~	~~0~~	~~435~~	~~87~~
629.52	2.50	2.70	9		23.3	41.3	***814.6***	~~815~~	~~0~~	~~0~~	~~448~~	~~89~~
627.02	2.50	2.70	9		23.3	41.3	***837.9***	~~838~~	~~0~~	~~0~~	~~461~~	~~92~~
622.02	5.00	2.70	9		46.6	41.3	***884.5***	~~884~~	~~0~~	~~0~~	~~486~~	~~97~~
617.02	5.00	2.70	9		46.6	41.3	***931.0***	~~931~~	~~0~~	~~0~~	~~512~~	~~102~~
614.52	2.50	2.70	9		23.3	41.3	***954.3***	~~954~~	~~0~~	~~0~~	~~525~~	~~104~~
612.02	2.50	2.70	9		23.3	41.3	***977.6***	~~978~~	~~0~~	~~0~~	~~538~~	~~107~~
607.02	5.00	2.70	9		46.6	41.3	***1024.2***	~~1024~~	~~0~~	~~0~~	~~563~~	~~112~~
602.02	5.00	2.70	9			41.3						

Pile Design Table for N Abut utilizing Boring #6

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 16"Φ w/.312" walls		
173	95	22
208	114	24
242	133	27
245	135	29
270	149	32
368	202	39
375	206	42
394	217	44
418	230	47
440	242	49
465	256	52
489	269	54
512	282	57
535	294	59
555	306	62
578	318	64
Metal Shell 16"Φ w/.375" walls		
173	95	22
208	114	24
242	133	27
245	135	29
270	149	32
368	202	39
375	206	42
394	217	44
418	230	47
440	242	49
465	256	52
489	269	54
512	282	57
535	294	59
555	306	62
578	318	64
603	331	67
626	344	69
652	359	72
677	372	74
698	384	77
Metal Shell 14"Φ w/.25" walls		
204	112	27
210	116	29
232	128	32
315	173	39
324	178	42
341	188	44
362	199	47
381	210	49
403	221	52
Metal Shell 14"Φ w/.312" walls		
204	112	27
210	116	29
232	128	32
315	173	39
324	178	42
341	188	44
362	199	47
381	210	49
403	221	52
423	233	54
443	244	57
464	255	59
482	265	62
501	276	64
Steel HP 8 X 36		
196	108	54
205	113	57
215	118	59
223	123	62
232	128	64
242	133	67
252	139	69
263	145	72
273	150	74
282	155	77
Steel HP 10 X 42		
196	108	44
208	115	47
220	121	49
233	128	52
244	134	54
256	141	57
268	147	59
277	153	62
289	159	64
302	166	67
313	172	69
327	180	72

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
200	110	44
213	117	47
224	123	49
238	131	52
250	137	54
262	144	57
273	150	59
283	156	62
295	162	64
308	169	67
320	176	69
334	184	72
347	191	74
357	196	77
369	203	79
381	210	82
393	216	84
405	223	87
417	229	89
429	236	92
453	249	97
Steel HP 12 X 53		
176	97	32
213	117	34
230	127	42
241	133	44
256	141	47
270	148	49
286	157	52
300	165	54
314	173	57
328	180	59
339	187	62
353	194	64
369	203	67
383	211	69
400	220	72
415	228	74
Steel HP 12 X 63		
177	98	32
215	119	34
233	128	42
243	134	44
259	142	47
272	150	49
289	159	52
303	166	54
317	174	57
331	182	59
343	188	62
356	196	64
372	205	67
386	213	69
403	222	72
418	230	74
431	237	77
445	245	79
459	252	82
473	260	84
487	268	87
Steel HP 12 X 74		
180	99	32
219	120	34
236	130	42
247	136	44
262	144	47
276	152	49
293	161	52
307	169	54
321	177	57
336	185	59
347	191	62
361	198	64
377	208	67
392	215	69
409	225	72
424	233	74
438	240	77
451	248	79
465	256	82
480	264	84
494	272	87
508	280	89
523	287	92
551	303	97
580	319	102
Steel HP 12 X 84		
183	101	32
222	122	34
239	132	42
250	138	44
266	146	47
280	154	49
297	163	52
311	171	54
326	179	57
340	187	59
352	194	62
366	201	64
383	210	67
397	218	69
415	228	72
430	236	74
442	243	77
457	251	79
471	259	82
486	267	84
500	275	87
515	283	89
530	291	92
559	307	97
588	323	102
602	331	104
617	339	107
646	355	112

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
197	108	29
216	119	32
266	146	34
280	154	42
292	161	44
311	171	47
327	180	49
347	191	52
363	200	54
380	209	57
397	218	59
410	225	62
425	234	64
445	245	67
462	254	69
482	265	72
500	275	74
514	282	77
530	292	79
547	301	82
564	310	84
Steel HP 14 X 89		
199	110	29
219	120	32
270	148	34
284	156	42
296	163	44
315	173	47
331	182	49
351	193	52
368	202	54
385	212	57
402	221	59
414	228	62
430	237	64
450	248	67
467	257	69
488	268	72
506	278	74
520	286	77
536	295	79
553	304	82
570	314	84
587	323	87
604	332	89
621	341	92
655	360	97
688	379	102
Steel HP 14 X 102		
202	111	29
222	122	32
273	150	34
287	158	42
300	165	44
319	175	47
335	184	49
355	195	52
372	205	54
389	214	57
406	224	59
419	231	62
436	240	64
456	251	67
473	260	69
494	272	72
512	281	74
526	289	77
543	298	79
560	308	82
577	317	84
594	327	87
611	336	89
628	345	92
662	364	97
696	383	102
713	392	104
730	402	107
764	420	112
Steel HP 14 X 117		
204	112	29
225	124	32
277	152	34
291	160	42
303	167	44
323	178	47
339	186	49
360	198	52
377	207	54
394	217	57
411	226	59
424	233	62
441	242	64
461	254	67
478	263	69
500	275	72
518	285	74
532	292	77
549	302	79
566	311	82
583	321	84
601	330	87
618	340	89
635	349	92
669	368	97
704	387	102
721	397	104
738	406	107
773	425	112
Precast 14"x 14"		
184	101	22
222	122	24
260	143	27
Timber Pile		
152	83	24

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== S Abut
REFERENCE BORING ========== 5
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ==========: 718.18 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 716.18 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 1322 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 35.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts =====: 300.71 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts =====: 112.77 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.375" walls
Pile Perimeter==========: 4.189 FT.
Pile End Bearing Area========== 1.396 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
704 KIPS	**698** KIPS	**384** KIPS	**72** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
713.97	2.21	1.50	4		13.9		***29.3***	29	0	0	16	4
711.47	2.50	1.00	5		11.6	15.3	***40.9***	41	0	0	22	7
708.97	2.50	1.00	5		11.6	15.3	***70.9***	71	0	0	39	9
706.47	2.50	2.20	7		20.3	33.7	***94.3***	94	0	0	52	12
703.97	2.50	2.40	7		21.5	36.7	***117.3***	117	0	0	65	14
701.47	2.50	2.50	8		22.1	38.3	***137.8***	138	0	0	76	17
698.97	2.50	2.40	7		21.5	36.7	***159.3***	159	0	0	88	19
696.47	2.50	2.40	8		21.5	36.7	***174.7***	175	0	0	96	22
693.97	2.50	2.00	10		19.1	30.6	***216.7***	217	0	0	119	24
691.47	2.50	3.50	12		28.1	53.6	***232.5***	233	0	0	128	27
688.97	2.50	2.70	10		23.3	41.3	***254.3***	254	0	0	140	29
686.47	2.50	2.60	8		22.7	39.8	***296.9***	297	0	0	163	32
683.97	2.50	3.90	9		30.5	59.7	***347.3***	347	0	0	191	34
681.47	2.50	5.20	13		34.1	79.6	***373.7***	374	0	0	206	37
678.97	2.50	4.70	12		34.1	72.0	***395.5***	396	0	0	218	39
676.47	2.50	3.90	12		30.5	59.7	***410.7***	411	0	0	226	42
673.97	2.50	2.90	12		24.5	44.4	***436.7***	437	0	0	240	44
671.47	2.50	3.00	12		25.1	45.9	***457.2***	457	0	0	251	47
668.97	2.50	2.70	11		23.3	41.3	***483.5***	484	0	0	266	49
666.47	2.50	2.90	12		24.5	44.4	***512.6***	513	0	0	282	52
663.97	2.50	3.20	12		26.3	49.0	***538.9***	539	0	0	296	54
661.47	2.50	3.20	12		26.3	49.0	***554.4***	554	0	0	305	57
658.97	2.50	2.50	9		22.1	38.3	***576.5***	577	0	0	317	59
656.47	2.50	2.50	9		22.1	38.3	***601.6***	602	0	0	331	62
653.97	2.50	2.70	12		23.3	41.3	***624.9***	625	0	0	344	64
651.47	2.50	2.70	12		23.3	41.3	***648.2***	648	0	0	357	67
648.97	2.50	2.70	9		23.3	41.3	***671.5***	671	0	0	369	69
646.47	2.50	2.70	9		23.3	41.3	***697.8***	698	0	0	384	72
643.97	2.50	2.90	10		24.5	44.4	***722.3***	~~722~~	~~0~~	~~0~~	~~397~~	~~74~~
641.47	2.50	2.90	10		24.5	44.4	***746.8***	~~747~~	~~0~~	~~0~~	~~411~~	~~77~~
638.97	2.50	2.90	9		24.5	44.4	***771.3***	~~771~~	~~0~~	~~0~~	~~424~~	~~79~~
636.47	2.50	2.90	9		24.5	44.4	***795.7***	~~796~~	~~0~~	~~0~~	~~438~~	~~82~~
633.97	2.50	2.90	11		24.5	44.4	***820.2***	~~820~~	~~0~~	~~0~~	~~451~~	~~84~~
631.47	2.50	2.90	11		24.5	44.4	***844.7***	~~845~~	~~0~~	~~0~~	~~465~~	~~87~~
628.97	2.50	2.90	10		24.5	44.4	***869.2***	~~869~~	~~0~~	~~0~~	~~478~~	~~89~~
626.47	2.50	2.90	10		24.5	44.4	***893.7***	~~894~~	~~0~~	~~0~~	~~492~~	~~92~~
621.47	5.00	2.90	10		49.0	44.4	***942.6***	~~943~~	~~0~~	~~0~~	~~518~~	~~97~~
616.47	5.00	2.90	10			44.4						

Pile Design Table for S Abut utilizing Boring #5

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 16"Φ w/.312" walls		
175	96	22
217	119	24
233	128	27
254	140	29
297	163	32
347	191	34
374	206	37
396	218	39
411	226	42
437	240	44
457	251	47
484	266	49
513	282	52
539	296	54
554	305	57
577	317	59
Metal Shell 16"Φ w/.375" walls		
175	96	22
217	119	24
233	128	27
254	140	29
297	163	32
347	191	34
374	206	37
396	218	39
411	226	42
437	240	44
457	251	47
484	266	49
513	282	52
539	296	54
554	305	57
577	317	59
602	331	62
625	344	64
648	357	67
671	369	69
698	384	72
Metal Shell 14"Φ w/.25" walls		
199	109	27
218	120	29
253	139	32
295	162	34
319	176	37
340	187	39
354	195	42
377	207	44
395	218	47
Metal Shell 14"Φ w/.312" walls		
199	109	27
218	120	29
253	139	32
295	162	34
319	176	37
340	187	39
354	195	42
377	207	44
395	218	47
418	230	49
443	244	52
466	256	54
481	265	57
500	275	59
Steel HP 8 X 36		
199	109	49
211	116	52
222	122	54
228	125	57
237	130	59
247	136	62
257	141	64
267	147	67
276	152	69
Steel HP 10 X 42		
197	108	37
206	113	39
212	117	42
225	124	44
235	129	47
249	137	49
264	145	52
277	152	54
284	156	57
295	162	59
308	169	62
319	176	64
331	182	67

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
201	111	37
211	116	39
217	119	42
230	127	44
240	132	47
254	140	49
270	148	52
283	156	54
290	159	57
301	166	59
314	173	62
326	179	64
338	186	67
350	193	69
364	200	72
377	207	74
389	214	77
402	221	79
414	228	82
427	235	84
439	242	87
452	249	89
Steel HP 12 X 53		
197	108	32
234	128	34
247	136	37
257	141	39
262	144	42
278	153	44
289	159	47
306	168	49
325	178	52
340	187	54
347	191	57
360	198	59
376	207	62
390	215	64
404	222	67
Steel HP 12 X 63		
199	110	32
236	130	34
250	137	37
259	143	39
264	145	42
280	154	44
291	160	47
309	170	49
328	180	52
344	189	54
350	192	57
363	200	59
380	209	62
394	217	64
408	224	67
422	232	69
439	242	72
454	250	74
469	258	77
484	266	79
Steel HP 12 X 74		
203	111	32
240	132	34
254	140	37
263	145	39
268	147	42
284	156	44
296	163	47
313	172	49
332	183	52
349	192	54
355	195	57
368	203	59
385	212	62
399	220	64
414	227	67
428	235	69
445	245	72
460	253	74
475	262	77
491	270	79
506	278	82
521	286	84
536	295	87
551	303	89
566	311	92
Steel HP 12 X 84		
172	95	29
206	113	32
244	134	34
258	142	37
267	147	39
272	149	42
288	159	44
300	165	47
317	174	49
337	185	52
353	194	54
360	198	57
373	205	59
390	215	62
405	223	64
419	231	67
434	239	69
451	248	72
467	257	74
482	265	77
497	273	79
512	282	82
528	290	84
543	299	87
558	307	89
574	316	92
604	332	97

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
204	112	29
245	135	32
292	161	34
307	169	37
316	174	39
319	175	42
338	186	44
350	193	47
371	204	49
394	217	52
413	227	54
418	230	57
434	239	59
454	250	62
470	259	64
487	268	67
504	277	69
524	288	72
542	298	74
559	308	77
577	317	79
Steel HP 14 X 89		
192	105	27
207	114	29
249	137	32
297	163	34
311	171	37
320	176	39
323	177	42
342	188	44
355	195	47
375	206	49
399	219	52
418	230	54
423	233	57
439	242	59
459	253	62
476	262	64
493	271	67
510	280	69
531	292	72
548	302	74
566	311	77
584	321	79
602	331	82
619	341	84
637	350	87
655	360	89
672	370	92
Steel HP 14 X 102		
194	107	27
209	115	29
252	139	32
301	165	34
316	174	37
324	178	39
327	180	42
347	191	44
359	197	47
380	209	49
404	222	52
423	233	54
428	236	57
444	244	59
465	256	62
482	265	64
499	274	67
516	284	69
537	295	72
555	305	74
573	315	77
591	325	79
608	335	82
626	345	84
644	354	87
662	364	89
680	374	92
716	394	97
Steel HP 14 X 117		
197	108	27
212	117	29
256	141	32
305	168	34
320	176	37
329	181	39
331	182	42
351	193	44
363	200	47
384	211	49
409	225	52
428	236	54
433	238	57
450	247	59
470	259	62
487	268	64
504	277	67
522	287	69
543	299	72
561	309	74
579	319	77
597	329	79
615	338	82
634	348	84
652	358	87
670	368	89
688	378	92
724	398	97
Precast 14"x 14"		
190	105	22
234	129	24
253	139	27
Timber Pile		
150	82	22

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== N Abut
REFERENCE BORING ========== 6
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 718.55 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 716.55 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 1322 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 35.17 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.71 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.77 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.375" walls
Pile Perimeter========== 4.189 FT.
Pile End Bearing Area========== 1.396 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
704 KIPS	**697** KIPS	**383** KIPS	**67** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
714.02	2.53	3.00	7		25.4		***63.7***	64	0	0	35	5
711.52	2.50	2.50	6		22.1	38.3	***82.7***	83	0	0	45	7
709.02	2.50	2.30	5		20.9	35.2	***106.6***	107	0	0	59	10
706.52	2.50	2.50	6		22.1	38.3	***121.0***	121	0	0	67	12
704.02	2.50	2.00	7		19.1	30.6	***144.7***	145	0	0	80	15
701.52	2.50	2.30	8		20.9	35.2	***199.3***	199	0	0	110	17
699.02	2.50	4.50	12		34.1	68.9	***233.4***	233	0	0	128	20
696.52	2.50	4.50	13		34.1	68.9	***267.4***	267	0	0	147	22
694.02	2.50	4.50	14		34.1	68.9	***301.5***	302	0	0	166	25
691.52	2.50	4.50	14		34.1	68.9	***335.6***	336	0	0	185	27
689.02	2.50	4.50	30		34.1	68.9	***339.0***	339	0	0	186	30
686.52	2.50	2.50	7		22.1	38.3	***364.2***	364	0	0	200	32
684.02	2.50	2.70	10		23.3	41.3	***563.6***	564	0	0	310	35
681.52	2.50		33	Hard Till	19.1	217.5	***522.9***	523	0	0	288	37
679.02	2.50	10.30	25		34.1	157.7	***462.1***	462	0	0	254	40
676.52	2.50	4.10	14		31.7	62.8	***469.3***	469	0	0	258	42
674.02	2.50	2.50	8		22.1	38.3	***488.3***	488	0	0	269	45
671.52	2.50	2.30	8		20.9	35.2	***512.2***	512	0	0	282	47
669.02	2.50	2.50	8		22.1	38.3	***534.3***	534	0	0	294	50
666.52	2.50	2.50	8		22.1	38.3	***559.4***	559	0	0	308	52
664.02	2.50	2.70	9		23.3	41.3	***582.7***	583	0	0	321	55
661.52	2.50	2.70	9		23.3	41.3	***606.0***	606	0	0	333	57
659.02	2.50	2.70	9		23.3	41.3	***629.3***	629	0	0	346	60
656.52	2.50	2.70	9		23.3	41.3	***649.5***	650	0	0	357	62
654.02	2.50	2.50	8		22.1	38.3	***671.6***	672	0	0	369	65
651.52	2.50	2.50	8		22.1	38.3	***696.7***	697	0	0	383	67
649.02	2.50	2.70	9		23.3	41.3	***720.0***	~~720~~	~~0~~	~~0~~	~~396~~	~~70~~
646.52	2.50	2.70	9		23.3	41.3	***746.4***	~~746~~	~~0~~	~~0~~	~~410~~	~~72~~
644.02	2.50	2.90	10		24.5	44.4	***770.8***	~~771~~	~~0~~	~~0~~	~~424~~	~~75~~
641.52	2.50	2.90	10		24.5	44.4	***792.2***	~~792~~	~~0~~	~~0~~	~~436~~	~~77~~
639.02	2.50	2.70	9		23.3	41.3	***815.5***	~~816~~	~~0~~	~~0~~	~~449~~	~~80~~
636.52	2.50	2.70	9		23.3	41.3	***838.8***	~~839~~	~~0~~	~~0~~	~~461~~	~~82~~
634.02	2.50	2.70	9		23.3	41.3	***862.1***	~~862~~	~~0~~	~~0~~	~~474~~	~~85~~
631.52	2.50	2.70	9		23.3	41.3	***885.4***	~~885~~	~~0~~	~~0~~	~~487~~	~~87~~
629.02	2.50	2.70	9		23.3	41.3	***908.6***	~~909~~	~~0~~	~~0~~	~~500~~	~~90~~
626.52	2.50	2.70	9		23.3	41.3	***931.9***	~~932~~	~~0~~	~~0~~	~~513~~	~~92~~
621.52	5.00	2.70	9		46.6	41.3	***978.5***	~~978~~	~~0~~	~~0~~	~~538~~	~~97~~
616.52	5.00	2.70	9			41.3						

Pile Design Table for N Abut utilizing Boring #6

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 16"Φ w/.312" walls		
199	110	17
233	128	20
267	147	22
302	166	25
336	185	27
339	186	30
364	200	32
462	254	40
469	258	42
488	269	45
512	282	47
534	294	50
559	308	52
583	321	55
Metal Shell 16"Φ w/.375" walls		
199	110	17
233	128	20
267	147	22
302	166	25
336	185	27
339	186	30
364	200	32
462	254	40
469	258	42
488	269	45
512	282	47
534	294	50
559	308	52
583	321	55
606	333	57
629	346	60
650	357	62
672	369	65
697	383	67
Metal Shell 14"Φ w/.25" walls		
197	108	20
228	125	22
256	141	25
286	157	27
292	161	30
314	173	32
Metal Shell 14"Φ w/.312" walls		
197	108	20
228	125	22
256	141	25
286	157	27
292	161	30
314	173	32
397	219	40
406	224	42
423	233	45
444	244	47
463	255	50
485	267	52
505	278	55
Steel HP 8 X 36		
195	107	45
205	113	47
214	118	50
225	124	52
234	129	55
244	134	57
253	139	60
262	144	62
271	149	65
281	155	67
Steel HP 10 X 42		
188	104	32
216	119	35
233	128	40
234	129	42
243	134	45
256	141	47
267	147	50
280	154	52
292	160	55
303	167	57
315	173	60
325	179	62

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
192	106	32
221	122	35
239	131	40
239	132	42
249	137	45
261	144	47
273	150	50
286	157	52
298	164	55
310	170	57
322	177	60
332	182	62
343	189	65
356	196	67
368	203	70
382	210	72
395	217	75
405	223	77
417	230	80
429	236	82
441	243	85
453	249	87
Steel HP 12 X 53		
203	112	25
216	119	30
233	128	32
270	149	35
287	158	42
298	164	45
313	172	47
327	180	50
343	188	52
357	196	55
371	204	57
385	212	60
396	218	62
410	225	65
Steel HP 12 X 63		
205	113	25
219	120	30
235	129	32
273	150	35
290	159	42
301	165	45
316	174	47
330	181	50
346	190	52
360	198	55
374	206	57
388	214	60
400	220	62
413	227	65
430	236	67
444	244	70
461	253	72
476	262	75
488	268	77
Steel HP 12 X 74		
187	103	22
208	115	25
222	122	30
238	131	32
277	152	35
294	162	42
305	168	45
321	176	47
334	184	50
351	193	52
365	201	55
379	209	57
394	217	60
405	223	62
419	230	65
435	239	67
450	247	70
467	257	72
482	265	75
494	272	77
509	280	80
523	288	82
538	296	85
552	304	87
566	311	90
581	319	92
Steel HP 12 X 84		
190	105	22
212	116	25
225	124	30
242	133	32
281	155	35
298	164	42
309	170	45
325	179	47
339	186	50
355	196	52
370	204	55
385	212	57
399	220	60
411	226	62
425	234	65
441	243	67
456	251	70
473	260	72
489	269	75
501	276	77
516	284	80
530	292	82
545	300	85
559	308	87
574	316	90
588	324	92
617	340	97

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
184	101	20
221	121	22
254	140	25
264	145	30
284	156	32
333	183	35
348	191	42
360	198	45
379	208	47
394	217	50
414	228	52
431	237	55
447	246	57
464	255	60
477	262	62
493	271	65
512	282	67
529	291	70
550	302	72
567	312	75
Steel HP 14 X 89		
188	103	20
224	123	22
257	142	25
267	147	30
287	158	32
338	186	35
352	194	42
364	200	45
383	211	47
399	220	50
419	230	52
436	240	55
453	249	57
470	258	60
483	265	62
499	274	65
519	285	67
535	294	70
556	306	72
574	316	75
588	323	77
605	333	80
621	342	82
638	351	85
655	360	87
672	370	90
689	379	92
Steel HP 14 X 102		
190	105	20
227	125	22
261	144	25
271	149	30
291	160	32
342	188	35
356	196	42
368	203	45
388	213	47
404	222	50
424	233	52
441	243	55
458	252	57
475	261	60
488	269	62
504	277	65
525	289	67
542	298	70
563	309	72
581	319	75
594	327	77
612	336	80
629	346	82
646	355	85
663	364	87
680	374	90
697	383	92
731	402	97
Steel HP 14 X 117		
194	106	20
231	127	22
265	146	25
274	151	30
294	162	32
347	191	35
361	198	42
373	205	45
392	216	47
409	225	50
429	236	52
446	245	55
463	255	57
481	264	60
494	272	62
510	281	65
531	292	67
548	301	70
569	313	72
587	323	75
601	331	77
618	340	80
636	350	82
653	359	85
670	369	87
687	378	90
705	388	92
739	406	97
Precast 14"x 14"		
156	86	15
212	117	17
250	138	20
Timber Pile		
144	79	17

Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date: 7/13/15	Proposed SN: 050-0258	Route:	FAP 786, (IL 170)
Revised Date: 3-23-16	Existing SN: 050-0073	Section:	111VBR
Geotechnical Engineer: Terry McCleary of McCleary Engineering		County:	LaSalle
Structural Engineer: Joe Lowrance, Farnsworth Group		Contract:	66C58

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing):
A three span structure, 200 ft. in total length from back to back of abutments is proposed. The superstructure will be a concrete slab supported by steel beams on integral abutments and two solid stem piers. The abutments and piers will set outside of the existing abutments and piers lengthening the center span while keeping the two outside spans roughly the same. The foundation widths are estimated to be near 35.17 ft. Please refer to the draft TSL drawing for a more accurate picture of what is to be constructed.

Discuss the existing boring data, existing plans foundation information, new subsurface exploration and need for any additional exploration to be provided with SGR Technical Memo (attach all data and subsurface profile plot):
Three borings were taken for the proposed structure in 2008. Four additional embankment borings were taken for stability issues in the existing embankment. In general, the borings show similar soil stratification and strengths. Stiff to very stiff cohesive soils were encountered in all of the borings. Boring #5, at the south abutment shows approximately 27 ft. of stiff silty clay soils over 10 ft. of very stiff silty clay and silty clay loam soils over 5 ft. of hard silty clay loam till over 49.5 ft. of very stiff silty clay loam till. Boring #6 at the north abutment shows similar soil types but the Qu's in the upper 12 ft. are nearly twice that found in boring #5. Boring #7, at the pier show similar soil types and strengths as that found in boring B#5 at the south abutment. Each of the existing closed abutments as well as both piers rest on spread footing foundations with no piling. See the attached boring logs and soils profile for more detailed descriptions of the subsurface conditions.

Provide the location and maximum height of any new soil fill or magnitude of footing bearing pressure. Estimate the amount and time of the expected settlement. Indicate if further testing, analysis, and/or ground improvement/treatment is necessary: **At the time of this report it is the authors understanding there is to be 2.2 ft. of additional embankment near the new integral abutments to accommodate an increase in vertical clearance to 23 ft. between the existing rails and the proposed beams. Preliminary settlement amounts near the south abutment using boring B-5, based on Qu's and moisture contents, are near 0.25 inches. This is below the theoretical threshold amount of 0.40 inches for down drag to be a concern for the piling. To reduce the steepness of the existing profile grade varying fill depths will be added along the existing grade. The highest fill on the south approach near station 706+00 is approximately 9 ft. The highest fill on the north approach, near station 695+00 is approximately 8 ft. At these locations the settlement is estimated to be near 0.72 inches. No ground improvement beyond normal construction practice is expected at this site therefore no further testing or analysis is proposed at this time. At this time settlement platforms do not appear necessary. Please see the attached settlement calculation sheets.**

Identify any new cuts or fill slope angles and heights. Estimate the factor of safety against slope failure. Indicate if further testing, analysis or ground improvement/treatment is necessary. **As mentioned earlier the grade change at the abutments is approximately 2.2 ft. of fill. The end slope on the rail side of the abutment will remain a 1:2(V:H) slope with side slopes filled out to a 1:3(V:H) slope. The maximum slope heights are near 29 ft. to the PGL at the proposed north abutment. The short term FOS is estimated to be 3.93. We estimate the long term FOS to be 1.66. These factors of safety were estimated using the commercially available software SLIDE 6.0. Boring #5 for the South Abutment and boring #7 from the South Pier were used for the analysis. No further analysis, testing or ground improvement is expected for this project. Additional analyses were performed for the side slopes of the proposed embankment. The current plans show 1:3 (V:H) side slopes. The lowest Factor of Safety, FOS, of all of the quadrants, 1.52, was for the long term condition for the southwest quadrant. Boring B-5 was used for this analysis. Comparing boring B-5 to B-6, it is understandable this quadrant would be the lowest but still arguably safe quadrant slope. The east slopes of both approaches were repaired with rock fill in 2008. This repair is in good condition and now responsible for increased stability in the proposed approach configuration. As part of the repair 2x10 treated lumber was attached to the guardrail posts and appears to be working well as a curb to reduce the amount of water flowing over the repair. These repairs may stay in place but should be drained with a perforated tile prior to the new fill needed to flatten the slopes is placed. A curb should be provided at the edge of pavement to direct surface water away from the slope, resulting in reduced erosion and improved slope stability. The new fill should be benched into the existing slope fill material, including the rock fill. Placing a geotextile over the rock fill surface is recommended to mitigate the migration of the new fill material into the rock fill void space. See the attached graphical results.**

Indicate at each substructure, the 100-year and 200-year total scour depths in the Hydraulics Report, the non-granular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations. **Because this structure does not cross a waterway scour was not investigated.**

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if the soils are liquefiable. **This site is in a seismic performance zone, SPZ=1 and has a seismic soil site class of "C", an S_{DS} = 0.129 and an S_{D1}=0.073. In accordance with AGMU Memo 10.1 because the SPZ is 1 a liquefaction analysis was not performed.**

Confirm feasibility of the proposed foundation or wall type and provide design parameters. Attach a pile design table indicating feasible pile types, various nominal required bearings, factored resistances available and corresponding estimated lengths at locations where piles will be used. Provide factored bearing resistance and unit sliding resistance at various elevations and confirm no ground improvement/treatment is necessary where spread footings are proposed. Estimated top of rock elevations as well as preliminary skin friction and end bearing values shall be indicated when drilled shafts are proposed.

Driven Piling

Spread footing and driven pile foundations were analyzed for the piers. Only driven pile foundations were analyzed for the abutments. See the attached Pile Length Discussion and Pile Length/Resistance Tables.

Spread Footing at Piers

Both strength and service limit states were used to analyze the spread footing option. As can be seen in boring B-7 the soils beneath an assumed bottom of footing elevation of 690.91 ft. are cohesive. The strengths in the upper 6.5 ft. are stiff with an average Qu=1.3 tsf. The strengths below this material are very stiff to hard with an average Qu=5.7 tsf. Because of these high Qu values the factored bearing resistance from a strength limit state approach is quite high at 6.4 ksf.

From a service limit state approach using 1 inch of allowable settlement, the soils have a calculated bearing resistance of 2.9 ksf. No laboratory test data was available for the soils at this site. The service limit state bearing resistance value is based on an estimated C_r=0.0225, e_o=0.6, σ_o=480 psf and a 7 ft. thick compressible layer beneath the footing. Based on these results a bearing resistance of 2.9 ksf may be used for design purposes. To increase this value the footing may be lowered or the stiff material may be removed and replaced with a well compacted crushed aggregate.

The friction factor for the stiff soils is estimated to be 0.30. Multiplying this times the load of 1909 kips over a 19 ft. x 35 ft. spread footing results in a unit frictional resistance of 0.87 ksf. For the passive resistance force a passive horizontal pressure coefficient, Kp = 1.0 may be used.

Calculate the estimated water surface elevation and determine the need for cofferdam(s) and seal coat: **This structure does not cross a waterway and no groundwater was noted on any of the boring logs for this structure, therefore no cofferdams or seal coat work is expected for this project. However, the contractor should expect and be prepared to evacuate any surface water and/or ground water encountered during construction. The little amount of water expected should be able to be evacuated by using the traditional sump and pump methods.**

Assess the need for sheeting/soil retention versus using a temporary construction slope and provide recommendation for the most feasible option. **At this time the author anticipates the structure to be constructed under closed road conditions therefore Temporary Sheet Piling will not be needed at a stage line. As mentioned in the section above the piers are over 30 ft. away from the centerline of the track. At this distance and at a depth less than 4 ft. the excavations may simply be graded back at a 1:1 slope.**

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terry@mcclearyengineering.com
Office Number 815-780-8486

Mc Cleary Engineering

"Specializing in Geotechnical Solutions"

August 23, 2016

Mr. Paul Loete
Illinois Department of Transportation
Attn: Steve Ferguson
700 East Norris Drive
Ottawa, IL 61350

PTB 153/36
Various Geotechnical Reports, Various Routes, Various Counties
Region 2/District 3
P-93-024-09

Geotechnical Memorandum for SN050-0258

Mr. Ferguson:

As discussed earlier this week, I performed a pile length/resistance analysis for the piers for the proposed structure SN050-0258 carrying IL 170 over BNSF Railroad. To perform this analysis, I used the IDOT Pile Length spreadsheet, but changed the pile shape dimensions to that of the MS16 we discussed earlier, see Table 1 for a summary of changes made. The drive stress and the drive stress factor remained unchanged at 45 ksi and 0.85, respectively.

Table 1, Summary of Pile Dimensions

Pile Type & Size	Plug Perimeter, ft.	Plug End Area, sqft.	Drive Area, sqin.
MS 16, with 0.312" walls	4.189	1.396	15.379
MS 16, with 0.375" walls	4.189	1.396	18.41

Enclosed please find the resulting pile length/resistance table for your use.

If you have any questions please don't hesitate to contact me at your convenience.

Respectfully submitted,

Terrence L. McCleary

Terrence L. McCleary

STATE OF ILLINOIS
062-050019
TERRENCE L.
MC CLEARY
LICENSED ENGINEER

3705 Progress Blvd., Suite 2, Peru, Illinois 61354
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Pile Design Table for Piers utilizing Boring #7

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 16"Φ w/.312" walls		
295	162	52
317	174	55
339	186	57
361	198	60
383	211	62
405	223	65
427	235	67
449	247	70
471	259	72
496	273	75
520	286	77
546	300	80
570	314	82
Metal Shell 16"Φ w/.375" walls		
295	162	52
317	174	55
339	186	57
361	198	60
383	211	62
405	223	65
427	235	67
449	247	70
471	259	72
496	273	75
520	286	77
546	300	80
570	314	82
592	326	85
615	338	87
651	358	90
679	373	92
Metal Shell 14"Φ w/.25" walls		
292	161	57
311	171	60
331	182	62
350	193	65
369	203	67
389	214	70
408	224	72
Metal Shell 14"Φ w/.312" walls		
292	161	57
311	171	60
331	182	62
350	193	65
369	203	67
389	214	70
408	224	72
430	236	75
450	248	77
473	260	80
494	272	82

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
286	157	80
299	164	82
309	170	85
321	177	87
341	188	90
356	196	92
375	206	95
391	215	97
410	225	100
427	235	102
444	244	105
Steel HP 12 X 53		
296	163	72
312	172	75
327	180	77
343	189	80
358	197	82
370	204	85
384	211	87
409	225	90
Steel HP 12 X 63		
286	157	70
299	165	72
315	173	75
330	181	77
347	191	80
362	199	82
374	206	85
388	213	87
413	227	90
430	237	92
455	250	95
473	260	97
497	273	100
Steel HP 12 X 74		
290	159	70
303	167	72
320	176	75
334	184	77
351	193	80
367	202	82
379	208	85
393	216	87
419	230	90
436	240	92
461	254	95
480	264	97
504	277	100
524	288	102
544	299	105
565	310	107

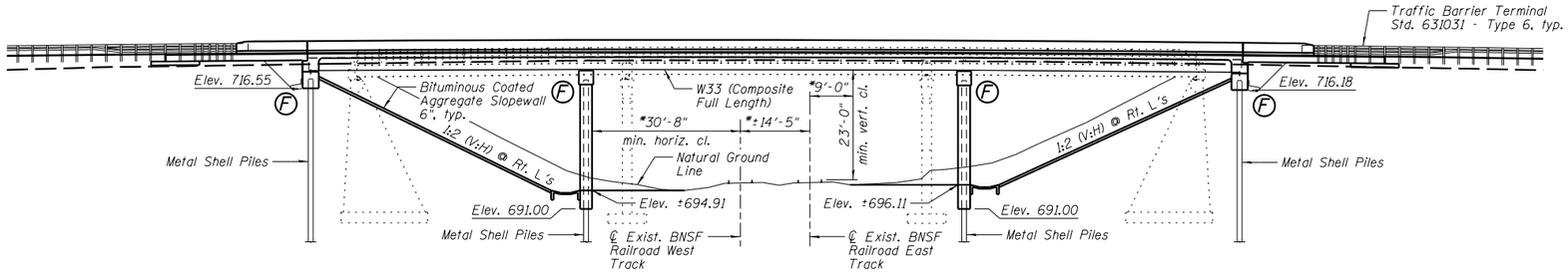
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
295	162	62
311	171	65
327	180	67
343	189	70
359	197	72
378	208	75
395	217	77
416	229	80
433	238	82
447	246	85
463	255	87
496	273	90
516	284	92
546	300	95
568	312	97
Steel HP 14 X 89		
283	156	60
299	164	62
315	173	65
331	182	67
347	191	70
363	200	72
383	211	75
400	220	77
421	231	80
438	241	82
452	249	85
469	258	87
502	276	90
522	287	92
552	304	95
575	316	97
603	332	100
627	345	102
651	358	105
675	371	107
698	384	110
Steel HP 14 X 102		
286	158	60
303	166	62
319	175	65
335	184	67
351	193	70
367	202	72
388	213	75
405	222	77
426	234	80
444	244	82
457	252	85
474	261	87
508	279	90

Benchmarks: #2 Railroad Spike in light pole opposite Plumb Street, Elevation = 691.81, Sta. 709+64.58/37.92' LT.
#7, Railroad Spike in power pole, Elevation = 701.18, Sta. 693+58.78/38.49' RT.

Existing Structure: Structure No. 050-0073 was originally built in 1935 as SBI Route 70A, Section 111-VBC. In 1973, the concrete deck was replaced under Section 111-VBR. In 1998, the bridge approaches were resurfaced and the guardrail terminators were upgraded. In 2001, the expansion joints at the abutments were replaced. The superstructure consists of a three-span, rolled steel beam bridge with a 7½" concrete slab. The substructure consists of

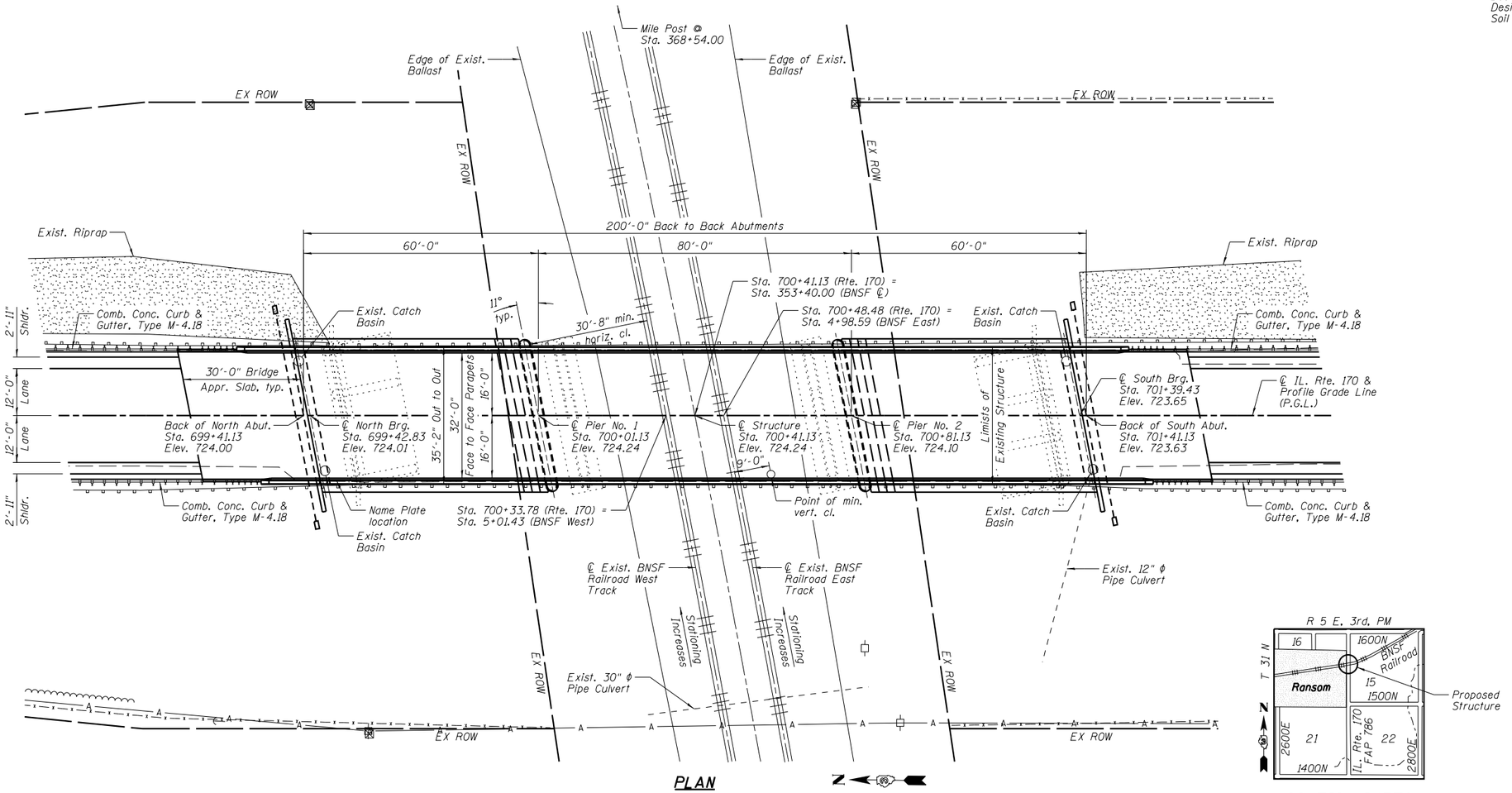
The back-to-back of abutment dimension measures 180'-4¾" and the out-to-out dimension measures 35'-0". The span lengths are 58'-6¼", 63'-4¾", and 58'-5¾" with a 11°54'20" right-forward skew. Traffic will be detoured during construction.

No Salvage.



ELEVATION

*Dimensions @ Rt. L's to Track



PLAN

HIGHWAY CLASSIFICATION

F.A.P. Route 786 (IL 170)
Functional Class: Minor Arterial (Rural)
A.D.T.: 1200 (2013), ____ (2032)
D.H.V.: 162
A.D.T.T.: 120 (2013)
Design Speed: 55 M.P.H.
Posted Speed: 55 M.P.H.
Two Way Traffic
Directional Distribution: 50/50

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

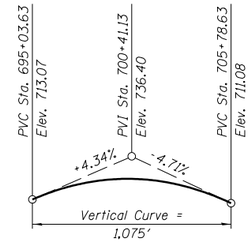
2014 AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 7th Edition

DESIGN STRESSES

FIELD UNITS:
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (AASHTO M270 Grade 50W)

SEISMIC DATA

Seismic Performance Zone (SPZ) = _
Design Spectral Acceleration at 1.0 sec. (SD1) = _____
Design Spectral Acceleration at 0.2 sec. (SDs) = _____
Soil Site Class = _



PROFILE GRADE

(Along ℄ Roadway)

LOCATION SKETCH

IL. ROUTE 170 OVER BNSF RAILROAD
F.A.P. 786 - SECTION 111 VBR
LASALLE COUNTY
STATION 700+41.13
STRUCTURE NO. 050-0258

Farnsworth GROUP, INC.
2709 McGraw Drive
Bloomington, Illinois 61704
309/663-8435, 309/663-1571 fax

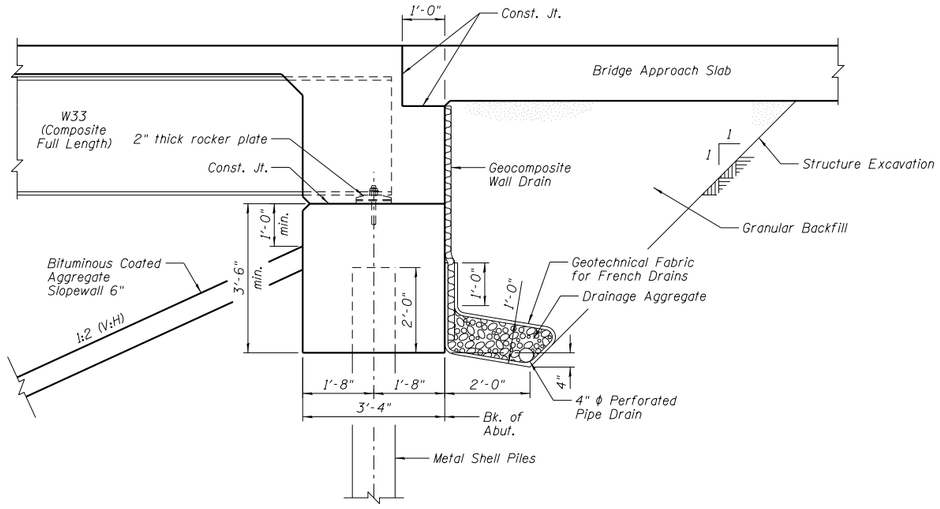
	DESIGNED - TCR	REVISED
	CHECKED - JML	REVISED
	DRAWN - DJM	REVISED
DATE - 06/30/15	CHECKED - JML	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN
STRUCTURE NO. 050-0258
SHEET NO. OF SHEETS

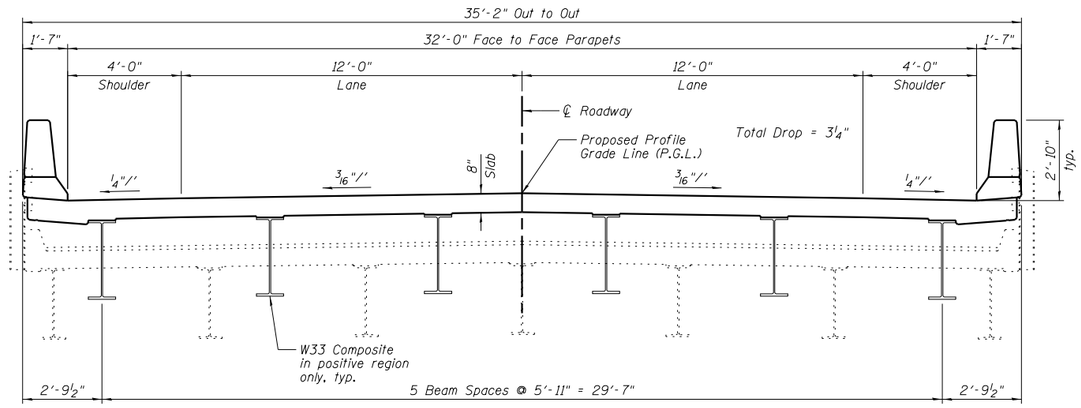
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
786	111 VBR	LASALLE	2	1
		CONTRACT NO. 66C58		
	ILLINOIS FED. AID PROJECT			

24-9078



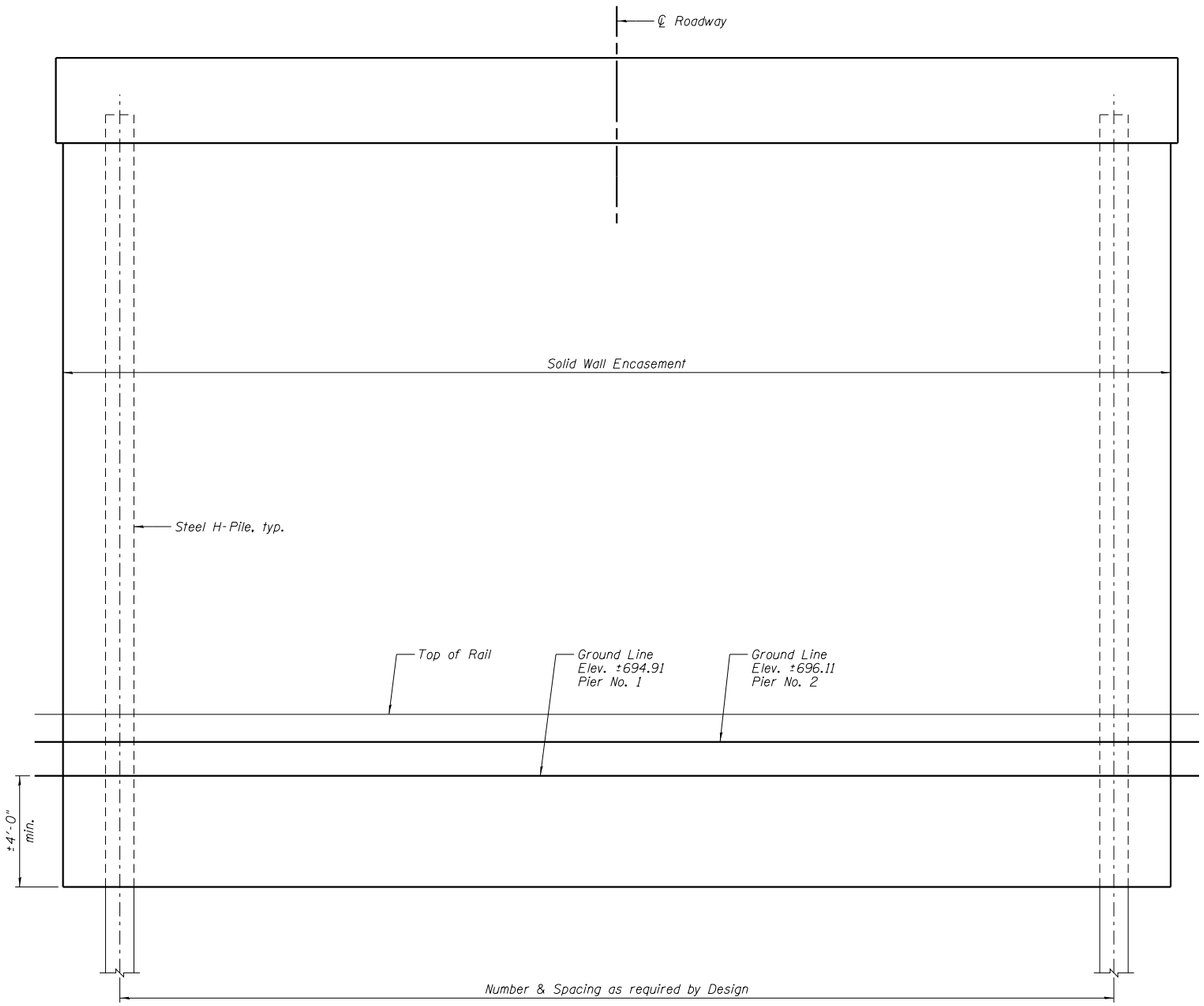
SECTION THRU ABUTMENT

(Horizontal dimensions @ Rt. L's)



CROSS SECTION

(Looking South)



PIER SKETCH

(Looking South)

Farnsworth
GROUP, INC.
2709 McGraw Drive
Bloomington, Illinois 61704
309/663-8435, 309/663-1571 fax

	DESIGNED - TCR	REVISED
	CHECKED - JML	REVISED
	DRAWN - DJM	REVISED
DATE - 06/30/15	CHECKED - JML	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

DETAILS
STRUCTURE NO. 050-0258
SHEET NO. OF SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
786	111 VBR	LASALLE	2	2
		CONTRACT NO. 66C58		
	ILLINOIS FED. AID PROJECT			

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/16/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159947, **Longitude** -88.644594

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 1
Station 698+22
Offset 13.0 ft Lt.
Ground Surface Elev. 718.71 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Augered Bituminous, Black Silty Clay / Silty Clay Loam Topsoil (Fill)
				716.21
	2			Medium to Very Stiff Gray and Brown Silty Clay / Silty Clay Loam Fill (Some Till) and some Black Topsoil mixed in.
	3 3	1.0 P	23	
-5				
	1			
	3 3	1.8 P	20	
	3			
	3 5	3.1 S	21	
-10				
	1			
	3 2	1.5 P	25	
				706.21
	1			Medium to Hard Gray, Black, Brown Silty Clay and Silty Clay Loam Fill - some Till
	3 5	3.5 P	23	
-15				
	1			
	3 2	4.0-1.0 P	22	
	1			
	5 4	3.9 S	23	
-20				
	1			Medium to Hard Gray, Black, Brown Silty Clay and Silty Clay Loam Fill - some Till *(continued)*
	5 6	4.0 P	26	
				697.21
	1			Very Stiff to Hard Black Silty Clay Loam Topsoil with pieces of Gray Silt, Organics and debris - Fill
	3 5	2.5 P	33	
-25				
	1			
	5 6	3.0 P	27	
				691.21
	2			Medium to Very Stiff Brown and Gray Silty Clay Loess - Native
	4 5	2.0 P	28	
-30				
	1			
	2 2	1.0 P	31	
				686.71
	3			Hard Brown Silty Clay Loam Till
	5 7	7.8 S	20	
-35				
	5			
	7 11	8.0 S	18	
				682.21
				End of Boring
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/16/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.160317, **Longitude** -88.644596

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 2
Station 697+09
Offset 13.0 ft Lt.
Ground Surface Elev. 712.79 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				Augered White Shoulder Stone, Black Silty Clay Loam (Fill)
710.29				
	2			Stiff to Very Stiff Black, Brown, Gray Silty Clay Loam and Silty Clay (Fill)
	3 2	2.0 P	31	
-5				
	2			
	3 3	2.5 P	23	
705.79				
	1			Stiff to Very Stiff Gray and Black Silty Clay and Silty Clay Loam - Some Topsoil
	3 3	2.0 P	25	
703.29				
-10				Medium to Very Stiff Gray, Brown, Black, Greenish Silty Clay Loam with some san highly mixed fill material
	WH			
	3 3	.5-2.5 P	24	
700.79				
	3			Stiff to Very Stiff Black and Green/Gray Silty Clay Loam (Fill) - lots of topsoil mixed in
	5 5	2.5 P	28	
-15				
	1			
	4 4	2.0 P	29	
695.79				
	3			Stiff to Very Stiff Black Silty Clay Loam Topsoil (Fill) with Gray Silt, pieces of Organics and debris
	2 5	1-2.5 P	32	
693.29				
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	4			Very Stiff Greenish Gray/Brown Silty Clay Loess *(continued)*
	5 6	2.7 S	29	
690.79				
				Hard Brown and Gray Silty Clay Loam Till
	6			
	8 11	7.6 S	18	
-25				
	7			
	8 12	7.9 S	19	
686.29				
				End of Boring
-30				
-35				
-40				

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/17/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.158833, **Longitude** -88.644568

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 3
Station 702+30
Offset 13.0 ft Lt.
Ground Surface Elev. 718.92 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 685.9 ft ▽
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Augered 17" Bituminous Shoylder over Brown, Gray Silty Clay (Fill) (Soft Fill)
716.42				
	3			Medium to Very Stiff Brown Silty Clay Loam and Silty Clay Till with Silt Pockets (Fill)
	4 3	1-3.0 P	19	
-5				
	2			
	3 4	3.0 P	20	
711.42				
	2			Stiff to Very Stiff Black, Gray and Brown Silty Clay and Silty Clay Loam (Fill) with some Till (Fill)
	2 3	1.5-3.5 P	24	
709.42				
-10				Very Stiff Brown Silty Clay Loam Till (Fill)
	3			
	4 5	3.0 P	17	
	1			
	4 5	3.9 S	21	
703.92				
-15				Very Stiff Black, Gray and Brown Silty Clay Loam Till (Fill) with Silt pockets at 20'
	1			
	3 5	3.0 P	24	
	2			
	2 5	3.1 B	22	
-20				
	2			Very Stiff Black, Gray and Brown Silty Clay Loam Till (Fill) with Silt pockets at 20' *(continued)*
	3 5	2.7 S	18	
	2			
	3 5	2.5 S	21	
694.42				
-25				Very Stiff to Hard Black and Gray Silty Clay Loam, Silty Clay with topsoil mixed in and sandy areas and old road bed at 28.5'
	3			
	4 7	4.0-2.5 P	20	
	4			
	5 18		24	
689.42				
-30				Very Stiff Black Silty Clay Loam Topsoil - Native
	4			
	7 11	3.8 S	25	
687.42				
				Gray and Brown Loess
				▽
684.92				
-35				Very Stiff Brown and Gray Silty Clay Loam Till
	2			
	3 4	2.3 P	24	
682.42				
-40				End of Boring

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/17/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.158443, **Longitude** -88.644552

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 4
Station 703+75
Offset 13.0 ft Lt.
Ground Surface Elev. 712.91 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion Dry ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Augered White Shoulder Stone, Black and Gray Silty Clay Loam (Fill) - some Topsoil Fill under shoulder
710.41				
	2			Stiff to Very Stiff Brown Silty Clay Loam (Fill) - some Till Fill and some Very Silty layers / pockets
	2 3	1.5-2.5 P	21	
-5				
	2			
	4 4	2.5 P	21	
	2			
	2 3	1.5-3.0 P	21	
-10				
	WH			
	2 3	1.5-3.0 P	19	
700.91				
	3			Hard Brown and Gray Silty Clay Till (Fill) with several Silt layers / pockets < 1" thick
	4 5	4.4 S	19	
-15				
	3			
	5 4	4.0 S	19	
	3			
	4 5	4.3 P	20	
693.91				
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			Very Stiff Black, Gray and Brown Silty Clay and Silty Clay Loam (Fill) with lots of Topsoil mixed in *(continued)*
	3 4	3.0 P	24	
690.41				
	22			Very Dense Brown and White Stone - old road bed
689.41	19		8	
	7	4.0 P		Hard Black Silty Clay Loam Topsoil - Native
687.91 -25				
	4			Very Stiff Greenish Gray and Brown Silty Clay Loess
	5 7	3.0 P	25	
686.41				End of Boring
-30				
-35				
-40				

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/20/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159014, **Longitude** -88.644568

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 5 (S. Abut.)
Station 701+62
Offset 14.0 ft Lt.
Ground Surface Elev. 720.97 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Augered Bituminous, Black, Brown Silty Clay (Fill)
718.47				
	2			Stiff Black, Brown, Gray Silty Clay / Silty Clay Loam (Fill) with Topsoil mixed in
	3 3	1.8 P	22	
-5				
	2			
	2 2	1.5 P	26	
713.97				
	1			Stiff to Medium Black / Green Gray Silty Clay / Silty Clay Loam (Fill) with Heavy Topsoil mixed in
	2 3	1.0 P	29	
-10				
	1			
	2 3	1.0 P	24	
708.97				
	2			Stiff to Very Stiff Black / Green Gray Silty Clay / Silty Clay Loam (Fill) with Heavy Topsoil mixed in
	3 4	2.2 B	22	
-15				
	2			
	3 4	2.4 B	25	
	2			
	4 4	2.5 B	24	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	2			Stiff to Very Stiff Black / Green Gray Silty Clay / Silty Clay Loam (Fill) with Heavy Topsoil mixed in *(continued)*
	3 4	2.4 B	24	
	2			
	3 5	2.4 B	24	
695.97 -25				
	3			Stiff to Very Stiff Black Silty Clay Loam Topsoil with pieces of Gray Silty Clay (Fill)
	4 6	2.0 P	30	
	4			
	4 8	3.5 P	27	
				Old road bed at 29' (oily dirty gravel)
690.97 -30				
	4			Very Stiff Black Silty Clay Loam Topsoil
	4 6	2.7 S	27	
688.97				
	3			Very Stiff Brown, Gray Silty Clay Loess
	4 4	2.6 B	27	
686.47				
-35				
	1			Very Stiff Brown and Gray Silty Clay Loam Till
	4 5	3.9 S	20	
683.97				
	4			Hard Gray and Brown Silty Clay Loam Till
	5 8	5.2 S	18	
681.47				
-40				Hard Gray Silty Clay Loam Till

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/20/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**, **Latitude** 41.159014, **Longitude** -88.644568

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 5 (S. Abut.)
Station 701+62
Offset 14.0 ft Lt.
Ground Surface Elev. 720.97 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Hard Gray Silty Clay Loam Till *(continued)*	4		
	5 7	4.7 B	17
678.97			
Very Stiff Gray Silty Clay / Silty Clay Loam Till	4		
	5 7	3.9 B	19
-45	4		
	5 7	2.9 B	19
	3		
	5 7	3.0 B	20
-50	3		
	5 6	2.7 B	20
	3		
	5 7	2.9 B	20
-55	3		
	5 7	3.2 B	20
-60			
Very Stiff Gray Silty Clay / Silty Clay Loam Till *(continued)*	3		
	4 5	2.5 B	14
-65	3		
	5 7	2.7 B	21
-70	3		
	4 5	2.7 S	21
-75	2		
	4 6	2.9 S	22
-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/20/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159014, **Longitude** -88.644568

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 5 (S. Abut.)
Station 701+62
Offset 14.0 ft Lt.
Ground Surface Elev. 720.97 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ **Hrs.** _____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
	3			Very Stiff Gray Silty Clay / Silty Clay Loam Till *(continued)*
	4 5	2.9 S	20	
-85	3			
	5 6	2.9 S	20	
-90	3			
	5 5	2.9 S	20	
629.47				
				End of Boring
-95				
-100				

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/21/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159695, **Longitude** -88.644587

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 6 (N. Abut.)
Station 699+11
Offset 13.0 ft Lt.
Ground Surface Elev. 721.02 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Augered Bituminous, Black Silty Clay Loam (Fill)
718.52				
	4			Very Stiff Brown and Gray Silty Clay Loam Till (Fill)
	4	3.0 P	23	
716.02				
-5	3			Stiff to Very Stiff Black, Gray and Brown Silty Clay and Silty Clay Loam (Fill) with mixed Topsoil
	3	3.0	21	
	4	P		
	2			
	3	2.5	30	
	3	P		
-10				
	2			
	2	2.3	25	
	3	P		
	3			
	3	2.5	23	
	3	P		
-15				
	2			
	3	2.0	27	
	4	P		
	2			
	3	2.3	19	
702.02	5	P		
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	4			Hard Brown and Gray Silty Clay / Silty Clay Loam (Fill) with Silt pockets and Layers with some layers of Black Topsoil (Fill) *(continued)*
	6	4.5	19	
	6	P		
	4			
	6	4.5	19	
	7	P		
-25				
	4			
	7	>4.5	19	
	7	P		
	6			
	7	>4.5	20	
	7	P		
691.02 -30				
	10			Hard / Dense Black Silty Clay Loam Topsoil (Fill) and two layers of Gravel each 6"-8" - old road bed
	15	4.5	11	
	15	P		
688.52				
	2			Very Stiff Bluish Gray Silty Clay Loess
	3	2.5	26	
	4	S		
686.52				
-35				Very Stiff to Hard Gray and Brown Silty Clay Loam Till
	3			
	4	2.7	25	
	6	S		
684.02				
	10			Hard Brown to Gray Silty Clay Loam Till
	15	8.9	17	
	18	S		
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/21/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159695, **Longitude** -88.644587

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 6 (N. Abut.)
Station 699+11
Offset 13.0 ft Lt.
Ground Surface Elev. 721.02 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Hard Brown to Gray Silty Clay Loam Till *(continued)*	8		
	10 15	10.3 S*	15
* Max Rimac @ 15%	4		
	6 8	4.1 S	18
676.52			
Very Stiff Gray Silty Clay / Silty Clay Loam Till - Very Uniform	-45		
	2		
	3 5	2.5 B	20
	1		
	3 5	2.3 B	20
	-50		
	1		
	3 5	2.5 B	20
	-55		
	1		
	4 5	2.7 B	21
	-60		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray Silty Clay / Silty Clay Loam Till - Very Uniform *(continued)*	2		
	4 5	2.7 B	21
	-65		
	3		
	4 4	2.5 B	22
	-70		
	3		
	4 5	2.7 B	22
	-75		
	3		
	5 5	2.9 B	21
	-80		

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/21/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159695, **Longitude** -88.644587

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 6 (N. Abut.)
Station 699+11
Offset 13.0 ft Lt.
Ground Surface Elev. 721.02 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ **Hrs.** _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray Silty Clay / Silty Clay Loam Till - Very Uniform *(continued)*		3		
		4	2.7	20
	639.52	5	B	
End of Boring				
	-85			
	-90			
	-95			
	-100			

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/27/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**, **Latitude** 41.159293, **Longitude** -88.644464

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 7
Station 700+69
Offset 33.0 ft Lt.
Ground Surface Elev. 696.31 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

Material	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Augered Large Stone and Sand / Gravel Railroad Bed (Fill)				
	-5			
691.31		4		
Stiff to Very Stiff Black / Brown Silty Clay Loam with Sand (Fill)		3 3	1.5 P	26
689.31				
Stiff Black / Gray Clay and Silty Clay (Fill)		2		
		3 4	1.5 P	34
686.81				
Stiff Brown and Gray Silty Clay Loess	-10	1		
		2 2	1.0 P	26
684.81				
Very Stiff Brown and Gray Silty Clay Loam Till		2		
		6 7	3.5 P	23
682.31				
Hard Gray Silty Clay Loam Till	-15	3		
		6 9	5.8 S	15
		3		
		8 12	7.9 S	17
676.81				
	-20			
Very Stiff Gray Silty Clay Loam / Silty Clay Till *(continued)*		2		
		4 8	3.7 B	17
		2		
		3 5	2.7 B	18
	-25			
		2		
		3 6	2.5 B	20
	-30	1		
		3 6	2.5 B	21
	-35	3		
		3 5	2.5 B	20
	-40			

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/27/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**, **Latitude** 41.159293, **Longitude** -88.644464

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 7
Station 700+69
Offset 33.0 ft Lt.
Ground Surface Elev. 696.31 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			Very Stiff Gray Silty Clay Loam / Silty Clay Till *(continued)*
	3 5	2.5 B	21	
-45	3			
	4 6	2.5 B	22	
-50	3			
	5 7	2.5 B	21	
-55	3			
	5 8	2.7 B	26	
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	4			Very Stiff Gray Silty Clay Loam / Silty Clay Till *(continued)*
	6 8	2.9 B	22	
-65	3			
	5 9	2.7 B	20	
-70	4			
	8 12	3.5 S	21	
				623.31 Hard Gray Silty Clay Loam / Silty Clay Till
-75	6			
	9 10	4.0 S	22	
-80				

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 10/27/08

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** Larry Myers

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude 41.159293, **Longitude** -88.644464

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 7
Station 700+69
Offset 33.0 ft Lt.
Ground Surface Elev. 696.31 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ **Hrs.** _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Hard Gray Silty Clay Loam / Silty Clay Till *(continued)*		6		
		8 13	4.3 S	26
	-85	7		
		10 14	4.3 S	29
609.81				
End of Boring	-90			
	-95			
	-100			

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 2/8/00

ROUTE IL170 (SBI-70A) **DESCRIPTION** IL 170 over BNSF Railroad, 13.15 miles South of US 6 **LOGGED BY** LARRY K.

SECTION 111 VB **LOCATION** NW 1/4, **SEC.** 15, **TWP.** 31N, **RNG.** 5E, 3rd **PM**,
Latitude , **Longitude**

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0073
Station 700+41.38

BORING NO. 1A
Station 699+35
Offset 14.0 ft Rt.
Ground Surface Elev. ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

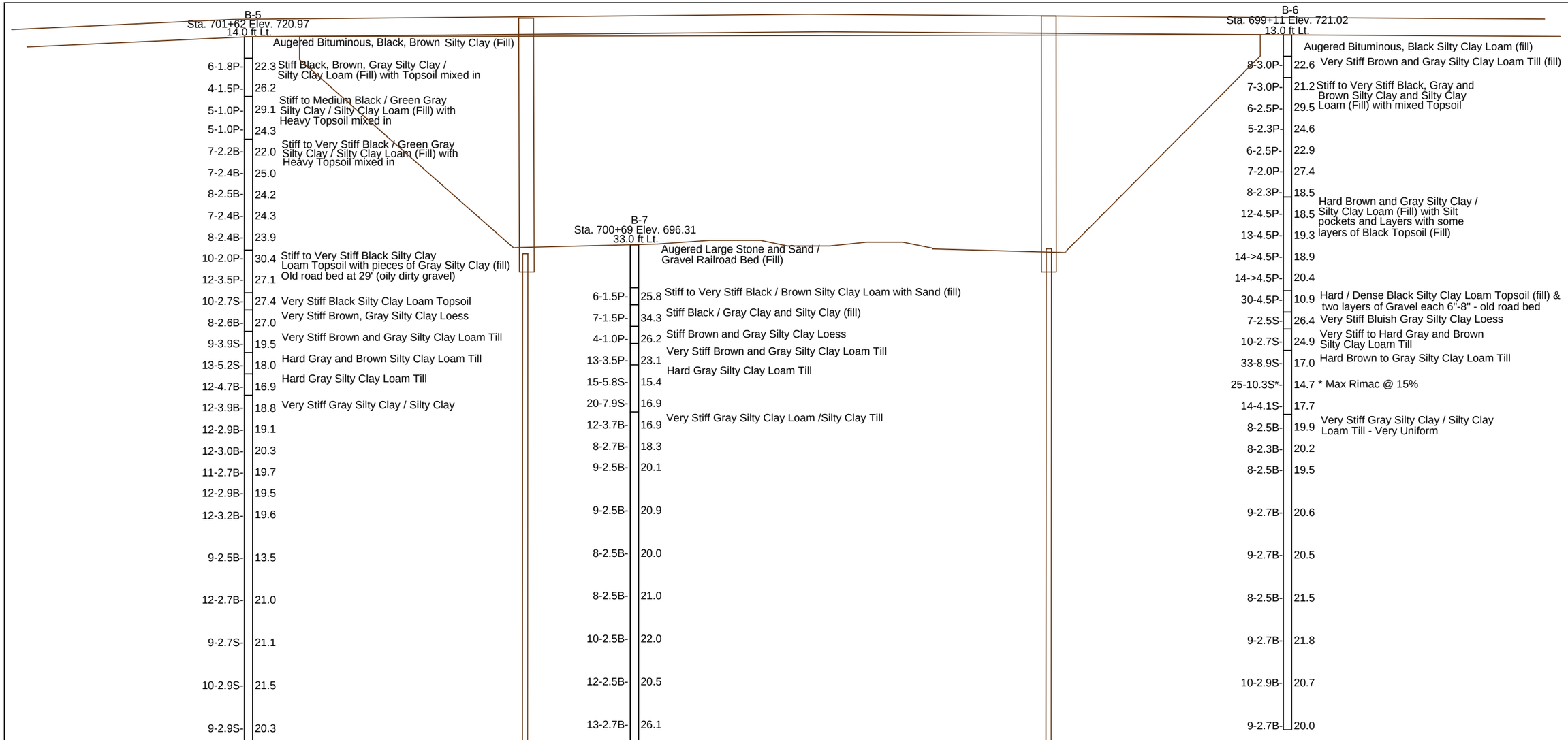
DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Stiff Light Brown SILTY CLAY
	2			
	4 4	1.7 P	24	
-5				Stiff Brown SILTY CLAY
	2			
	2 4	1.5 P	23	
				Stiff Dark Brown & Gray SILTY CLAY LOAM TILL
	2			
	2 3	1.5 P	33	
-10				
	2			
	1 3	1.5 P	25	
				Stiff to Very Stiff Brown-Gray SILTY CLAY TILL
	2			
	3 4	1.7 P	24	
-15				
	1			
	3 4	2.0 P	23	
	3			
	3 5	2.8 P	24	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	2			Very Stiff Dark Brown SILTY CLAY *(continued)*
	4 5	3.0 P	30	
				Stiff Black SILTY CLAY (ORIGINAL GROUND)
	1			
	4 5	1.6 P	30	
-25				End of Boring
-30				
-35				
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING 050-0073.GPJ IL_DOT.GDT 11/18/14



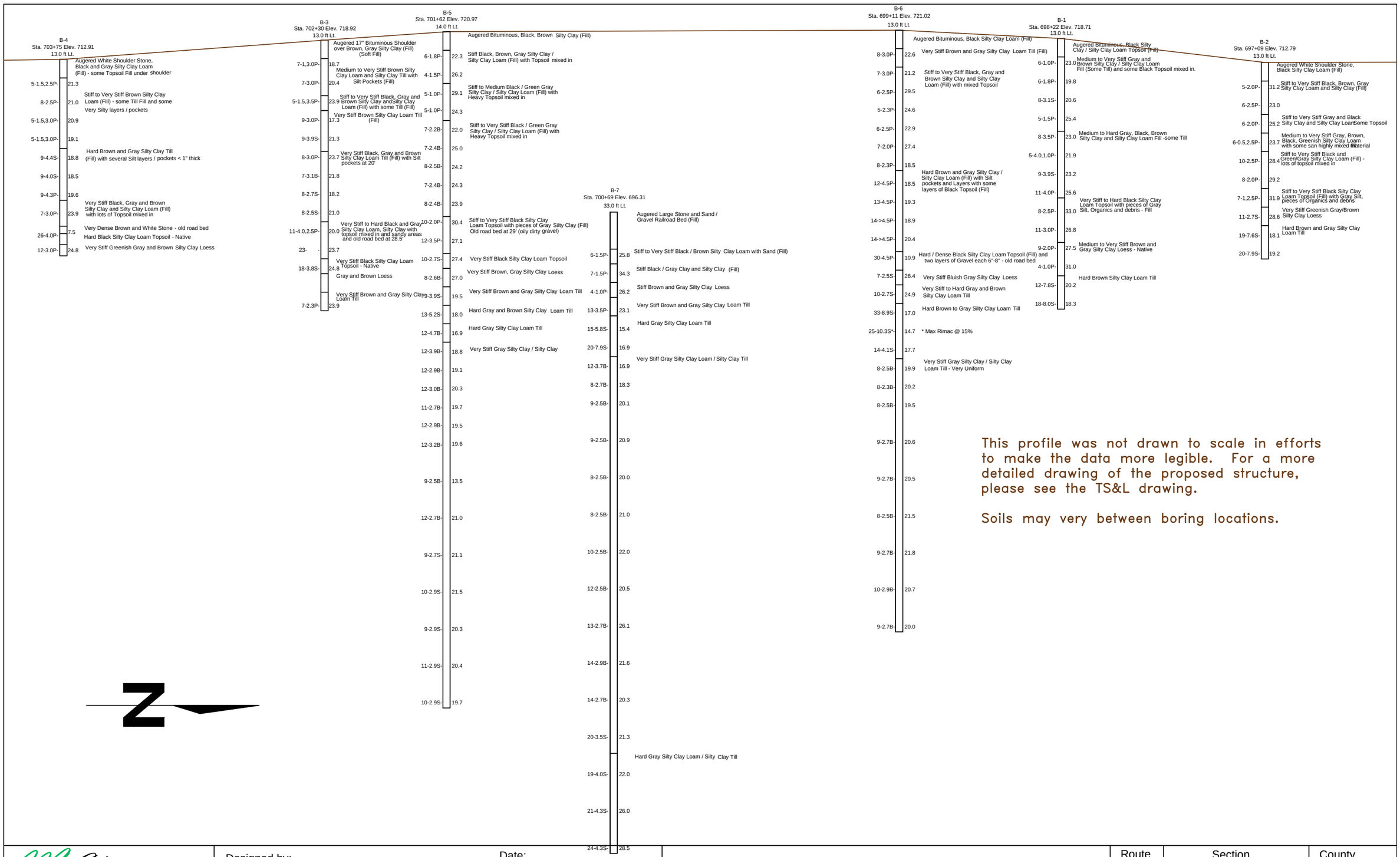
This profile was not drawn to scale in efforts to make the data more legible. For a more detailed drawing of the proposed structure, please see the TS&L drawing.

Soils may very between boring locations.

N

McCleary Engineering

Designed by:	Date:	IL 170 over BNSF Railroad	Route	Section	County
Drawn by: MLL	Date: 6/25/15		IL 170	111VBR	LASALLE
Checked by:	Date:	Scale = NA Sheet 1 of 1 Sta. _____ to Sta._____	Bridge number: 050-0073		



This profile was not drawn to scale in efforts to make the data more legible. For a more detailed drawing of the proposed structure, please see the TS&L drawing.

Soils may very between boring locations.

McCleary Engineering	Designed by:	Date:	IL 170 over BNSF Railroad	Route	Section	County
	Drawn by: MLL	Date: 6/25/15		IL 170	111VBR	LASALLE
	Checked by:	Date:	Scale = NA Sheet 1 of 1 Sta. _____ to Sta._____	Bridge number: 050-0073		

COHESIVE SOIL SETTLEMENT ESTIMATE

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified on 12/9/14

LOCATION AND BORING USED ====: South Approach at Station 706+00
TYPE OF SURCHARGE ==========: 1 (1=2:1 bridge cone, 2=continuous embank., 3=rectangular surch.)
DEPTH TO WATER TABLE (below top of existing embankment) ==: 20 FT

NEW EMBANKMENT:
- NEW EMBANKMENT FILL UNIT WEIGHT ==========: 120 PCF
- NEW EMBANKMENT FILL HEIGHT ==========: 19.05 FT
- PROPOSED WIDTH AT TOP ==========: 36 FT
- PROPOSED WIDTH AT BOTTOM ==========: 150 FT (which is a 3.0:1 slope)

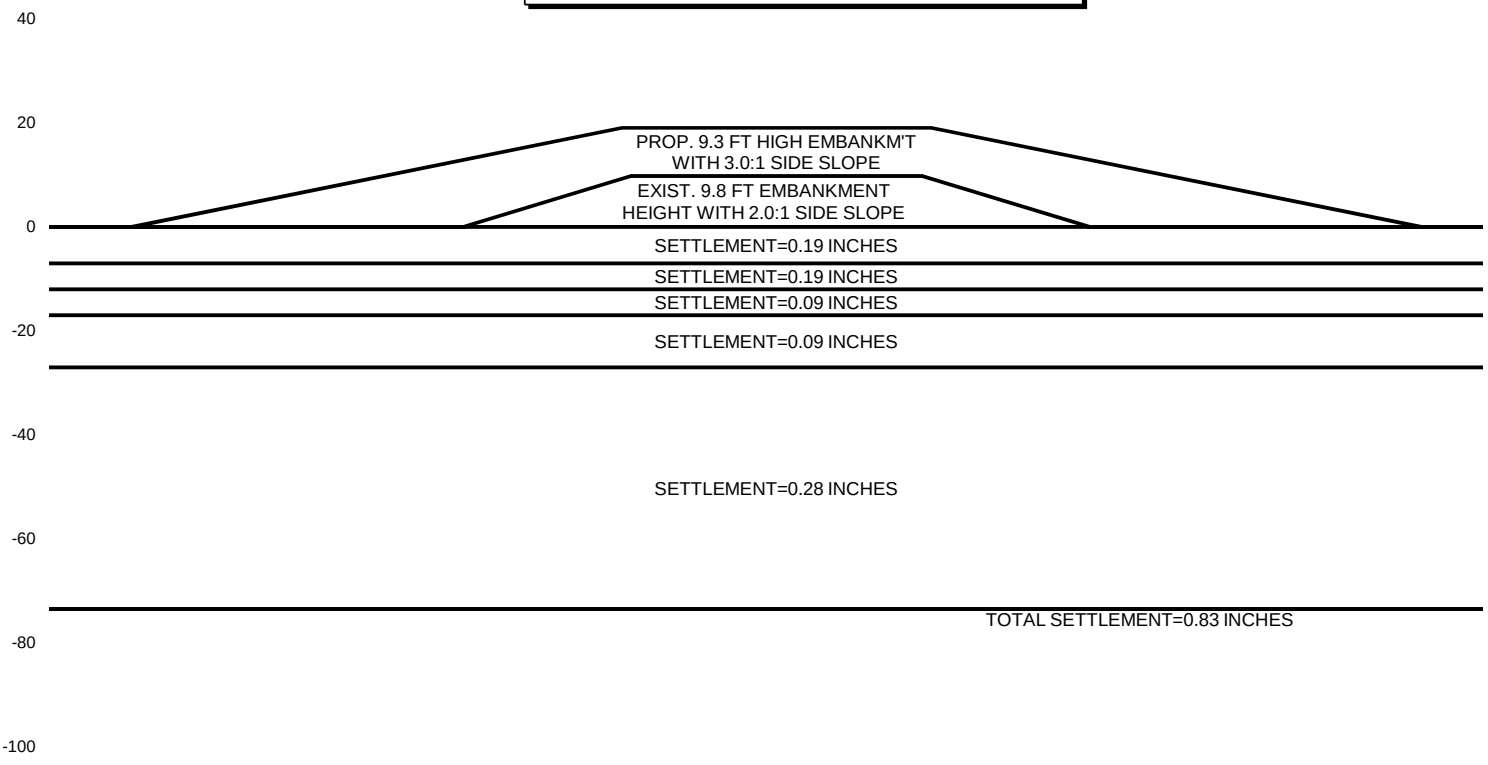
EXISTING EMBANKMENT (IF ANY):
- EXISTING EMBANKMENT UNIT WEIGHT ==========: 120 PCF
- EXISTING EMBANKMENT HEIGHT ==========: 9.78 FT
- EXISTING WIDTH AT TOP ==========: 34 FT
- EXISTING WIDTH AT BASE ==========: 73 FT (which is a 2.0:1 slope)

ASSUMPTIONS:
- Soil Deposit is Normally Consolidated
- Cohesive Layers are Saturated
- Soils have a Low Sensitivity
- Liquid Limit (LL)=Moist. Content (MC%)
- Initial Void Ratio (Eo)=2.7*(MC%)/100
- Comp. Index (Cc)=0.009*(LL-10)
- Neglecting Granular & Secondary Settlem't

LAYER THICK (FT)	*TOTAL UNIT WT. (PCF)*	*UNCONF. COMP. STRENGTH (Qu) (TSF)*	*MOIST. CONTENT (%)*	*EXISTING PRESSURE (KSF)*	*PRESSURE INCREASE (KSF)*	*INITIAL VOID RATIO*	*COMPRESSION INDEX (Cc)*	*Qu CORRECTION FACTOR*	*LAYER SETTLEMENT (IN.)*
7.0	120	1.70	24	1.527	1.112	0.648	0.126	0.127	**0.19**
5.0	120	1.00	26.5	2.133	1.107	0.716	0.149	0.200	**0.19**
5.0	120	2.50	27	2.374	1.093	0.729	0.153	0.100	**0.09**
10.0	120	4.40	18.5	2.681	1.059	0.500	0.077	0.100	**0.09**
46.5	120	2.70	20	4.004	0.860	0.540	0.090	0.100	**0.28**

TOTAL SETTLEMENT UNDER CENTER OF BRIDGE CONE = 0.83 IN.

EMBANKMENT AND SOIL PROFILE



COHESIVE SOIL SETTLEMENT ESTIMATE

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified on 12/9/14

LOCATION AND BORING USED ====: South Abutment
TYPE OF SURCHARGE ==========: 1 (1=2:1 bridge cone, 2=continuous embank., 3=rectangular surch.)
DEPTH TO WATER TABLE (below top of existing embankment) ==: 50 FT

NEW EMBANKMENT:
- NEW EMBANKMENT FILL UNIT WEIGHT ==========: 120 PCF
- NEW EMBANKMENT FILL HEIGHT ==========: 24.93 FT
- PROPOSED WIDTH AT TOP ==========: 36 FT
- PROPOSED WIDTH AT BOTTOM ==========: 185 FT (which is a 3.0:1 slope)

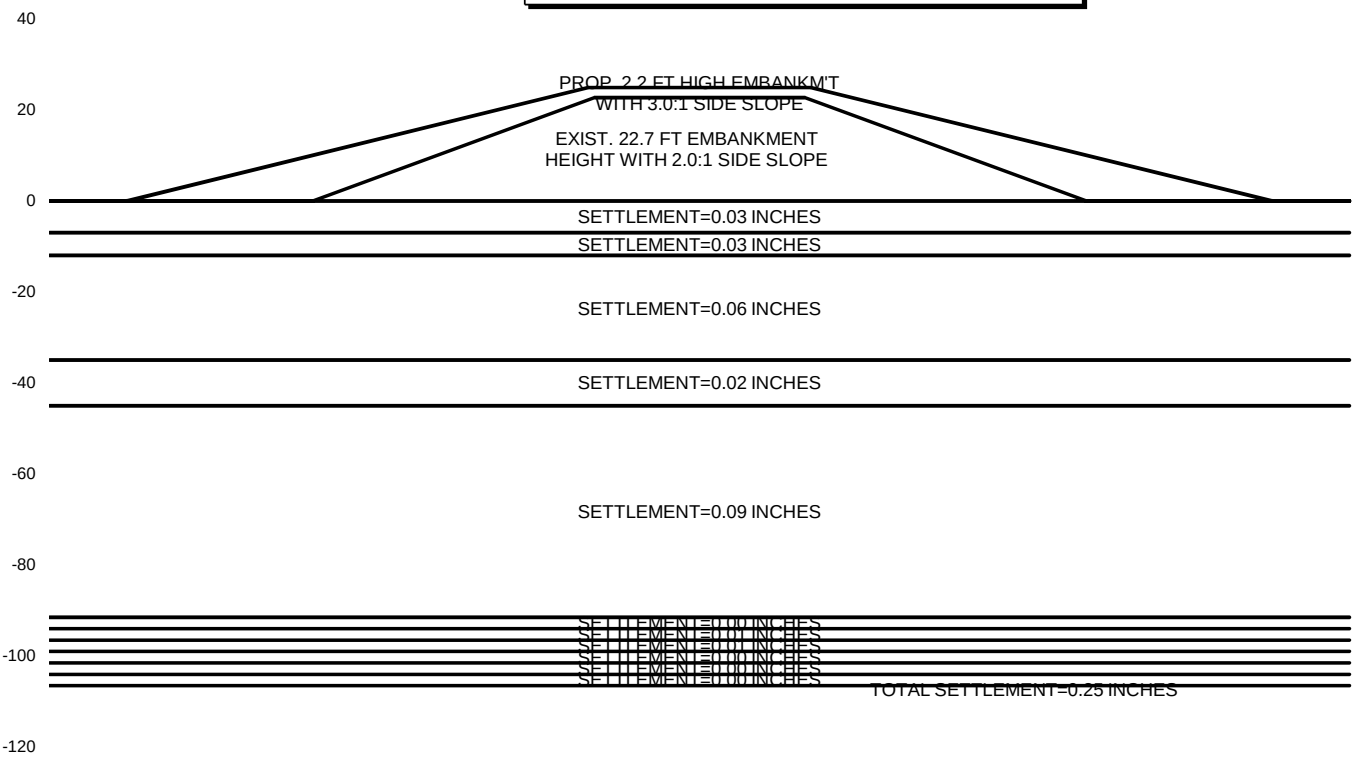
ASSUMPTIONS:
- Soil Deposit is Normally Consolidated
- Cohesive Layers are Saturated
- Soils have a Low Sensitivity
- Liquid Limit (LL)=Moist. Content (MC%)
- Initial Void Ratio (Eo)=2.7*(MC%)/100
- Comp. Index (Cc)=0.009*(LL-10)
- Neglecting Granular & Secondary Settlem't

EXISTING EMBANKMENT (IF ANY):
- EXISTING EMBANKMENT UNIT WEIGHT ==========: 120 PCF
- EXISTING EMBANKMENT HEIGHT ==========: 22.71 FT
- EXISTING WIDTH AT TOP ==========: 34 FT
- EXISTING WIDTH AT BASE ==========: 125 FT (which is a 2.0:1 slope)

LAYER THICK (FT)	*TOTAL UNIT WT. (PCF)*	*UNCONF. COMP. STRENGTH (Qu) (TSF)*	*MOIST. CONTENT (%)*	*EXISTING PRESSURE (KSF)*	*PRESSURE INCREASE (KSF)*	*INITIAL VOID RATIO*	*COMPRESSION INDEX (Cc)*	*Qu CORRECTION FACTOR*	*LAYER SETTLEMENT (IN.)*
7.0	120	1.70	24	3.078	0.267	0.648	0.126	0.127	**0.03**
5.0	120	1.00	27	3.672	0.271	0.729	0.153	0.200	**0.03**
23.0	120	2.50	26	5.009	0.300	0.702	0.144	0.100	**0.06**
10.0	120	4.40	19	5.806	0.330	0.513	0.081	0.100	**0.02**
46.5	120	2.80	24	6.948	0.333	0.648	0.126	0.100	**0.09**
2.5	120	2.50	28	8.088	0.310	0.756	0.162	0.100	**0.00**
2.5	120	2.00	29	8.210	0.307	0.783	0.171	0.111	**0.01**
2.5	120	1.00	32	8.333	0.304	0.864	0.198	0.200	**0.01**
2.5	120	2.50	29	8.456	0.301	0.783	0.171	0.100	**0.00**
2.5	120	2.70	29	8.580	0.298	0.783	0.171	0.100	**0.00**
2.5	120	7.60	18	8.705	0.295	0.486	0.072	0.100	**0.00**

TOTAL SETTLEMENT UNDER CENTER OF BRIDGE CONE = 0.25 IN.

EMBANKMENT AND SOIL PROFILE



COHESIVE SOIL SETTLEMENT ESTIMATE

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified on 12/9/14

LOCATION AND BORING USED ====: North Abutment
TYPE OF SURCHARGE ================================ 1 (1=2:1 bridge cone, 2=continuous embank., 3=rectangular surch.)
DEPTH TO WATER TABLE (below top of existing embankment) == 50 FT

NEW EMBANKMENT:
- NEW EMBANKMENT FILL UNIT WEIGHT ================ 120 PCF
- NEW EMBANKMENT FILL HEIGHT ==================== 24.93 FT
- PROPOSED WIDTH AT TOP ========================= 36 FT
- PROPOSED WIDTH AT BOTTOM ====================== 185 FT (which is a 3.0:1 slope)

EXISTING EMBANKMENT (IF ANY):
- EXISTING EMBANKMENT UNIT WEIGHT ================ 120 PCF
- EXISTING EMBANKMENT HEIGHT ==================== 22.71 FT
- EXISTING WIDTH AT TOP ========================= 34 FT
- EXISTING WIDTH AT BASE ========================== 125 FT (which is a 2.0:1 slope)

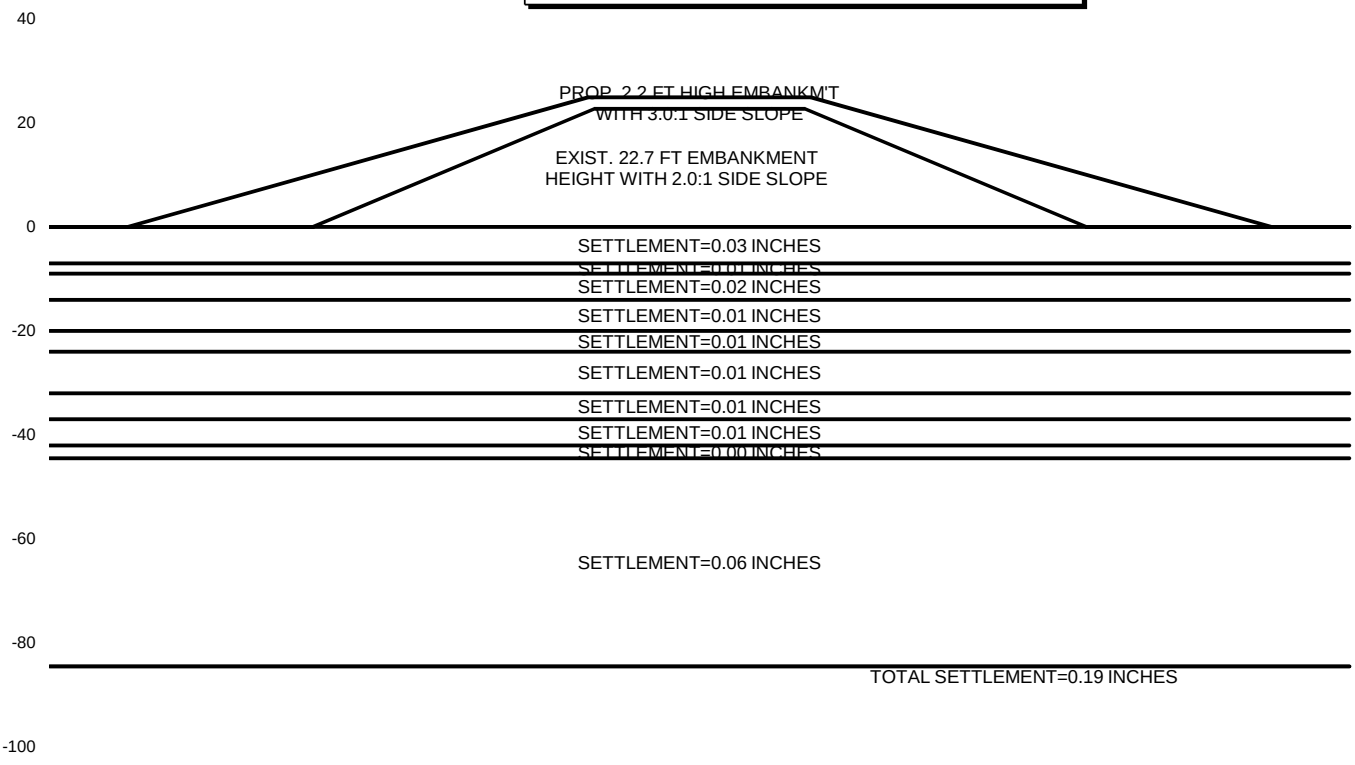
ASSUMPTIONS:

Soil Deposit is Normally Consolidated
Cohesive Layers are Saturated
Soils have a Low Sensitivity
Liquid Limit (LL)=Moist. Content (MC%)
Initial Void Ratio (Eo)=2.7*(MC%)/100
Comp. Index (Cc)=0.009*(LL-10)
Neglecting Granular & Secondary Settlem't

LAYER THICK (FT)	*TOTAL UNIT WT. (PCF)*	*UNCONF. COMP. STRENGTH (Qu) (TSF)*	*MOIST. CONTENT (%)*	*EXISTING PRESSURE (KSF)*	*PRESSURE INCREASE (KSF)*	*INITIAL VOID RATIO*	*COMPRESSION INDEX (Cc)*	*Qu CORRECTION FACTOR*	*LAYER SETTLEMENT (IN.)*
7.0	120	1.60	23.5	3.078	0.267	0.635	0.122	0.134	**0.03**
2.0	120	1.50	33	3.525	0.270	0.891	0.207	0.142	**0.01**
5.0	120	1.60	24.5	3.866	0.274	0.662	0.131	0.134	**0.02**
6.0	120	2.40	23.5	4.393	0.285	0.635	0.122	0.100	**0.01**
4.0	120	2.30	30	4.867	0.297	0.810	0.180	0.100	**0.01**
8.0	120	4.50	20	5.392	0.310	0.540	0.090	0.100	**0.01**
5.0	120	2.60	25.5	5.612	0.322	0.689	0.140	0.100	**0.01**
5.0	120	9.60	16	5.788	0.329	0.432	0.054	0.100	**0.01**
2.5	120	4.10	18	5.926	0.333	0.486	0.072	0.100	**0.00**
40.0	120	2.50	21	6.784	0.336	0.567	0.099	0.100	**0.06**

TOTAL SETTLEMENT UNDER CENTER OF BRIDGE CONE = 0.19 IN.

EMBANKMENT AND SOIL PROFILE



COHESIVE SOIL SETTLEMENT ESTIMATE

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified on 12/9/14

LOCATION AND BORING USED ====: North Approach at Station 695+00
TYPE OF SURCHARGE ==========: 1 (1=2:1 bridge cone, 2=continuous embank., 3=rectangular surch.)
DEPTH TO WATER TABLE (below top of existing embankment) ==: 20 FT

NEW EMBANKMENT:
- NEW EMBANKMENT FILL UNIT WEIGHT ==========: 120 PCF
- NEW EMBANKMENT FILL HEIGHT ==========: 15.23 FT
- PROPOSED WIDTH AT TOP ==========: 36 FT
- PROPOSED WIDTH AT BOTTOM ==========: 126 FT (which is a 3.0:1 slope)

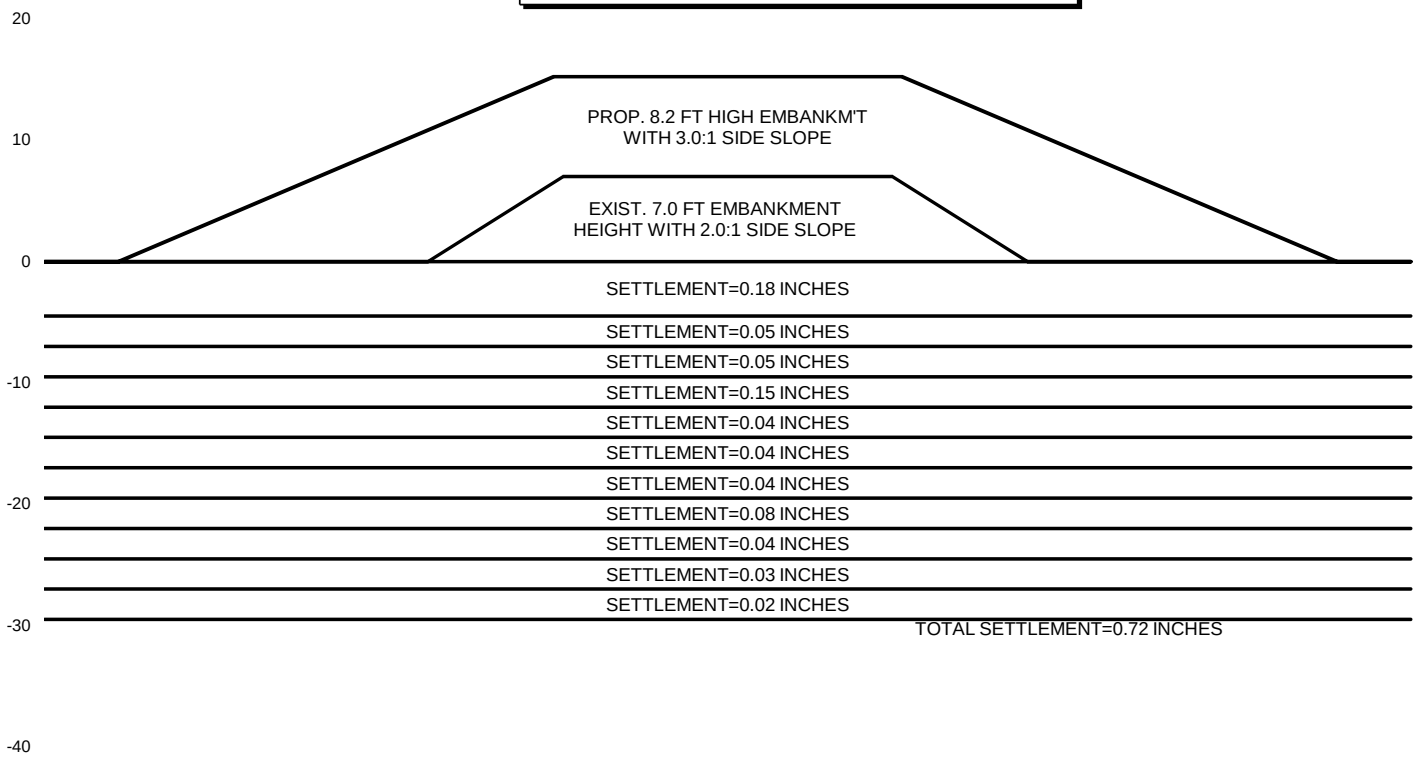
ASSUMPTIONS:
- Soil Deposit is Normally Consolidated
- Cohesive Layers are Saturated
- Soils have a Low Sensitivity
- Liquid Limit (LL)=Moist. Content (MC%)
- Initial Void Ratio (Eo)=2.7*(MC%)/100
- Comp. Index (Cc)=0.009*(LL-10)
- Neglecting Granular & Secondary Settlem't

EXISTING EMBANKMENT (IF ANY):
- EXISTING EMBANKMENT UNIT WEIGHT ==========: 120 PCF
- EXISTING EMBANKMENT HEIGHT ==========: 7 FT
- EXISTING WIDTH AT TOP ==========: 34 FT
- EXISTING WIDTH AT BASE ==========: 62 FT (which is a 2.0:1 slope)

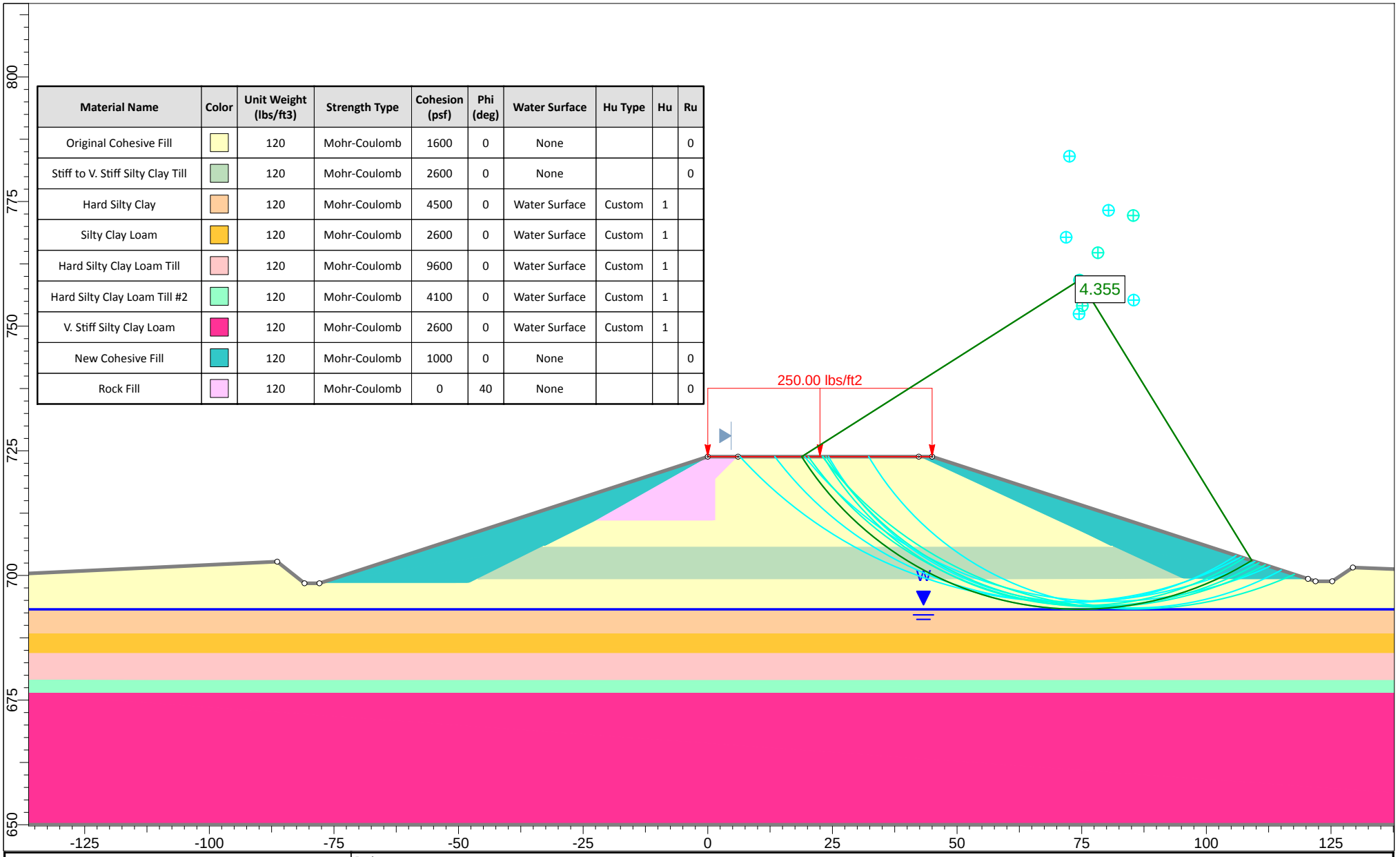
LAYER THICK (FT)	*TOTAL UNIT WT. (PCF)*	*UNCONF. COMP. STRENGTH (Qu) (TSF)*	*MOIST. CONTENT (%)*	*EXISTING PRESSURE (KSF)*	*PRESSURE INCREASE (KSF)*	*INITIAL VOID RATIO*	*COMPRESSION INDEX (Cc)*	*Qu CORRECTION FACTOR*	*LAYER SETTLEMENT (IN.)*
4.5	120	2.00	31	1.067	0.987	0.837	0.189	0.111	**0.18**
2.5	120	2.50	23	1.423	0.984	0.621	0.117	0.100	**0.05**
2.5	120	2.00	25	1.680	0.977	0.675	0.135	0.111	**0.05**
2.5	120	0.50	25	1.940	0.968	0.675	0.135	0.361	**0.15**
2.5	120	2.50	24	2.188	0.955	0.648	0.126	0.100	**0.04**
2.5	120	2.50	28	2.297	0.939	0.756	0.162	0.100	**0.04**
2.5	120	2.00	29	2.409	0.922	0.783	0.171	0.111	**0.04**
2.5	120	1.00	32	2.523	0.903	0.864	0.198	0.200	**0.08**
2.5	120	2.50	29	2.639	0.884	0.783	0.171	0.100	**0.04**
2.5	120	2.70	29	2.758	0.864	0.783	0.171	0.100	**0.03**
2.5	120	7.60	18	2.878	0.843	0.486	0.072	0.100	**0.02**

TOTAL SETTLEMENT UNDER CENTER OF BRIDGE CONE = 0.72 IN.

EMBANKMENT AND SOIL PROFILE



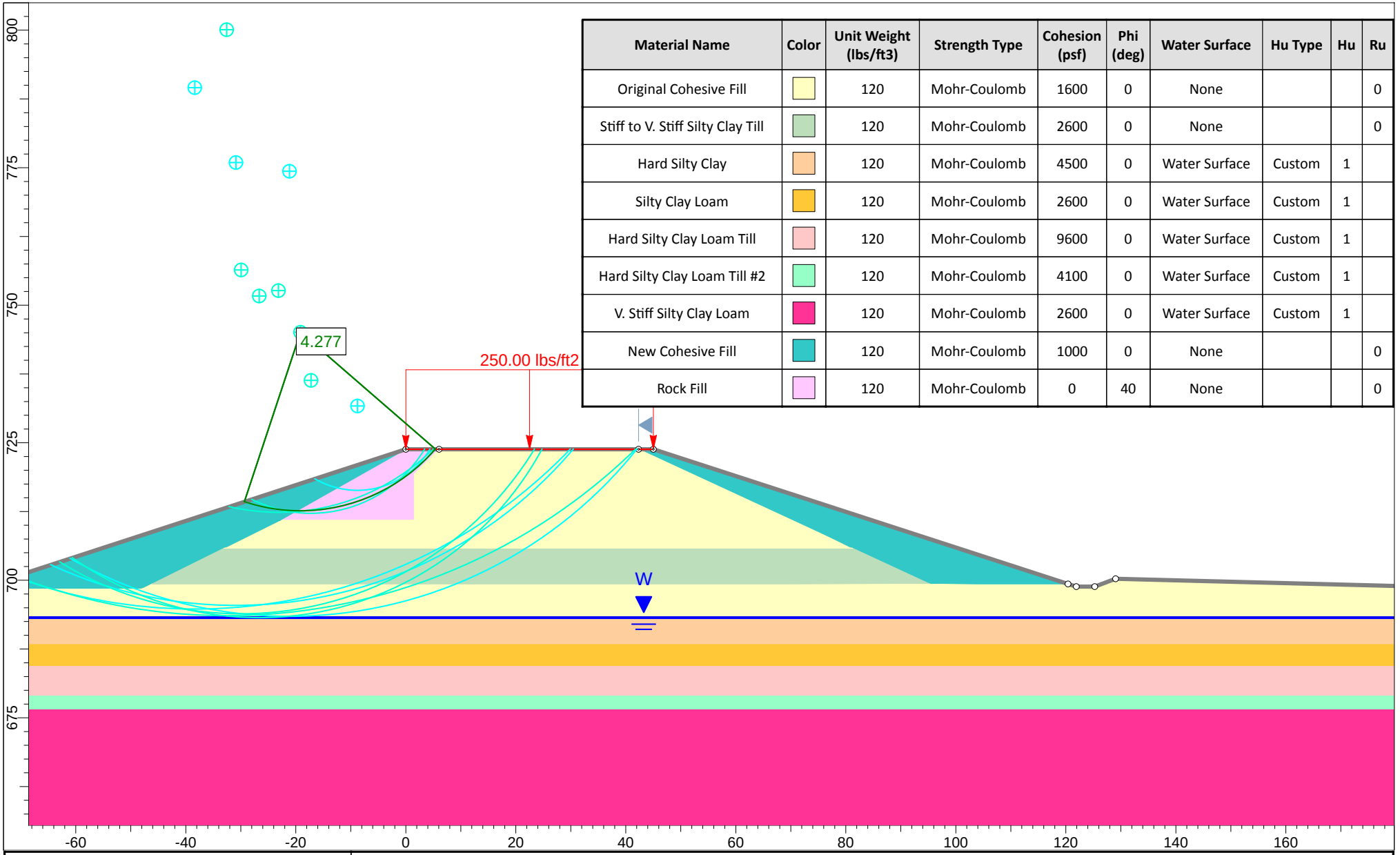
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Original Cohesive Fill		120	Mohr-Coulomb	1600	0	None			0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	2600	0	None			0
Hard Silty Clay		120	Mohr-Coulomb	4500	0	Water Surface	Custom	1	
Silty Clay Loam		120	Mohr-Coulomb	2600	0	Water Surface	Custom	1	
Hard Silty Clay Loam Till		120	Mohr-Coulomb	9600	0	Water Surface	Custom	1	
Hard Silty Clay Loam Till #2		120	Mohr-Coulomb	4100	0	Water Surface	Custom	1	
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	2600	0	Water Surface	Custom	1	
New Cohesive Fill		120	Mohr-Coulomb	1000	0	None			0
Rock Fill		120	Mohr-Coulomb	0	40	None			0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - NW Quad - Boring B-6, Sta 699+11		
Analysis Description	Undrained (End of Construction) - Bishop		
Drawn By	Terry McCleary	*Company*	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	*File Name*	Ransom N Abut W Undrained.slim

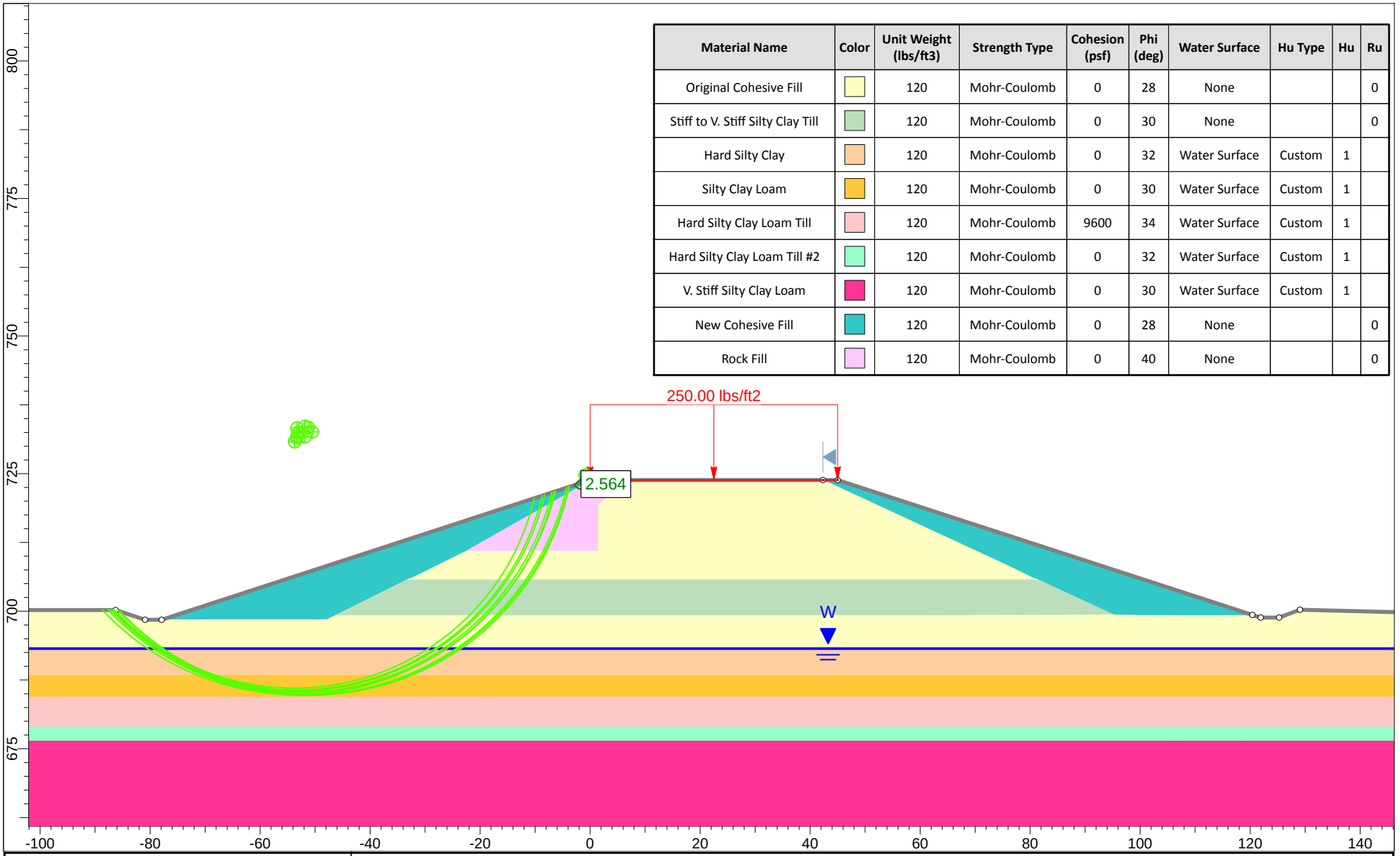
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Original Cohesive Fill		120	Mohr-Coulomb	1600	0	None			0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	2600	0	None			0
Hard Silty Clay		120	Mohr-Coulomb	4500	0	Water Surface	Custom	1	
Silty Clay Loam		120	Mohr-Coulomb	2600	0	Water Surface	Custom	1	
Hard Silty Clay Loam Till		120	Mohr-Coulomb	9600	0	Water Surface	Custom	1	
Hard Silty Clay Loam Till #2		120	Mohr-Coulomb	4100	0	Water Surface	Custom	1	
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	2600	0	Water Surface	Custom	1	
New Cohesive Fill		120	Mohr-Coulomb	1000	0	None			0
Rock Fill		120	Mohr-Coulomb	0	40	None			0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - NE Quad - Boring B-6, Sta 699+11		
Analysis Description	Undrained (End of Construction) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom N Abut E Undrained.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Original Cohesive Fill		120	Mohr-Coulomb	0	28	None			0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	0	30	None			0
Hard Silty Clay		120	Mohr-Coulomb	0	32	Water Surface	Custom	1	
Silty Clay Loam		120	Mohr-Coulomb	0	30	Water Surface	Custom	1	
Hard Silty Clay Loam Till		120	Mohr-Coulomb	9600	34	Water Surface	Custom	1	
Hard Silty Clay Loam Till #2		120	Mohr-Coulomb	0	32	Water Surface	Custom	1	
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	0	30	Water Surface	Custom	1	
New Cohesive Fill		120	Mohr-Coulomb	0	28	None			0
Rock Fill		120	Mohr-Coulomb	0	40	None			0



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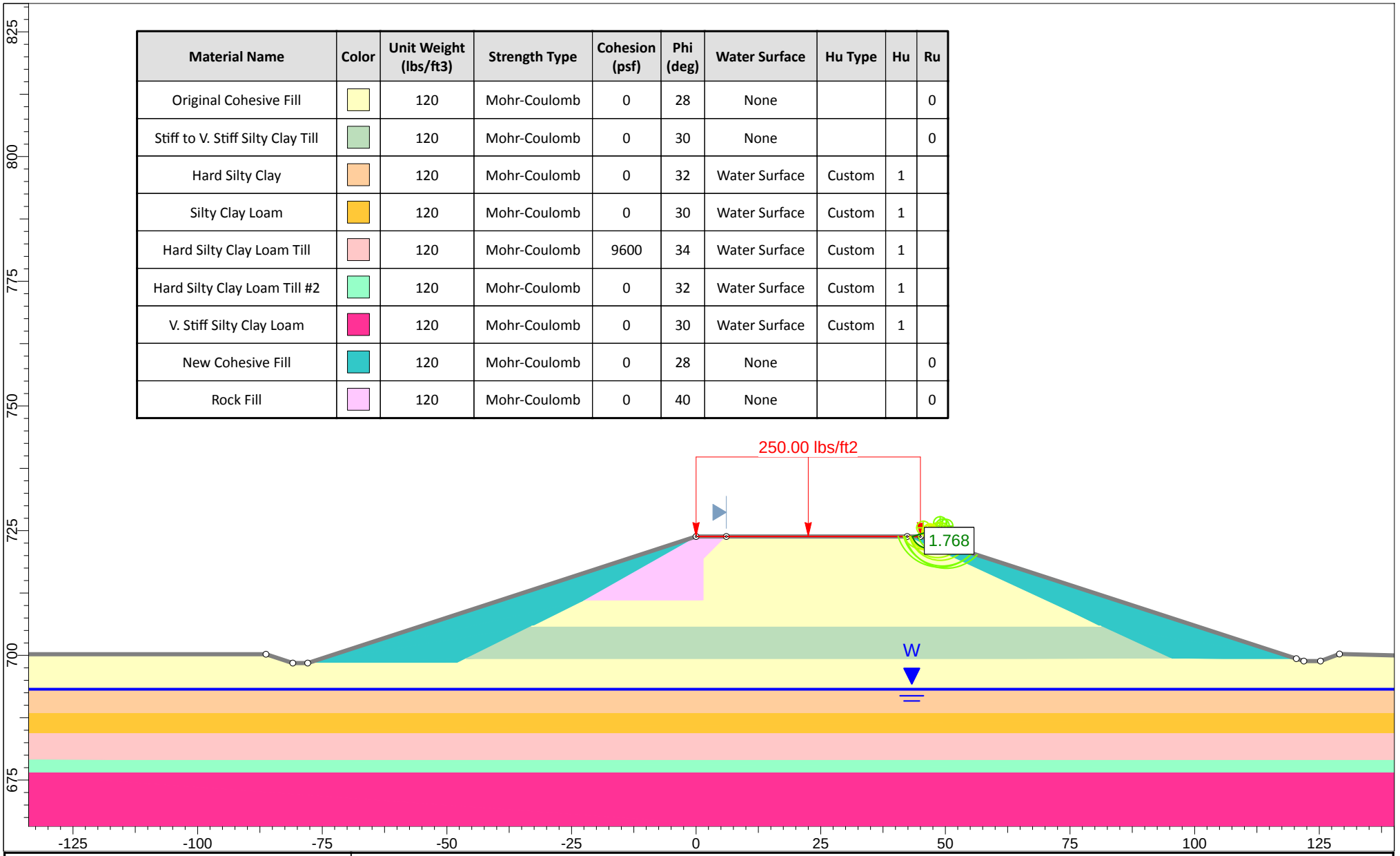
SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - NE Quad - Boring B-6, Sta 699+11
Analysis Description	Drained (Long Term) - Bishop
Drawn By	Terry McCleary
Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM
File Name	Ransom N Abut E Drained.slim

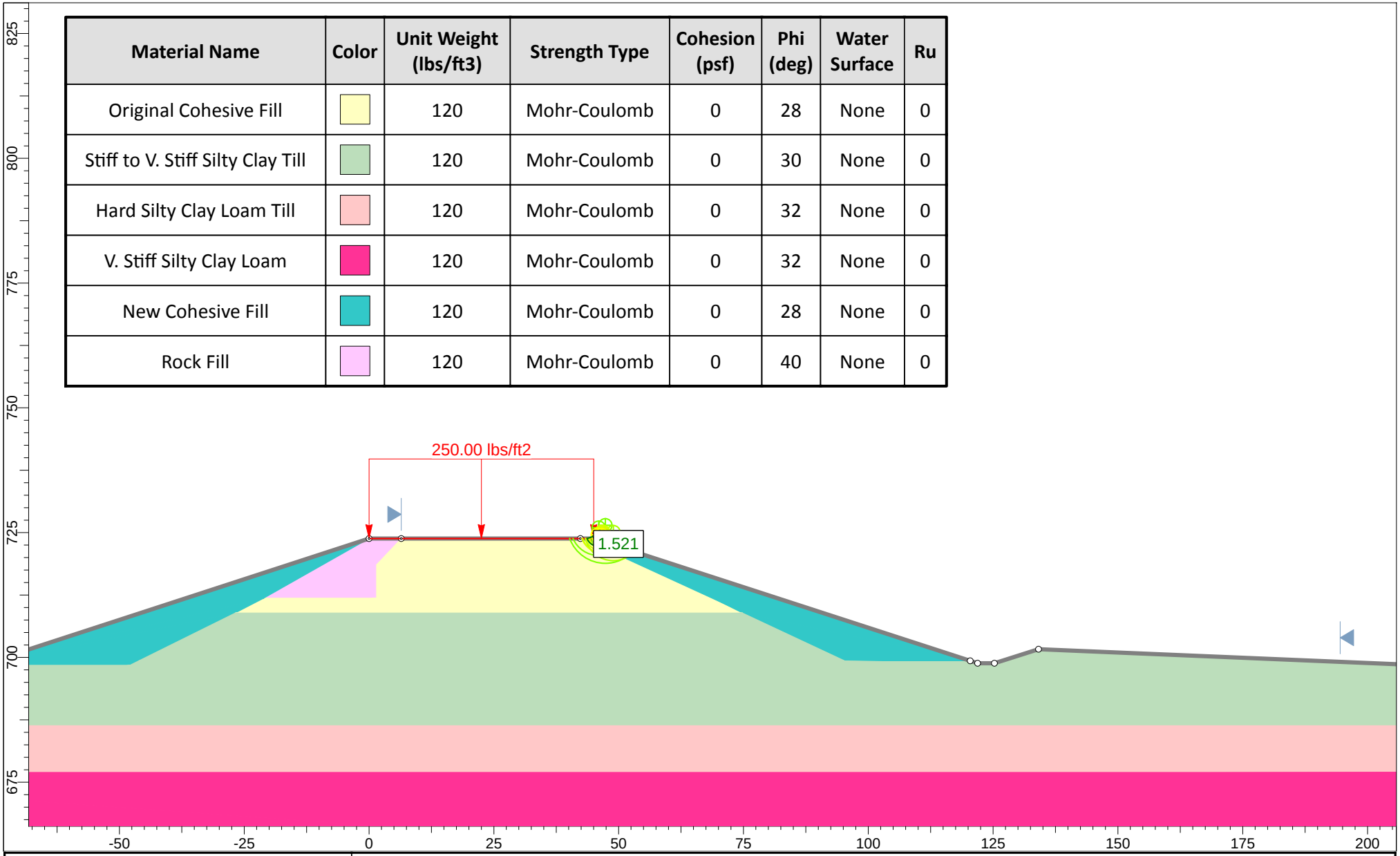
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Original Cohesive Fill		120	Mohr-Coulomb	0	28	None			0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	0	30	None			0
Hard Silty Clay		120	Mohr-Coulomb	0	32	Water Surface	Custom	1	
Silty Clay Loam		120	Mohr-Coulomb	0	30	Water Surface	Custom	1	
Hard Silty Clay Loam Till		120	Mohr-Coulomb	9600	34	Water Surface	Custom	1	
Hard Silty Clay Loam Till #2		120	Mohr-Coulomb	0	32	Water Surface	Custom	1	
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	0	30	Water Surface	Custom	1	
New Cohesive Fill		120	Mohr-Coulomb	0	28	None			0
Rock Fill		120	Mohr-Coulomb	0	40	None			0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - NW Quad - Boring B-6, Sta 699+11		
Analysis Description	Drained (Long Term) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom N Abut W Drained.slim

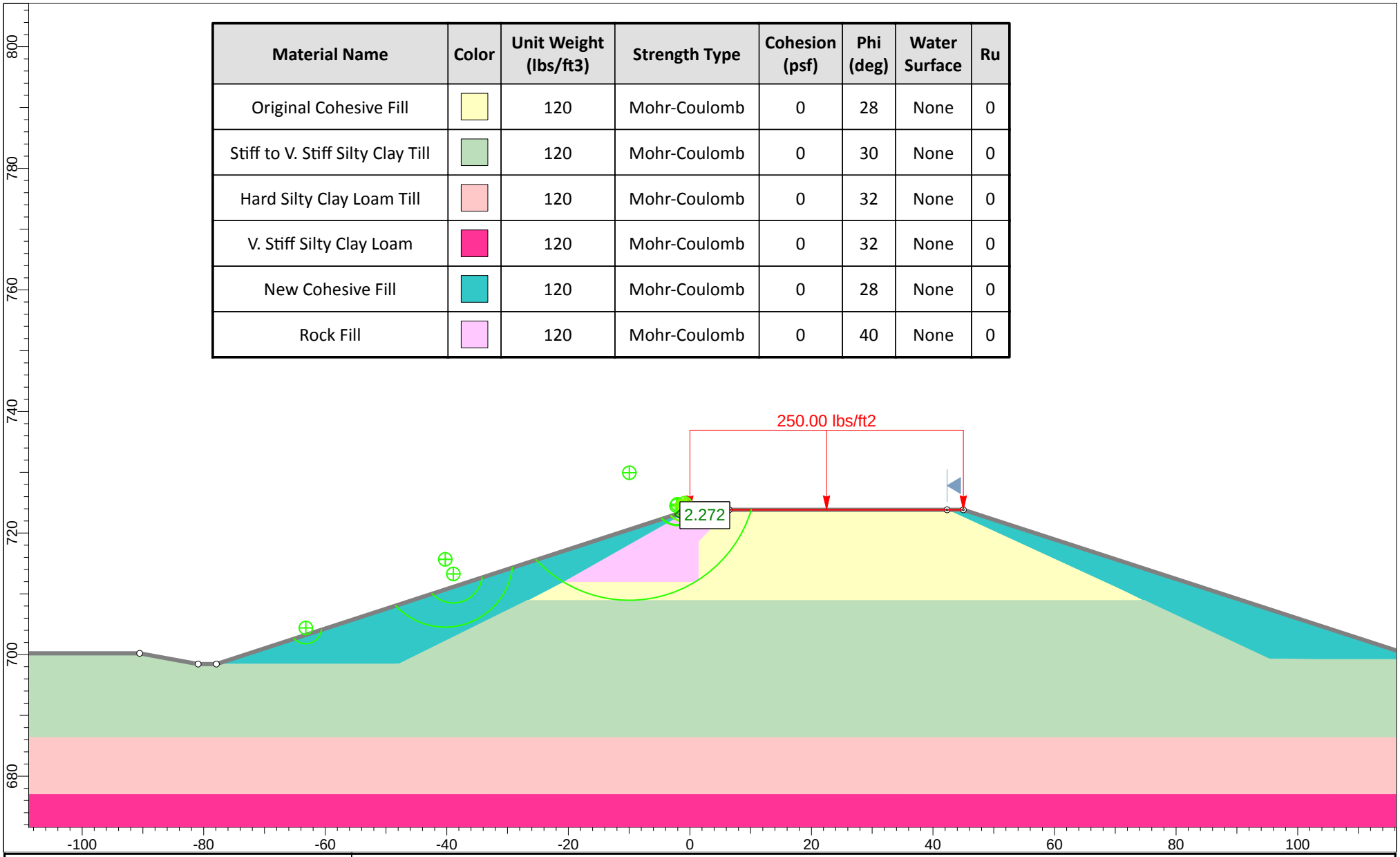
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Original Cohesive Fill		120	Mohr-Coulomb	0	28	None	0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	0	30	None	0
Hard Silty Clay Loam Till		120	Mohr-Coulomb	0	32	None	0
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	0	32	None	0
New Cohesive Fill		120	Mohr-Coulomb	0	28	None	0
Rock Fill		120	Mohr-Coulomb	0	40	None	0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - SW Quad - Boring B-5, Sta701+62		
Analysis Description	Drained (Long Term) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom S Abut W Drained.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Original Cohesive Fill		120	Mohr-Coulomb	0	28	None	0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	0	30	None	0
Hard Silty Clay Loam Till		120	Mohr-Coulomb	0	32	None	0
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	0	32	None	0
New Cohesive Fill		120	Mohr-Coulomb	0	28	None	0
Rock Fill		120	Mohr-Coulomb	0	40	None	0



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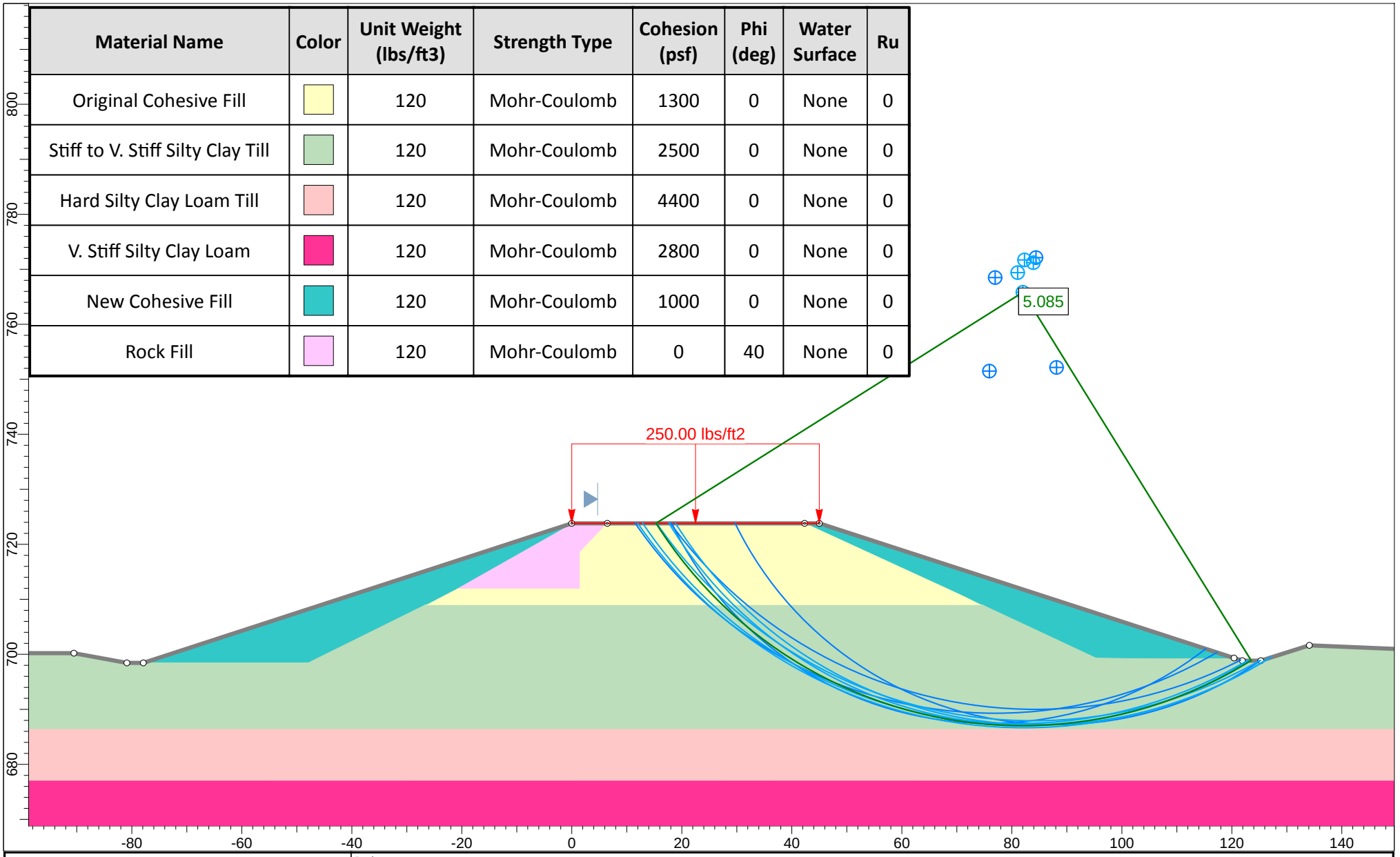
SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - SE Quad - Boring B-5, Sta701+62		
Analysis Description	Drained (Long Term) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom S Abut E Drained.slim

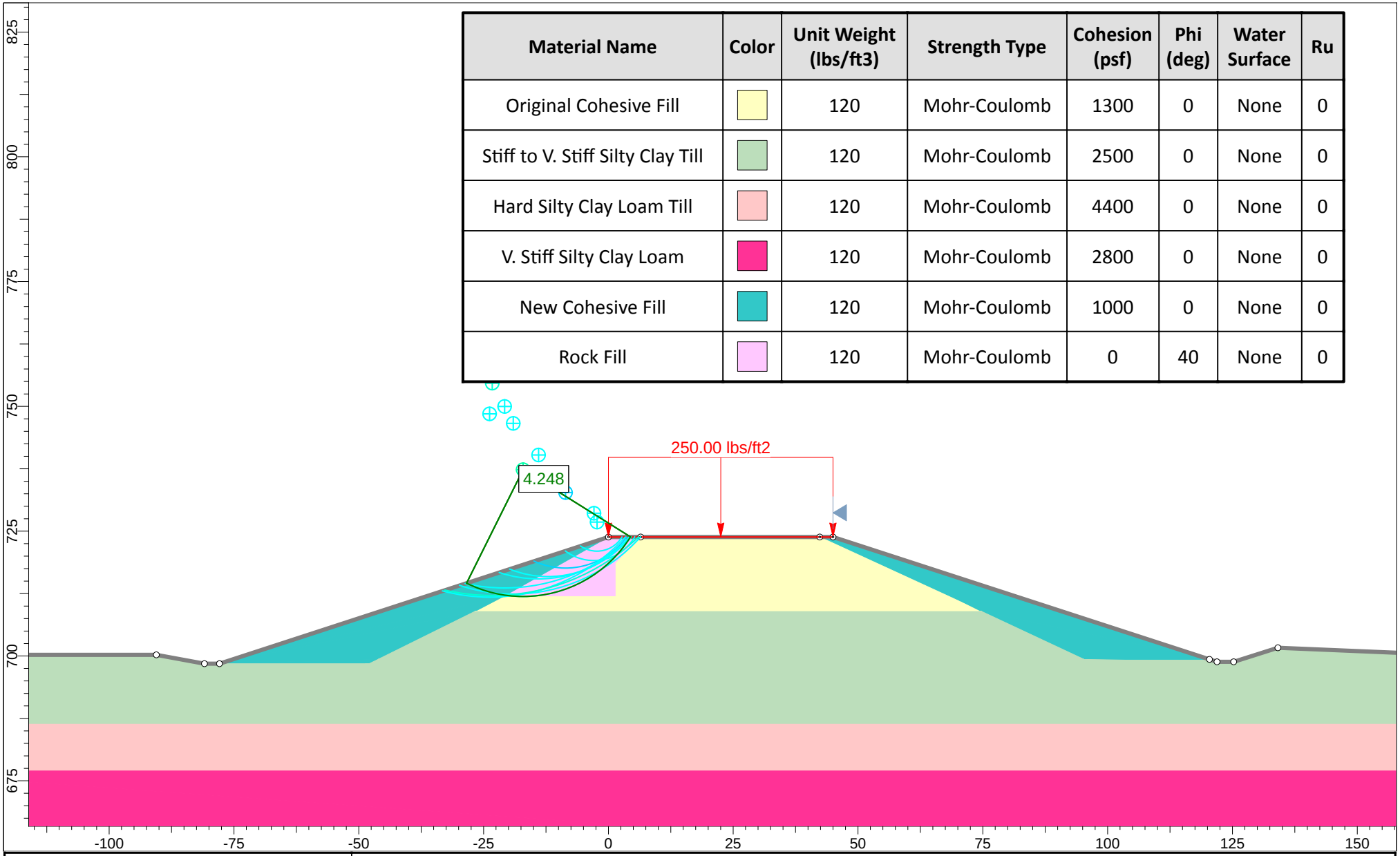
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Original Cohesive Fill		120	Mohr-Coulomb	1300	0	None	0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	2500	0	None	0
Hard Silty Clay Loam Till		120	Mohr-Coulomb	4400	0	None	0
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	2800	0	None	0
New Cohesive Fill		120	Mohr-Coulomb	1000	0	None	0
Rock Fill		120	Mohr-Coulomb	0	40	None	0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - SW Quad - Boring B-5, Sta701+62		
Analysis Description	Undrained (End of Construction) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom S Abut W Undrained.slim

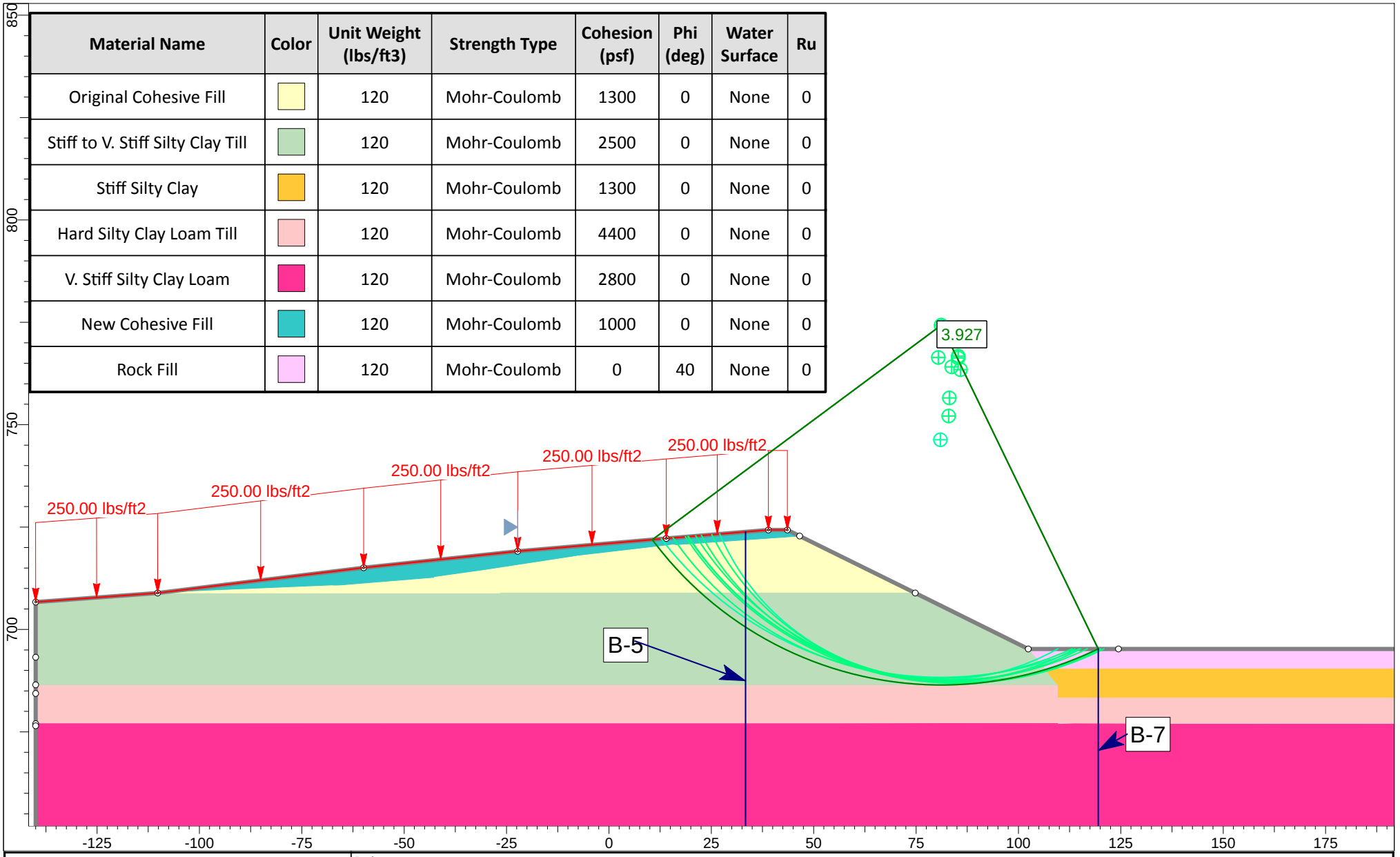
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Original Cohesive Fill		120	Mohr-Coulomb	1300	0	None	0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	2500	0	None	0
Hard Silty Clay Loam Till		120	Mohr-Coulomb	4400	0	None	0
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	2800	0	None	0
New Cohesive Fill		120	Mohr-Coulomb	1000	0	None	0
Rock Fill		120	Mohr-Coulomb	0	40	None	0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - SE Quad - Boring B-5, Sta701+62		
Analysis Description	Undrained (End of Construction) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom S Abut E Undrained.slim

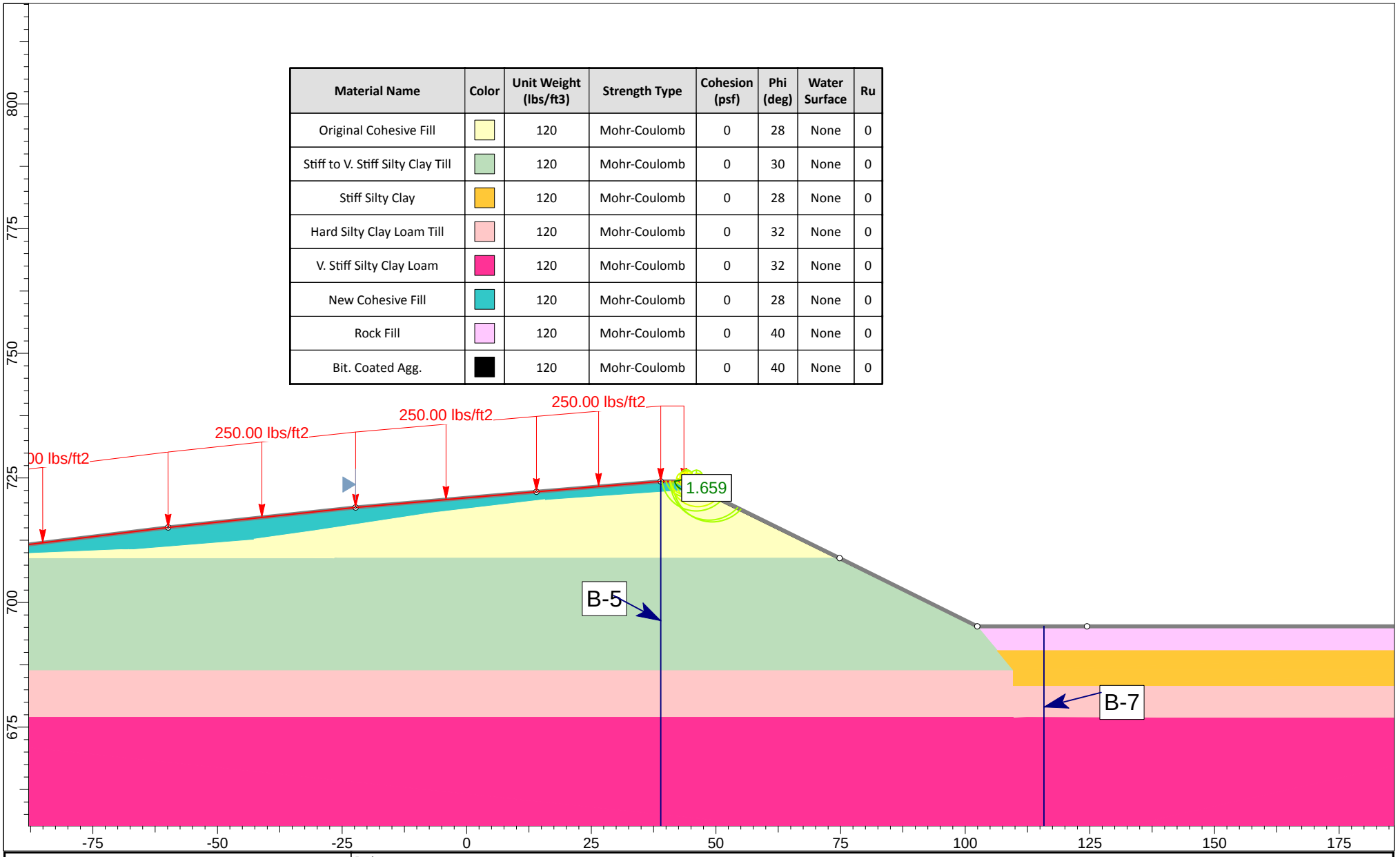
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Original Cohesive Fill		120	Mohr-Coulomb	1300	0	None	0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	2500	0	None	0
Stiff Silty Clay		120	Mohr-Coulomb	1300	0	None	0
Hard Silty Clay Loam Till		120	Mohr-Coulomb	4400	0	None	0
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	2800	0	None	0
New Cohesive Fill		120	Mohr-Coulomb	1000	0	None	0
Rock Fill		120	Mohr-Coulomb	0	40	None	0



SLIDEINTERPRET 6.033

Project	IL 170 over BNSF Railroad - SN050-0258 - S. Abut. End Slope - Boring B-5 & B-7
Analysis Description	Undrained (End of Construction) - Bishop
Drawn By	Terry McCleary
Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM
File Name	Ransom S Abut End Slope Undrained.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Original Cohesive Fill		120	Mohr-Coulomb	0	28	None	0
Stiff to V. Stiff Silty Clay Till		120	Mohr-Coulomb	0	30	None	0
Stiff Silty Clay		120	Mohr-Coulomb	0	28	None	0
Hard Silty Clay Loam Till		120	Mohr-Coulomb	0	32	None	0
V. Stiff Silty Clay Loam		120	Mohr-Coulomb	0	32	None	0
New Cohesive Fill		120	Mohr-Coulomb	0	28	None	0
Rock Fill		120	Mohr-Coulomb	0	40	None	0
Bit. Coated Agg.		120	Mohr-Coulomb	0	40	None	0



Project	IL 170 over BNSF Railroad - SN050-0258 - S. Abut. End Slope - Boring B-5 & B-7		
Analysis Description	Drained (Long Term) - Bishop		
Drawn By	Terry McCleary	Company	McCleary Engineering
Date	7/2/2015, 11:36:09 AM	File Name	Ransom S Abut End Slope Drained.slim

SLIDEINTERPRET 6.033

SEISMIC SITE CLASS DETERMINATION

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified on 12/10/10

PROJECT TITLE=====IL 170 over BNSF Railroad SN050-0258

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	716.55	ft.
Pile or Shaft Dia.	12	inches
Boring Number	6	
Top of Boring Elev.	721.02	ft.
Approximate Fixity Elev.	710.55	ft.

Individual Site Class Definition:

N (bar): 10 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 2.81 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	718.5	2.50	5	1.50	b
	713.5	5.00	7	3.00	
4.5	706.0	7.50	6	2.50	
9.5	701.0	5.00	8	2.20	
22.0	688.5	12.50	17	4.50	b
27.0	683.5	5.00	8	2.60	
32.0	678.5	5.00	29	9.60	b
34.5	676.0	2.50	14	4.10	b
39.5	671.0	5.00	8	2.40	
71.0	639.5	31.50	9	2.70	
100.0	610.5	29.00	9	2.70	b

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	691	ft.
Pile or Shaft Dia.	12	inches
Boring Number	7	
Top of Boring Elev.	696.31	ft.
Approximate Fixity Elev.	685	ft.

Individual Site Class Definition:

N (bar): 14 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 3.22 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
0.7	684.3	12.00	6	1.30	b
9.7	675.3	9.00	15	5.25	b
56.7	628.3	47.00	11	2.60	b
61.7	623.3	5.00	20	3.50	
66.7	618.3	5.00	19	4.00	
71.7	613.3	5.00	21	4.30	
74.2	610.8	2.50	24	4.30	
100.0	585.0	25.80	22	4.30	b

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	691	ft.
Pile or Shaft Dia.	12	inches
Boring Number	7	
Top of Boring Elev.	696.31	ft.
Approximate Fixity Elev.	685	ft.

Individual Site Class Definition:

N (bar): 15 (Blows/ft.) Soil Site Class D
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 3.86 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
0.7	684.3	12.00	6	1.30	b
9.7	675.3	9.00	15	5.25	b
56.7	628.3	47.00	11	2.60	b
61.7	623.3	5.00	20	3.50	
66.7	618.3	5.00	19	4.00	
71.7	613.3	5.00	21	4.30	
74.2	610.8	2.50	24	4.30	
100.0	585.0	25.80	22	4.30	b

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	716.18	ft.
Pile or Shaft Dia.	12	inches
Boring Number	5	
Top of Boring Elev.	720.97	ft.
Approximate Fixity Elev.	710.18	ft.

Individual Site Class Definition:

N (bar): 10 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 2.7 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	718.5	2.50	5	1.50	
1.7	708.5	10.00	5	1.33	b
24.7	685.5	23.00	9	2.50	b
34.7	675.5	10.00	12	4.40	b
44.7	665.5	10.00	12	2.90	
81.2	629.0	36.50	10	2.80	
100.0	610.2	18.80	10	2.80	b

Global Site Class Definition: Substructures 1 through 4

N (bar): 12 (Blows/ft.) Soil Site Class E
N_{ch} (bar): (Blows/ft.) NA
s_u (bar): 3.15 (ksf) Soil Site Class C <----Controls

USGS Design Maps Summary Report

User–Specified Input

Report Title IL 170 over BNSF RR (SN050-0258)
Wed March 23, 2016 03:31:55 UTC

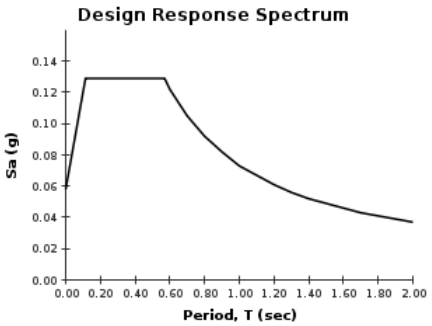
Building Code Reference Document 2009 AASHTO Guide Specifications for LRFD Seismic Bridge Design
(which utilizes USGS hazard data available in 2002)

Site Coordinates 41.15926°N, 88.64459°W

Site Soil Classification Site Class C – "Very Dense Soil and Soft Rock"

USGS–Provided Output

PGA =	0.048 g	**A_s =**	0.058 g
S_s =	0.107 g	**S_{ds} =**	0.129 g
S_1 =	0.043 g	**S_{d1} =**	0.073 g



Pile Discussion for 050-0258:

In 2008, two abutment borings, one pier boring and 4 embankment borings were taken to design the foundations of the proposed structure and evaluate the slope failure on the east side of both approach embankments. In 2000, a boring, boring 1A, was taken just north of the west corner of the north abutment, but only extended to the bottom of the embankment. This boring was used as a reference only during the writing of this report. The factored loads for the foundation units are estimated to be 1322 kip for the abutments and 1909 kip for the piers.

Based on the IDOT All Bridge Designers Memorandum 12.3 "2012 Integral Abutment Bridge Policies and Details" an integral abutment will work at this site with the stiff to very stiff embankment soils found in boring B-6 at the north abutment. Based on the stiff soil present at the North Abutment, and the ABD memo 12.3, only H-piles are feasible with the use of integral abutment. However, if the piles at the North Abutment are pre-cored to 10 feet below the bottom of the pile cap and the annulus is filled with bentonite, 14" metal shell piles will be allowed with the use of integral abutments. Because of the overall boring information, 14" metal shell piles should be used.

A lateral load analysis was performed on the south pier using the commercial software, AllPile7, and the soil information from boring B-7 The smallest of the recommended H-pile found in Table 1, HP14x73, was analyzed using a 71 ft. driven depth below the pier stem. A strength shear value of 6 kips and a strength moment of 115 kip-ft. was used at the bottom of the pier stem. For the analysis, the bottom of the pier stem was treated as the top of the pile. The graphic output displays the results for a range of lateral loads from 0.6 kips/pile to 6 kips/pile for a free head condition. The graphical results are attached to this report. The lateral load analysis is preliminary and should be verified in the final design.

Pile shoes are not recommended for this project. However, at least one test pile is recommended for the north pier where no boring information is available. It may be prudent to utilize a test pile at each of the four substructure elements.

Assumptions used for the pile length analysis include:

1. Bottom of North Abutment elevation = 716.55 ft.
2. Pile Cutoff for the North Abutment = 718.55 ft.
3. Bottom of South Abutment elevation = 716.18 ft.
4. Pile Cutoff for the South Abutment = 718.18 ft.
5. Bottom of both Pier Stem elevations = 691.00 ft.
6. The pile cutoff elevation for the piers = 718.00 ft.
7. Because of the soil types and strengths and the fact the bridge does not cross a waterway no geotechnical losses were accounted for.
8. A 2.0 ft. pile embedment into the abutment is presumed.

By: TCR 06-24-15
Check: MSJ 06-30-15

SGR LOADS:

Project: IL 170 over BNSF RR
Route: FAP 786 (IL 170)
Section: 111VBR
County: LaSalle
Structure: SN 050-0073 (Existing)

TOTAL VERTICAL REACTION (KIPS)				
LOAD	N. ABUTMENT	PIER 1	PIER 2	S. ABUTMENT
SERVICE	928	1370	1370	928
STRENGTH	1322	1909	1909	1322

WORST CASE VERTICAL PILE REACTION (KIPS)				
LOAD	N. ABUTMENT	PIER 1	PIER 2	S. ABUTMENT
SERVICE	159	218	218	159
STRENGTH	238	308	308	238

TOTAL LATERAL REACTION (KIPS, FT-KIPS)				
LOAD	N. ABUTMENT	PIER 1	PIER 2	S. ABUTMENT
SERVICE SHEAR	N/A	23	23	N/A
SERVICE MOMENT	N/A	591	591	N/A
STRENGTH SHEAR	N/A	55	55	N/A
STRENGTH MOMENT	N/A	1152	1152	N/A

WORST CASE LATERAL PILE REACTION (KIPS, FT-KIPS)				
LOAD	N. ABUTMENT	PIER 1	PIER 2	S. ABUTMENT
SERVICE SHEAR	N/A	2	2	N/A
SERVICE MOMENT	N/A	59	59	N/A
STRENGTH SHEAR	N/A	6	6	N/A
STRENGTH MOMENT	N/A	115	115	N/A

Notes:

1. Live Load: HL-93
2. Future Wearing Surface: 50 psf
3. Dead Load at abutments includes 3.4 k/ft for approach pavement
4. Number of piles per abutment: 6
5. Number of piles per pier: 10
6. To estimate lateral stiffness of pier, assumed MS 14x0.312 and 5' depth to fixity
7. Lateral reactions are resisting forces acting perpendicular to the pier wall
8. Lateral reactions are located at bottom of concrete wall
9. Lateral loads not evaluated at abutments because integral abutments satisfy ABD Memo 12.3
10. Train impact load is not included in the analysis due to the piers being greater than 25' from CL of track

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 1/7/2014

STRUCTURE NUMBER==========	IL 170 over BNSF Railroad w/o precore	
STRUCTURE TYPE ==========	MULTI-SPAN	
STRUCTURE SKEW==========	11	DEGREES
TOTAL STRUCTURE LENGTH==========	200.00	FT
LONGEST END SPAN LENGTH ==========	80.00	FT

ABUTMENT #1 DATA

ABUTMENT NAME ==========	North	
ABUTMENT REFERENCE BORING==========	B-6	
BOTTOM OF ABUTMENT ELEVATION==========	716.55	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	

ABUTMENT #2 DATA

ABUTMENT NAME ==========	South	
ABUTMENT REFERENCE BORING==========	B-5	
BOTTOM OF ABUTMENT ELEVATION==========	716.18	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	LAYER THICKNESS (FT)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	N S.P.T. VALUE (BLOWS/12 IN.)	Qu EQUIV. FOR N VALUE (TSF)
714.05	2.50	3.0		
711.55	2.50	2.5		
709.05	2.50	2.3		
706.55	2.50	2.5		

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	LAYER THICKNESS (FT)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	N S.P.T. VALUE (BLOWS/12 IN.)	Qu EQUIV. FOR N VALUE (TSF)
713.97	2.21	1.5		
711.47	2.50	1.0		
708.97	2.50	1.0		
706.18	2.79	2.20		

10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1=======: 2.58 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #1
= 1/(1.45-[0.3*2.58])========== 1.48

WEIGHTED AVERAGE Qu FOR ABUTMENT #2=======: 1.45 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #2
Equal to 1.0 since ave. Qu < 1.5========== 1.00

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1.48*6*0+1*6*200]/[1.48*6+1*6]========== 80.77 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1*6*0+1.48*6*200]/[1*6+1.48*6]========== 119.23 FT

EFFECTIVE EXPANSION LENGTH (EEL) CALCULATION

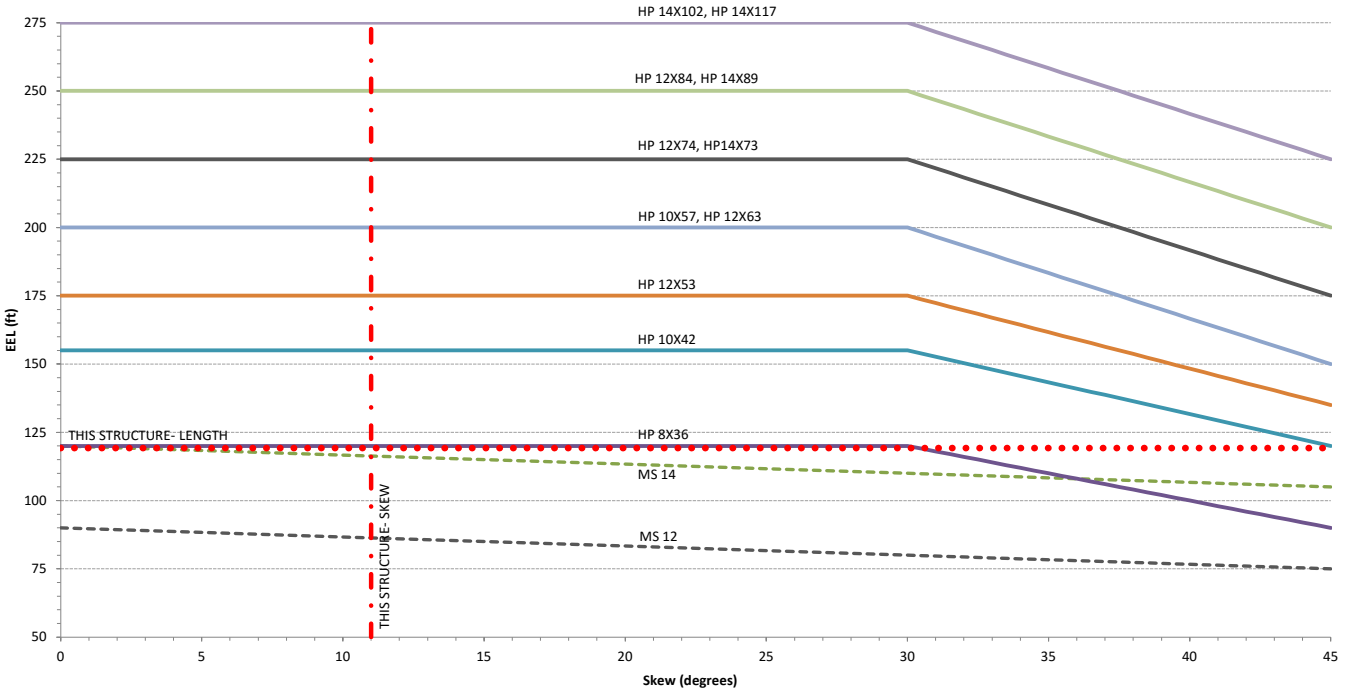
CONTROLLING ABUTMENT==========	ABUT. #2 South	
CONTROLLING EXPANSION LENGTH (DISTANCE TO CENTROID OF STIFFNESS FROM CONTROLLING ABUTMENT) ==========	119.23	FT
WEIGHTED AVE. Qu FOR CONTROLLING ABUTMENT ==========	1.45	TSF
Qu CORRECTION FACTOR ==========	N/A	
EFFECTIVE EXPANSION LENGTH (EEL) ==========	119.23	FT

FEASIBLE PILE TYPES PER CHART IN ABD MEMO 12.3 BASED ON SKEW AND EEL OR MODIFIED EEL:

PILE SIZES AT OR ABOVE THE LENGTH LINE AT THE INTERSECTION WITH THE SKEW LINE ARE ALLOWED FOR USE WITH THIS INTEGRAL ABUTMENT STRUCTURE

AVAILABLE PILE SIZES:

HP 8X36, HP 10X42, HP 12X53, HP 10X57, HP 12X63, HP 12X74, HP 14X73, HP 12X84, HP 14X89, HP 14X102, HP 14X117



INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 1/7/2014

STRUCTURE NUMBER==========	IL 170 over BNSF Railroad w/precore	
STRUCTURE TYPE ==========	MULTI-SPAN	
STRUCTURE SKEW==========	11	DEGREES
TOTAL STRUCTURE LENGTH==========	200.00	FT
LONGEST END SPAN LENGTH ==========	80.00	FT

ABUTMENT #1 DATA

ABUTMENT NAME ==========	North	
ABUTMENT REFERENCE BORING==========	B-6	
BOTTOM OF ABUTMENT ELEVATION==========	716.55	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	

ABUTMENT #2 DATA

ABUTMENT NAME ==========	South	
ABUTMENT REFERENCE BORING==========	B-5	
BOTTOM OF ABUTMENT ELEVATION==========	716.18	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	LAYER THICKNESS (FT)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	N S.P.T. VALUE (BLOWS/12 IN.)	Qu EQUIV. FOR N VALUE (TSF)
714.05	2.50	1.5		
711.55	2.50	1.3		
709.05	2.50	1.2		
706.55	2.50	1.3		

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	LAYER THICKNESS (FT)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	N S.P.T. VALUE (BLOWS/12 IN.)	Qu EQUIV. FOR N VALUE (TSF)
713.97	2.21	1.5		
711.47	2.50	1.0		
708.97	2.50	1.0		
706.18	2.79	2.20		

10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1=======: 1.29 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #1
Equal to 1.0 since ave. Qu < 1.5========== 1.00

WEIGHTED AVERAGE Qu FOR ABUTMENT #2=======: 1.45 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #2
Equal to 1.0 since ave. Qu < 1.5========== 1.00

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1*6*0+1*6*200]/[1*6+1*6]========== 100.00 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1*6*0+1*6*200]/[1*6+1*6]========== 100.00 FT

EFFECTIVE EXPANSION LENGTH (EEL) CALCULATION

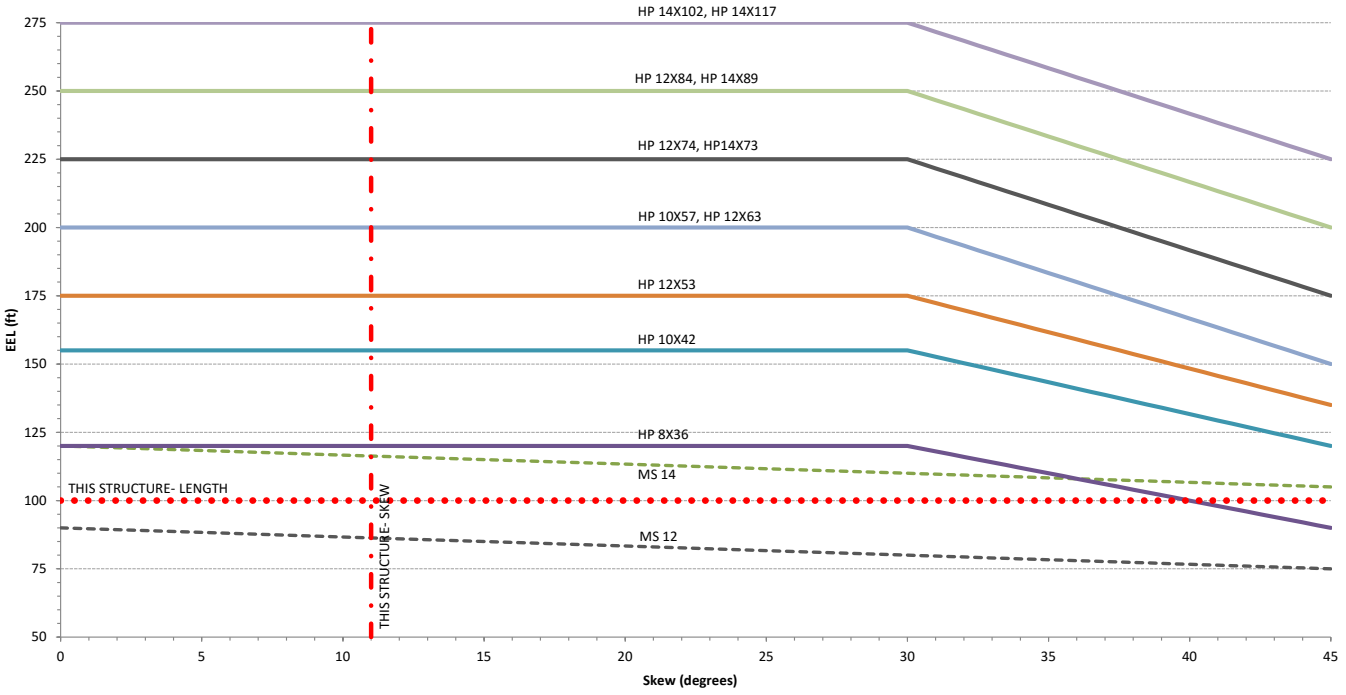
CONTROLLING ABUTMENT==========	EITHER	
CONTROLLING EXPANSION LENGTH (DISTANCE TO CENTROID OF STIFFNESS FROM CONTROLLING ABUTMENT) ==========	100.00	FT
WEIGHTED AVE. Qu FOR CONTROLLING ABUTMENT ==========	1.45	TSF
Qu CORRECTION FACTOR ==========	N/A	
EFFECTIVE EXPANSION LENGTH (EEL) ==========	100.00	FT

FEASIBLE PILE TYPES PER CHART IN ABD MEMO 12.3 BASED ON SKEW AND EEL OR MODIFIED EEL:

PILE SIZES AT OR ABOVE THE LENGTH LINE AT THE INTERSECTION WITH THE SKEW LINE ARE ALLOWED FOR USE WITH THIS INTEGRAL ABUTMENT STRUCTURE

AVAILABLE PILE SIZES:

MS 14, HP 8X36, HP 10X42, HP 12X53, HP 10X57, HP 12X63, HP 12X74, HP 14X73, HP 12X84, HP 14X89, HP 14X102, HP 14X117



Pile Design Table for South Abut. utilizing Boring #5

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 14"Φ w/.25" walls		
199	109	27
218	120	29
253	139	32
295	162	34
319	176	37
340	187	39
354	195	42
377	207	44
395	218	47
Metal Shell 14"Φ w/.312" walls		
199	109	27
218	120	29
253	139	32
295	162	34
319	176	37
340	187	39
354	195	42
377	207	44
395	218	47
418	230	49
443	244	52
466	256	54
481	265	57
500	275	59
Steel HP 8 X 36		
199	109	49
211	116	52
222	122	54
228	125	57
237	130	59
247	136	62
257	141	64
267	147	67
276	152	69
Steel HP 10 X 42		
197	108	37
206	113	39
212	117	42
225	124	44
235	129	47
249	137	49
264	145	52
277	152	54
284	156	57
295	162	59
308	169	62
319	176	64
331	182	67

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
201	111	37
211	116	39
217	119	42
230	127	44
240	132	47
254	140	49
270	148	52
283	156	54
290	159	57
301	166	59
314	173	62
326	179	64
338	186	67
350	193	69
364	200	72
377	207	74
389	214	77
402	221	79
414	228	82
427	235	84
439	242	87
452	249	89
Steel HP 12 X 53		
197	108	32
234	128	34
247	136	37
257	141	39
262	144	42
278	153	44
289	159	47
306	168	49
325	178	52
340	187	54
347	191	57
360	198	59
376	207	62
390	215	64
404	222	67
Steel HP 12 X 63		
199	110	32
236	130	34
250	137	37
259	143	39
264	145	42
280	154	44
291	160	47
309	170	49
328	180	52
344	189	54
350	192	57
363	200	59
380	209	62
394	217	64
408	224	67
422	232	69
439	242	72
454	250	74
469	258	77
484	266	79
Steel HP 12 X 74		
203	111	32
240	132	34
254	140	37
263	145	39
268	147	42
284	156	44
296	163	47
313	172	49
332	183	52
349	192	54
355	195	57
368	203	59
385	212	62
399	220	64
414	227	67
428	235	69
445	245	72
460	253	74
475	262	77
491	270	79
506	278	82
521	286	84
536	295	87
551	303	89
566	311	92
Steel HP 12 X 84		
206	113	32
244	134	34
258	142	37
267	147	39
272	149	42
288	159	44
300	165	47
317	174	49
337	185	52
353	194	54
360	198	57
373	205	59
390	215	62
405	223	64
419	231	67
434	239	69
451	248	72
467	257	74
482	265	77
497	273	79
512	282	82
528	290	84
543	299	87
558	307	89
574	316	92
604	332	97

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
204	112	29
245	135	32
292	161	34
307	169	37
316	174	39
319	175	42
338	186	44
350	193	47
371	204	49
394	217	52
413	227	54
418	230	57
434	239	59
454	250	62
470	259	64
487	268	67
504	277	69
524	288	72
542	298	74
559	308	77
577	317	79
Steel HP 14 X 89		
192	105	27
207	114	29
249	137	32
297	163	34
311	171	37
320	176	39
323	177	42
342	188	44
355	195	47
375	206	49
399	219	52
418	230	54
423	233	57
439	242	59
459	253	62
476	262	64
493	271	67
510	280	69
531	292	72
548	302	74
566	311	77
584	321	79
602	331	82
619	341	84
637	350	87
655	360	89
672	370	92
Steel HP 14 X 102		
194	107	27
209	115	29
252	139	32
301	165	34
316	174	37
324	178	39
327	180	42
347	191	44
359	197	47
380	209	49
404	222	52
423	233	54
428	236	57
444	244	59
465	256	62
482	265	64
499	274	67
516	284	69
537	295	72
555	305	74
573	315	77
591	325	79
608	335	82
626	345	84
644	354	87
662	364	89
680	374	92
716	394	97
Steel HP 14 X 117		
197	108	27
212	117	29
256	141	32
305	168	34
320	176	37
329	181	39
331	182	42
351	193	44
363	200	47
384	211	49
409	225	52
428	236	54
433	238	57
450	247	59
470	259	62
487	268	64
504	277	67
522	287	69
543	299	72
561	309	74
579	319	77
597	329	79
615	338	82
634	348	84
652	358	87
670	368	89
688	378	92
724	398	97
Precast 14"x 14"		
190	105	22
234	129	24
253	139	27
Timber Pile		
151	83	27

Pile Design Table for Piers utilizing Boring #7

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
242	133	58
Metal Shell 12"Φ w/.25" walls		
292	160	66
308	170	68
325	179	71
341	188	73
Metal Shell 14"Φ w/.25" walls		
287	158	58
306	168	61
325	179	63
345	190	66
364	200	68
383	211	71
403	221	73
Metal Shell 14"Φ w/.312" walls		
287	158	58
306	168	61
325	179	63
345	190	66
364	200	68
383	211	71
403	221	73
424	233	76
445	245	78
467	257	81
489	269	83
508	279	86
Steel HP 8 X 36		
277	152	93
Steel HP 10 X 42		
289	159	83
300	165	86
311	171	88
331	182	91

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
295	163	83
306	168	86
318	175	88
338	186	91
352	194	93
372	204	96
388	213	98
407	224	101
423	233	103
440	242	106
Steel HP 12 X 53		
293	161	73
309	170	76
323	177	78
340	187	81
354	195	83
366	202	86
380	209	88
406	223	91
Steel HP 12 X 63		
295	162	73
312	171	76
326	179	78
343	189	81
358	197	83
370	203	86
384	211	88
409	225	91
427	235	93
451	248	96
470	258	98
493	271	101
Steel HP 12 X 74		
286	157	71
299	165	73
316	174	76
330	182	78
348	191	81
363	199	83
375	206	86
389	214	88
415	228	91
433	238	93
457	251	96
476	262	98
500	275	101
520	286	103
540	297	106
561	308	108
581	320	111
Steel HP 12 X 84		
290	159	71
304	167	73
320	176	76
335	184	78
352	194	81
368	202	83
380	209	86
395	217	88
421	232	91
438	241	93
463	255	96
483	266	98
507	279	101
527	290	103
548	301	106
568	313	108
589	324	111
609	335	113
630	347	116
651	358	118

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
291	160	63
307	169	66
322	177	68
338	186	71
354	195	73
374	206	76
390	215	78
411	226	81
429	236	83
442	243	86
459	252	88
491	270	91
511	281	93
541	298	96
563	310	98
Steel HP 14 X 89		
294	162	63
310	171	66
326	180	68
342	188	71
358	197	73
378	208	76
395	217	78
416	229	81
434	239	83
448	246	86
464	255	88
497	273	91
517	285	93
548	301	96
570	314	98
599	329	101
622	342	103
646	355	106
670	368	108
694	382	111
Steel HP 14 X 102		
282	155	61
298	164	63
314	173	66
330	182	68
347	191	71
363	199	73
383	211	76
400	220	78
421	232	81
439	241	83
453	249	86
470	258	88
503	277	91
524	288	93
554	305	96
577	317	98
606	333	101
630	346	103
654	360	106
678	373	108
702	386	111
726	399	113
750	413	116
774	426	118
Steel HP 14 X 117		
285	157	61
302	166	63
318	175	66
334	184	68
351	193	71
367	202	73
387	213	76
405	223	78
426	234	81
444	244	83
458	252	86
475	261	88
509	280	91
530	291	93
561	308	96
584	321	98
613	337	101
637	351	103
662	364	106
686	377	108
710	391	111
735	404	113
759	417	116
783	431	118
Precast 14"x 14"		
242	133	46
Timber Pile		
145	80	46

Pile Design Table for North Abut. utilizing Boring #6

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 14"Φ w/.25" walls		
204	112	27
210	116	29
232	128	32
315	173	39
324	178	42
341	188	44
362	199	47
381	210	49
403	221	52
Metal Shell 14"Φ w/.312" walls		
204	112	27
210	116	29
232	128	32
315	173	39
324	178	42
341	188	44
362	199	47
381	210	49
403	221	52
423	233	54
443	244	57
464	255	59
482	265	62
501	276	64
Steel HP 8 X 36		
196	108	54
205	113	57
215	118	59
223	123	62
232	128	64
242	133	67
252	139	69
263	145	72
273	150	74
282	155	77
Steel HP 10 X 42		
196	108	44
208	115	47
220	121	49
233	128	52
244	134	54
256	141	57
268	147	59
277	153	62
289	159	64
302	166	67
313	172	69
327	180	72

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
200	110	44
213	117	47
224	123	49
238	131	52
250	137	54
262	144	57
273	150	59
283	156	62
295	162	64
308	169	67
320	176	69
334	184	72
347	191	74
357	196	77
369	203	79
381	210	82
393	216	84
405	223	87
417	229	89
429	236	92
453	249	97
Steel HP 12 X 53		
176	97	32
213	117	34
230	127	42
241	133	44
256	141	47
270	148	49
286	157	52
300	165	54
314	173	57
328	180	59
339	187	62
353	194	64
369	203	67
383	211	69
400	220	72
415	228	74
Steel HP 12 X 63		
177	98	32
215	119	34
233	128	42
243	134	44
259	142	47
272	150	49
289	159	52
303	166	54
317	174	57
331	182	59
343	188	62
356	196	64
372	205	67
386	213	69
403	222	72
418	230	74
431	237	77
445	245	79
459	252	82
473	260	84
487	268	87
Steel HP 12 X 74		
180	99	32
219	120	34
236	130	42
247	136	44
262	144	47
276	152	49
293	161	52
307	169	54
321	177	57
336	185	59
347	191	62
361	198	64
377	208	67
392	215	69
409	225	72
424	233	74
436	240	77
451	248	79
465	256	82
480	264	84
494	272	87
508	280	89
523	287	92
551	303	97
580	319	102
Steel HP 12 X 84		
183	101	32
222	122	34
239	132	42
250	138	44
266	146	47
280	154	49
297	163	52
311	171	54
326	179	57
340	187	59
352	194	62
366	201	64
383	210	67
397	218	69
415	228	72
430	236	74
442	243	77
457	251	79
471	259	82
486	267	84
500	275	87
515	283	89
530	291	92
559	307	97
588	323	102
602	331	104
617	339	107

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
197	108	29
216	119	32
266	146	34
280	154	42
292	161	44
311	171	47
327	180	49
347	191	52
363	200	54
380	209	57
397	218	59
410	225	62
425	234	64
445	245	67
462	254	69
482	265	72
500	275	74
514	282	77
530	292	79
547	301	82
564	310	84
Steel HP 14 X 89		
199	110	29
219	120	32
270	148	34
284	156	42
296	163	44
315	173	47
331	182	49
351	193	52
368	202	54
385	212	57
402	221	59
414	228	62
430	237	64
450	248	67
467	257	69
488	268	72
506	278	74
520	286	77
536	295	79
553	304	82
570	314	84
587	323	87
604	332	89
621	341	92
655	360	97
688	379	102
Steel HP 14 X 102		
202	111	29
222	122	32
273	150	34
287	158	42
300	165	44
319	175	47
335	184	49
355	195	52
372	205	54
389	214	57
406	224	59
419	231	62
436	240	64
456	251	67
473	260	69
494	272	72
512	281	74
526	289	77
543	298	79
560	308	82
577	317	84
594	327	87
611	336	89
628	345	92
662	364	97
696	383	102
713	392	104
730	402	107
764	420	112
Steel HP 14 X 117		
204	112	29
225	124	32
277	152	34
291	160	42
303	167	44
323	178	47
339	186	49
360	198	52
377	207	54
394	217	57
411	226	59
424	233	62
441	242	64
461	254	67
478	263	69
500	275	72
518	285	74
532	292	77
549	302	79
566	311	82
583	321	84
601	330	87
618	340	89
635	349	92
669	368	97
704	387	102
721	397	104
738	406	107
773	425	112
Precast 14"x 14"		
184	101	22
222	122	24
260	143	27
Timber Pile		
143	78	27

FOUNDATION PROFILE & SOIL CONDITIONS

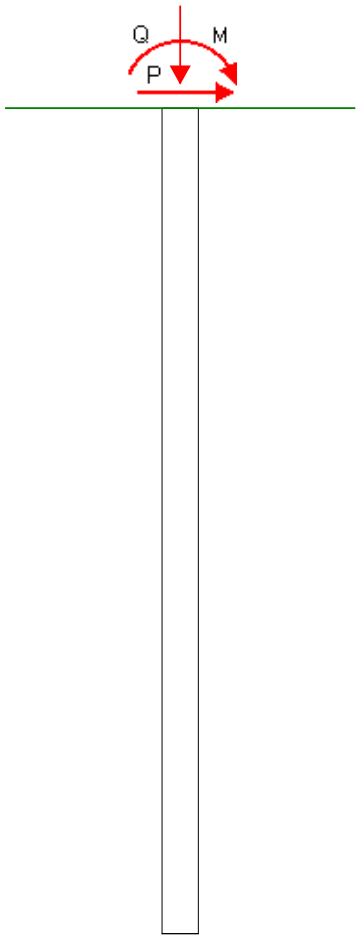
Non-displacement pile: H pile or open-ended pipe. Little soil is displaced. Friction is less than displacement pile. Effective area is used.

FOUNDATION PROPERTIES

Depth	Width-in	A'-in2	Per.-in	I'-in4	E-kp/i2	W-kp/f
0.0	14.6	21.4	56.4	729.0	29000	0.07

Steel (smooth)

71.0



SOIL PROPERTIES

Depth	γ -lb/f3	ϕ	C-kp/f2	k-lb/i3	e50 %	Nspt
0.0	122.2	0.0	1.33	136.8	1.19	6

Stiff Silty Clay

7.0	131.9	0.0	4.72	559.4	0.68	15

Very Stiff to Hard Silty Clay Loam Till

20.0	130.7	0.0	2.70	402.3	0.79	12

Very Stiff Gray Silty Clay Loam Till

68.0	132.8	0.0	4.20	862.4	0.56	21

Hard Silty Clay Loam Till

Depth from Ground-ft

0 15 30 45 60 75 90

Batter Angle=0 (Pile diameter not to scale) Surface Angle=0

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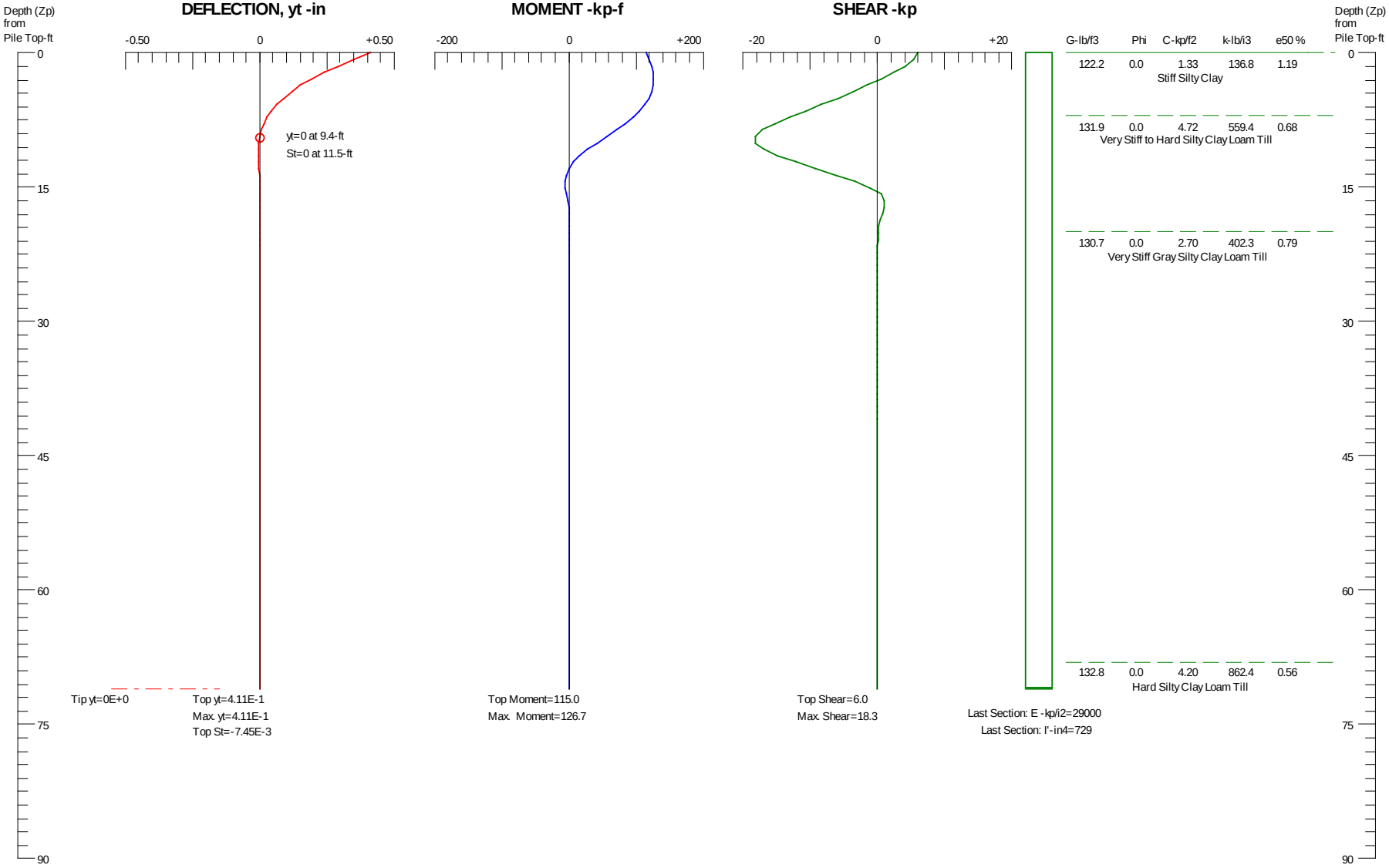
IL 170 over BNSF RR, SN050-0258
Pier, HP14x73

Figure 1

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



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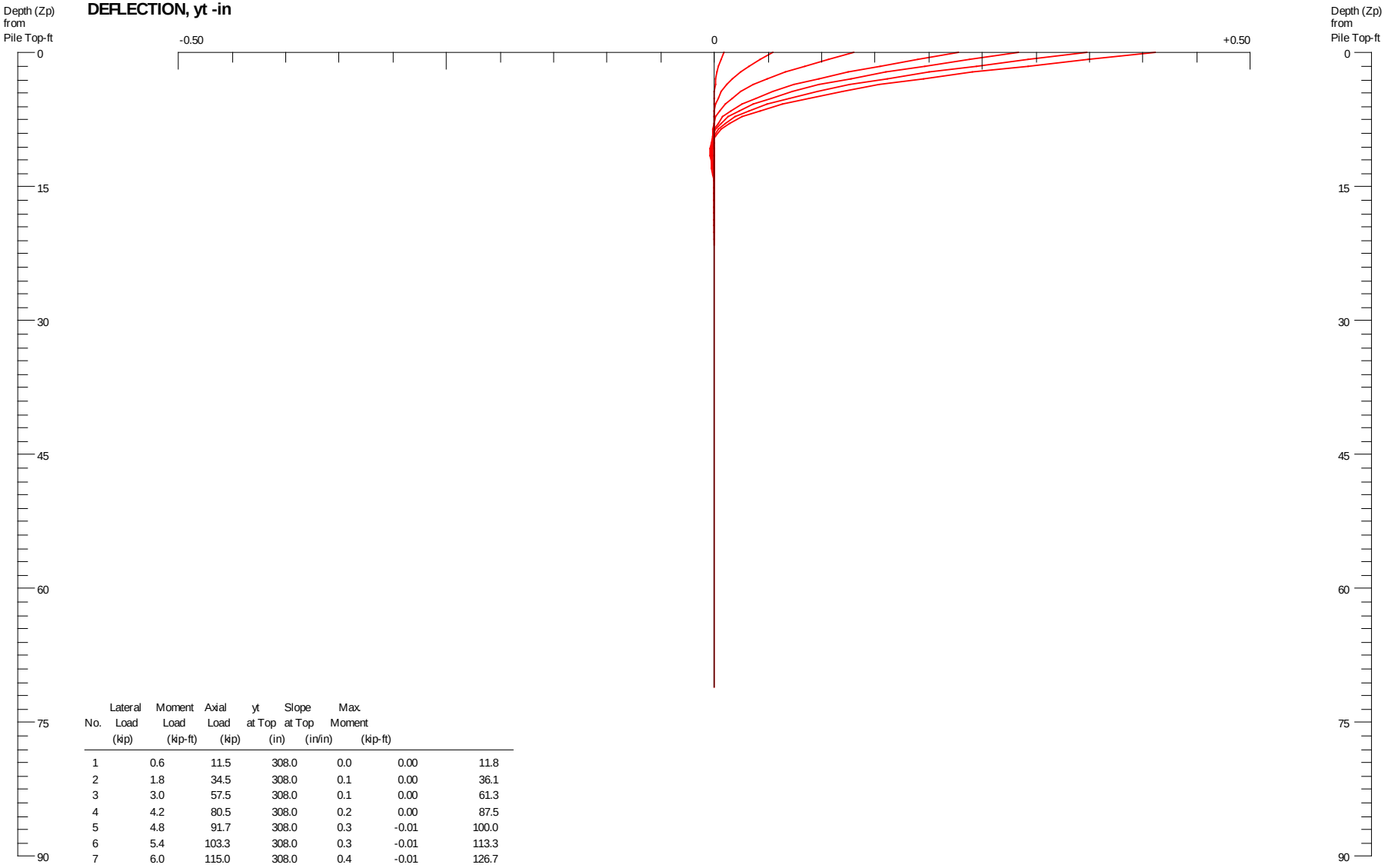
Pier, HP14x73

Figure 2

PILE DEFLECTION vs LOADING

Single Pile, Khead=1, Kbc=1



No.	Lateral Load (kip)	Moment Load (kip-ft)	Axial Load (kip)	yt at Top (in)	Slope at Top (in/in)	Max. Moment (kip-ft)
1	0.6	11.5	308.0	0.0	0.00	11.8
2	1.8	34.5	308.0	0.1	0.00	36.1
3	3.0	57.5	308.0	0.1	0.00	61.3
4	4.2	80.5	308.0	0.2	0.00	87.5
5	4.8	91.7	308.0	0.3	-0.01	100.0
6	5.4	103.3	308.0	0.3	-0.01	113.3
7	6.0	115.0	308.0	0.4	-0.01	126.7

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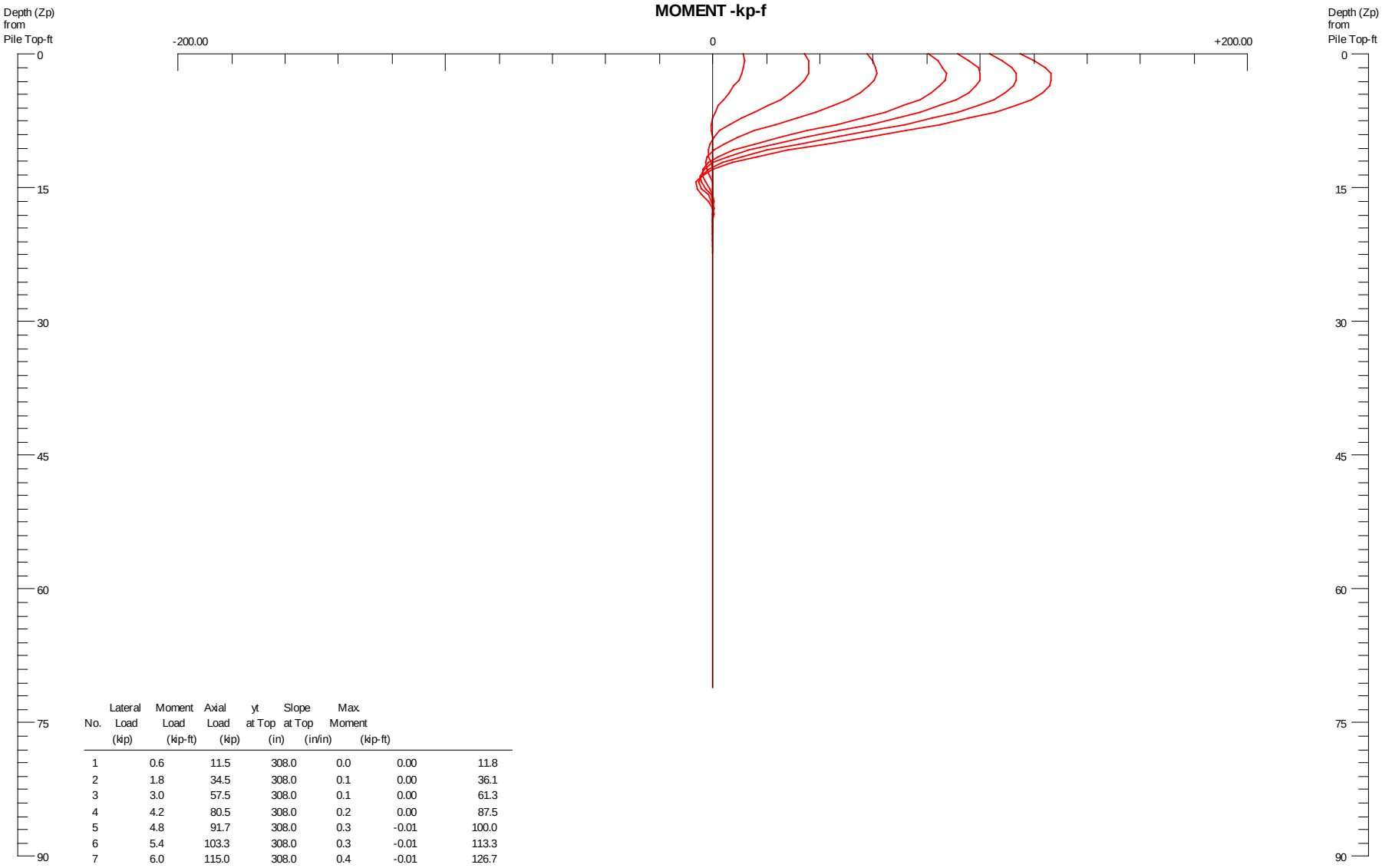
Pier, HP14x73

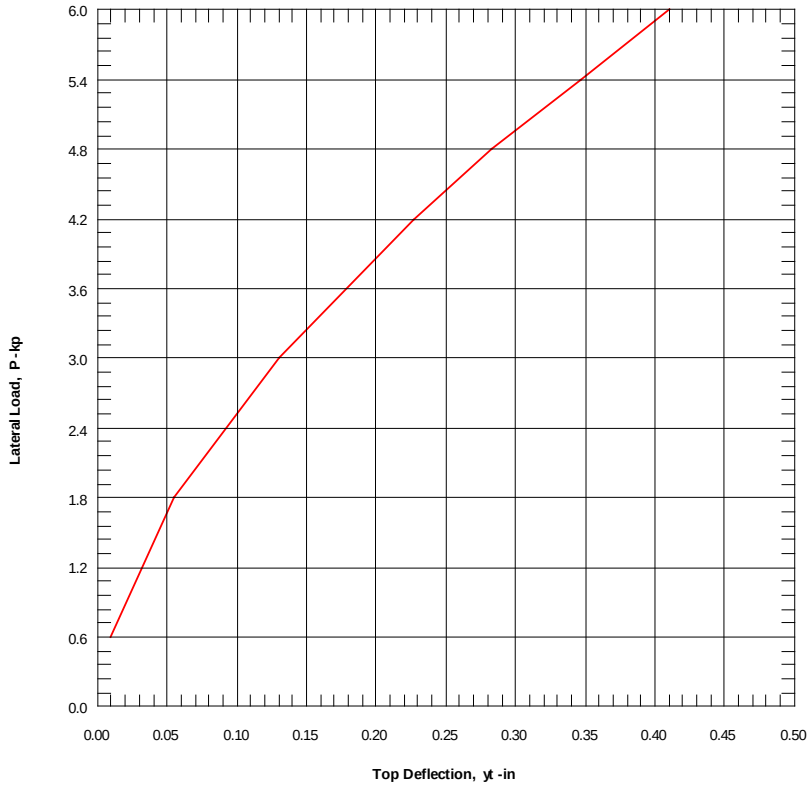
Figure 2

PILE MOMENT vs LOADING
Single Pile, Khead=1, Kbc=1



No.	Lateral Load (kip)	Moment Load (kip-ft)	Axial Load (kip)	yt at Top (in)	Slope at Top (in/in)	Max. Moment (kip-ft)
1	0.6	11.5	308.0	0.0	0.00	11.8
2	1.8	34.5	308.0	0.1	0.00	36.1
3	3.0	57.5	308.0	0.1	0.00	61.3
4	4.2	80.5	308.0	0.2	0.00	87.5
5	4.8	91.7	308.0	0.3	-0.01	100.0
6	5.4	103.3	308.0	0.3	-0.01	113.3
7	6.0	115.0	308.0	0.4	-0.01	126.7

LATERAL LOAD vs DEFLECTION & MAX. MOMENT



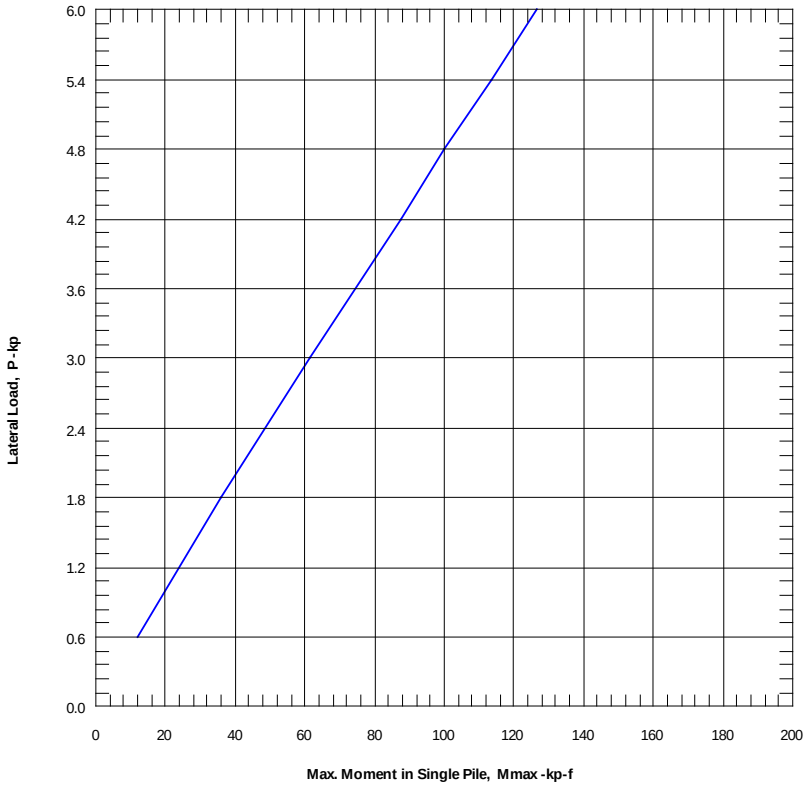


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Figure 2