

Abbreviated Structure Geotechnical Report

Original Report Date: 6/7/2022	Proposed SN: 012-0076	Route:	FAS 1707
Revised Date: 11/1/22	Existing SN: 012-0018	Section:	(CX-B)B
Geotechnical Engineer: BBS Foundation	ons & Geotech Unit Bill Kramer	County:	Clark
Structural Engineer: BBS Bridge Plann	ing Unit Nick Barnett	Contract:	

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): The proposed structure consists of a 3-span reinforced concrete deck on steel plate girders supported by integral abutments and pile bent piers. The proposed out-to-out width is 34'-10" and the back-to-back of abutments is 294'-0". The skew should be 25 degrees ahead left and the low beam elevation should be 575.4.

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): *Existing Structure 012-0018 was originally constructed in 1954 as a 3-span reinforced concrete haunch T-beam superstructure with a reinforced concrete deck supported by open, counterfort abutments and solid wall piers on pile supported footings.*

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: No significant fill is being placed so settlement is not a concern.

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: No significant fill is being placed so slope stability is not a concern.

Indicate at each substructure, the 100-year and 200-year total scour depths in the Hydraulics report, the nongranular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations: The scour calculations in the Hydraulic report indicated 13.9 and 14.45 at the left bank (pier 1) and 12.46 and 12.93 on the right bank (pier 2) for the 100yr and 200yr flows respectively. The bottom of the pier encasement is at El. 564.70.

We attached scour adjustment calculations which reflect some reductions due to the cohesive soils at the surface. However, we recommend no reduction since the borings are not close, and the hydraulic and adjusted scour depths extend either into or very close to a thick granular layer, which make our adjustment calculation less reliable and thus we recommend no reductions which is reflected in the table below.

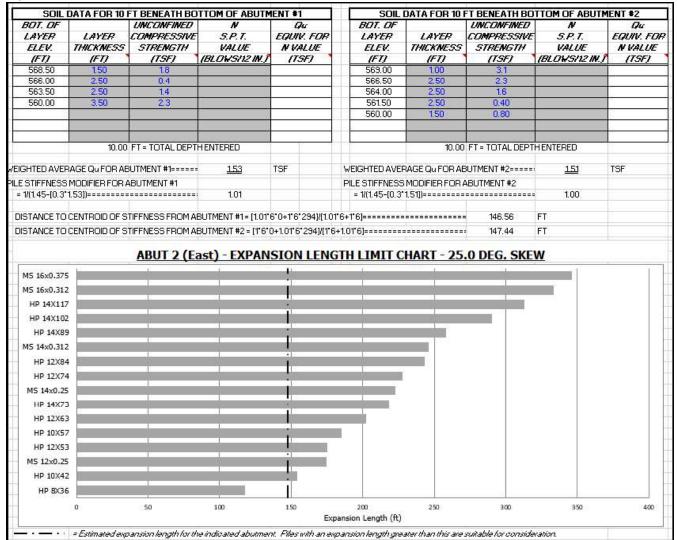
Event/Limit		Design Scour	Design Scour Elevations (ft.)					
State	West Abut.	Pier 1	East Abut.	113				
100 yr.	572.16	553.6	555.0	572.39				
200 yr	572.16	553.1	554.6	572.39	8			
Design	572.16	553.6	555.0	572.39				
Check	572.16	553.1	554.6	572.39				

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if that the soils are liquefiable: *Liquefaction is not an issue at this location and the seismic data run is attached and shown below:*

> Seismic Performance Zone 2 Design Spectral Acceleration at 1.0 sec (SD1) 0.181g Design Spectral Acceleration at 0.2 sec (SDS) 0.385g Soil Site Class D

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 factored unit side and tip resistance values shall be indicated when drilled shafts are proposed: *Per ABD*

Memo 19.8 the Integral Abutment Pile Selection chart indicates, integral abutments are feasible. To see the piles are believed to work, see the table below:

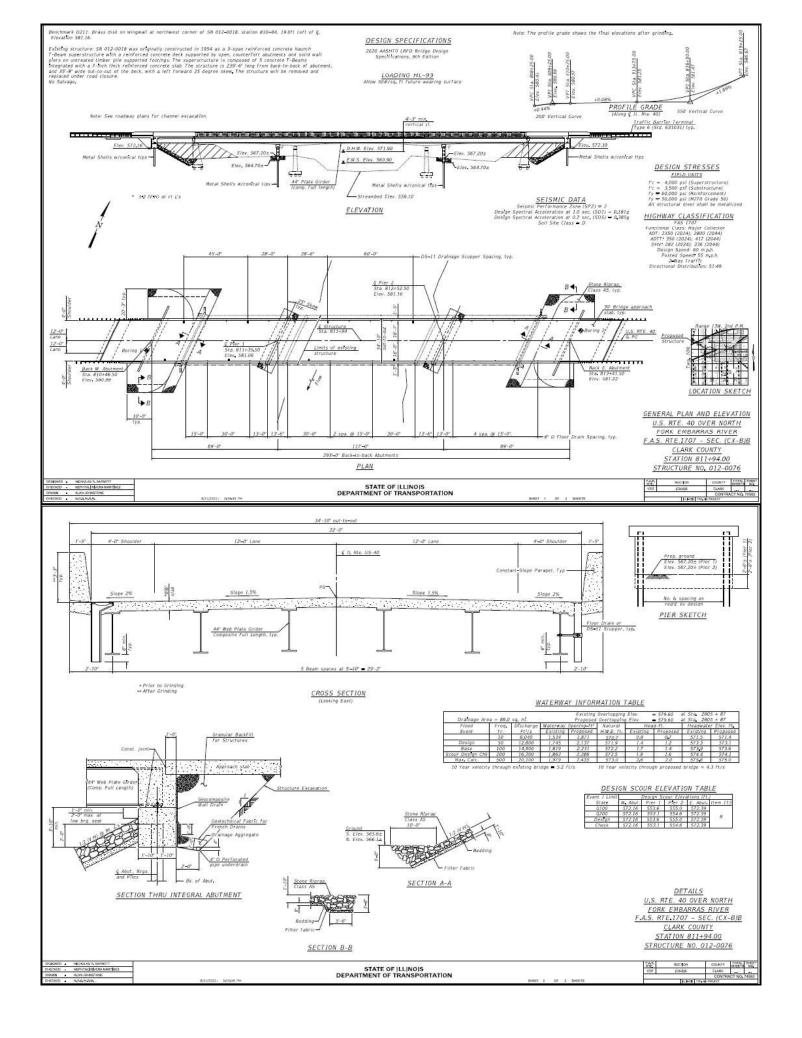


We recommend using 14" metal shell piles (min) at all substructures based on the deep distance to rock and shorter estimated lengths (see attached bearing vs. est. length tables, which are based on a pile cutoff elevation of 574.3). We also recommend conical tips at all substructures due to the stiff soils at depth.

The estimated pile lengths at the piers are shown in the attachments which assumes a pile cutoff elevation of 574.3. If pile bent is not feasible, we can use a solid wall pier stem on a pile supported footing, but the pile lengths would need to be reduced based on the reduction in the new pile cut off change. The pier pile lengths have accounted for scour and test piles are recommended at pier 1 and the east abutment.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: *The estimated water surface elevation (EWSE) is 560.89 according to the Hydraulic Report dated 3/12/21 and confirmed by bridge planning. Cofferdams will not be necessary since the bottom of the substructures concrete is above the EWSE.*

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: The retained height and soils below the abutment excavation indicate temporary sheet piling is feasible using an embedment of 10 ft and a minimum section modulus of 15in3/ft. However after reviewing the final TSL, we see that construction will be completed using a road closure so no soil retention should be required. We recommend construction slopes be sloped and 1:1 per OSHA and see no problem with temporary slope stability.



	2 2 4 840	Route	FAS 1707		Sheet		
(W) Illinois Depa	rtment	Section	(C-XB)B		Comp By	NRB	5/2/2022
of Transpor	τation	County	Clark		Chkd By		1 - 1
		Structure N	umber	012-0076			
Substruture Loads for Founda	tion Design						
Loads applied: superstructure	DL, substruc	ture DL, live loads, approac	h slab loa	d			
Dead Loads (Strength 1) - ABL	JTMENTS			Rxn	beams	Load	
Superstructure Reaction	DC1	(MDX Output)		31	6	186	k
Parapets	DC2	(MDX Output)		7	6	42	k
Future Wearing Surface	DW	(MDX Output)		14	6	84	k
Approach Slab	DC1	=1.25 (3.4k/')(34.8333')			148	k
		Length	Width	Height	Factor		
Diaphragm	DC1	38.43396	3.667	4.177	1.25	110	
Сар	DC1	38.43396	3.667	3.5	1.25	92	
Live Load (Strength 1) - ABUT	MENTS						
Live Load	LL	(see LL spreadsheet)				380	k
				ABUTN	IENT TOTAL	1043	k
						-	
Dead Loads (Strength 1) - PIEF		(1992) (C. 19		Rxn	beams	Load	
Superstructure Reaction	DC1	(MDX Output)		115	6	690	k
Parapets	DC2	(MDX Output)		25	6	150	k
Future Wearing Surface	DW	(MDX Output)		50	6	300	k
		Length	Width	Height	Factor		
Сар	DC1	42.833	2.5	2.5	1.25	50	
Wall	DC1	42.5	2	16.060	1.25	256	
				wall ht = bot	of bm ele at P1 -	565 from I	Misc Info
Live Load (Strength 1) - PIERS							
Live Load	LL	(see LL spreadsheet)				592	k

PIER TOTAL 2039 k

6		_			Route	FAS 170	17	Sheet			
(1)) Illinois I of Tran	Depar	tment		Section	(CX-B)B		Comp By	NRB	4/22/	2022
(B)	of Iran	sport	ation		County	Clark		Chkd By			
					Structure	Number	012-007	5			
EWSE					-						
Water Su	rface Adjust	ment in	feet								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	3	4	5	6	7	8	9	10	11	12
1.5	1.5 (0.75	0	0.75	1.5	2.25	3	3.75	3	2.25	1.5
Existing V	Vater Surfac	e Elevatio	on	559.39	File						
Top of Ba	nk Elevation	i I		564.89	File						
Streambe	ed Elevation			557.4	File						
Month of	f Survey			12	File						
Adjustme	ent			1.5	ft						
April High	n Water Elev	ation		560.89	Existing v	vater eleva	tion <mark>+</mark> adjust	ment			
Check Ma	ax Water Elev	vation				ĺ					
Assumed	September	Elevatior	1	557.14	April high	water elev	vation - Sept	adjustmen	t		
One foot	above stream	mbed		558.4							
Septemb	er Elevation			558.40	Max of A	ssumed Sej	ot. Elev <mark>a</mark> tion	and One Fo	oot above	streambed	
75% Diffe	erence betwe	en Sept.	Elevation	n and To	p of Ban	k Elevatio	n				
				563. <mark>2</mark> 7	= 0.75(To	p of Bank E	le - Sept Ele)	+ Sept Ele			
Fetimate	d Water Sur	face Flev	ation	560 89	Minimur	hotwoon	April High W	ater and 750	% Differen	ce elevatio	

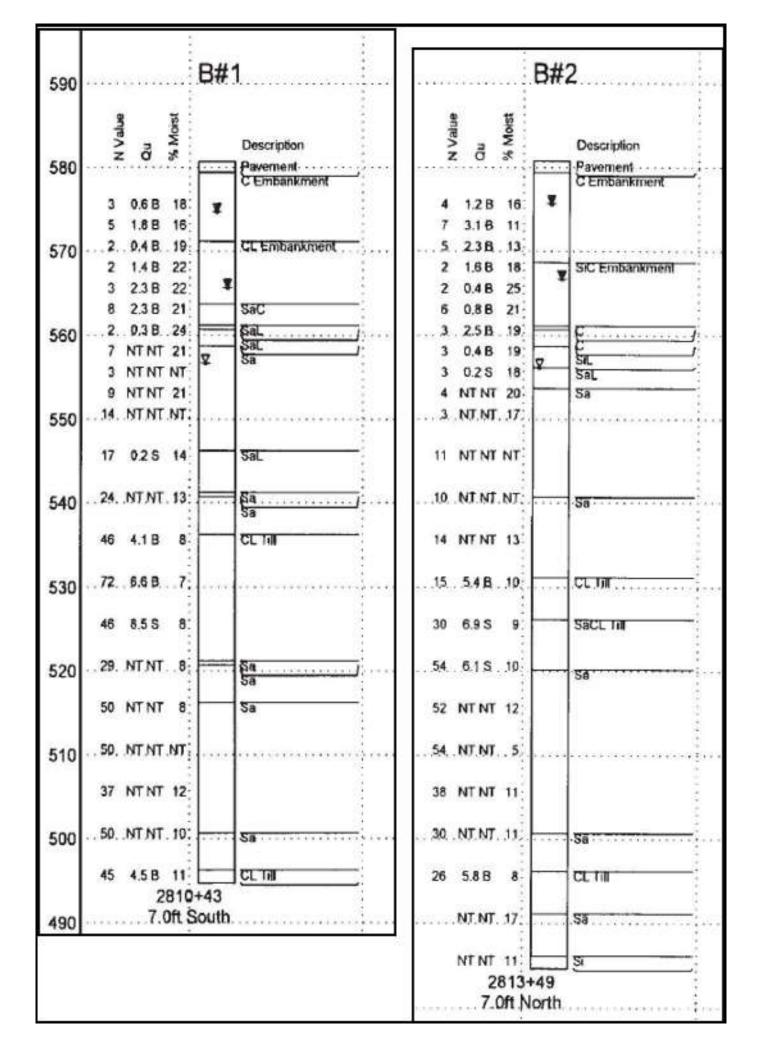
KASKASKIA ENGINEERING GROUP, LLC 12-Mar-21			
Survey Date	12/30/2014		
Water Surface Elevation	559.39		(Station 1+35)
Correction for December	+1.5'		
EWSE	560.89		METHOD 1
Assumed September Elevation	560.89-3.75 =	557.14	
One foot above streambed elevation	557.40+1.0 =	558.40	(Station 1954)
558.40 > 557.14, therefore use 558.40			
Top of Bank Elevation	564.89		(Station 1954)
75% of (564.89-558.40) + 558.40	563.27		METHOD 2
560.89 < 563.27 therefore use 560.89	560.89		EWSE

			ulations			pur cuicu	lations a	nd Grou	nd Mo	tion M	aps	
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Latitude-Longitude	12	1.24		Zip Code	1.0	0.128 S	U1 - Site	class C				
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Calculate			Calcula		Period (sec)	Sa (g)						
PGA, Ss, and S1		As,	SDs, an	id SD1	0.0	0.181 A						
						0.385 S 0.181 S	Ds - Site D1 - Site					
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SUBST BORING BOTTO	M OF SUBSTR	ELATIVE TO S	SUBSTRUC	URE UNIT:				012-0076 boring 1 PIER 1 left bank NEAR 565.0	Clear Input Print
Q100 S	SCOUR DEPTH	AT SUBSTRU	CTURE PER	R APPROV	ED HYDRAULIC	REPORT (HR Q REPORT (HR Q		567.5 13.90 FT 14.45 FT	
	BOTTOM OF LAYER	DEPTH BELOW		VALUE	ROCK TYPE		SCOUR RESISTANCE	REMAINING Q100 SCOUR	REMAINING Q200 SCOUR
1	565.5	2.0	2.00	0.4	IF APPLICADL	0%	2.00	BELOWLAYER (FT) 11.90	DELOW LAYER (FT) 12.45
2	564.3 563.0	3.3 4.5	1.25	0.4		0%	1.25	10.65 8.98	11.20 9.53
4	561.8 560.5	5.8 7.0	1.25	0.8		25%	1.67 2.50	7.32 4.82	7.87 5.37
6	559.3	8.3	1.25	2.5		50%	2.50	2.32	2.87
7	558.0 556.8	9.5 10.8	1.25	0.4		0%	1.25	1.07	1.62
9 10	555.5 554.3	12.0 13.3	1.25	0.2		0%	1.25 1.25		0.00
11	553.0	14.5	1.25	0		0%	1.25		
12 13	551.8 550.5	15.8 17.0	1.25	0		0%	1.25 1.25		
14 15	549.3 548.0	18.3	1.25	0		0%	1.25		
• Wan			enist be		Adjusted and should be eva	t Hydraulic		SCOUR FIGUR	T 1:
asses	s potential flu	ectuations in	the vert	ical limits	of sail layers	between the			
judgm	ent should be	e used in de	termining	r an adjus	ited scour dep			SURFACE ELEVATION	LAYER 1: Qu = 0.
	NGTH LIMIT S				. 0100) 553.6	FT	565.5		LAYER 2: Qu = 0.
LAYER	IN WHICH ADJU	ISTED Q100 SC	COURSTO	PS====	LAYER 8	1920.0	564.25		LAYER 3: Qu = 0.
DEPTH	INTO LAYER 8 / BELOW GROUP	ND SURFACE	TO ADJUS	TED Q100	1.1 10.6	FT FT	563		
	× ADJUSTMEN COUR ELEVATI				24.0%	TFT	561.75		LAYER 4: Qu = 0.
					A51		0.00000		LAYER 5: Qu = 2.
UNADJ	USTED Q200 SC	COURDEPTH			553.1	FT	560.5		LAYER 6: Qu = 2.
	IN WHICH ADJU INTO LAYER 97				LAYER 9 0.4	FT	559.25		LAYER 7: Qu = 0.
	BELOW GROUP				11.1 23.1%	FT	558		LAYER 8: Qu = 0.
	COUR ELEVATI				<u></u>	FT	556.75	ADJ. Q100	
							555.5	ROJ GIN	LAYER 9: Qu = 0.
LEGEN	ADJUSTED Q1						00000000		LAYER 10: GRANULA
							554.25	· · · · · · · · · · · · · · · · · · ·	
s c	ADJUSTED Q2 RALL (1200 Sr OUR		LYS	5 I S 1.D.O.T. I	FOR BBS FOUNDATI	ONS AND GEOT	553 GRAN ECHNICAL UNIT	* HIL GTUD * HIL GTUD * HIL GTUD * HIL GTUD U L A R C O I 012-0076 boring 2	N DITIONS Modified 5/28/24
	ADJUSTED Q2 ADJUSTED Q2 ADJUS			SIS I.D.O.T. E	FOR BBS FOUNDATI	ONS AND GEOT	553 GRAN	ULAR COI	I AVED 12. GDANI II A
TRUCT UBSTR ORING OTTON ROUNI	ADJUSTED Q2 PALL DOD ST OUR NUMBER = NUCTURE UNIT LOCATION REI LOCATION REI 1 OF SUBSTRU D SURFACE ELI COUR DEPTH A	A N A	UBSTRUC ATION	URE UNIT=	FOR BBS FOUNDATI	ONS AND GEOT	553 G R A N ECHNICAL UNIT 100) =====	ULAR COI 012-0076 boring 2 PIER 2 right bank NEAR	Modified 5/28/20
SC TRUCT UBSTR ORING OTTON ROUNI 100 SC 200 SC	ADJUSTED Q2 ADJU 7200 SC OUR URE NUMBER = NUCTURE UNIT = LOCATION REI LOCATION REI D SURFACE ELI COUR DEPTH A COUR DEPTH A BOTTOM	A N A A N A LATIVE TO SI CTURE ELEV/ EVATION AT T SUBSTRUC DEPTH	UBSTRUC ATION === SUBSTRU TURE PER TURE PER	URE UNIT= CTURE == APPROVE APPROVE	EDITION FOR BES FOUNDATIN ED HYDRAULIC ED HYDRAULIC ED HYDRAULIC ROCK	REPORT (HR Q SCOUR	553 G R A N ECHNICAL UNIT 100) ====== 200) ====== <i>SCOUR</i>	012-0076 boring 2 PIER 2 right bank NEAR 565.0 567.5 12.46 FT 12.93 FT BEMAINING	LAVED 12: CDANNILA NDITIONS Modified 5/28/21 Clear Input Print REMAINING
SC TRUCT UBSTR ORING OTTOM ROUNE 100 SC 200 SC 4YER NO.	ADJUSTED Q2 DALL 0200 SF OUR UNBER = NOTINE UNIT LOCATION REI NOT SUBSTRU D SURFACE ELI COUR DEPTH A BOTTOM DF LAYER ELEV. (FT) SL		UBSTRUC ATION SUBSTRUC TURE PER TURE PER THICK: (FT)	URE UNIT=	EDODT FOR BBS FOUNDATI	ONS AND GEOT REPORT (HR Q REPORT (HR Q REPORT (HR Q SCOUR REDUCTION E. [%]	553 G R A N ECHNICAL UNIT 100) ====== 200) ====== SCOUR RESISTANCE OF LAVER (FT,	ULAR COI 012-0076 boring 2 PIER 2 right bank NEAR \$65.0 \$66.0 \$67.5 12.46 FT 12.93 FT <i>REMANNING</i> <i>GTUD SCOUR</i> <i>BELOW LAYER (FT)</i>	LAVED 12: CDANIII A N D I T I O N S Modified 5/28/20 Clear Input Print Print REMAINING Q200 SCOUR BELOW LAYER (FT)
S C TRUCT UBSTR ORING OTTOM ROUNI 100 SC 200	ADJUSTED CZ DALI (1200 SC OUR NUMBER = NUCTURE UNIT I OF SUBSTRU D SURFACE ELL COUR DEPTH A COUR DEPTH A C	A N A LATIVE TO SI CTURE ELEV, EVATION AT T SUBSTRUC DEPTH BELOW	UBSTRUC ATION	CTURE == CTURE == APPROVE APPROVE VALUE (155) (2 2.30	EEDODT FOR BES FOUNDATI	REPORT (HR Q REPORT (HR Q REPORT (HR Q SCOUR REDUCTION E S0% 50%	553 G R A N ECHNICAL UNIT 100) ====== 100) ===== 5COUR W RESISTANCE OF LAYER (FT, 2.50	ULAR COI 012-0076 boring 2 PIER 2 right bank NEAR 565.0 567.5 12.46 FT 12.93 FT <i>REMAINING</i> <i>QI00 SCOUR</i> <i>BELOW LAYER (FT)</i> 3.36 7.46	I AVED 12: CDANIUL A N D I T I ON S Modified 5/28/2 Clear input Print Print REMAINING G200 SCOUR BELOW LAYER [FT] 10.43 7.33
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	Nominal	Factored	Estimated		Nominal	Factored	Estimated	1	Nominal	Factored	Estimated
	Required	Resistance	Pile		Required	Resistance	Pile		Required	Resistance	Pile
	Bearing	Available	Length		Bearing	Available	Length		Bearing	Available	Length
1	(Kips)	(Kips)	(Ft.)		(Kips)	(Kips)	(Ft.)		(Kips)	(Kips)	(Ft.)
Metal S	shell 14"Φ	w/.25" walls		Steel HP	10 X 42			Steel H	P 12 X 84		0.10
	91	50	27		124	68	50		137	75	45
	253	139	30		144	79	52		145	80	47
	273	150	32		163	90	55	-	160	88	50
	364	200	35	1	183	101	57	-	184	101	52
	390	214	37		193	106	60	-	208	114	55
Madal C	459	252	40		200	110	62	-	232	127	57
vietai s	91	w/.312" wall	s 27		225 243	124	65 67	-	250 264	137	60 62
	253	139	30	2	243	134	70	-	283	145	65
	273	150	32	10	240	147	72		307	169	67
	364	200	35		272	150	75		328	181	70
	390	214	37		283	156	77		350	192	72
	436	240	40		302	166	80		361	198	75
	466	256	42		307	169	82		374	206	77
	475	261	45	Steel HP	10 X 57				401	220	80
	570	314	47		129	71	50		404	222	82
Metal S		w/.312" wall	T Deserves		148	82	52	Steel H	P 14 X 73	5078	
	105	58	27		168	92	55	-	135	75	40
	315	173	30		188	103	57	-	147	81	42
	339	186	32		198	109	60		157	86	45
	454	250	35		206	113	62	-	166	91	47
	484	266	37		229	126	65		182	100	50
	540 573	297	40 42		249 254	137	67 70		210 238	115	52 55
	5/3	315	42		254	140	70		238	131	55
	654	319	45		274	153	72		289	140	60
Metal S		w/.375" wall			290	159	77		305	168	62
	105	58	27		310	170	80		325	179	65
	315	173	30		314	173	82		353	194	67
	339	186	32	Steel HP					379	209	70
	454	250	35		137	75	47		404	222	72
	484	266	37		149	82	50		430	237	75
	540	297	40		172	95	52	-	449	247	77
	573	315	42	2	196	108	55	-	478	263	80
	581	319	45		219	120	57		483	266	82
	610	336	47	-	239	131	60	Steel H	P 14 X 89		
	782	430	50		252	139	62		140	77	40
		le for w pie		ng Boring	#B1						
	Nominal	Factored	Estimated		Nominal	Factored	Estimated		Nominal	Factored	Estimate
	Nominal Required	Factored Resistance	Estimated Pile		Nominal Required	Resistance	Pile		Required	Resistance	Pile
	Nominal Required Bearing	Factored Resistance Available	Estimated Pile Length		Nominal Required Bearing	Resistance Available	Pile Length		Required Bearing	Resistance Available	Pile Lengti
	Nominal Required Bearing (Kips)	Factored Resistance	Estimated Pile Length (Ft.)		Nominal Required Bearing (Kips)	Resistance	Pile	Steel	Required Bearing (Kips)	Resistance	Pile
	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)		Nominal Required Bearing (Kips)	Resistance Available	Pile Length	Steel	Required Bearing	Resistance Available	Pile Lengt
	Nominal Required Bearing (Kips) nell 14"Ф	Factored Resistance Available (Kips) w/.25" walls	Estimated Pile Length (Ft.)		Nominal Required Bearing (Kips) 10 X 42	Resistance Available (Kips)	Pile Length (Ft.)	Steel I	Required Bearing (Kips) HP 12 X 84	Resistance Available (Kips)	Pile Lengt (Ft.)
	Nominal Required Bearing (Kips) nell 14"Ф 77	Factored Resistance Available (Kips) w/.25" walls 19	Estimated Pile Length (Ft.) 32		Nominal Required Bearing (Kips) 10 X 42 191	Resistance Available (Kips) 91	Pile Length (Ft.) 67	Steel	Required Bearing (Kips) HP 12 X 84 191	Resistance Available (Kips) 88	Pile Lengti (Ft.) 60
	Nominal Required Bearing (Kips) nell 14"Ф 77 238	Factored Resistance Available (Kips) w/.25" walls 19 107	Estimated Pile Length (Ft.) 32 35		Nominal Required Bearing (Kips) 10 X 42 191 210	Resistance Available (Kips) 91 102	Pile Length (Ft.) 67 70	Steel I	Required Bearing (Kips) HP 12 X 84 191 214	Resistance Available (Kips) 88 101	Pile Lengt (Ft.) 60 62
	Nominal Required Bearing (Kips) Tell 14"Ф 77 238 259	Factored Resistance Available (Kips) w/.25" walls 19 107 118	Estimated Pile Length (Ft.) 32 35 37		Nominal Required Bearing (Kips) 10 X 42 191 210 230	Resistance Available (Kips) 91 102 113	Pile Length (Ft.) 67 70 72	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233	Resistance Available (Kips) 88 101 111	Pile Lengt (Ft.) 60 62 65
	Nominal Required Bearing (Kips) nell 14"Ф 77 238 259 349 375 401	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 183 197	Estimated Pile Length (Ft.) 32 35 37 40 42 45		Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 258 262	Resistance Available (Kips) 91 102 113 117 128 131	Pile Length (Ft.) 67 70 72 75 77 80	Steel I	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289	Resistance Available (Kips) 88 101 111 118 129 142	Pile Lengt (Ft.) 60 62 65 67 70 70 72
	Nominal Required Bearing (Kips) 1011 14"Ф 77 238 259 349 375 401 427	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 183 197 211	Estimated Pile Length (Ft.) 32 35 35 37 40 42 45 47		Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273	Resistance Available (Kips) 91 102 113 117 128 131 137	Pile Length (Ft.) 67 70 72 75 77 80 82	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311	Resistance Available (Kips) 88 101 111 118 129 142 154	Pile Lengt (Ft.) 60 62 65 67 70 72 72 75
etal Sh	Nominal Required Bearing (Kips) etell 14"Ф 77 238 259 349 375 401 427 459	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 183 183 197 211 252	Estimated Pile Length (Ft.) 32 35 37 40 40 42 45 47 50		Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292	Resistance Available (Kips) 91 102 113 117 128 131 137 147	Pile Length (Ft.) 67 70 72 75 77 80 82 85	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332	Resistance Available (Kips) 88 101 111 118 129 142 154 166	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77
etal Sh	Nominal Required Bearing (Kips) eell 14"00 77 238 259 349 375 401 427 459 eell 14"0	Factored Resistance Available (Kips) wl.25" walls 19 107 118 168 183 197 211 252 wl.312" wall	Estimated Pile Length (Ft.) 32 35 37 40 42 45 47 50 \$	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297	Resistance Available (Kips) 91 102 113 117 128 131 137	Pile Length (Ft.) 67 70 72 75 77 80 82	Steel I	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80
etal Sh	Nominal Required Bearing (Kips) eell 14"0 77 238 259 349 375 401 427 459 eell 14"0 77	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19	Estimated Pile Length (Ft.) 32 35 37 40 42 45 47 50 \$ 32		Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87	Steel I	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 80 82
etal Sh	Nominal Required Bearing (Kips) hell 14*0 77 238 259 349 375 401 427 459 hell 14*0 77 238	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312	Estimated Pile Length (FL) 32 35 37 40 42 45 47 45 45 50 8 8 32 35	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94	Pile Length (FL) 67 70 72 75 77 80 82 85 85 87 67	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85
etal Sh	Nominal Required Bearing (Kips) hell 14"0 77 238 259 349 375 401 427 459 hell 14"0 77 238 259	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312" wall 19 007 118	Estimated Pile Length (FL) 32 35 37 35 37 40 42 45 47 40 42 45 50 \$ 32 35 37 32 35 37	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104	Pile Length (Ft.) 67 70 72 75 77 80 82 85 85 87 67 70		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 349 362 389 392	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 80 82
etal Sh	Nominal Required Bearing (Kips) hell 14*0 77 238 259 349 375 401 427 459 hell 14*0 77 238 259 349	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 107 118	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 \$ 32 35 37 37 40	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 235	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 70 72		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 362 389 392 HP 14 X 73	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87
etal Sh	Nominal Required Bearing (Kips) hell 14"0 77 238 259 349 375 401 427 459 hell 14"0 77 238 259	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312" wall 19 007 118	Estimated Pile Length (FL) 32 35 37 35 37 40 42 45 47 40 42 45 50 \$ 32 35 37 32 35 37	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104	Pile Length (Ft.) 67 70 72 75 77 80 82 85 85 87 67 70		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 349 362 389 392	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85
etal Sh	Nominal Required Bearing (Kips) nell 14"0 77 238 259 349 375 401 427 459 nell 14"0 77 238 259 349 349 349	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 \$ 32 35 32 35 37 40 42 42 47 40 42	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 262 273 292 297 10 X 57 196 215 235 245	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 87 57
etal Sh	Nominal Required Bearing (Kips) nell 14"0 77 238 259 349 375 401 427 459 nell 14"0 77 238 259 349 375 349 349 375 401	Factored Resistance Available (Kips) wl.25" walls 19 107 118 168 183 197 211 252 wl.312" wall 19 211 252 wl.312" wall 19 107 118 168 183 197	Estimated Pile Length (Ft.) 32 35 37 40 42 45 40 42 45 50 \$ 32 35 37 40 40 42 45	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 262 263 273 292 297 10 X 57 196 215 235 245 245	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131	Pile Length (Ft) 67 70 72 75 77 80 82 85 87 67 70 70 72 75 77		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 389 392 HP 14 X 73 189 217	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 85 85 87 57 60
etal Sh	Nominal Required Bearing (Kips) etell 14"0 77 238 259 349 375 401 427 459 etell 14"0 77 238 259 349 375 401 375 401 427	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312* wall 19 107 118 168 183 197 211	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 50 8 32 35 37 35 37 40 42 45 42 45 47	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 258 262 273 292 297 10 X 57 196 215 245 245 264 269	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134	Pile Length ((Ft)) 67 70 72 75 77 80 82 85 87 67 70 70 72 75 77 80		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 362 389 392 HP 14 X 73 189 217 245	Resistance Available (Kips) 888 101 111 118 129 142 154 166 175 182 197 199 85 100 115	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 75 77 80 80 82 85 87 57 60 62
etal Sh	Nominal Required Bearing (Kips) hell 14"0 77 238 259 349 375 401 427 459 nell 14"0 77 238 259 349 375 349 375 401 427 453 570	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 s 32 35 37 40 42 45 35 37 40 42 45 47 50 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 297 10 X 57 196 215 235 245 264 269 280	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 82		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128	Pile Lengt (ft.) 60 62 65 67 70 72 75 77 80 82 85 87 87 57 60 62 65
etal Sh	Nominal Required Bearing (Kips) hell 14"0 77 238 259 349 375 401 427 459 nell 14"0 77 238 259 349 375 349 375 401 427 453 570	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 s 32 35 37 40 42 45 35 37 40 42 45 47 50 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 262 273 292 297 10 X 57 196 215 235 245 264 264 269 280 300 304	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 80 82 85		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 57 60 62 65 67
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etal Sh	Nominal Required Bearing (Kips) 147 238 259 349 375 401 427 459 nell 14* 0 77 238 259 349 375 401 427 453 359 349 375 401 427 453 570 88 82 99 322	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 211 226 314 137 150	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 52 37 40 42 45 47 50 52 52 32 35 37 40 42 45 47 50 52 52 32 35 37 40 40 45 47 50 52 52 52 52 52 52 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 235 245 264 269 280 300 304 300 304 222	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151 154 95 105	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 77 80 82 85 87 62 65		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 304	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 137 148 164 178	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 87 60 62 65 67 70 72 75 77
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etal Sh	Nominal Required Bearing (Kips) 177 238 259 349 375 401 427 459 nell 14°0 77 238 259 349 375 238 259 349 375 349 375 401 427 453 570 88 299 222 437 407	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 137 150 213 230	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 52 5 52 52 52 32 35 37 40 42 45 45 47 50 52 52 52 52 52 52 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 262 273 292 297 10 X 57 196 215 235 245 264 269 280 300 304 12 X 53 202 222 235 252	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 140 151 154 154 95 105 113 122	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 82 85 87 67 70 72 75 77 70 72 75 77 70 70 72 75 77 80 82 85 87 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 80 82 85 87 87 80 82 85 87 70 70 72 75 77 77 80 80 82 85 87 70 70 72 75 77 70 72 75 77 77 80 80 82 85 87 70 70 72 75 77 70 70 72 75 77 77 80 80 82 85 87 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 80 82 85 87 70 70 72 75 77 70 70 72 75 77 70 70 70 72 75 77 70 70 72 75 77 70 80 85 87 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 80 82 85 87 77 77 80 85 87 77 77 77 77 75 77 70 72 75 77 77 77 77 70 75 77 77 70 72 75 77 77 80 82 85 87 77 77 77 77 80 82 85 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 87 77 77 80 87 77 77 80 87 77 77 80 87 77 77 80 87 87 77 77 77 77 77 77 77 77 77 77 77		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 362 389 392 HP 14 X 73 189 217 2456 268 284 305 333 359 204 410 433	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 177 148 164 178 192 206 219	Pile Lengti (FL) 60 62 65 67 70 72 75 77 80 82 85 85 87 57 60 62 65 67 70 72 75 77 80 82 85 85 87 87 87 87 80 82 85 85 87 87 80 82 85 85 85 85 85 85 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) 77 238 259 349 375 401 427 459 60 77 238 259 60 77 238 259 349 60 77 77 238 259 349 401 427 453 570 68 299 322 437 467 497	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 137 150 213 230 246	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 52 32 35 37 40 42 45 47 50 52 52 52 52 52 35 37 40 42 45 47 50 52 52 52 53 53 53 53 53 53 53 53 53 53	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 245 245 245 245 245 245 245 245 245 24	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 140 151 154 95 105 113 122 135	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 77 80 82 85 87 70 72 75 77 80 82 85 87 70 72 75 77 70 72 75 77 77 80 82 85 87 70 70 72 75 77 70 72 75 77 70 77 80 82 85 85 87 70 70 72 75 77 80 82 85 85 87 70 70 72 75 77 70 70 72 75 77 70 80 82 85 85 87 77 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 72 75 77 70 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 85 87 77 77 80 82 85 85 87 77 77 80 82 85 85 87 77 77 80 82 85 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 77 80 82 85 87 77 70 77 77 77 77 77 80 82 85 87 77 70 77 70 77 77 77 77 80 82 85 77 77 70 77 77 77 77 77 77 77 77 77 77		Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 362 389 392 HP 14 X 73 189 217 245 266 389 217 245 265 333 359 304 410 433	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 178 192 206 219 232	Pile Lengti (FL) 60 62 65 67 70 72 75 77 80 82 85 85 85 85 85 87 9 9 60 62 62 67 70 72 75 77 80 82 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) rell 14"0 77 238 259 349 375 401 427 459 77 238 259 349 rell 14"0 77 238 259 349 375 401 427 453 570 1427 453 570 161 6 88 299 322 437 467 497 526	Factored Resistance Available (Kips) 19 107 1118 168 183 197 211 252 w/.312* wall 9 107 118 168 183 197 211 226 314 w/.312* wall 21 211 226 314 137 150 213 230 246 262	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 52 32 35 37 40 42 45 47 50 52 55 52 5 5 52 52 52 53 53 53 53 53 53 53 53 53 53	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 262 273 292 297 196 215 245 245 245 269 280 300 304 12 X 53 202 222 235 202 222 235 252 275 297	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151 134 140 151 154 95 105 105 105 113 113 122 135 147	Pile Length (FL) 67 70 72 75 77 80 82 85 87 67 70 72 75 80 82 85 87 77 80 82 85 87 62 05 67 70 72 75	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 217 245 268 284 303 333 359 204 410 410 433 359	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 177 148 164 178 192 206 219	Pile Lengti (FL) 60 62 65 67 70 72 75 77 80 82 85 85 87 57 60 62 65 67 70 72 75 77 80 82 85 85 85 85 87 87 87 80 82 85 85 85 85 85 85 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) 140 77 238 259 349 375 401 427 459 001 427 77 238 259 349 375 401 427 453 570 001 427 453 570 001 427 453 570 001 427 453 570 001 427 453 570 001 427 453 570 001 427 453 526 556	Factored Resistance Available (Kips) 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 211 226 314 w/.312" wall 213 230 246 262 279	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 52 37 40 42 45 37 40 42 45 37 37 40 42 45 37 37 37 37 37 37 37 37 37 37	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 235 245 269 280 300 304 269 280 300 304 222 235 225 225 225 275 297 317	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151 154 95 105 113 122 135 147 158	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 67 77 80 82 85 87 77 77 80 82 85 87 77 77 77 77 77 77 77 77 77 77 77 77	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 304 410 410 433 359 304 410 410 410 410 410 410 410 410 410 4	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 178 192 206 219 232 239	Pile Lengti (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 87 57 60 62 65 67 70 72 75 77 80 82 85 87 70 82 85 87
etal Sh	Nominal Required Bearing (Kips) 77 238 259 349 375 401 427 459 a 40 401 427 459 a 49 375 401 427 453 349 375 441 427 453 570 88 299 222 437 467 467 497 526 556 653	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 226 314 w/.312" wall 21 237 150 213 230 246 262 279 359	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 s 32 35 37 40 42 45 32 35 37 40 42 45 52 s 32 35 37 40 42 45 52 47 50 52 35 52 35 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 235 245 245 245 264 269 280 300 304 12 X 53 202 222 235 252 252 255 297 317 334	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151 154 95 105 113 122 135 147 158 167	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 67 70 72 75 67 70 72 75 80 82 85 87 87 80 82 85 87 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 87 80 82 85 87 80 82 85 87 80 82 85 87 80 82 85 87 87 80 82 85 87 80 82 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 87 77 70 72 75 77 80 82 85 87 77 77 80 82 85 85 87 77 77 80 82 85 87 77 77 80 80 82 85 87 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 77 77 80 82 85 87 87 80 82 85 87 87 80 82 85 87 80 82 85 87 87 87 80 82 85 87 87 80 82 85 87 87 80 82 85 87 87 80 82 85 87 87 80 82 85 87 87 87 80 82 85 87 87 80 88 87 87 77 80 88 87 87 87 87 80 82 85 87 77 77 80 80 82 85 87 77 77 80 80 82 85 87 77 77 80 80 82 85 87 77 77 80 80 80 80 80 80 80 80 80 80 80 80 80	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 204 410 433 359 204 410 433 459 HP 14 X 89 195	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 137 148 164 178 192 206 219 232 239 88	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 57 60 62 65 67 70 72 75 77 80 82 85 87 77 80 82 85 87 77 57 75 77 75 77 70 75 77 80 82 85 87 70 70 70 70 70 70 70 70 70 70 70 70 70
etal Sh	Nominal Required Bearing (Kips) Nominal Required Bearing (Kips) Pearing (Kips) 77 238 259 349 375 401 427 459 349 375 401 427 453 570 68 299 322 437 467 97 526 556 653 nell 10"Φ	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 137 150 213 230 246 262 279 359 w/.375" wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 5 5 32 32 35 37 40 42 45 47 50 52 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 50 52 55 55 55 55 55 55 55 55 55	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 235 245 245 264 269 280 300 304 12 X 53 202 280 300 304 12 X 53 202 222 235 252 275 297 317 334 347	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 104 115 121 134 140 151 154 95 105 113 122 135 147 158 167 174	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 65 67 70 72 75 77 80 82 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 77 80 72 75 77 77 80 72 75 77 77 80 72 75 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 80 85 85 87 77 70 72 75 77 70 72 75 77 70 72 75 77 80 82 85 87 77 70 72 75 77 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 77 80 82 85 85 77 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 77 70 72 75 77 70 80 82 85 87 70 70 72 75 77 70 82 85 87 77 77 70 72 75 77 70 82 85 87 77 77 80 82 85 87 77 77 77 80 82 85 87 77 77 77 77 77 80 82 85 77 77 77 77 77 80 82 85 77 77 77 77 77 80 82 85 87 77 77 77 77 77 80 80 80 80 80 80 80 80 80 80 80 80 80	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 217 245 268 284 305 333 359 204 410 433 457 459 204 410 433 457 459 223	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 175 128 137 148 164 178 192 206 219 232 239 88 103	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 57 60 62 65 67 70 72 75 77 80 82 85 87 70 72 75 77 80 82 85 87 70 70 72 75 75 77 80 82 85 85 85 87 87 80 82 85 85 85 85 85 85 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) rell 14"0 77 238 259 349 375 401 427 459 rell 14"0 77 238 259 rell 14"0 77 238 259 349 375 401 427 453 570 rell 16"0 88 299 322 467 467 467 497 526 550 rell 16"0 88	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 213 230 246 262 279 359 w/.375" wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 32 35 37 40 42 45 52 32 35 37 40 42 45 52 35 37 40 42 45 52 35 37 40 42 45 52 55 57 50 52 55 57 50 52 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 50 55 57 57 50 55 57 57 50 55 57 57 57 57 57 57 57 57 57	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 245 264 264 264 264 269 280 300 4 12 X 53 202 222 235 202 222 235 297 304 347 347 372	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 140 151 154 95 105 113 122 135 147 158 167 174 188	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 65 67 70 72 75 577 80 82 85 87 77 80 82 85 87	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 362 389 392 HP 14 X 73 189 217 245 266 284 305 333 359 304 410 433 457 469 HP 14 X 89 195 223 251	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 178 192 206 219 232 239 88 103 118	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 57 60 62 65 67 70 72 75 77 80 82 85 87 70 72 75 77 80 82 85 87 77 80 82 85 87 70 82 85 87 80 82 85 87 80 82 85 85 87 87 80 82 85 85 85 87 80 82 85 85 87 80 82 85 85 85 87 80 82 85 85 85 87 80 82 85 85 85 87 80 82 85 85 85 85 87 80 82 85 85 85 85 85 85 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) rell 14" 0 77 238 259 349 375 401 427 459 77 238 259 349 259 349 375 401 427 453 570 nell 16" 0 88 299 022 437 467 467 467 467 467 48 299 022 655 655 566 653 nell 16" 0 88 299	Factored Resistance Available (Kips) 19 107 1118 168 183 197 211 252 w/.312 wall 9 107 118 168 183 197 211 226 314 w/.312 wall 210 211 226 314 w/.312 wall 230 246 262 279 359 w/.375 wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 5 32 35 37 40 42 45 47 50 52 5 5 5 5 5 5 5 5 5 5 5 5 5	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 258 262 273 292 297 297 196 215 235 245 245 269 280 300 304 304 269 280 300 300 304 300 304 322 222 235 252 252 252 255 255 297 317 334 347 372 376	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 104 115 121 134 140 151 154 95 105 113 122 135 147 158 167 174	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 65 67 70 72 75 77 80 82 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 77 80 72 75 77 77 80 72 75 77 77 80 72 75 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 80 85 85 87 77 70 72 75 77 70 72 75 77 70 72 75 77 80 82 85 87 77 70 72 75 77 70 72 75 77 70 70 72 75 77 70 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 77 80 82 85 85 77 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 77 70 72 75 77 70 80 82 85 87 70 70 72 75 77 70 82 85 87 77 77 70 72 75 77 70 82 85 87 77 77 80 82 85 87 77 77 77 80 82 85 87 77 77 77 77 77 80 82 85 77 77 77 77 77 80 82 85 77 77 77 77 77 80 82 85 87 77 77 77 77 77 80 80 80 80 80 80 80 80 80 80 80 80 80	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 204 410 433 359 204 410 435 335 359 204 410 410 415 251 251 273	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 137 148 164 175 128 137 206 219 232 239 88 103 118 131	Pile Lengt (ft.) 60 62 65 67 77 80 82 85 87 87 57 60 62 65 67 70 275 77 80 62 85 87 77 80 62 85 87 77 80 62 65 87 77 80 62 85 85 87 70 70 80 85 85 87 70 80 85 85 87 70 70 80 85 85 87 70 70 80 85 85 87 70 70 70 70 70 70 70 70 70 70 70 70 70
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etal Sh	Nominal Required Bearing (Kips) 17 238 259 349 375 401 427 459 001 427 453 375 349 375 349 375 401 427 453 570 16 [™] 427 453 570 16 [™] 427 427 453 570 16 [™] 427 427 453 570 16 [™] 427 427 453 570 16 [™] 427 427 453 570 16 [™] 427 427 427 427 427 427 427 427	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 137 150 213 230 246 262 279 359 w/.375" wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 5 32 35 37 40 40 42 45 50 52 52 52 52 52 52 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 10 X 57 196 215 235 245 245 245 245 245 245 269 280 300 304 12 X 53 202 222 235 252 252 252 252 252 257 317 334 347 376 12 X 63 207	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151 154 95 105 113 122 135 147 158 167 174 188 167 174 188	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 05 67 70 72 75 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 85 87 77 77 77 77 77 77 77 77 77 77 77 77	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 204 410 433 355 333 359 204 410 433 457 223 251 469 HP 14 X 89 195 223 251 251 290 312	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 175 128 137 148 164 175 206 219 232 239 88 103 118 131 140 152	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 57 60 62 65 67 70 72 77 80 82 85 87 77 80 62 65 67 77 80 82 65 67 77 70 70 72 75 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 80 85 85 87 77 80 82 85 85 77 77 80 82 85 85 87 77 80 85 85 87 77 80 82 85 85 87 77 80 85 85 87 77 80 85 85 85 87 77 80 85 85 85 87 77 80 85 85 85 87 77 80 85 85 85 85 77 77 80 85 85 85 85 77 77 80 85 85 85 77 77 80 85 85 85 77 77 80 82 85 85 77 77 80 85 85 85 77 77 80 85 85 85 77 77 80 82 85 85 77 77 80 85 85 85 77 77 80 82 85 85 77 77 80 82 85 85 77 77 80 82 85 85 77 77 80 85 85 87 77 80 85 85 87 77 80 80 85 85 87 77 77 80 85 85 87 77 80 85 85 87 87 87 87 87 87 87 87 87 80 87 87 87 87 87 80 88 85 85 87 87 87 87 87 87 87 80 85 85 87 87 87 87 87 80 85 85 87 87 87 80 85 85 85 87 87 87 87 87 80 85 85 85 87 87 87 80 85 85 87 87 87 80 85 85 85 85 85 85 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) 141 4 0 77 238 259 349 375 401 427 459 349 375 238 259 349 375 238 259 349 375 401 427 453 570 88 299 322 437 467 556 653 653 653 653 653 88 299 222 437 467	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 21 226 314 w/.312" wall 21 137 150 213 230 246 262 279 359 w/.375" wall 21 137 150 213 230	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 32 35 37 40 42 45 50 52 5 52 52 52 52 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 258 262 273 292 297 70 X 57 196 215 235 245 264 269 280 300 304 12 X 53 202 222 235 252 252 255 252 275 297 317 334 347 372 376 207 227	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 140 151 154 155 105 113 122 135 105 113 122 135 147 158 167 174 158 167 174 188 190	Pile Length (Ft.) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 05 67 70 72 75 77 80 82 85 87 77 80 82 85 87 77 80 82 85 87 77 70 72 75 77 77 77 77 77 77 77 77 77 77 77 77	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 217 246 268 284 305 333 359 204 410 433 457 469 204 410 433 457 469 204 410 433 457 246 284 305 333 359 204 410 433 457 469 205 333 359 204 410 433 457 246 288 284 305 333 359 204 410 410 433 457 265 289 205 289 205 205 205 205 205 205 205 205 205 205	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 178 197 206 219 232 206 219 232 239 88 103 118 131 140 152 167	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 62 85 87 57 60 62 65 67 70 72 75 77 80 82 85 87 70 72 75 77 80 82 85 87 70 72 75 77 70 70 72 75 77 70 72 75 77 70 72 75 77 70 70 75 77 70 70 75 77 70 70 75 77 77 80 85 85 85 85 85 85 85 85 85 85 85 85 85
etal Sh	Nominal Required Bearing (Kips) rell 14" 0 77 238 259 349 375 401 427 459 rell 14" 0 77 238 259 rell 14" 0 453 570 rell 14" 0 88 299 322 437 467 497 526 556 653 rell 16" 0 88 299 322 437 467 467 487	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 211 231 231 246 262 279 359 w/.375" wall 21 137 150 213 220 246 262 279 359 w/.375" wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 5 32 35 37 40 42 45 47 50 52 52 52 52 52 52 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 238 258 262 273 292 297 10 X 57 196 215 245 264 269 280 300 412 X 53 202 222 235 245 262 263 203 304 12 X 53 202 225 252 275 297 317 334 347 372 376 12 X 63 207 227 240	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 140 151 154 154 95 105 113 122 135 147 158 167 174 188 167 174 188 190 97 108 115	Pile Length (FL) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 05 67 70 72 75 77 80 82 85 87 77 80 82 85 87 76 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 80 82 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 87 77 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 77 76 82 85 85 87 77 76 77 76 77 76 77 76 77 77 76 77 77	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 204 410 433 457 469 HP 14 X 89 223 251 273 295 225 225 225 225 225 225 225 225 225	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 175 128 137 148 164 175 128 137 148 164 175 206 219 232 239 88 103 118 131 140 152 167 181	Pile Lengti (FL) 60 62 65 67 70 72 75 77 80 82 85 87 77 60 62 65 67 70 72 75 77 80 82 85 87 87 80 62 65 67 70 72 75 77 70 72 75
etal Sh	Nominal Required Bearing (Kips) rell 14" 0 77 238 259 349 375 401 427 453 259 349 259 349 375 401 427 453 570 nell 16" 0 88 299 022 437 467 467 497 526 653 nell 16" 0 88 299 322 437 467 497 526	Factored Resistance Available (Kips) 19 107 1118 168 183 197 211 252 w/.312 wall 19 107 118 168 183 197 211 226 314 w/.312 211 226 314 w/.312 213 230 246 262 279 359 w/.375 [*] wall 21 137 150 213 230 246 262 279 359 w/.375 [*] wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 5 32 35 37 40 42 45 47 50 52 5 5 32 35 37 40 42 45 47 50 52 55 57 40 42 45 47 50 52 55 57 40 42 45 47 50 55 57 40 42 45 47 50 55 57 40 42 45 47 50 55 57 40 42 45 47 47 50 55 57 40 42 45 47 40 42 45 47 40 42 45 57 50 57 40 42 45 57 50 57 50 57 50 57 40 42 45 47 47 50 55 57 50 55 57 57 50 57 57 50 57 57 50 57 57 50 57 57 57 57 50 57 57 57 57 57 57 57 57 57 57	Steel HP	Nominal Required Bearing (Kips) 10 X 42 191 210 230 238 262 273 292 297 297 196 215 245 245 264 269 280 300 12 X 53 202 222 235 264 269 280 300 12 X 53 202 222 235 252 275 297 317 347 372 376 12 X 63 207 227 240 258	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 131 134 140 151 154 95 105 113 122 135 147 158 167 174 158 167 174 158 190 97 108 115 125	Pile Length (FL) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 05 67 70 72 75 77 80 82 85 87 62 65 67 70 72 75 77 77 80 82 85 87 77 77 80 82 85 87 77 77 77 77 77 77 77 77 77 77 77 77	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 303 335 92 44 245 268 284 303 335 9 004 410 433 359 004 410 433 359 904 410 433 359 904 410 410 410 410 410 410 410 410 410 4	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 175 128 137 148 164 219 232 239 88 103 118 103 118 131 140 152 167 181 195	Pile Lengt (ft.) 60 62 65 67 77 80 82 85 87 77 80 62 65 67 70 72 75 77 80 62 65 67 70 72 75 77 70 62 65 67 77 80 62 65 67 77 77 80 62 65 77 77 77 77 80 65 87 77 70 80 87 87 70 80 87 87 70 80 87 87 70 80 87 87 70 80 87 87 70 80 80 87 70 70 70 70 70 70 70 70 70 70 70 70 70
etal Sh	Nominal Required Bearing (Kips) rell 14"0 77 238 259 349 375 401 427 459 rell 14"0 77 238 259 rell 14"0 77 238 259 349 375 401 427 453 570 rell 16"0 88 299 322 437 467 556 553 rell 16"0 88 299 322 437 467 467 467 497	Factored Resistance Available (Kips) w/.25" walls 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 252 w/.312" wall 19 107 118 168 183 197 211 226 314 w/.312" wall 211 231 231 246 262 279 359 w/.375" wall 21 137 150 213 220 246 262 279 359 w/.375" wall	Estimated Pile Length (FL) 32 35 37 40 42 45 47 50 5 32 35 37 40 42 45 47 50 52 5 32 35 37 40 42 45 47 50 52 52 52 52 52 52 52 52 52 52	Steel HP	Nominal Required Bearing (Kips) 10 X 42 230 238 258 262 273 292 297 10 X 57 196 215 245 264 264 269 280 300 412 X 53 202 222 235 297 304 12 X 53 202 225 297 317 334 347 372 376 12 X 63 207 227 240	Resistance Available (Kips) 91 102 113 117 128 131 137 147 150 94 104 115 121 134 140 151 154 154 95 105 113 122 135 147 158 167 174 188 167 174 188 190 97 108 115	Pile Length (FL) 67 70 72 75 77 80 82 85 87 67 70 72 75 77 80 82 85 87 62 05 67 70 72 75 77 80 82 85 87 77 80 82 85 87 76 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 80 82 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 85 87 77 80 82 85 87 77 77 80 82 85 87 77 80 82 85 85 87 77 80 82 85 87 77 80 82 85 85 87 77 70 72 75 77 77 80 82 85 85 87 77 70 72 75 77 70 72 75 77 77 80 82 85 85 87 77 77 76 82 85 85 87 77 76 77 76 77 76 77 76 77 77 76 77 77	Steel	Required Bearing (Kips) HP 12 X 84 191 214 233 246 265 289 311 332 349 362 389 392 HP 14 X 73 189 217 245 268 284 305 333 359 204 410 433 457 469 HP 14 X 89 223 251 273 295 225 225 225 225 225 225 225 225 225	Resistance Available (Kips) 88 101 111 118 129 142 154 166 175 182 197 199 85 100 115 128 137 148 164 175 128 137 148 164 175 128 137 148 164 175 206 219 232 239 88 103 118 131 140 152 167 181	Pile Lengt (Ft.) 60 62 65 67 70 72 75 77 80 82 85 87 57 60 62 65 67 70 72 75 77 80 82 85 87 70 72 75 77 80 82 85 87 70 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 77 80 82 85 85 85 85 85 77 70 72 75 77 70 72 75 77 70 72 75 77 70 72 75 77 77 80 82 85 85 85 77 80 82 85 85 85 77 80 82 85 85 77 80 82 85 85 85 85 85 77 80 82 85 85 85 85 85 85 85 85 85 85 85 85 85

	Managinal	Enstand	Estimated	ng Borir	Nominal	Exclosed	Estimated		Managinal	Factored	Cationata
	Nominal	Factored	A COMPANY CONTRACTOR			Factored			Nominal	1.0000000000	Estimated
	Required	Resistance	Pile		Required	Resistance	Pile	_	Required	Resistance	Pile
	Bearing	Available	I ength		Bearing	Available	Length		Bearing	Available	l ength
	(Kips)	(Kips)	(Ft.)		(Kips)	(Kips)	(Ft.)		(Kips)	(Kips)	(Ft.)
Metal S	Shell 14"0	w/.25" walls		Steel H	IP 10 X 42			Steel H	IP 12 X 84		
	184	83	42		198	99	62		201	98	55
	232	109	45	-	222	111	65	-	227	112	57
	459	252	47	-	241	122	67	-	246	122	60
			6				VS/S	-			
vietai		w/.312" walls	2000	-	246	125	70	-	260	130	62
	184	83	42	_	265	135	72	_	279	140	65
	232	109	45		270	138	75		303	153	67
	453	231	47	Steel H	IP 10 X 57				325	165	70
	486	249	50		196	97	60	-	346	177	72
	570	314	52	-	204	101	62	-	358	184	75
			2008055				2.5932-47			184	75
Metal		w/.312" walls	100-00 C	_	226	114	65	Steel	IP 14 X 73		
	187	82	40	_	246	125	67	_	200	95	50
	221	101	42		252	128	70		213	102	52
	278	132	45		272	139	72		230	111	55
	562	288	47		277	141	75		260	128	57
				044-411		1.41	10	-			
	600	309	50	Steel	IP 12 X 53				284	141	60
	653	359	52		189	91	55		300	150	62
Metal S	Shell 16"Φ	w/.375" walls	s		214	105	57		321	162	65
	187	82	40		235	117	60		349	177	67
	221	101	40	1	248	124	62	1	375	191	70
				1							
	278	132	45	-	265	133	65		400	205	72
	562	288	47	-	288	146	67	-	426	219	75
	600	309	50		310	158	70	Steel H	IP 14 X 89		
	638	330	52		330	169	72		205	98	50
	782	430	55		343	176	75		218	105	52
Steel	IP 8 X 36	100		Steel	IP 12 X 63				236	115	55
JICCIF		00	70	Jieer		04					
	189	96	70	-	194	94	55		266	131	57
	204	104	72		219	108	57		290	144	60
	209	106	75		240	119	60		306	153	62
					254	127	62		328	165	65
Dilo D	logian Tak	lo for E Ab	utmont u	tilizing	Poring #P2	1					
rie D		ole for E Ab		unzing	1		F 2	-			F
	Nominal	Factored	Estimated		Nominal	Factored	Estimated	_	Nominal	Factored	Estimate
	Required	Resistance	Pile		Required	Resistance	Pile		Required	Resistance	Pile
	Bearing	Available	Length		Bearing	Available	Length		Bearing	Available	Length
	(Kips)	(Kips)	(Ft.)		(Kips)	(Kips)	(Ft.)		(Kips)	(Kips)	(Ft.)
				0.1			0.6	0.1			0.0
Metal		ф w1.25" w	1	Steel	HP 10 X 4:			Steel	HP 12 X 8		
	96	53	22		134	74	45		136	75	42
	152	84	25		160	88	47		171	94	45
	161	89	27		169	93	50		202	111	47
	164	90	30		177	98	52		213	117	50
	100000		236			2.6.2		-			
	172	95	32		189	104	55	-	224	123	52
	184	101	35		209	115	57		239	132	55
	191	105	40		212	116	60		265	146	57
	221	121	42		219	121	62		282	155	60
		252	45					-			
	459		1	-	249	137	65	-	291	160	62
Metal	I Shell 14	¢ ₩1.312" •	alls	1	262	144	67		317	174	65
			22		267						67
	96	53	22	-	207	147	70		340	187	01
			363	Steel						187	
	152	84	25	Steel	HP 10 X 5	7	70	Steel	354	187 195	70
	152 161	84 89	25 27	Steel	HP 10 X 5 138	7 76	70 45	Steel	354 HP 14 X 7	187 195 '3	70
	152 161 164	84 89 90	25 27 30	Steel	HP 10 X 5 138 164	7 76 90	70 45 47	Steel	354 HP 14 X 7 120	187 195 ' 3 66	70 40
	152 161	84 89	25 27	Steel	HP 10 X 5 138	7 76	70 45	Steel	354 HP 14 X 7	187 195 '3	70
	152 161 164	84 89 90	25 27 30	Steel	HP 10 X 5 138 164	7 76 90	70 45 47	Steel	354 HP 14 X 7 120	187 195 ' 3 66	70 40
	152 161 164 172 184	84 89 90 95 101	25 27 30 32 35	Steel	HP 10 X 5 138 164 173 181	7 76 90 95 100	70 45 47 50 52	Steel	354 HP 14 X 7 120 156 195	187 195 ' 3 66 86 107	70 40 42 45
	152 161 164 172 184 191	84 89 90 95 101 105	25 27 30 32 35 40	Steel	HP 10 X 5 138 164 173 181 193	7 76 90 95 100 106	70 45 47 50 52 55	Steel	354 HP 14 X 7 120 156 195 232	187 195 3 66 86 107 128	70 40 42 45 47
	152 161 164 172 184 191 221	84 89 90 95 101 105 121	25 27 30 32 35 40 42	Steel	HP 10 X 5 138 164 173 181 193 214	7 76 90 95 100 106 118	70 45 47 50 52 55 55 57	Steel	354 HP 14 X 7 120 156 195 232 245	187 195 ' 3 66 86 107 128 135	70 40 42 45 47 50
	152 161 164 172 184 191	84 89 90 95 101 105	25 27 30 32 35 40 42 45	Steel	HP 10 X 5 138 164 173 181 193 214 217	7 76 90 95 100 106 118 119	70 45 47 50 52 55	Steel	354 HP 14 X 7 120 156 195 232 245 257	187 195 3 66 86 107 128	70 40 42 45 47 50 52
	152 161 164 172 184 191 221	84 89 90 95 101 105 121	25 27 30 32 35 40 42	Steel	HP 10 X 5 138 164 173 181 193 214	7 76 90 95 100 106 118	70 45 47 50 52 55 55 57	Steel	354 HP 14 X 7 120 156 195 232 245	187 195 ' 3 66 86 107 128 135	70 40 42 45 47 50
	152 161 164 172 184 191 221 268	84 89 90 95 101 105 121 147	25 27 30 32 35 40 42 45	Steel	HP 10 X 5 138 164 173 181 193 214 217	7 76 90 95 100 106 118 119	70 45 47 50 52 55 55 57 60	Steel	354 HP 14 X 7 120 156 195 232 245 257	187 195 ' 3 66 86 107 128 135 141	70 40 42 45 47 50 52
	152 161 164 172 184 191 221 268 489 523	84 89 90 95 101 105 121 147 269 287	25 27 30 32 35 40 42 45 47	Steel	HP 10 X 5 138 164 173 181 193 214 217 225 255	7 76 90 95 100 106 118 119 124 141	70 45 47 50 52 55 57 60 62 65	Steel	354 HP 14 X 7 120 156 232 245 257 274 304	187 195 '3 66 86 107 128 135 141 151 151	70 40 42 45 47 50 52 55 55 57
	152 161 164 172 184 191 221 268 489 523 570	84 89 90 95 101 105 121 147 269 287 314	25 27 30 32 35 40 42 45 47 50 52	Steel	HP 10 X 5 138 164 173 181 193 214 217 225 255 269	7 76 90 95 100 106 118 119 124 141 148	70 45 47 50 52 55 57 60 60 62 65 67	Steel	354 HP 14 X 7 120 156 195 232 245 257 274 304 328	187 195 ' 3 66 86 107 128 135 141 151 167 181	70 40 42 45 47 50 52 55 57 60
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16 ⁻	84 89 90 95 101 105 121 147 269 287 314 ♥ ♥/.312 [™] ♥	25 27 30 32 35 40 42 45 47 50 52 *alls		HP 10 X 5 138 164 173 181 193 214 217 225 225 255 269 274	7 76 90 95 100 106 118 119 124 141 141 148 150	70 45 47 50 52 55 57 60 62 65	Steel	354 HP 14 X 7 120 156 195 232 245 257 274 304 328 345	187 195 3 66 86 107 128 135 141 151 151 167 181 189	70 40 42 45 47 50 52 55 55 57 60 62
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16⁻ 112	84 89 90 95 101 105 121 147 269 269 287 314 ℃ *7.312~ • 62	25 27 30 32 35 40 42 45 47 50 52 52 valls 22		HP 10 X 5 138 164 173 181 193 214 217 255 255 265 263 274 HP 12 X 5	7 76 90 95 100 106 118 119 124 141 141 148 150 3	70 45 47 50 52 55 57 60 62 62 65 67 70	Steel	354 HP 14 X 7 120 156 195 232 245 257 274 304 328 345 365	187 195 3 66 107 128 135 141 151 151 167 181 189 201	70 40 42 45 47 50 52 55 57 80 62 65
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16 ⁻	84 89 90 95 101 105 121 147 269 287 314 ♥ ♥/.312 [™] ♥	25 27 30 32 35 40 42 45 47 50 52 *alls		HP 10 X 5 138 164 173 181 193 214 217 225 225 255 269 274	7 76 90 95 100 106 118 119 124 141 141 148 150	70 45 47 50 52 55 57 60 60 62 65 67	Steel	354 HP 14 X 7 120 156 195 232 245 257 274 304 328 345	187 195 ' 3 66 86 107 128 135 141 151 151 167 181 189	70 40 42 45 47 50 52 55 55 57 60 62
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16⁻ 112	84 89 90 95 101 105 121 147 269 269 287 314 ℃ *7.312~ • 62	25 27 30 32 35 40 42 45 47 50 52 52 valls 22		HP 10 X 5 138 164 173 181 193 214 217 255 255 265 263 274 HP 12 X 5	7 76 90 95 100 106 118 119 124 141 141 148 150 3	70 45 47 50 52 55 57 60 62 62 65 67 70	Steel	354 HP 14 X 7 120 156 195 232 245 257 274 304 328 345 365	187 195 3 66 107 128 135 141 151 151 167 181 189 201	70 40 42 45 47 50 52 55 57 60 62 65
Metal	152 161 164 172 184 191 221 268 489 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 523 524 116 116 116 116 116 117 117 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 118 119 118 119 119 119 119 119 119 119 119 119 119 119 119 111 119 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 11 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111 111	84 89 90 95 101 105 121 147 269 287 314 ○ ↓.312⁻ ↓ 62 102 108	25 27 30 32 35 40 42 45 47 50 52 50 52 x alls 22 25 27		HP 10 X 5' 138 164 173 181 193 214 217 225 255 265 265 265 265 265 274 HP 12 X 5' 128 161	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88	70 45 47 50 52 55 57 60 62 65 67 70 42 45		354 HP 14 X 7 120 156 195 232 245 257 274 304 328 345 345 393 419	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 231	70 40 42 45 50 52 55 57 80 62 65 67
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16^{**} 112 186 196 198	84 89 90 95 101 105 121 147 269 287 314 Φ ★1.312* • 62 102 108 109	25 27 30 32 35 40 42 45 50 52 52 v alls 22 25 27 30		HP 10 X 5 138 164 173 181 193 214 217 225 265 263 274 HP 12 X 5 128 161 181	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 105	70 45 47 50 52 55 57 60 62 65 62 65 67 70 42 45 47		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 X 8	187 195 3 66 86 107 128 135 141 141 167 181 189 201 216 201 216 231	70 40 42 45 47 50 52 55 57 60 62 65 67 70
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16⁻¹ 112 186 196 198 208	84 89 90 95 101 105 121 147 269 287 314 ⊕ ♥/.312 ⁻ • 62 102 108 109 114	25 27 30 32 35 40 42 45 47 50 52 52 ¥alls 22 25 27 30 32		HP 10 X 5 138 164 173 193 214 217 225 255 255 269 274 HP 12 X 5 128 161 191 202	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 105 111	70 45 47 50 52 55 57 60 62 65 67 70 42 45 45 47 50		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 385 385 385 385 419 HP 14 X 8 123	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 216 231 231 5 9 68	70 40 42 45 50 52 55 57 60 62 65 67 67 70 40
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16^{**} 112 186 196 198	84 83 90 95 101 105 121 147 269 287 314 ⊕ *7.312⁻ • 62 102 108 109 114 122	25 27 30 32 35 40 42 45 50 52 52 v alls 22 25 27 30		HP 10 X 5 138 164 173 181 193 214 217 225 265 263 274 HP 12 X 5 128 161 181	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 105	70 45 47 50 52 55 57 60 62 65 62 65 67 70 42 45 47		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 333 419 HP 14 X 8 123 160	187 195 3 66 86 107 128 135 141 141 167 181 189 201 216 201 216 231	70 40 42 45 47 50 52 55 57 60 62 65 67 70
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16⁻¹ 112 186 196 198 208	84 89 90 95 101 105 121 147 269 287 314 ⊕ ♥/.312 ⁻ • 62 102 108 109 114	25 27 30 32 35 40 42 45 47 50 52 52 ¥alls 22 25 27 30 32		HP 10 X 5 138 164 173 193 214 217 225 255 255 269 274 HP 12 X 5 128 161 191 202	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 105 111	70 45 47 50 52 55 57 60 62 65 67 70 42 45 45 47 50		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 385 385 385 385 419 HP 14 X 8 123	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 216 231 231 5 9 68	70 40 42 45 50 52 55 57 60 62 65 67 67 70 40
Metal	152 161 164 172 184 191 221 268 489 523 570 15hell 16 ⁻ 186 196 196 198 208 222 228	84 83 90 95 101 105 121 147 269 287 314 ⊕ *7.312⁻ • 62 102 108 109 114 122	25 27 30 32 40 42 45 47 55 52 ★ alls 22 25 27 30 32 35 40		HP 10 X 5 138 164 173 181 193 214 217 225 255 255 274 HP 12 X 5 128 161 191 202 212 226	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 71 88 105 111 117	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 50 52 55		354 HP 14 X 7 120 156 232 245 257 274 304 345 365 393 419 HP 14 X 8 123 160 200	187 195 3 66 86 107 128 135 141 151 167 181 181 189 201 216 231 231 5 9 68 88	70 40 42 45 50 52 55 57 60 62 65 67 70 40 42 45
Metal	152 161 164 172 184 191 221 268 489 523 570 150 150 150 150 186 198 208 202 222 228 262	84 89 90 95 101 105 121 147 269 287 314 Φ ♥/.312 ⁻ • 62 102 108 109 114 122 126 144	25 27 30 32 40 42 45 47 50 52 v alls 22 25 27 30 32 35 40 42		HP 10 X 5 138 164 173 181 183 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 226 251	7 76 90 95 100 106 118 119 124 141 148 150 3 71 88 105 111 117 124 138	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 45 47 50 52 55 55 57		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 X 8 123 120 200 237	187 195 3 66 86 107 128 135 141 151 167 181 167 181 216 216 216 231 216 231 5 5 88 88 110 130	70 40 42 45 50 52 55 57 80 62 65 67 70 40 42 45 47
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16^{**} 112 186 198 208 222 228 262 319	84 89 90 95 101 105 121 147 269 287 314 ⊕ ★7.312** 62 102 108 109 114 122 126 144 176	25 27 30 32 35 40 42 45 50 52 25 25 27 30 32 35 40 42 45		HP 10 X 5 138 164 173 181 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 212 212 226 251 270	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 105 111 117 124 138 148	70 45 47 50 52 55 57 60 62 65 62 65 67 70 42 45 47 50 52 55 55 57 60		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 X 8 123 160 200 237 250	187 195 3 66 86 107 128 135 141 167 181 167 181 189 201 216 231 216 231 216 231 5 9 68 88 88 110 130	70 40 42 45 47 50 52 55 57 60 62 65 67 70 70 40 42 40 42 45 47 50
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16⁻ 112 186 196 198 208 222 228 262 319 604	84 89 90 95 101 105 121 147 269 287 314 ⊕ ♥/.312 ⁻ • 62 102 108 109 114 122 126 144 176 332	25 27 30 32 35 40 42 45 50 52 25 27 30 32 35 40 32 35 40 42 45 47		HP 10 X 5 138 164 173 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 226 261 270 279	7 76 90 95 100 106 118 119 124 124 141 141 148 150 3 71 88 105 111 117 124 138 148 153	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 50 52 55 55 57 60 60 62		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 X 8 123 160 200 237 250 262	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 216 231 216 231 231 5 9 68 88 88 110 130 137 137	70 40 42 45 47 50 52 55 57 60 62 65 67 70 40 42 45 40 42 45 47 50 52
Metal	152 161 164 172 184 191 221 268 489 523 570 I Shell 16^{**} 112 186 198 208 222 228 262 319	84 89 90 95 101 105 121 147 269 287 314 ⊕ ★7.312** 62 102 108 109 114 122 126 144 176	25 27 30 32 35 40 42 45 50 52 25 25 27 30 32 35 40 42 45		HP 10 X 5 138 164 173 181 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 212 212 212 226 251 270	7 76 90 95 100 106 118 119 124 141 141 148 150 3 71 88 105 111 117 124 138 148	70 45 47 50 52 55 57 60 62 65 62 65 67 70 42 45 47 50 52 55 55 57 60		354 HP 14 × 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 × 8 123 160 200 237 250	187 195 3 66 86 107 128 135 141 167 181 167 181 189 201 216 231 216 231 216 231 59 68 88 810 130 130	70 40 42 45 47 50 52 55 57 60 62 65 67 70 70 40 42 40 42 45 47 50
	152 161 164 172 184 191 221 268 489 523 570 15hell 16 ⁻ 112 186 196 198 208 222 228 262 228 262 219 604 653	84 89 90 95 101 105 121 147 269 287 314 ⊕ ♥/.312 ⁻ • 62 102 108 109 114 122 126 144 176 332	25 27 30 32 35 40 42 45 50 52 27 50 27 27 30 32 35 40 42 45 47 50		HP 10 X 5 138 164 173 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 226 261 270 279	7 76 90 95 100 106 118 119 124 124 141 141 148 150 3 71 88 105 111 117 124 138 148 153	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 50 52 55 55 57 60 62		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 X 8 123 160 200 237 250 262	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 216 231 216 231 231 5 9 68 88 88 110 130 137 137	70 40 42 45 47 50 52 55 57 60 62 65 67 70 40 42 45 40 42 45 47 50 52
	152 161 164 172 184 191 221 268 489 523 570 1 Shell 16 ⁻ 188 208 222 228 262 319 604 653 1 Shell 16 ⁻	84 83 90 95 101 105 121 147 269 287 314 62 102 108 109 114 122 126 144 176 332 359 ♥ ✔.375 ⁻	25 27 30 32 35 40 42 45 47 52 v alls 22 25 27 30 32 35 40 42 45 47 50 ₩ 22 25 27 30 32 35 40 40 42 45 52 ¥ 40 42 45 52 ¥ 40 52 ¥ 40 52 54 54 54 54 54 54 54 54 54 54 54 54 54		HP 10 X 5 138 164 173 181 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 226 251 279 302 325	7 76 90 95 100 106 118 119 124 141 141 144 150 3 71 88 105 111 117 124 138 105 111 117 124 138 148 148 148 148 148 148	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 45 47 50 52 55 57 60 62 65 67		354 HP 14 × 7 120 156 232 245 257 274 304 328 345 365 333 419 HP 14 × 8 123 160 200 237 250 262 280 311	187 195 3 66 86 107 128 135 135 135 135 135 135 135 135 201 216 231 216 231 231 216 231 231 216 231 231 216 231 231 216 231 216 231 231 24 24 231 25 24 25 25 25 26 21 21 21 21 21 21 21 21 21 21 21 21 21	70 40 42 47 50 52 55 57 60 62 65 67 70 70 40 42 45 47 50 52 55 55 57
	152 161 164 172 184 191 221 268 489 523 570 15hell 16 [°] 186 196 196 198 208 222 228 262 319 604 653 15hell 16 [°] 12	84 89 90 95 101 105 121 147 269 287 314 0 ♥1.312 ⁻ 1 62 102 108 109 114 122 126 144 176 332 359 0 ♥1.375 ⁻ 62	25 27 30 32 40 42 45 47 50 52 ★ alls 22 25 27 30 32 35 40 42 45 40 42 45 50 ♥ ♥ 8 10 50 50 9 10 50 50 9 10 50 50 9 10 50 50 50 50 50 50 50 50 50 50 50 50 50	Steel	HP 10 X 5 138 164 173 181 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 226 251 226 251 270 279 302 279 302 279 303	7 76 90 95 100 106 118 119 124 141 148 150 3 71 88 105 111 117 124 138 148 153 166 179 187	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 50 52 55 57 60 60 62 65		354 HP 14 X 7 120 156 232 245 257 274 304 345 365 393 419 HP 14 X 8 123 160 200 237 250 262 280 311 334	187 195 3 66 86 107 128 135 141 151 167 181 216 231 216 231 216 231 39 68 88 110 130 137 130 137 144 144 171 184	70 40 42 45 55 55 57 60 62 65 67 70 40 42 45 47 50 55 55 57 80
	152 161 164 172 184 191 221 268 489 523 570 I Shell 16 ^{**} 112 186 198 208 222 228 262 319 604 653 654 112 186	84 89 90 95 101 105 121 147 269 287 314 Φ ★/.312* • 62 102 108 109 114 122 126 144 176 332 359 Φ ★/.375* 62 102	25 27 30 32 35 40 42 45 50 52 25 27 30 32 25 27 30 32 35 40 42 45 47 45 47 52 25 27 30 32 35 40 32 35 40 42 45 52 52 52 53 54 54 54 54 55 54 55 55 55 56 56 56 56 56 56 56 56 56 56	Steel	HP 10 X 5 138 164 173 193 214 217 225 269 274 HP 12 X 5 181 181 181 202 212 226 251 270 279 302 279 302 339 HP 12 X 5	7 76 90 95 100 106 118 119 124 141 148 150 3 71 88 105 111 117 124 138 148 153 166 179 187 3	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 50 52 55 55 57 60 62 65 67 70		354 HP 14 × 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 × 8 123 160 203 250 262 280 311 334	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 231 216 231 216 231 216 33 201 216 33 201 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 217 216 231 216 231 217 216 231 217 216 231 217 217 217 217 217 217 217 217 217 21	70 40 42 45 47 50 52 55 57 60 62 65 67 70 40 42 40 42 45 47 50 52 55 57 60 62
	152 161 164 172 184 191 221 268 489 523 570 15hell 16 [°] 186 196 196 198 208 222 228 262 319 604 653 15hell 16 [°] 12	84 89 90 95 101 105 121 147 269 287 314 0 ♥1.312 ⁻ 1 62 102 108 109 114 122 126 144 176 332 359 0 ♥1.375 ⁻ 62	25 27 30 32 40 42 45 47 50 52 ★ alls 22 25 27 30 32 35 40 42 45 40 42 45 50 ♥ ♥ 8 10 50 50 9 10 50 50 9 10 50 50 9 10 50 50 50 50 50 50 50 50 50 50 50 50 50	Steel	HP 10 X 5 138 164 173 181 193 214 217 225 265 269 274 HP 12 X 5 128 161 191 202 212 226 251 226 251 270 279 302 279 302 279 303	7 76 90 95 100 106 118 119 124 141 148 150 3 71 88 105 111 117 124 138 148 153 166 179 187	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 45 47 50 52 55 57 60 62 65 67		354 HP 14 X 7 120 156 232 245 257 274 304 345 365 393 419 HP 14 X 8 123 160 200 237 250 262 280 311 334	187 195 3 66 86 107 128 135 141 151 167 181 216 231 216 231 216 231 39 68 88 110 130 137 130 137 144 144 171 184	70 40 42 45 55 57 60 62 65 67 70 40 42 45 47 50 55 55 57 60
	152 161 164 172 184 191 221 268 489 523 570 I Shell 16⁻¹ 198 208 222 228 268 262 319 604 653 I Shell 16⁻¹ 112 186 198 208 222 228 268 262 319 604 653 I Shell 16⁻¹ 12 13 16 19 16 19 10 10 10 10 10 10 10 10 10 10	84 89 90 95 101 105 121 147 269 287 314 Φ ★/.312* • 62 102 108 109 114 122 126 144 176 332 359 Φ ★/.375* 62 102	25 27 30 32 35 40 42 45 50 52 25 27 30 32 25 27 30 32 35 40 42 45 47 45 47 52 25 27 30 32 35 40 32 35 40 42 45 52 52 52 53 54 54 54 54 55 54 55 55 55 56 56 56 56 56 56 56 56 56 56	Steel	HP 10 X 5 138 164 173 193 214 217 225 269 274 HP 12 X 5 128 161 191 202 212 212 226 251 270 279 302 339 HP 12 X 6 132	7 76 90 95 100 106 118 119 124 141 148 150 3 71 88 105 111 117 124 138 148 153 166 179 187 3	70 45 47 50 52 55 57 60 62 65 67 70 42 45 47 50 52 55 57 60 62 65 57 60 62 65 67 70 62 65 67 70 62 65 67 70 60 62 65 67 70 60 62 65 67 70 60 65 67 70 70 70 70 70 70 70 70 70 7		354 HP 14 X 7 120 156 232 245 257 274 304 328 345 365 393 419 HP 14 X 8 123 160 200 237 250 262 280 311 334 350	187 195 3 66 86 107 128 135 141 151 167 181 189 201 216 231 216 231 216 231 216 33 201 216 33 201 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 216 231 217 216 231 216 231 217 216 231 217 216 231 217 217 217 217 217 217 217 217 217 21	70 40 42 55 55 55 60 62 65 67 70 40 42 45 47 50 52 55 57 60 62 65
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of Transpo Distance of Highways	ortatio	n		SC	DIL BORING LOG		'age)ate	110-22 (22)	of 5/21
ROUTE FAS 1707 (US 40)	DESC	RIPTION	N N	US 40	over North Fork of Embarras River LO	GGED	BYE	San	dsch
COUNTY Clark D	RILLING M		04207253	Latitu	SEC. 6, TWP. 10N, RNG. 13W, 2 rd PM, ude N 39.338838, Longitude W 87.898492 em auger & split spoon HAMMERAuto ETF	2 = 91	8%	ത 57	4 br
012-0018 (Existin STRUCT. NO. 012-0076 (Propos Station 2811+94.00 BORING NO. 1 West Abutmen Station 2810+43 Offset 7.0 ft South Ground Surface Elev. 580.70	9) ed) D E P t H	B L O W S	U C S Qu (tsf)	M 0 1 S T (%)	Surface Water Elev. 555.50 ft Stream Bed Elev. 554.30 ft Groundwater Elev.: First Encounter 556.7 ft ¥ Upon Completion 574.7 ft √	D E P T H	B L O W S	U C S Qu (tsf)	M 0 1 5 T (%)
" Asphalt over 10 " Concrete	· · ·					-	1	0.3 B	24
CLAY Embankment	579.37				558.70	-	1	Б	
	<u>, 2</u> 7				Loose, wet, brown, fine-grained, SAND 3.2% pasaing #200 Sleve	+	3 4	NT NT	21
Medium, moist, brown	1	5 1	0.6	18	Very loose -	-25	1	NT	NT
iouan, most, aronn	<u>v</u>	2 	В			-	2	NT	
Suff	÷	2 3	1.8 B	16	Loose 1.3% passing #200 Sieve 	+	3 6	NT NT	21
Soft, moist, brown, CLAY LOAM	571.20		0.4 B	19	Medium, grey, coarse, with 1/4 to	-30	1 6 8	NT NT	N
	1	WH	0			1		NI	
Stiff		1	1.4 B	22		_			
/ery Stiff	Ţ	5 1 1 2	2.3 B	22	546.20 Medium, wet, grey, coarse, SANDY LOAM	-35	5 8 9	0.2 S	14
/ery stiff, moist, grey, SANDY CLAY	563.70	1 5 3	2.3	21	-	-			
Soft, moist, grey, SANDY LOAM	561.20 560.70 -2		В		541.20 540.70	-	11		

NT-Not Tested. ŋ,

ROUTE FAS 1707 (US 40) D		OTION	an a	110 40	and black Field of Field and Division 1.4		Date		5/21
		IPTION			1945)	GGE	DBF	San	Isch
SECTION (CX-B)B			- ohl	Lätitu	EC. 6, TWP. 10N, RNG. 13W, 2 rd PM, de N 39.338838, Longitude W 87.898492			20	1
COUNTY Clark DRILLIN 012-0018 (Existing)	G ME	THOD	Hol	low ste	em auger & split spoon HAMMERAuto ET	R = 9	91.8%	@ 57	4 bp
STRUCT. NO. 012-0076 (Proposed) Station 2811+94.00 SORING NO. 1 West Abutment Station 2810+43 Offset 7.0 ft South	DLPTH	B L O W S	U U S Qu	M U I S T	Surface Water Elev. 555.50 ft Stream Bed Elev. 554.30 ft Groundwater Elev.: First Encounter 556.7 ft ▼ Upon Completion 574.7 ft ♀	DEPTH	B L O W S	DE N G	MO I S T
Ground Surface Elev. 580.70 ft Medium, wet, grey, fine-grained	(ft)	(/6")	(tsf) NT	(%)	After 120 Hrs. 565.7 ft ¥ Medium, wet, grey, coarse.	(ft)	(/6")	(tsf)	(%)
SAND with 1/4 to 1/2" angular gravel		13	NT		gravelly, SAND 10.9% passing #200 Sieve	-	16	NT	
6.4% passing #200 Sleve	1				relate passing along serve	-			
						-			
	-					_			
536.3	0				516.20	-			
Hard, moist, grey, CLAY LOAM	-45	8	4.1	8	Dense, wet, medium, SAND with 1/2" to 1-1/2" angular gravel	-65	26 24	NT	8
	3	26	B	0	12.8% passing #200 Sieve	-	26	NT	•
	-					-			
	-					-			
	-								
	-50	16 33	0.0	-		.70	12	NT	-
	1	39	6.6 B	7		-	24 26	NT NT	NT
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	-55	29			40.00	.75	19		
		46 50 5*	8.5 S	8	10.8% passing #200 Sieve	-	17 20	NT NT	12
						-			
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	_					_			
22.03						-			
521.2 520.7	10 10 -60	10			500.70	-50	19		

The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206), WH-Weight of Hammer, NT-Not Tested.

SECTION(CX-B)B	ion SCR	IPTION LOCAT		US 40 SW, S	Page 3 of 3 DIL BORING LOG Date 8/5/21 I over North Fork of Embarras River LOGGED BYE Sandscha SEC. 6, TWP, 10N, RNG, 13W, 2 ^{re} PM, Ide N 39.338838, Longitude W 87.898492 em auger & split spoon HAMMERAuto ETR = 91.8% @ 57.4 bpr
012-0018 (Existing) STRUCT. NO. 012-0076 (Proposed) Station 2811+94.00 BORING NO. 1 West Abutment Station 2810+43 Offset 7.0 ft South Ground Surface Elev. 580.70	D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M 0 1 5 T (%)	Surface Water Elev. 555.50 ft Stream Bed Elev. 554.30 ft Groundwater Elev.: First Encounter 556.7 ft ¥ Upon Completion 574.7 ft ½ After 120 Hrs. 565.7 ft ¥
Dense, wet, medium, SAND with 1/2" to 1-1/2" angular gravel 14.8% passing #200 Sieve 495.2		24	NT NT		
Hard, moist, grey, CLAY LOAM Till 494.7	-85	9 18 27	4.5 B	11	
Benchmark: National Geodetic Survey Marker D 211 1959 - Brass Disk set in top of the South End Back Wall at the West-Northwest Corner of SN 012-0018, 19 feet North of Centerline. End of Boring					

ROUTEFAS 1707 (US 40) DESCRIPTION				US 40 over North Fork of Embarras River LOGGED BYE. Sandscha						
			۱							
SECTION (CX-B)B			1122	Latitu	ude N 39.339211, Longitude W 87.8975					
COUNTY Clark DRILL 012-0018 (Existing)	ING ME	THOD	HO	NOW SD	em auger & split spoon HAMMERAuto	ETR =	91.8%	@ 57	.4 bp	
Station	DEP	B L O	U C S	M O I	Surface Water Elev. 555.50 ft Stream Bed Elev. 554.30 ft	D E P	B L O	U C S	M O I	
BORING NO. 2 East Abutment Station 2813+49 Offset 7.0 ft North	T H	W S	Qu	S T	Groundwater Elev.: First Encounter 556.2 ft Upon Completion 575.7 ft	Ž 📄	w s	Qu	S T	
Ground Surface Elev. 580.72	ft (ft)	(/6")	(tsf)	(%)	After 96 Hrs. 566.7 ft	Z (ft)	(/6")	(tsf)	(%)	
6" Asphalt over 10" of Concrete	-	1				-	1 2	2.5 B	19	
	9.42	ł				-	-			
Brown, CLAY Embankment					558	72	1			
					Soft, moist, grey, SILTY LOAM	-	1	0.4	19	
		1					2	B		
	_				556	25	-			
	⊽ -5	2			Very soft, wet, brown, SANDY	-25	1			
Stiff, moist	1	2	1.2 B	16	LOAM	-	1	0.2 S	18	
	_	-		-		1	~	0		
					553	72			6	
Very stiff	8	2	3.1	11	Very loose to loose, moist, grey, 1 fine grained, SAND	-	1 2	NT	20	
	1	4	в				2	NT		
	100						- 13			
	- 10	1		and a		-30	WH			
	-	2	2.3 B	13	Very loose 14.9% passing #200 Sieve	1.4	1	NT NT	17	
		-	В	-			-	1911	-	
	8.72									
Stiff, moist, grey, SILTY CLAY Embankment	-	1	1.6	18						
	100	1	В	1005						
	₽					-				
Pro March 1997	-15	WH				-35	3			
Soft, brown	-	1	0.4 B	25	Medium		6 5	NT NT	NT	
				11			272		-	
	-	1				_				
Medium, grey	-	3	0.8	21	-	1. 11				
		3	В							
56	1.22					1				
the second	0.72 -20	WH			540	72 -40	5			

The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206), WH-Weight of Hammer, NT-Not Tested.

ROUTE FAS 1707 (US 40) DE	SCR	PTION		US 40	over North Fork of Embarras River	OGG	Date ED BY		6/21
SECTION (CX-B)B	_ I	OCAT		SW, S	EC. 6, TWP. 10N, RNG. 13W, 3 rd PM, ade N 39.339211, Longitude W 87.897544				
COUNTY Clark DRILLING 012-0018 (Existing)	ME	THOD	Hol		em auger & split spoon HAMMERAuto E		91.8%	@ 57	4 bp
STRUCT. NO. 012-0076 (Proposed) Station 2811+94.00 BORING NO. 2 East Abutment Station 2813+49 Offset 7.0 ft North Ground Surface Elev. 580.72	DEPTH (ft)	B L O W S (/6")	U C S Qu (tsf)	M 0 I S T (%)	Surface Water Elev. 555.50 ft Stream Bed Elev. 554.30 ft Groundwater Elev.: First Encounter 556.2 ft ¥ Upon Completion 575.7 ft ¥ After _96 Hrs. 566.7 ft ¥		B L O W S (/6")	U C S Qu (tsf)	M 0 1 5 T (%
No Recovery	-	5 5	NT NT		520.22 Dense, grey, medium grained,	2	26 28	6.1 S	10
	1				SAND	-		~	-
	-					-			
	-								
Wet 11.8% passing #200 Sieve	-45	7	NT	13	Very dense, wet, with 1/2" to 1-1/2" rounded gravel 11.2% passing #200 Sieve	-65	12 22	NT	12
	_	7	NT	10		_	30	NT	12
	-					-			
	-					-			
	-								
531.22						-	5		
Hard, moist, grey, CLAY LOAM	-60	3	5.4	10	With 1/2" to 1-1/2" angular gravel	-70	20 27	NT	5
	_	7	В		and the second second		27	NT	
	_					_			
				ų.		-		1	
	-					-			
526.22	_								
Hard, moist, grey, SANDY CLAY LOAM Till	-55		6.9	201 - 325 - 1	Dense, with 1/2" angular gravel 11.2% passing #200 Sieve	-75	9 19	NT	11
		17	S			_	19	NT	-
	_					_			
	-					_			
	-					-			
	-60	12			500.7		19		

Illinois Departr of Transportati	nen on	ıt		sc	DIL BORING LOG
ROUTE FAS 1707 (US 40) DE	SCRIP	TION		US 40	over North Fork of Embarras River LOGGED BYE. Sandschafe
SECTION(CX-B)B	_ LC	DCAT			EC. 6, TWP. 10N, RNG. 13W, 3" PM.
COUNTY Clark DRILLING	MET	HOD	Hol		ide N 39.339211, Longitude W 87.897544 em auger & split spoon HAMMERAuto ETR = 91.8% @ 57.4 bpm
012-0018 (Existing) STRUCT. NO. 012-0076 (Proposed) Station 2811+94.00 BORING NO. 2 East Abutment Station 2813+49 Offset 7.0 ft North	D E P T H	B L O W S	U C S Qu	M O I S T	Surface Water Elev. 555.50 ft Stream Bed Elev. 554.30 ft Groundwater Elev.: 556.2 ft ¥ Upon Completion 575.7 ft ¥
Ground Surface Elev. 580.72 ft	(ft) ((/6'')	(tsf)	(%)	After <u>96</u> Hrs. <u>566.7</u> ft 2
With 1/2" to 1" gravel 12.6% passing #200 Sieve	-	15 15	NT NT	-11	
	-				
496.22					
Hard, moist, grey, CLAY LOAM Till	-85	8	5.8	8	
1	-	18	В		
9	_				
3	_				
3	_				
Very dense, wet, grey,		40			
ine-grained, SAND	-3	50 -3/4"	NT NT	17	
		50 -3/41			
	_ ^r	-3/4)			
	_				
(1				
486.22 Very dense, moist, grey, very		22			
ine-grained, SILTY SAND 484.72	-5	50 -3/8"	NT NT	11	
Benchmark: National Geodetic Survey Marker D 211 1959 - Brass Disk set in top of the South End Back Wall at the West-Northwest Corner of SN 012-0018, 19 feet North of Centerline. End of Boring		50 -1/8			